MOpA©: A Multiple Opportunity Screening Heuristic for Entrepreneurs[1]

Thomas J. Lynch IV, Audioxsell
McRae C. Banks and Jerome J. Schaufeld, Worcester Polytechnic Institute
Department of Management, 100 Institute Road, Worcester MA 01609-2280 USA

Abstract

Much of the opportunity assessment literature focuses on evaluating a single opportunity rather than multiple opportunities. However, discussions with entrepreneurs, as well as personal experience, suggests that many entrepreneurs have multiple opportunities that they are screening in parallel. As such, the challenge is to assess each opportunity for its viability individually ***and*** against other opportunities under review. A second challenge is retaining objectivity in the opportunity assessment process. More than one entrepreneur, including one of the authors, spoke of how particular opportunities resonated with them, even before any research had been conducted. If entrepreneurs have a means to evaluate multiple opportunities objectively, they will have a much more realistic view of which opportunities have the highest potential for success.

The authors explored how opportunities are analyzed, then modeled the process for multiple opportunities and developed a heuristic to assist entrepreneurs with the effort. The Multiple Opportunity Analysis Process (MOpA©) was pre-tested with students in undergraduate and postgraduate entrepreneurship courses, and with entrepreneurs. After making appropriate changes, a single case study was conducted in which one entrepreneur's multiple opportunities were assessed. The heuristic proved to be viable at narrowing the opportunities quickly to a much smaller set, as well as identifying the best alternative.

To the authors' knowledge, this heuristic is the only one of its type, and, with further testing, may hold significant value for the field.

Keywords: Opportunity evaluation, Opportunity analysis, Entrepreneurial heuristic

Conceptual Paper

1. Introduction

From long exposure to entrepreneurs, it is clear that many of them have more than one viable opportunity to evaluate, thus it becomes important to have the ability to discriminate between the potential opportunities by assessing them against each other. Yet the literature is silent on how to do this, focusing instead on single opportunities. In that literature, it is known that some entrepreneurs evaluate with gut feeling or by emotion, others use one or more heuristics, others use both (Bryant, 2006). However, if entrepreneurs have multiple opportunities, how are they to proceed? To address that issue, we sought to develop a heuristic that would help entrepreneurs identify the opportunity or opportunities with the highest potential for success. It is the *process* of evaluating *multiple opportunities*, to find the most rewarding venture, that many believe is at the heart of the entrepreneurial process and improves the probability of success of the venture (Hills, et al. 2004).

[1] This paper is based on the first author's senior thesis (Major Qualifying Project) at Worcester Polytechnic Institute in 2009.

It is understood among entrepreneurs and researchers that the ability to recognize and capitalize on a potential opportunity can only be exploited by a limited number of people; entrepreneurs who are able to see potential market needs and create customer value are those who will be the most successful (Park, 2005). This is reinforces the importance of opportunity recognition and evaluation. Others have found that successful entrepreneurs use personal knowledge, previous experience, and market insight to see opportunities where others do not (Ucbasaran, et al., 2009).

Current research in the opportunity recognition/evaluation field focuses on three major topic areas. One area is how opportunities arise, such as opportunity discovery vs. creation, the psychological process of opportunity identification, and the influence of personal traits of entrepreneurs on the opportunity recognition process (OpR). A second area is the process of evaluating a single opportunity, which consists primarily of conceptual models and frameworks for determining how entrepreneurs determine the potential success of opportunities. The third area looks at how opportunities are transformed into business ventures through the use of a business plan. A common theme among the three areas is that the mitigation and reduction of risk in the opportunity increases the chance of success. (Keh, et al., 2002)

By its very nature, opportunity analysis (OpA) is an important area to study. Entrepreneurs spend years of their lives, tremendous effort, and often considerable personal funding, starting a new business. Clearly entrepreneurs would not purposely pursue a sub-optimal opportunity. However, the optimal opportunity is not easy to discern, thus the potential value of a heuristic to evaluate opportunities, especially multiple opportunities, is high.

This paper investigates how multiple opportunities are analyzed, compared, and ultimately narrowed down to one that is later pursued to launch a new business venture. This process will be referred to as the Multiple Opportunity Analysis Process (MOpA). In addition to reviewing the literature in the field of OpR and OpA, insights were sought from entrepreneurs, angel investors, and venture capitalists. A model was developed and a heuristic instrument was created based on the model. The heuristic was pre-tested with undergraduate and postgraduate students in entrepreneurship courses, as well as with entrepreneurs. One entrepreneur who was in the active search process applied the resulting heuristic to a set of 19 opportunities that he identified.

2. Literature Review

2.1 What is an Entrepreneurial Idea?

Entrepreneurial ideas, in their simplest form, are new ideas for a product or service, or a new way to create incremental improve for an existing product or service that has commercial viability. These ideas can come from many sources and can be created by almost any person. (Saks and Gaglio, 2002) At this stage ideas are only that - ideas; they are not yet business opportunities, or a new products or services.

Entrepreneurial ideas transition to opportunities when they have the ability to satisfy a market need and provide new customer value. Entrepreneurial opportunities exist when there is potential of generating revenue from the idea and certain commercial factors can be validated. Ideas can be transitioned to opportunities with a small number of tests. For example: Can you talk to some

potential customers? Do they think the idea satisfies a need they may have? Are they willing to pay to have that need satisfied?

If the answers to those questions are yes, the idea can be recognized as a potential opportunity. There are no indications of the potential outcome of the opportunity at this point. Furthermore there are also no indications of the magnitude of the opportunity. Just because some people might buy a product or service does not mean that enough people will buy it, or pay an appropriate price, to develop a profitable business. There are many more questions that must be answered. The following sections discuss how opportunities are realized, validated, and evaluated.

2.2 How Opportunities Arise

The research in the field of how opportunities arise consists of three main topics: articles discussing the differences between (1) opportunity discovery, (2) opportunity creation (Ardichvili, et al., 2000), and (3) how traits of entrepreneurs relate to their ability to identify and understand market need. (Puhakka) Despite the different ideas on how entrepreneurs realize opportunities, researchers agree that opportunities do not just appear. Through using a specific process or by sheer creativity, opportunity recognition takes a considerable amount of time and effort.

Major factors that contribute to the underlying ability to recognize opportunities are: understanding of the target market, the general industry, the technology, and the customers. Researchers believe that entrepreneurs who have a full understanding of those elements will have a better chance to recognize potentially successful opportunities. (Ardichvili, et al., 2000)

Opportunities can come from many different sources. Specific needs of customers or markets, major market shifts, regulatory changes, and new technologies can all spawn the potential for new entrepreneurial opportunities. (Hills and Shrader, 1999)

2.3 Opportunity Discovery vs. Creation

Researchers and practitioners believe that there are two different ways opportunities are recognized: opportunity discovery and opportunity creation.

Discovery is the process where entrepreneurs realize there is an opportunity to (D1) create customer value for an existing market need due to a change in market conditions, (D2) customer needs, (D3) technology, or (D4) social trends. In the case of opportunity discovery the entrepreneur uses his knowledge to make the non-obvious seem possible. (Gregorie and Shepherd) Opportunity discovery usually consists of a structured process, although not necessarily formal. Lumpkin and Lichtenstein (2005) suggest the process consists of three stages: Preparation, Incubation, and Insight. They believe that opportunities are not discovered during a single enlightening experience, but rather through a phased approach.

The preparation phase is heavily influenced by the entrepreneur's past experiences and knowledge. During this phase, understanding of the market, industry, and technology for a

potential opportunity give the entrepreneur insight into the potential success of the opportunity. (Lumpkin and Lichtenstein, 2005)

The incubation phase is where the entrepreneur is contemplating the inner workings of the opportunity. They look at the customer need, market readiness, and execution of bringing the opportunity to market. Many options are evaluated; the critical thinking and problem solving skills of the entrepreneur are tested. Due to the large amount of thinking or churning of the opportunity in the entrepreneur's head, this stage may take significant time. This is also the stage where the entrepreneur may talk with other entrepreneurs or potential customers to gather feedback on the value proposition of the opportunity. Key fundamental assumptions of the opportunity may change during this phase; the entire direction of the opportunity can also change. (Lumpkin and Lichtenstein, 2005)

The insight stage can be described as the point where the true identity of the opportunity becomes clear. The answers to the questions developed during the incubation phase may all be answered, seemingly at once. The entrepreneur experiences a convergence of all the things previously being considered. It is at this point the entrepreneur realizes the existence of a substantial business opportunity. The process indicates that the entrepreneur has a vast understanding of background information related to the opportunity. The entrepreneur deliberates over the opportunity, and through the process of thinking the problems are solved. An issue with this process is that it does not take into account creativity or intuition. These are two of the major factors in the opportunity creation process. (Lumpkin and Lichtenstein, 2005)

Opportunity creation is the process where an entrepreneur creates a new market opportunity that was not previously recognized. Sometimes these opportunities are characterized as very large paradigm shifts; one could argue that the invention of personal computers or the iPod were creation opportunities. Creation opportunities take an immense amount of knowledge by the entrepreneur in a certain field, so much that they are able to predict the next big market innovation. Ardichvili, Cardozo, and Ray (2000) suggest that five key factors are integral to the creative opportunity recognition and development process: (C1) Entrepreneurial alertness, (C2) information asymmetry and prior knowledge, (C3) social networks, (C4) personality traits including optimism, self-efficacy and creativity, and the (C5) type of opportunity itself.

With the creation method of opportunity recognition, the key concept of entrepreneurial alertness describes the creative and perceptive traits entrepreneurs leverage to recognize opportunities. This entrepreneurial alertness allows entrepreneurs to sense or perceive a new market need, and use their creativity to develop a fit between needs in the market and resources available. Finally, they are able to create a new business or commercial opportunity based on their prior knowledge. (Gaglio and Katz, 2001)

Ardichvili, Cardozo, and Ray (2000) summarize the creation ideology of opportunity recognition as "Creation involves redirecting or recombining resources in order to create and deliver value superior to that currently available. Concept creation may go well beyond adjustment of current matches of resources and needs and may even lead to dramatic restructuring of an existing business or radical innovation."

The concept of information asymmetry and prior knowledge describes the trend that individuals notice and understand things they already know. This is the idea that prior knowledge in a particular area triggers opportunity recognition. Any given entrepreneurial opportunity is not obvious to all potential entrepreneurs, the rationale being that all people do not possess the same information all the time. (Kirzner, 1997) Each person's idiosyncratic prior knowledge creates a knowledge corridor that allows the entrepreneur to recognize certain opportunities, but not others. Three major dimensions of prior knowledge are important to the process of entrepreneurial recognition through creation: prior knowledge of markets, prior knowledge of ways to serve markets, and prior knowledge of customer problems. (Ronstadt, 1988)

Social networks play an important role in the opportunity creation process; the ability to converse with many like-minded as well as non like-minded individuals can increase the potential for successfully recognizing opportunities. Hills et al., (1997) assert that entrepreneurs who have extended social networks identify significantly more opportunities than solo entrepreneurs. They also hypothesize that the quality of the social contacts can affect other characteristics, such as alertness and creativity. (Ardichvili, Cardozo, and Ray, 2000)

Personality traits, specifically creativity, are a major factor that allows entrepreneurs to recognize opportunities that others do not. While hard to quantify, creativity provides entrepreneurs the basis for innovation and allows them to solve problems that others believe have no solution.

Personality traits of the entrepreneur are related to the final factor in the opportunity creation process - the type of opportunity. Opportunities that are recognized through the creative process are usually of a specific type; as mentioned earlier, these opportunities are sometimes based upon totally new technologies or paradigm shifting ideas. Baseline knowledge and previous experience coupled with personality traits feeds into the entrepreneur's social network, leading to discussion, which becomes the basis for entrepreneurial alertness.

Despite the two different schools of thought on how opportunities are recognized (discovery vs. creation) recent research suggests that entrepreneurs that are able to incorporate both discovery and creativity opportunity recognition concepts are far more successful than individuals who practice one method or the other. (Park, 2005) Elements of the opportunity discovery method (D1 – D4), and the opportunity creation method (C1 – C5) can be seen interacting. After an opportunity is identified, more work is required to determine the potential of the opportunity. The need to evaluate opportunities has led to research frameworks and models to evaluate a single opportunity.

The models are broken into two categories: identifying opportunities and evaluating opportunities. Both models assess many of the factors that influence the potential successfulness of the opportunity. The models evaluate the market, the competition, the technology, the economics, the capital requirements, risks, and exit strategy.

At the highest level, the evaluation process consists of elaborating and evaluating on key elements of the opportunity. During this phase the entrepreneur is testing assumptions and investigating the direction of the opportunity. (Corbett, 2005)

Many models exist for evaluating a single opportunity. The Timmons and Spinelli (2004) model gives complete list of potential factors to evaluate. These factors are grouped into areas such as competitive, technological, economic, risks, and so forth.

The areas to evaluate in the market are: the customers, the value proposition, the market type, the market size, competitive forces, market growth/shrinking rate, pricing and perceived cost benefit. These areas provide an understanding of the overall market and customer needs. The following confluence of conditions indicates a potentially successful opportunity: large market, high value proposition, and customers who see the value of the product or service.

The competitive analysis consists of looking at the competitive forces, what competitive barriers can be erected against the competition (i.e., an intellectual property barrier), what strategies are in place to overcome the competition, and how much effort is required.

The technological analysis evaluates existing technologies that support the opportunity. If the technology does not exist it will take significant time and money to develop the technology and intellectual property. But if the technology can create IP barriers against the competition, the opportunity has a greater potential for success. Existing intellectual property must also be evaluated. If patents currently exist, research will need to determine if the proposed technology will infringe.

The economic analysis can determine if the product or service can be delivered at a price customers will pay, while being profitable for the business. Economic analysis will look at the cost of development, cost of manufacturing, cost of running the business, and cost of marketing and selling the product or service. All of these factors will determine the gross margin and potential return on investment (ROI) for the initial capital required to setup the business.

The opportunity analysis process focuses on the mitigation of risk, and the exit strategy of the opportunity. If the opportunity is low risk, and the exit strategy is such that it provides a large upside potential, the opportunity is generally viewed as favorable.

As previously stated, the Timmons and Spinelli (2004) list presents the most thorough list of factors. For each aspect of the opportunity they describe situations that indicate high potential and low potential for success of the opportunity. The factors can be found and are listed in Appendix A. One issue with this list, and current available research is the lack of documented correlations between specific factors that prove a successful opportunity exists.

2.4 A Gap in the Research

Thus far in the literature review, research has been presented on how opportunities are identified, discovered or created, and models have been presented on how to evaluate a single opportunity. An important element of the research that is sparsely discussed is how opportunities are evaluated against other opportunities. Entrepreneurs have more than one idea when they are screening new business ventures to launch. The process developed in this paper on Multiple Opportunity Analysis (MOpA) can increase the probability of the success of the entrepreneur.

Currently little is known about how entrepreneurs sift through, compare and choose the opportunity to follow into business. Some entrepreneurs seem to use rough comparison while others use a subjective process. A major problem that has been identified with entrepreneurs is that they are sometimes blinded by their assumptions early in the process. This leads them to pursue business ventures that may not have the highest potential for success.

To try to make sense of this, we created the graphic found in Appendix 1. Using that as the basis, we created a questionnaire as a heuristic device to guide entrepreneurs through an evaluation of multiple opportunities using a comprehensive set of criteria.

3. Overview of the Heuristic

In a perfect world entrepreneurs would have unlimited time to vet new opportunities. Unfortunately, that is not the case and it is often prudent to act on a new opportunity as quickly as possible. The purpose of this heuristic is to give entrepreneurs a systematic method of evaluating multiple opportunities while doing enough research to analyze them.

The Multiple Opportunity Analysis heuristic (MOpA) was developed through the evaluation of current academic research, knowledge of private sector practitioners obtained through interviews, and personal experience. The MOpA heuristic was improved and iterated several times, through testing on personal opportunities, opportunities from members of the WPI Venture Forum, and the introduction and experimentation of the heuristic in multiple formal classroom environments. Using the MOpA heuristic consists of three steps: Completing a Single Opportunity Questionnaire for each opportunity, reviewing the preliminary results, and if necessary, adjusting the control parameters to increase variation and identify the opportunities with the highest potential for success.

Before analyzing opportunities with the MOpA heuristic, two criteria must be true for each opportunity. The opportunity must truly be an entrepreneurial opportunity, not merely an idea, and basic data and analyses must be completed so that the questions in the Single Opportunity Questionnaire (SOQ), found in Appendix 2, can be answered as accurately as possible.

For the purpose of using this heuristic, entrepreneurial opportunities exist when they have the ability to satisfy a defined market need, provide new customer value, generate revenue, and commercialization aspects can be validated. It is important to understand the value proposition of the opportunity to the potential customers, and have some idea what the potential customers are willing to pay for that perceived value. If these aspects of the opportunity cannot be ascertained the opportunity may be only an idea. Retaining those ideas is also important, as is reviewing them periodically, as new market trends, market shifts or a different personal perspective may allow the idea to evolve into an opportunity.

The initial evaluation must be thorough enough to answer questions relating to the all of the eight main categories of the SOQ: market, competitive forces, technology, economics, sales and marketing, capital requirements, risks, and exit strategy.

Some preliminary questions asked before answering the SOQ and during the cursory evaluation are: How large is the market? What is the competitive landscape? Can the technology be

protected? Is it going to be expensive to develop? What is the cost to develop and produce the product/service vs. the price a customer will pay? Is there enough margin to sustain a business? How will it be marketed/sold? How much capital is required and when? What are the risks? and What is the exit strategy?

Once the opportunity is validated and the initial evaluation completed, the SOQ can be answered. Additional research may be required to answer some questions during the SOQ. The MOpA heuristic is designed to take the output of any number of SOQs and objectively analyze the opportunities to identify the opportunities with the greatest potential for success.

Once all SOQs are completed, the second step of the MOpA heuristic is the automated analysis and correlation of the SOQ answers to develop weighted scores for each question, the main categories, and the opportunity as a whole. This second step does not require any user input. The algorithms developed in this step are discussed in detail in the analysis model section of this paper. The final step allows the user to adjust the model control parameters to increase variability to identify the opportunities with the highest potential for success.

3.2 The Single Opportunity Questionnaire

The SOQ consists of 60 questions, most with multiple-choice answers. The questions fall into eight categories: market, competitive forces, technology, economics, sales and marketing, capital requirements, risks, and exit strategy. Fifty-four questions are quantifiable while six are open-ended. It was understood that the closed-ended nature of many of these questions could be a limitation, but that format was deemed most appropriate for making the questionnaires reasonably easy to use. Considerable effort was made to capture all possible answer scenarios. Each question has a comment field where the user can record assumptions or information used to determine the selected answer. These comments can be beneficial if the entrepreneur wants to revisit an opportunity through his or her SOQ results at a later date.

The SOQ questions were compiled from reviewing leading academic research, and interviews with successful entrepreneurs, venture capitalists and angel investors. During the interviews, the latter were asked to identify key areas and questions they used to evaluate new business opportunities. All of this information was incorporated during the development of the SOQ questions and answers.

The multiple-choice answers were designed to represent ranges, which allowed the SOQ to remain highly objective. Approximately 60 WPI students, six colleagues, and 15 members of the WPI Venture Forum, a member-based not-for-profit organization focused on helping nascent and seed-stage entrepreneurs evaluated the SOQ. They were asked to answer the questions with a potential opportunity in-mind, and provide feedback on the questions and answers. This exercise was repeated until no new feedback was received.

The number of answers for each question ranged from two answers (yes/no) to five answers (answers that were a set of ranges). Depending on the answer selected, each question is assigned a raw value of 0-10 (0 = less favorable, 10 = more favorable) based on two variables: the number of multiple choice answers in the question, and the answer profile. The first variable, the *number of multiple choice answers,* has four options: questions with 2, 3, 4, or 5 answers. The second

variable, the *answer profile* has for options: down, up, bell, reverse bell. The answer profile is used to determine how the 0-10 scale is distributed. Table 1 shows the number of answers in a question vs. the 0-10 value that gets assigned depending on the selected answer (A - E). The SOQ is designed so that first or last answer of any given question is not always the highest or lowest assigned raw score. This variability removes any potential for the user to select the more favorable answers.

Answer Profile	2 Answers		3 Answers			4 Answers				5 Answers				
	A	B	A	B	C	A	B	C	D	A	B	C	D	E
Down	10	0	10	5	0	10	6.6	3.3	0	10	7.5	5	2.5	0
Up	0	10	0	5	10	0	3.3	6.6	10	0	2.5	5	7.5	10
Bell			0	10	0	0	10	10	0	0	7.5	10	7.5	0
Reverse Bell			10	0	10	10	0	0	10	10	2.5	0	2.5	10

Table 1 - Multiple Choice Answer Scale Distribution

The SOQ output is a raw score for each of the 54 questions. These raw scores are then fed into the analysis model.

3.3 The Analysis Model

The analysis model consists of two components, a matrix analysis based on a set of weighted factors and a correlation analysis based on a set of specific answers present between different questions. The output of these two analysis components is a weighted score for each opportunity that is ultimately broken into: a total opportunity score (sum of all weighted scores), and a score in each of the eight SOQ question categories (sum of weighted scores for each question in each category).

3.3.1The Matrix Analysis

The matrix analysis component generates weighted scores for each opportunity where they are all evaluated on the same set of factors. This provides the objectivity and a uniform foundation of analysis. Each raw score value, for each SOQ question from each opportunity, is entered automatically into a matrix similar to the one shown in Table 2; each opportunity - Opp(n) is placed along the top Y-axis, and each question of the SOQ is placed along the X-axis.

	Opp(1)	Opp(2)	Opp(3)	Opp(4)	Opp(n)
Question(1)	Raw Score	Raw Score	Raw Score	Raw Score	Raw Score
Question(2)	Raw Score	Raw Score	Raw Score	Raw Score	Raw Score
Question(3)	Raw Score	Raw Score	Raw Score	Raw Score	Raw Score
Question(4)	Raw Score	Raw Score	Raw Score	Raw Score	Raw Score
Question(n)	Raw Score	Raw Score	Raw Score	Raw Score	Raw Score

Table 2 - MOpA SOQ Answer Score Matrix

Existing research and interviews with practitioners identified that some aspects of an opportunity are more important than others (Timmons and Spinelli, 2004). This led to the development of multiplying the raw score by a weighting value. The weighted value was derived from identifying which SOQ question holds more importance. Each of the questions in the SOQ was given an importance factor ranging from one to three, with one having average importance and three having high importance. These factors would eventually act as a linear multiplier for that question's score in the analysis. This can be seen in Table 3.

For example, research has shown if an opportunity has an intellectual property advantage (i.e. Patent Protection) it will have a higher chance of success. Thus a question regarding the level of intellectual property is given a higher level of importance, than one regarding level of effort required to build a working prototype. The two questions are related but if the intellectual property cannot be protected, the amount of time to build a working prototype is less important. Also the question about intellectual property is more important to the potential success of the opportunity where as the question regarding the number of hours required to build a prototype speaks to the length of time needed to demonstrate a working product.

	Importance Factor	Opp(1)	Opp(2)	Opp(3)	Opp(4)	Opp(n)
Question(1)	3	Raw Score*3	Raw Score*3	Raw Score*3	Raw Score*3	Raw Score*3
Question(2)	1	Raw Score*1	Raw Score*1	Raw Score*1	Raw Score*1	Raw Score*1
Question(3)	2	Raw Score*2	Raw Score*2	Raw Score*2	Raw Score*2	Raw Score*2
Question(4)	1	Raw Score*1	Raw Score*1	Raw Score*1	Raw Score*1	Raw Score*1
Question(n)	3	Raw Score*3	Raw Score*3	Raw Score*3	Raw Score*3	Raw Score*3

Table 3 - MOpA SOQ Answer Score with Importance Factor Matrix

After the multiplication of the importance factor shown in Table 3, the matrix now contains the opportunities with weighted scores for each question. These weighted scores, as shown in Table 4, are summed by each of the eight categories as well as an overall opportunity score.

	Opp(1)	Opp(n)
Category(1)		
Question(1)	Weighted Score	Weighted Score
Question(2)	Weighted Score	Weighted Score
Question(n)	Weighted Score	Weighted Score
Sum of Category(1)	Sum for Category(1)	Sum for Category(1)
Category(2)		
Question(3)	Weighted Score	Weighted Score

Question(4)	Weighted Score	Weighted Score
Question(n)	Weighted Score	Weighted Score
Sum of Category(2)	Sum for Category(2)	Sum for Category(2)
.	.	.
.	.	.
.	.	.
Sum of Category(8)	Sum for Category(8)	Sum for Category(8)
Total Opportunity Score	Sum of All Weighted Scores	Sum of All Weighted Scores

Table 4 - Summarized SOQ Weighted Score and Overall Score

3.3.2The Correlation Analysis

Important correlations between how specific questions were answered appeared in the research as well as during interviews of practitioners. These correlations can be divided into positive and negative correlations. In the model these correlations were defined as if/then statements. These are if (some conditions exist) then (some output; positive or negative exists) type statements.

For example, one positive correlation could be an opportunity that has an intellectual property advantage and a rapidly expanding market. A negative correlation is an opportunity that has a very small market with a few well-defined competitors, or a market that is shrinking and large competitive barriers to entry.

Approximately 20 correlations were defined and built into the analysis model. After computing the weighted score for each opportunity, the analysis model evaluates a set of rules and determines if any of these correlations exist for each question in the SOQ. If any of the correlations exist, that opportunity is given an additional correlation score, either positive or negative. The total weighted opportunity score is the multiplied by the total sum of correlation scores, yielding a final score for each opportunity.

Multiplying the weighted score with the correlation score acts as a non-linear effect to the final score of each opportunity. Each opportunity is then compared and evaluated based on this final score. This final score, for each opportunity, takes into account all aspects of the opportunity, the raw score data, the weighted score data based on question importance, and the correlations between questions.

At this point a preliminary output is available. The model predicts the opportunities with the greatest potential for success. All of the opportunities are compared on a bar chart, and the opportunities with the highest potential have the highest overall score. A comparison by weighted score in each of the eight category areas is also provided.

At this point opportunities with a higher potential for success have been identified based on the importance factors and correlations from research and speaking with practitioners. To help entrepreneurs understand and evaluate the output of the initial analysis, a set of variables, or adjustable control parameters, were defined to fine tune the model to different circumstances.

3.3 Analysis Model Adjustable Control Parameters

The final step in the analysis is varying the adjustable heuristic parameters. There are two areas of adjustable parameters: selecting driving SOQ categories, and defining specific SOQ category thresholds.

By selecting one or more driving categories from the eight SOQ categories, the model will place higher importance on scores generated by questions in the selected category or categories. This is important because an entrepreneur may be looking for an opportunity with a strength in any one of the SOQ category areas. For example, perhaps one is looking for a lifestyle business vs. a business that would be sold or where technology licensed. Selecting a driving category allows the output to be tailored to these different situations. It also allows the user to identify the strengths and weaknesses of each opportunity, while adjusting the parameters and comparing the output results.

The second area consists of the ability to set thresholds in the heuristic that are used to differentiate further the opportunities. These thresholds define a cut-off point where, if the opportunity does not meet the cut-off point, the entire opportunity is deemed potentially un-successful (given a final score of 0). This feature of the model can be turned on and off, and was designed as a normalizing factor across multiple executions of the MOpA heuristic with distinct sets of opportunities.

3.4 MOpA Output

The final outcome of the MOpA heuristic, combining the SOQ, the analysis model and any adjustable parameters, is two graphs. One graph shows the final score of each opportunity, while the other graph shows each opportunity broken into the SOQ category areas.

Figure 1 displays the MOpA heuristic overall output for 19 personal opportunities of the first author. Opportunities 8, 16, and 18 have been clearly identified as opportunities with a high potential for success.

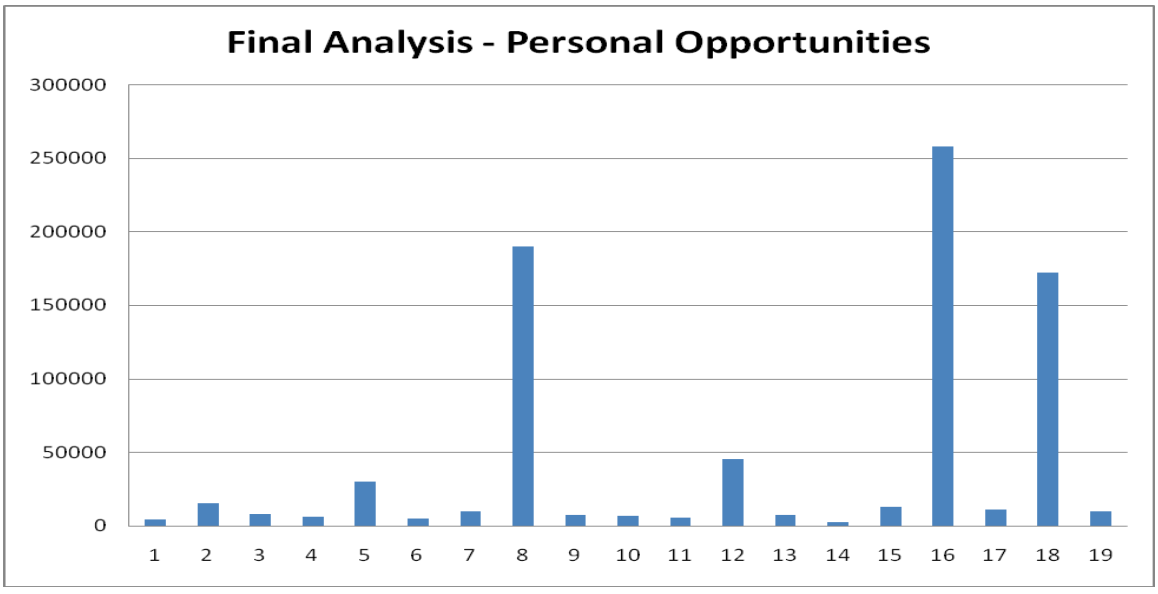


Figure 0 - Final MOpA Output for Personal Opportunities of author Thomas J. Lynch IV

Figure 2 contains the final output of the top five opportunities broken down by the SOQ categories. In this all opportunities had the same exit strategy so that is not displayed. This graph gives the entrepreneur a good understanding of strengths and weaknesses of each opportunity.

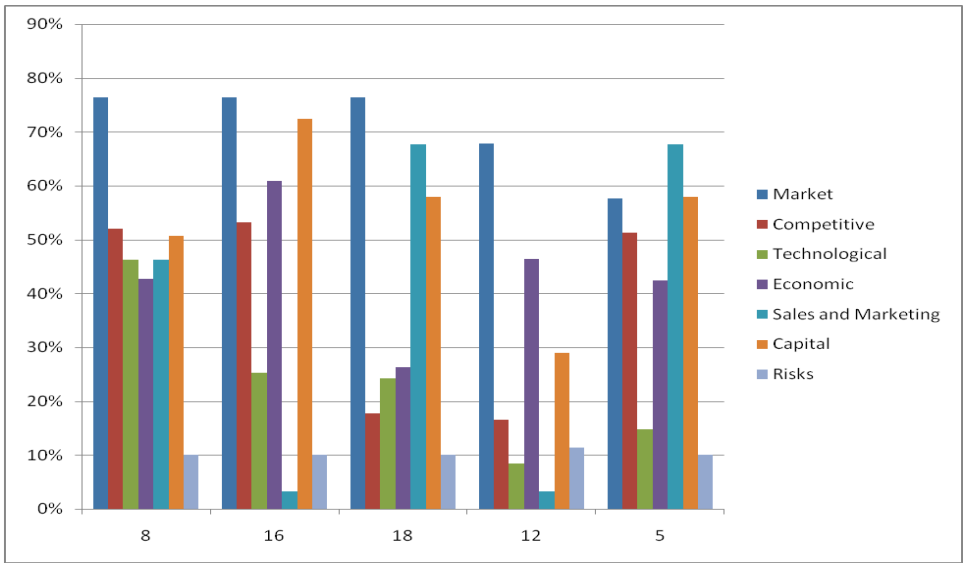


Figure 0 - Final MOpA Output for Personal Opportunities of T.J. Lynch IV by SOQ Category

4. Conclusions

The MOpA heuristic is important because many entrepreneurs have biased methods of evaluating opportunities. Entrepreneurs can be too emotionally connected to their opportunities to evaluate the chance of success objectively. The MOpA heuristic is an attempt to develop a unified, non-biased process for objectively evaluating multiple opportunities.

It is important to realize that the MOpA heuristic should be only used on validated entrepreneurial opportunities as opposed to ideas, and that adequate initial research of potential opportunities must be completed before attempting to answer the SOQ.

Failing to complete these two steps will lead to inaccurate opportunity analysis results. The initial research will allow the entrepreneur to have enough background knowledge about the opportunity to answer the SOQ questions as accurately as possible. It was demonstrated during initial testing at the undergraduate level that if the MOpA heuristic is used on ideas, or opportunities where the SOQ was not answered accurately, the resulting analysis could not be validated.

These tests indicate that the heuristic is only as good as the data in the SOQ; inaccuracies in the SOQ answers translate to inaccurate analysis. This is intuitive; the output is only as good as the input. After running the heuristic multiple times on various sets of opportunities, it is interesting to note that the opportunities entrepreneurs thought would come out on top were not always

identified as top opportunities. Such a result should then be used to adjust how the entrepreneur thinks about the opportunity, many times identifying strengths or weaknesses not initially seen. That was a key take-away for those testing the heuristic.

Despite finding the undergraduate classroom experiment less than desirable in terms of opportunities vs. ideas, it was found that the heuristic stimulated discussion about the various SOQ items and various opportunities. That, too, was a good outcome, even though it was not the one sought.

In our model, after the MOpA heuristic identified one or two opportunities as having a high potential for success, the entrepreneur would begin the in-depth research required to write a business plan. At this point, as more research is conducted, the entrepreneur is encouraged to validate the answers of those opportunities on the SOQ. This will ensure that the data in the SOQ are as accurate as possible. The way the model is built, if an answer to a question on a specific opportunity's SOQ changed, the output and analysis would update as well.

In a perfect world the level of research needed to write a business plan would be conducted on every opportunity. But the immense level of effort required to do so would circumvent the entrepreneurial process and by the time the entrepreneur had determined the best opportunity, that opportunity could have been realized by another party. The MOpA heuristic attempts to balance in-depth research with action needed to evaluate personal entrepreneurial business opportunities.

We recognize that what we have presented here is new. Considerable additional research on the heuristic will strengthen it. For example, further validation of the correlations between factors in the MOpA heuristic is warranted. Additionally, we could test how entrepreneurs perceive their ideas before using the heuristic, then compare the heuristic results. Further research into successful companies started by entrepreneurs and how they perceived their opportunity, at the time of inception, could be completed using the MOpA heuristic to validate and strengthen the algorithms used to determine potentially successful opportunities. The ultimate validation of the MOpA heuristic will be a longitudinal study that will compare heuristic results to the ventures launched based on them years following their formation.

References

[1] Ardichivili, A., Cardozo, R., and Ray, D. (2003), "A theory of Entrepreneurial Opportunity Identification and Development" *Journal of Business Venturing*, vol. 18, 105-123.

[2] Bryant, P. (2006). "Self-regulation and decision heuristics in entrepreneurial opportunity evaluation and exploitation" *Management Decision*, 45(4), 732-748.

[3] Corbett, A., (2005). "Experiential Learning Within the Process of Opportunity Identification and Exploitation" *Entrepreneurship Theory & Practice* (July) 473-491.

[4] Gaglio, C. and Katz, J. (2001). The Psychological Basis of Opportunity Identification: Entrepreneurial Alertness. *Small Business Economics*. 16, 95-111.

[5] Gregorie, D. and Shepherd, D. (2005) "What Makes Opportunities More or Less Obvious? Findings from an Experiment with Entrepreneurs" Frontiers of Entrepreneurship Research, Wellesley, MA: Babson College.

[6] Hills, G., and Shrader, R. (1999), "Successful Entrepreneurs' Insights Into Opportunity Recognition" Frontiers of Entrepreneurship Research, Wellesley, MA: Babson College.

[7] Hills, G., Singh, R., Lumpkin, G.T., and Baltrusaityte, J. (2004) "Opportunity Recognition: Examining How Search Formality and Search Processes Relate to the Reasons for Pursuing Entrepreneurship and Impact Firm Founding" Frontiers of Entrepreneurship Research. Wellesley, MA: Babson College.

[8] Keh, H., Foo, M., and Lim, B. (2002), "Opportunity Evaluation under Risky Conditions: The Cognitive Processes of Entrepreneurs" *Entrepreneurship Theory and Practice,* (Winter),125 – 148.

[9] Kirzner, I., 1997. Entrepreneurial Discovery and the Competitive Market Process: an Austrian Approach. *Journal of Economic Literature* 35, 60-85.

[10] Lumpkin, G.T. and Lichtenstein, B.B. (2005) "The Role of Organizational Learning in the Opportunity Recognition Process" *Entrepreneurship Theory & Practice* (July), 451-471.

[11] Lynch IV, Thomas J. (2009) The Development and Application of a Multiple Opportunity Analysis Tool for Entrepreneurs. Retrieved from: http://www.wpi.edu/Pubs/E-project/Available/E-project-050509-091115/unrestricted/tjl-MQP-MOpA-Tool-D09.pdf

[12] Park, J. (2005), "Opportunity Recognition and Product Innovation In Entrepreneurial Hi-Tech Start-Ups: A new Perspective and Supporting Case Study" *Technovation,* 25, 739-752.

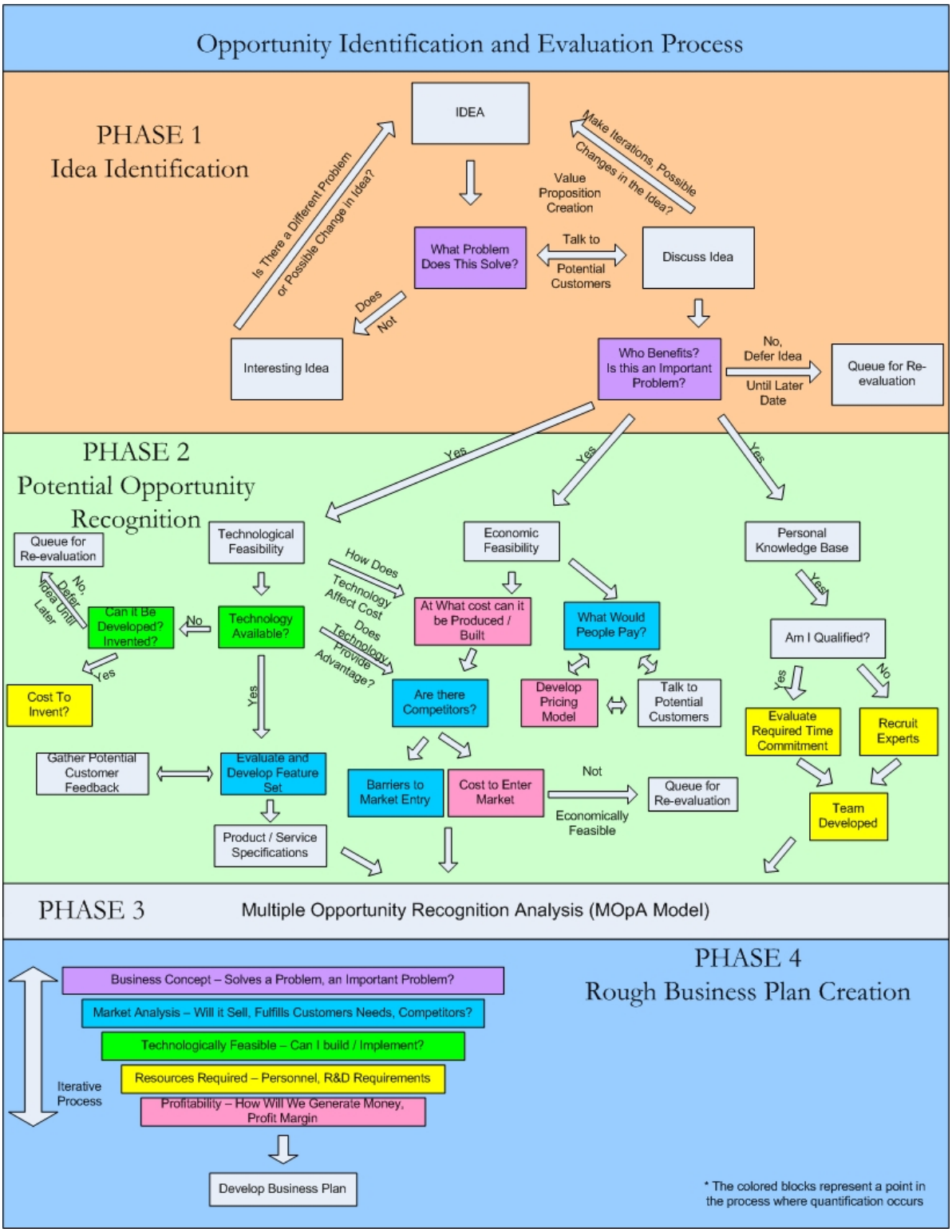
[13] Puhakka, V. (2007), "Effects of Opportunity Discovery Strategies of Entrepreneurs on Performance of New Ventures" *The Journal of Entrepreneurship*, 16(1), 20-51.

[14] Ronstadt, R., 1988. The Corridor Principle. J. Bus. Venturing 1 (3), 31 – 40.

[15] Saks, N. and Gaglio, C. (2002), "Can Opportunity Identification be Taught?" *Journal of Enterprising Culture,* 10 (4), 313-347.

[16] Timmons, J. and Spinelli, S. (2004). New Venture Creation Entrepreneurship for the 21st Century. New York: McGraw Hill/Irwin.

Appendix 1: The Model



Appendix 2: Heuristic Instrument

Market Analysis:

1. How would you rate the perceived customer value of this product or service?
A. Strong B. Average C. Weak

2. Can you identify a specific need or problem that your product or service solves?
A. Yes B. No

3. For whom is this an important problem?
A. Everyone in the World B. Only Potential Customers C. Not Very Important to Most People

4. Who are the potential customers?
A. Every Person B. The Average Person C. A Select Specific Group D. Very Few

5. What would the customers being willing to pay for this product or service?
(Use a range if unsure of exact amount) Enter Amount:

6. How large is the market for this product or service, in dollars?
A. 1 Billion or More B. 100 Million – 1 Billion C. 1 Million – 100 Million
D. 100 Thousand – 1 Million E. Less than 100 Thousand

7. What is the market's current direction?
A. Growing B. Stable C. Shrinking

8. What is the type of market for this opportunity?
A. Niche Market B. General Market C. Large Broad Market

9. What is your product's lifespan?
A. Multiple Years B. Months C. One-Time Use D. Not Applicable

10. Does your service allow for repeat business with the same customer?
A. Yes B. No C. Not Applicable

11. Is there an opportunity for a family of products or services around the initial concept?
A. Yes B. No

12. Are there currently any similar products or services available in this market?
A. Yes B. No

13. For potential customers, what is the alternative to using your product or service?
A. No Alternative B. Using Inferior Product or Service C. Similar Product

14. If there is an alternative, does your product or service have a distinct advantage?
A. Yes B. No C. Not Applicable

15. How long will the window of opportunity be open to capitalize on this product or service?
A. Multiple Years B. 6 Months – 1 Year C. 1 Month – 6 Months D. Days

Competitive Analysis:
16. Can you identify the competitive forces on your product or service?
A. Yes B. No

17. What size companies are the competitors? (Choose any that apply)
A. Large Established Companies B. Medium Sized Companies C. Small Companies
D. Other Start-ups E. Not Applicable

18. What type of competitive advantage does the competition have?
A. Large Advantage B. Medium Advantage C. Small Advantage D. Not Applicable

19. Do you have a strategy to overcome their competitive advantage?
A. Yes B. No C. Not Applicable

20. How hard is it to overcome their competitive advantage?
A. Hard B. Moderate C. Easy D. Not Applicable

21. How big is your competitive advantage?
A. Large B. Medium C. Small D. Not Applicable

22. What is your lead time to market over the competition, or potential competition, for your specific product or service?
A. Years B. 6-12 Months C. 1-6 Months D. None

23. Can you create competitive barriers?
A. Yes B. No

Technological Analysis:
24. Does this product or service involve the use of technology?
A. Yes B. No

25. Is the technology readily available to implement the product or service?
A. Yes B. No C. Not Applicable

26. How mature is the technology for the product or service? (Choose any that Apply)
A. Underdeveloped or Research Stage B. New and Emerging C. Stable
D. End of Life E. Not Applicable

27. Is there an intellectual property advantage?
A. Yes B. No

28. What is the source of the technology? (Choose any that Apply)
A. In-House Developed B. Licensed C. Outsourced D. Answers A, B, and C
E. Not Applicable

29. If developed in-house, is the technology patentable?
A. Yes B. No C. Not Applicable

30. What is the level of effort required to build a working prototype?
A. Large (500+ Hours) B. Medium (100+ Hours) C. Small (<100 Hours)

31. What is the estimated development investment required to reach prototype stage?
Enter Dollar Amount:

32. Can the technology be licensed to others?
A. Yes B. No C. Not Applicable

33. Can the technology be used in a totally different non-obvious market?
A. Yes B. No C. Not Applicable

Economic Analysis:
34. What is the estimated range of production cost per unit of product or service?
A. High Cost (>$1000) B. Medium Cost ($100 – $1000) C. Low Cost (<$100)

35. What is the exact per unit production cost?
Enter Dollar Amount:

36. How complicated is the business process for making money?
A. Complicated Process B. Average Process C. Simple Process

37. What is the revenue model? (Choose any that Apply)
A. One Time Use B. Service Revenue Only C. Reoccurring
D. One Time + Service Revenue E. Reoccurring + Service Revenue

38. Is there a potential for re-occurring revenue?
A. Yes, from physical products and services B. Yes, from services only
C. Yes, from physical products only D. No

39. What is the gross margin?
A. High Margin (>%75) B. Medium Margin (%50 - %75) C. Low Margin (<%50)

40. What is the first year revenue projection?
A. Above 10 Million B. 1 – 10 Million C. 100k – 1 Million D. Under 100k

41. What is the three year revenue projection?

A. Above 100 Million B. 50 – 100 Million C. 20 – 50 Million
D. 1 – 20 Million E. Under 1 Million

Sales and Marketing Analysis:

42. What is the business presence?
A. Brick and Mortar Store B. Brick and Mortar w/ Online Store
C. Online D. Warehouse and Distribution

43. How is the product or service sold? (Choose any that Apply)
A. Direct Sales B. Channel Sales C. Use of Sales Force in the Field D. Tele-Sales

44. What is the sales timeline, how long does it take to make a sale?
A. Long (Multi-Year) B. Medium (6 – 12 Months) C. Short (1 - 6 Months) D. Immediate

45. What is the estimated cost of marketing?
A. High Cost ($100,000 +) B. Medium Cost ($10k – $100k) C. Small Cost (Under $10K)

46. How many barriers to market entry exist?
A. Many Barriers B. 1-3 Barriers C. None

Capital Requirements:

47. How much investment is required in the first year?
A. Large Investment ($10+ Million) B. Average ($1 – $10 Million)
C. Small ($100,000 – $1 Million) D. Extremely Small (< $100,000)

48. How long will it take to become profitable?
A. 3+ Years B. 1 – 3 Years C. Less than a Year

49. What percentage of initial capital required is going to be used for sales and marketing?
Enter Percentage:

50. What percentage of initial capital required is going to be used for research and development?
Enter Percentage:

51. What percentage of initial capital required is going to be used for general business administration?
Enter Percentage:

Risks:

52. Does your product or service require regulatory compliance?
A. Yes B. No

53. Do you have a strategy to overcome the compliance risks?
A. Yes B. No C. Not Applicable

54. Is your product or service at the risk of “acts of god”?

A. Yes B. No

55. Do you have a strategy to mitigate risk factors substantially out of your control?
A. Yes B. No

56. Is there a risk of aging consumers?
A. Yes B. No

57. Do you have a strategy to address a shrinking market?
A. Yes B. No C. Not Applicable

58. Does your product or service depend on a highly volatile resource?
A. Yes B. No

59. Do you have a strategy to control costs?
A. Yes B. No

Exit Strategy:

60. What is the exit strategy of this business?
A. Sell Business B. License Business C. Run Business as Lifestyle Business

"NO LONGER THE SPARKLING NEW IDEA"

Anchoring university entrepreneurship programmes in academic, entrepreneurial and regional policy networks

Dr. Paul Benneworth* & Prof. Aard Groen[§]

* Center for Higher Education Policy Studies (CHEPS), University of Twente, the Netherlands. Corresponding author: p.benneworth@utwente.nl

[§] Dutch Centre for Knowledge Intensive Entrepreneurship (NIKOS), University of Twente, Netherlands.

ABSTRACT

This paper is concerned with what makes a good university entrepreneurship programme (UEP), in particular with which features are necessary to allow UEPs to thrive within university settings. The paper begins from the paradox that UEPs are part of university's extended development periphery, and always risk being eliminated because they do not deliver core university outputs, teaching and research. The paper seeks to understand under what conditions UEPs can thrive, using a case study of one UEP, the Temporary Entrepreneurs Scheme (the TOP programme) of the University of Twente in the Netherlands, which has recently celebrated its silver jubilee, and offers a good example of a UEP which has evolved to continue to meet stakeholder needs. The paper identifies three main stakeholder groups whose needs UEPs must meet, university management, regional economic policy makes, and enterprising entrepreneurs. The paper identifies how UEPs can respond to those three groups needs, and concludes by setting out the ways in which UEPs can meet those needs, providing the basis for a more nuanced understanding of what constitutes a good UEP.

"NO LONGER THE SPARKLING NEW IDEA"

High-technology networks as a second order development periphery for university entrepreneurship programmes

Dr. Paul Benneworth* & Prof. Aard Groen[§]

* Center for Higher Education Policy Studies (CHEPS), University of Twente, the Netherlands. Corresponding author: p.benneworth@utwente.nl

[§] Dutch Centre for Knowledge Intensive Entrepreneurship (NIKOS), University of Twente, Netherlands.

SUMMARY

Problem definition

This paper seeks to contribute to a debate in university entrepreneurship programmes about what constitutes a 'good' UEP. The paper argues that to date, the efficacy of UEPs has been judged purely on output by cohort and provision of entrepreneurship resources, rather than the long-term sustainability of the networks which the UEPs build up to allow firms to access those resources. The paper seeks to understand under what conditions might universities, which are institutions primarily concerned with teaching and research, might be willing to support UEPs and allow them to operate within their institutional boundaries. The paper seeks to contribute to understanding to what makes a good UEP, and lead to better-designed, longer lasting UEPs.

Theoretical framework

The paper uses a resource-based approach to entrepreneurship (Dubini, 1989, Johannisson, 1989) in which the determining factor for rates of entrepreneurship *ceteris paribus* is access to the necessary resources for entrepreneurship (finance, technology, human capital, managerial skills, premises). Resource access is conceptualised in terms of inter-personal networks and social capital which are exploited by potential entrepreneurs to access those resources given limited time frames to create new businesses. University entrepreneurship programmes are conceptualised as assisting entrepreneurs by developing skills and facilitating relationships which allow entrepreneurs to access those resources, rather than providing them directly to the firms. University entrepreneurship programmes are also conceptualised from a public administration perspective as forming part of universities' extended development peripheries, and requiring continually rebinding to the core university elements to ensure their survival.

Research questions

- What mechanisms and connections anchor a spin-off programme within the university?
- How can these mechanisms be conceptualised in terms of university organisational theory
- What are the policy implications for university entrepreneurial programmes?

Research Design

The research is based on a case study of a single UEP that has recently celebrated its 25 year existence, the Temporary Entrepreneurs Scheme (the TOP programme) of the University of Twente in the Netherlands. The case study involved an ongoing series of interviews with around 70 actors involved in the TOP programme either directly as starters, mentors and advisers, or indirectly, through its involvement in the wider regional mission of the University of Twente.

Empirical context

The case study explores key crisis moments in the evolution of the TOP programme, and traces how its survival was as dependent on meeting the political needs of university managers and regional policy-makers as it was on providing entrepreneurship resources for new starters. The paper identifies nine variables (three for each stakeholder group) which help to anchor the UEP within the university and ensure its longer term viability. These nine variables provide a means to revisit the way that effective UEPs are considered, and the aims of participants in developing new UEPs.

"NO LONGER THE SPARKLING NEW IDEA"

Building an effective and sustainable university entrepreneurship programme: the case of the University of Twente.

Dr. Paul Benneworth* & Prof. Aard Groen[§]

* Center for Higher Education Policy Studies (CHEPS), University of Twente, the Netherlands. Corresponding author: p.benneworth@utwente.nl

[§] Dutch Centre for Knowledge Intensive Entrepreneurship (NIKOS), University of Twente, Netherlands.

1. SPIN-OFF COMPANIES' INSTITUTIONAL ENVIRONMENTS

Innovation is increasingly recognised as a critical factor for economic success, driving productivity growth and increases in living standards (*cf.* Temple, 1998). There is increasing interest in the better understanding the mechanisms which bridge between the knowledge and resource inputs which make innovation possible, and the market and institutional factors which reward successful innovations (*cf.* Cooke, 2005). University spin-off companies have entered the canon along with cluster organisations, science parks, technology transfer offices and open innovation centres as one possible solution to exploit existing knowledge capital, and apply it in novel contexts creating wealth and driving economic growth (Massey *et al.*, 192; Jones-Evans *et al.*, 1999; Pirnay *et al.*, 2003; Chesborough, 2003; Benneworth & Henry, 2004).

This has been paralleled by a rash of research into spin-off companies, seeking to identify under what conditions high-technology businesses can thrive when emerging from universities, evaluating programmes promoting those spin-offs, and developing new ideal-type models for successful high-technology entrepreneurship (*inter alia* Dahlstrand & Jacobsson, 2003; Di Gregario & Shane, 2003; Benneworth & Charles, 2005; Yenken, 2005). Much emphasis has been placed on the evolving relationships between those spin-offs and their parent institutions, observing the development of clusters and networks around universities that create more munificent entrepreneurial environments for future spin-off activities (Rappert *et al.*, 1999; Dahlstrand, 1999; Wicksteed, 2000; Lawton Smith *et al.*, 2003; Elgen *et al.*, 2004; Benneworth, 2007; Zomer, 2010). There is likewise a huge amount of effort within universities to promote entrepreneurship and high-technology venturing activities, creating pathways to help new start-up companies better access resources for entrepreneurship (Potter, 2008).

At the same time, there is a disjuncture between the knowledge about USOs and the policy measures which exist to promote them. The European Commission in particular regularly produces best-practice briefs on regional development programmes, and university spin-off activities are frequently mentioned as something worth promoting. However, the shelf-life of these projects is typically very low, and they have real issues with long-term sustainability, even where they have meticulously followed the recipe for supporting high-technology entrepreneurship around universities. As Dahlstrand (2008) argues "there is as yet no common consensus on the critical ingredients of a well-functioning spin-offs policy" (p. 237), despite a good understanding of what elements a good programme should provide. To begin to identify some of these critical ingredients, this paper takes an alternative perspective, looking at what makes a spin-off programme valuable to a university and therefore likely to continue it.

Obviously one element of that value lies in its creation of spin-off companies, but spin-off creation is a highly politicised notion that creates other kinds of potential value for a university.

The research question we ask in this paper is therefore what are the factors that make a (successful) spin-off programme valuable to a university, and more likely to support its survival? To address this research question, we consider the institutional setting of university spin-off programmes. Clark (1998) placed university spin-off activities within what he called the 'extended development periphery', a set of activities at the edge of the university, which are sufficiently loosely coupled to the core university businesses of teaching and research to acquire their own momentum.

Our hypothesis in this paper is that this 'peripherality' offers both the aforementioned strength, in terms of allowing a parallel set of valorisation knowledges to develop, but also a fundamental weakness, in that the activities are never seen as core university business, and therefore in the long-term, always expendable. Building long-term sustainability therefore requires anchoring those peripheral activities more solidly within the university *without* undermining the flexibility of the peripherality. This is tested with reference to a long-term case study of the TOP programme of the University of Twente, which has recently celebrated its 25th anniversary, and provides a means to empirically explore this concept of institutional anchoring. The paper then concludes by reflecting on the three main research questions.

2. THE PERIPHERY PARADOX IN UNIVERSITY ENTREPRENEURSHIP

This paper is concerned with the long-term survival and evolution of university entrepreneurship programmes (UEPs), and critically an apparent failure of many programmes to thrive despite following the well-understood best-practice recipe for providing necessary entrepreneurship resources. We characterise this as an administration issue, that it is not enough for entrepreneurship programmes to be successful in terms of creating new businesses, but rather those programmes have to support the core missions of universities. Despite increasing emphasis placed on the supposed rise of a third mission of societal relevance and business engagement, universities' core funding remains dependent on two primary processes, teaching and research, and on managing their physical and staff bases. Even in the UK, which has introduced a dedicated third-stream funding mechanism total allocations under this rarely account for more than a few percent of overall income (HEFCE, 2010).

The issue for UEPs is that they are at best tangentially related to these core mechanisms and certainly do not provide enough in the way of income to justify university effort in this area (Potter, 2008). At the same time, Feldman & Desrochers (2003) demonstrate how even where universities seek to prevent spin-offs, universities cannot completely suppress this process. The reality is that universities retain a range of linkages back to their spin-off activities that influence the way that they regard these activities (*inter alia* Dahlstrand & Jacobsson, 2003; Di Gregario & Shane, 2003; Benneworth & Charles, 2005; Yenken, 2005; Zomer, 2010). So our argument is not that spin-offs do not contribute to these core university missions, rather that this contribution is not systematic enough for universities to be able to exploit it with certainty. This therefore makes universities unwilling to support entrepreneurship programmes except where there are external resources made available, and unwilling to continue extant programmes where that funding expires.

Clark (1998) argues that university entrepreneurship forms part of the extended development periphery of the entrepreneurial university. The extended development periphery provides a secure institutional space which allows activities to be encouraged and their benefits harvested in the field of entrepreneurship and business engagement. Peripherality provides an advantage in allowing a decoupling of those transferring knowledge from those generating it, and allowing knowledge to be created which does not have immediate scientific value. Clark's extended development periphery is a solution to the problem of encouraging non-core university activities, giving the universities the certainty that they are not wasting resources on non-core missions, but allowing those that wish to behave entrepreneurially the opportunity to exploit their ideas commercially.

The weakness of this arrangement is that the decoupling process necessary to allow entrepreneurship activities freedom to innovate also runs the risk of detaching the business development office from the university. We argue that the problem of projectisation of entrepreneurship reflects this peripherality – universities naturally support projects as long as there is no direct cost to the institution, but once direct costs accrue, universities no longer provide that support. Therefore universities do not drive entrepreneurship support activities, but react to subsidy opportunities, with the result that there are relatively few long-term spin-off programmes, despite a range of evidence that the interpersonal networks that build up around spin-offs and programmes are a critical part of the resources which programmes provide to potential entrepreneurs (e.g. Cooke, 2007).

Rather than consider spin-off policies and programmes as objective activities seeking to provide resources to allow spin-offs to form, we therefore look at how spin-off programmes fit with the logics of university organisations. Drawing on higher education institutional management literatures, we firstly note the increasing managerialism in higher education in recent years, with increasing marketisation, payment by results and a shift from collegial institutional to top-down managerial forms of decision-making in universities (Slaughter and Leslie 1997, 2001; Barnett, 2003; Bridgman and Wilmott 2007). The issue for universities can be reframed not as whether particular entrepreneurship programmes are better or worse at creating spin-off numbers, but rather how far they help university managers to achieve their particular goals.

This paper therefore seeks to shed some light on the conditions under which spin-off programmes can align themselves with institutional managers' goals, without at the same time undermining the flexibility which peripherality brings, to allow individuals to exploit knowledge in non-academic ways to create valuable new businesses. This raises the question of how can peripheral activities such as spin-off programmes, which create indirect benefits for universities, become anchored within universities, despite not directly contributing to universities' immediate targets. To address this issue, we pose three main research questions:-

- What mechanisms and connections anchor a spin-off programme within the university?
- How can these mechanisms be conceptualised in terms of university organisational theory
- What are the policy implications for university entrepreneurial programmes?

3. METHODOLOGY

To answer these research questions, this paper draws on a long-term case study developed at the University of Twente since 2004, using open interviews undertaken in four waves. The first wave took place in the summer of 2004, and encompassed around thirty actors involved in spin-off activity around the university, including senior university managers, representatives of regional support organisations, spin-off entrepreneurs themselves as well as other companies working with UT. Subsequent waves of interviews were more focused on addressing questions which were not adequately answered in the first round of interviews, as well as keeping the case study of the programme up-to-date. A snowball methodology was used throughout the development of the case study, undertaking repeat interviews and new interviews to address the questions which were raised in the course of the study.

Alongside this primary research, an analysis of local, regional and national economic development strategies, policies and legislation was conducted to explore how successful UT were in persuading others of the value of the TOP process, alongside the extent to which these external supporters provided moral, financial, institutional and other kinds of support. Beyond that, a range of published material about the University of Twente itself, including anniversary books commissioned by UT itself and the reports of the university newspaper, *UT Nieuws*, have been used to prepare the case study. A full list of the secondary material used in this case study is presented in Benneworth & Hospers (2007). The case study itself finishes in 2006, with TOP securing its future by acquiring SKE funding (*qv*). Although there have been other significant developments since then, we do not consider these in a belief that those events are too recent to reasonably interpret, which will in part be a judgement made on the basis of future consequences which are not yet evident.

This paper is rooted in critical realist methodologies which accept that whilst perfect knowledge of a situation is never possible, it is nevertheless possible to develop imperfect understandings which can be used to answer questions posed (Yin, 1994). Moreover, by seeking out regularities and similarities between situations, it is possible to produced 'stylised facts' which are imperfect abstractions but which nevertheless convey sufficient essence of the situation to allow their logical conjunction. This allows larger structural narrative representations of situations to be produced, which can then be interpreted within the developed theoretical framework. In this paper, particular care has been taken in developing the stylised facts and structural narrative to avoid over-imposing authorial structure. The three critical moments in the life of TOP have been chosen on the basis on the balance of both what interviewees reported as well as what seemed reasonable in terms of their arguments and what was known about the situation at that time.

4. THE UNIVERSITY OF TWENTE AS AN ENTREPRENEURIAL INSTITUTION

This paper uses the University of Twente (UT) case because since 1984, UT has developed and promoted an entrepreneurship promotion programme which has been acknowledged as successful both in its own terms but also in securing the longer-term survival and development of the university. UT is located in Twente, in the east of the Netherlands; the region of Twente was relatively remote from the Netherlands' main economic centres and Twente's industrialisation did not begin until the formation of the Kingdom of the Netherlands in 1830 (Brouwer, 2005). In the wake of WWII, Twente's textiles industry faced the full brunt of international competition

from low-wage cost producers, and began a long-term sectoral decline from which it never recovered.

In 1951, a Foundation formed led by the largest textiles firm's CEO (Ten Cate) to lobby national government for a regional university to help them adapt to the demands of post-war markets, whilst the Twente textiles industry went into decline, steadily shedding around 1,200 jobs a year (from a 1950 level of 80,000). By 1957, the Dutch government decided to create a third technical university, in 1961 in the city of Enschede. The *Technische Hogeschool Twente* (THT) opened its doors in September 1964 with a clear mission to revitalise the ailing textiles industry and reverse the region's general economic stagnation.

Creating THT failed to address textiles' deep-seated structural problems, which continued its steady decline (Van Lambooy, 1995), whilst failing to recruit a sustainable level of students for its innovative course. In 1977, a parliamentary question asked whether THT's government grant would not better be spent on other more successful universities, and so THT began a decade of reinvention to avoid its closure, creating a more visible profile for its education, and improving its contribution to regional industry. A transfer office was created in 1978 to help businesses seeking advice of information from their professors. In 1984, THT launched the Temporary Entrepreneurs' Position (TOP, *qv*) funding, mentoring and supporting graduates to develop a business idea. The programme exists today and continues to result in around 20 new companies a year, as part of a wider portfolio of programmes exploiting university IP.

4.1 TOP and UT: the entrepreneurial university

The conventional story told of TOP is as an entrepreneurship programme providing key resources to potential entrepreneurs interested in establishing a high technology business linked to a UT research group (*cf.* Van der Sijde *et al.*, 2002a, 2002b). Its origins lay in one particular professor's interests in commercialisation. Harry van den Kroonenberg was active in energy research and noted in the late 1970s that a number of his masters' students had formed businesses after graduation using ideas developed through their masters' research. Van den Kroonenberg became UTs' Rector Magnificus in 1979, but remained fascinated in these graduate businesses, recognising that they could contribute to strengthening UT's regional economic contribution and media/ government profile.

In the early 1980s, the then-president of the university saw a story in the regional newspaper, concerning a new business consultancy (Van der Meer and Van Tilburg or VVT), realising that consultancies had a potentially greater regional contribution than manufacturing businesses, because they were selling university knowledge about business to their clients, and directed these consultants to Van den Kroonenberg, who subsequently commissioned VVT to study UT's graduate businesses. This study which caught the Ministry of Economic Affairs's attention, and they commissioned two further national level spin-off studies of universities and public laboratories respectively from VVT.

These two studies identified the support pillars necessary to support university entrepreneurship, namely a single university contact point for entrepreneurs, funds for writing a business plan, mentoring for the new entrepreneur, a meaningful link with a research group and university-level business training. MinEZ funded all 14 Dutch universities to establish experimental spin-off programmes; UT used the funds as a personal loan to the entrepreneurs, with repayments

creating a revolving fund. Since its inception in 1984, TOP has produced around 15 companies per year (see table 1 below).

Table 1 The rate of formation of TOP companies by Rector Magnificus 1984-Apr 2008

Rector Magnificus	Duration of term	TOP companies per year
W. Draaijer	1984-85	9.5
Harry van den Kroonenburg (II)	1986-88	17.7
Jos de Smit	1989-1992	14.7
Theo Popma	1992-96	18.2
Frans van Vught	1996-2004	16.6
Henk Zijm	2005-	13.9**

Source: authors' own calculations

TOP provides the other elements of the support pillars as well as the funds, with applicants proposing to establish a new company to work with a university professor: that proposal is evaluated by a committee. Approved proposals are entitled to a loan (currently €20,000) guaranteed by the entrepreneur to fund their first year in business, to develop a business plan for their idea, prove the concept, and begin generating revenue phase. The scheme provides physical space (within the research group), a business mentor (often a former TOP alumnus) and formal business training through UT's Business faculty.

5. THE SHIFTING SANDS OF TOP

The story of TOP given above has been widely published and disseminated, and its apparent simplicity has led to many unsuccessful attempts to copy the programme; indeed, of the 14 Dutch universities who received spin-out funding, all but UT abandoned the idea after exhausting those funds. In the intervening quarter-century, a number of institutions have created and abandoned other spin-off promotion activities. Despite celebrating its silver jubilee in 2009, TOP has faced a number of serious challenges to its survival; responding to those challenges has forced changes to TOP better. Those challenges, UT's responses, and the evolving TOP programme allow better understanding what constitutes a 'good' entrepreneurship promotion programme from a (university institutional perspective.

TOP was created at a time of general academic hostility to university commercialisation, but its early demonstrable success convinced many of its wider potential applications. Part of its success has been this allure promising greater future returns, and there has been a continual tension between extending the concept in some manner, and ensuring that the programme continues to deliver a steady stream of companies. These tensions have become particularly acute at three moments in the life of the programme, and in the following section, we set out how those problems emerged, how they were resolved, and the impacts that this had on the nature of TOP:-

- The end of the Ministry of Trade & Industry subsidy
- Cost-cutting, internationalisation & the *Transferpunt* crisis
- The end of ERDF subsidies and a recalcitrant Province

5.1 The end of the MinTI subsidy

The first crisis that the programme faced was the exhaustion of the initial subsidy provided to run the programme. In 1984, the Dutch government made a five year, *f.*2.5m grant to all universities to establish Industrial Liaison Offices (ILO) and promote spin-off activity[1]. UT began by providing one year grants of *f.*36,000 (€18,000) to the entrepreneurs, but the MinTI funding reduced by 20% each year, so the fund rapidly exhausted. UT switched from a grant to a loan, with loan repayments going back to the university, providing TOP with financial stability. There were 74 companies formed in these five years (one below target) and the establishment of the revolving fund meant that there were resources available to invest in the next wave of companies. The ILO manager bid for follow-up European Social Fund subsidies to top-up this revolving fund[2], and its financial as well as project success made its continuation relatively straightforward.

It could be argued that the decision to develop the revolving fund was the reason that the project outlived the grant period. When the government grant expired, all 14 Dutch universities considered whether subsidising graduate entrepreneurship was a sensible use of their core grant; 13 universities, with the exception of UT, decided to close their technology transfer offices. This was underlined by a national decision not to renew the grants to universities, following a very poor programme final evaluation. Following that evaluation, the government instead opted to create a national network of small firm innovation brokers (Syntens) to help firms access university knowledge.

That argument obscures the programme overhead and running costs, considerable sum in the context of an annual *f.* 500,000 grant. Each programme pillar incurred costs, including Transfer Office staff, the entrepreneurs' laboratory bench fees and administrative services, and educational costs. Whilst the other universities had to create their office from scratch, UT's *Transferpunt* had already been operational for five years on a very limited budget, building close links to the professors and developing a database of regional companies interested in innovation. The extra MinTI funds for an ILO and hence TOP consolidated existing infrastructure, whilst other universities were both trying to build new infrastructure and deliver commercialisation services from the single grant.

The overhead was a consequence of the commitment of university senior managers to TOP, who positively decide to retain the *Transferpunt* and TOP when the MinTI funds expired in 1987. By this point, Van den Kroonenberg had retired as Rector but in 1985, a new board member assumed the responsibility for engagement activity, and believed TOP to be attractive device for policy-makers which could help win other funding streams which would both serve UT's regional mission. Schutte was highly supportive of the *Transferpunt* and helped to ensure that the ILO and TOP survived, whilst the university as a whole never made a financial loss in this period.

5.2 Cost cutting and the end of Transferpunt

Although the Board were supportive of the activities, they were also insistant that UT was not willing to subsidise the *Transferpunt* in the long term. TOP offered a means to win further subsidies cover *Transferpunt*'s fixed cost base. As an extended development periphery *pur sang*, *Transferpunt* was extremely vulnerable position, as not all professors accepted the validity of commercialisation. Budget pressures in the early 1990s forced managers and the board to

closely scrutinise *Transferpunt* costs, and in particular to eliminate costs which were not directly contributing to core university missions. At this time, the university was forced to react to a government commitment to concentrate funding on excellent institutions, and the board of 1992 expended much energy in developing an institutional response to this challenge.

At this time, TOP's success was becoming internationally acknowledged, with Van der Meer & Van Tilburg undertaking an increasing amount of paid consultancy to transfer the model into other situations. At the same time, the *Transferpunt* were being pressured to generate income[3], and consultancy filled this financial hole. The *Transferpunt* became involved in a number of entrepreneurship promotion projects where novice entrepreneurs could establish new businesses. In some cases, these were university activities in other regions, with *Transferpunt* staff provided a training service. However, they also became involved in projects in other subsidised settings, including former Dutch colonies.

The *Transferpunt* increased in size, and a new director was recruited to manage this process. Pressure to generate income saw *Transferpunt*'s focus shift towards developing subsidy proposals, whilst TOP represented a drain on *Transferpunt*. Firstly, a number of university professors questioned the appropriateness of the *Transferpunt* (a service organisation) undertaking quasi-research activity in contexts far removed from their primary role of supporting UT's commercialisation activities. Secondly, a substantial deficit emerged in *Transferpunt*'s accounts, and it was rolled into Liaison Group, responsible for all UT's external relationships, from recruiting international students to the University Press[4]. Thirdly, the TOP Spin International (TSI) Foundation was formed in 1995 to take over activities more peripheral to university interests, such as the colonial entrepreneurship activities, involving VVT. This brought TOP back to its basics and removed its from its reliance on internal university subsidies whilst retaining the networks and expertise of the original TOP staff.

5.3 The gap in the subsidies (2002-06)

In 2001, the university decided to disband the Liaison Group with TOP activities merging with a Professorial Group to form the NIKOS research group, and as shown above, the flow of companies into the scheme continued unabated at around 16 annually. At this time two new university managers assumed their post, both supportive of TOP, because of its external profile, and the potential to use TOP to persuade external partners to invest in the university to help it improve its commercialisation outcomes. This external value was very important for ensuring TOP's survival of TOP during the third crisis, in 2002 when the European subsidies underwriting TOP expired. The university board agreed to fund the programme from internal funds, but the past experience of the TOP managers suggested to them that this funding source was not sustainable in the long-term. The programme economised to reduce its costs: in the shift from the guilder to the euro, the loan was cut from *f.* 3000 per month to €1000, whilst participants were charged €2500 from their loan to cover the research group premium.

At the same time, the Provincial Government became very interested in innovation policy, specifically responding to a national decision to focus regional development funds upon investment in innovation excellence. The 2003 Provincial Coalition accord set aside €5m to develop a provincial innovation strategy. The Province was already aware of TOP, and realised that TOP could fulfil this rubric of "innovation excellence". The Province were therefore very keen for TOP to continue; over the course of 2003-04, a number of civil servants wrote TOP into a number of key regional strategies for Twente.

TOP also came to the attention of national policy-makers developing the national economic development strategy *Pieken in de delta* ('High points in a low country'). TOP and the Business and Science Park in Enschede were named as a science part of strategic national significance, a model on which two other strategic science parks would be based, to exploit Leiden's medical school and Delft's engineering strengths in the university and the TNO headquarters[5]. *Pieken*'s vision for the east of the Netherlands was 'making use of knowledge concentrations', clearly referring to TOP as a vital means of achieving this.

University managers quickly realised that TOP provided a useful lever for accessing external resources, underlining that TOP was also a means of winning more resources for the university if a way could be found to increase the scale of the TOP activity. Central management support provided time to identify new subsidies to maintain the programme. The *Stimulering van Kennis Exploitatie* (SKE) *regeling* (Stimulating knowledge exploitation rule) provided funds to the university to help high technology starter funds after 2006. SKE required a set of programme changes, with independent service providers (accountants and banks) in the evaluating commissions, and helping the new firms to establish their financial systems. The size of the loan was increased €20,000 over the TOP year, with the charge for using university premises replaced with SKE providing a contribution to UT for running TOP.

6 INSTITUTION CRISIS MANAGEMENT STRATEGIES

Over the course of its life TOP experienced a number of critical turning points, and in reacting to these pressures, there were a series of changes to the programme which did not represent efforts to improve the way that resources are provided to entrepreneurs. These changes have instead been an attempt to ensure the survival of the project within the institutional setting of the university. In response to a set of **external** pressures (viewed from TOP's perspective), withdrawal of subsidies, a shift in university interests, and competing demands on university resources, the emphasis has been on survival. These pressures are both external to and derived elsewhere within the university. At the same time, there has been an **internal** evolution of the programme, as those involved with TOP have developed their own knowledge, and expressed that knowledge academically, about the business of spin-off creation.

The internal evolution has been well-documented elsewhere, but what is notable is that at least part of the evolution has been externally driven. Because the programme remains a subsidy activity, the development of new models has relied on finding new sponsors willing to experiment with new approaches, for example Rabobank for *Kansrijk Eigen Baas* and the Province for VentureLab[6]. This reflects the simple requirement for the TOP programme to acquire its own to ensure its own survival. But looking at the story at each of the three crisis moments, there has not been a simple iterative interplay that TOP has evolved to meet the needs of external sponsors, it has also evolved ensuring that it remained a university activity, which has driven a set of changes which are again not directed to improving the provision of entrepreneurship resources (except in the broadest sense of ensuring the project's survival).

One example of this being its anchoring within a professorial research group in 2001, to create a hybrid group, and from that moment, changing the TOP character from being a pure entrepreneurship promotion programme to also being a laboratory for entrepreneurship research. From the preceding narrative, we identify that the TOP programme has adopted three 'anchoring' strategies to ensure its retention within the institution of the university, and at the

same time these strategies have also changed the nature of the programme without regard for the provision of entrepreneurship resources. The three anchoring strategies are:-

- Staying light-touch, closely focused on promoting university entrepreneurship,
- Ensuring the programme was accepted as central to university missions, and
- Building wider political support for the activity, ensuring that others within the university appreciate the value of the continuation of the project.

6.1 Retaining a close focus on the main task of promoting entrepreneurship

The first anchoring strategy, which is necessary but not sufficient for the programme's survival, has been to be successful in terms of supporting entrepreneurship in Twente, whilst at the same time being unobtrusive, as one interviewee described it "as lean and mean as possible" with as few people involved as possible to reduce the visibility of its cost to the university. This anchored the programme within a **wider entrepreneurial system space**, from which, as we show in Table 1 above, around 15 to 20 companies emerged annually. From the outside, that might appear as a well-functioning process, but it can also be considered as an entrepreneurial ecology, where entrepreneurs sought a range of resources necessary to create new high-technology start-ups.

We would highlight a number of different elements to this entrepreneurship system anchored around the TOP. Firstly are the consultants involved with the TOP programme although not formally employed by the university who provide the dynamism in the system. The second is the role of former TOP alumni in providing mentoring, finance, material and moral support for the development of the programme. Thirdly are a number of networks that emerged around the TOP programme, such as the Twente Technology Circle (TKT), originally created to help small firms sell to large businesses but which now has a small firm networking role. Fourthly is the increasing availability of informal, angel and venture finance provided by serial regional entrepreneurs known to the key TOP consultants and animateurs.

This entrepreneurship system could be conceptualised as part of the university's extended development periphery. However, so many of the activities were at such a remove from the university itself, and indeed not within university control, but negotiated by inter-personal contacts from those involved in the programme, that the extended development periphery idea seems inapplicable. One way to think of this might be as a 'second order' development periphery, connected to the university's extended development periphery, but anchoring a much wider regional entrepreneurship system to the university. This second order anchoring meant that those individuals in the system do not have to be university employees, which reduces the problem of trying to find ways to engage staff who do not have competencies which fall within traditional university job descriptions. At the same time, those individuals within the university system do have to fit, making the success of the system at least in part dependent between how core and peripheral TOP staff are able to negotiate their contacts and relations.

6.2 Remaining central to core university missions

Although the three crises were very different in nature, each reflected the complexity and fluidity of the environment within which universities operate (*cf.* Slaughter & Leslie, 1997; 2001). At each point, the TOP team faced a tension between developing something 'innovative' as an

iteration of existing activities, and consolidating those existing activities. Central to this conundrum was the fact that in these cases, the innovations were not demand-led in the sense of improving the accessibility of resources to entrepreneurs. One interviewee noted the pressure that this created, to innovate in terms of the programme in a way that distracted from the business of entrepreneurship.

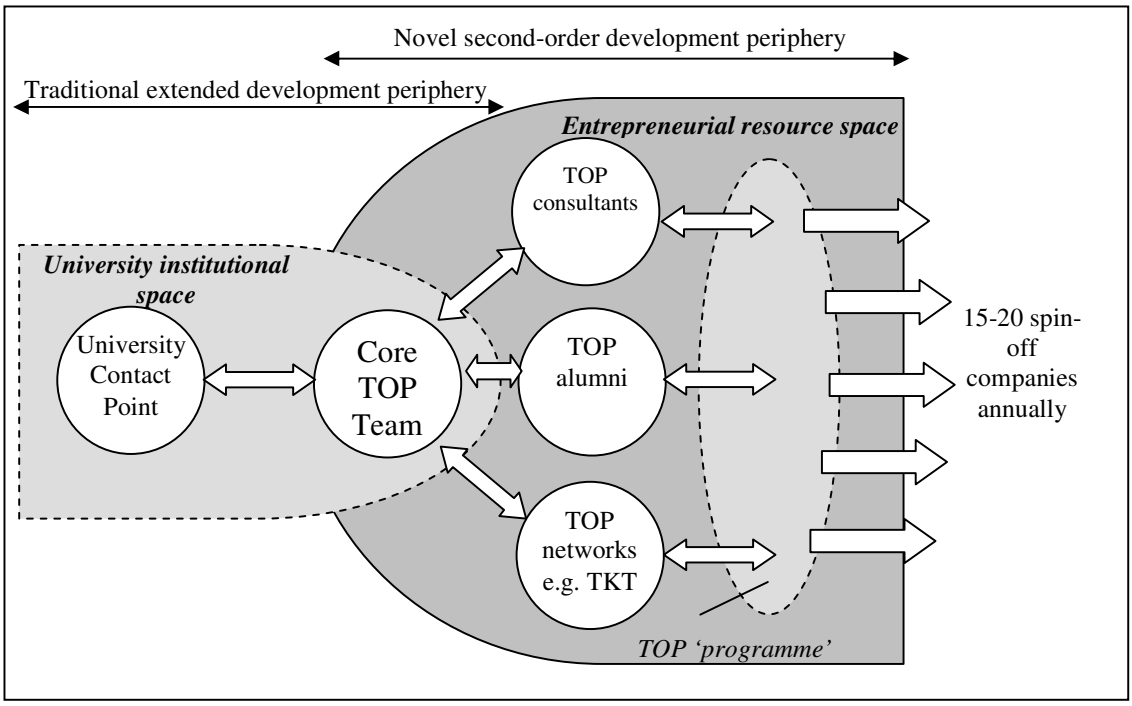
> "It is always the case with new activities in the long run, that people become accustomed to them, they see that there is nothing new. It is always a difficulty with innovation and entrepreneurship programmes, you are tied into the same system, and that's no longer the sparkling new idea. The only solution is that you always should support new young entrepreneurs."

A core strategy explicitly pursued by the TOP team was to ensure that TOP contributed to what was important to the university at each moment, *viz*. underwriting the regional mission in the 1980s, helping to win subsidy programmes in the 1990s and forming part of a wider bid for public support in the 2000s. Part of this has been directly contributing to the primary purpose of the university, creating linkages to companies to facilitate placements in business administration programmes, involving alumni in teaching activities and as users for applied research proposals. However, and arguably more important, was that TOP retained (or reinvented) its position as something that university senior managers talked about in describing the university to third parties, as proof of the university's entrepreneurial character.

TOP can be considered as a gateway to a set of external resources beyond the university but which are still of value to the university. These are depicted in Figure 1 below: a stylised reading of this could be that there is a TOP institutional space quite separate from the university institutional space. In order for the university to be able to claim the outputs from the TOP institutional space (which became important in terms of meeting the demands of external stakeholders upon the university), the university developed an interface from its core institutional structure to the TOP programme. In the 1980s, this was via *Transferpunt*, which was seen as being a key element of delivering its regional mission and ensuring its survival, in the 1990s, it was associated with internationalisation, and in the 2000s, with research excellence. This anchored TOP in the **academic institutional space of UT**, ensuring permission for its continued existence.

We bring the first two anchoring processes together in figure 1 below, which show how the TOP institutional space functions as a second-order development periphery to the university. The Core TOP team is loosely coupled to the university contact point, *Transferpunt*, Liaison Group or NIKOS, and in turn, the TOP team are loosely coupled to a set of actors in this wider entrepreneurship system. This wider entrepreneurship system in turn provides the main business resources necessary for new firm formation, with individuals having contacts with the main university research groups entering the TOP programme and emerging as new high-technology small firms.

Figure 1 The entrepreneurship programme as gateway to wider entrepreneurship system



6.3 Building wider sustainable political support for the activity

The third final anchoring strategy has been the development of wider political support for the entrepreneurship programme to support it during moments of crisis. TOP was supported internally for much of its history, as outlined above, as TOP activities fitted with the evolving university goals. The strategy involved trying persuading external partners to become champions of TOP. This was pursued by generating publicity in the early days through media appearances, more recently by publishing reports and documents, winning subsidy projects and finally most recently, developing larger visions for promoting entrepreneurship in the poor entrepreneurship environment of the east of the Netherlands. This anchored TOP in the **economic development policy space** of the east of the Netherlands, and made it a feature of those policy networks allocating resources to activities, ensuring its continued subsidy support.

The anchoring that this provided was to reduce the impact of external pressures on the university to divest themselves of the TOP activities. The university had a number of substantial financial crises in the period under examination necessitating reductions in expenditure. The fact that the TOP programme was externally supported encouraged the university senior managers to continue the programme of activity (this process is documented to a greater extent in Benneworth & Hospers, 2007). This in turn meant that the TOP programme had to be responsive to the needs and demands of a set of external stakeholders, in return for their support, which also supported the sustainability of the TOP programme within the university.

It is important not to portray this as the TOP and external organisations having worked together against the interests of the university. Rather, what happened was that a number of third parties – notably the Province and the Ministry of Economic Affairs – wanted UT to increase its overall

economic output and impact for the region. The university and these external bodies were able to agree that the TOP programme was an important mechanism for delivering this economic impact, and therefore this reinforced the anchoring of the programme within the university as a whole. As part of this process, and after the events described in this paper, the university's new estate development process, the so-called *Kennispark*, was described in a Ministry of Economic Affairs expert report as one of the three most important science parks and knowledge exchange areas in the Netherlands (BCI, 2010).

7 ANCHORING SPIN-OFF PROGRAMMES IN COMPLEMENTARY COMMUNITIES

These three anchoring processes provide an alternative means of conceptualising positive qualities of UEPs, not only in terms of the access they provide to entrepreneurship resources, but how they anchor the programme within key networks. One way to represent the previous discussion is to regard the entrepreneurship programme as being a point of anchoring between three separate spaces, the academic institutional space, the regional entrepreneurship space, and the economic development policy space. It appears from this case study that good entrepreneurship programmes fit effectively within those spaces and thereby ensure their own survival and the continuation of the access to entrepreneurship resources which they provide.

The way the programme is anchored in each of these three separate spaces is shown in figure 2 below. In figure 2, we distinguish two key elements of the entrepreneurship programme team, there are those who are more academic facing, and there are those that are more oriented towards entrepreneurship. The way those two elements hang together as a single unit appears to be a critical success factor in allowing the entrepreneurship programme to fit into these different spaces, each of which having their own particular requirements and logics.

The university institutional space has a **logic of survival**, not producing a deficit, and producing sufficient outputs to secure the resources necessary for its survival. The entrepreneurship resource space has a **logic of growth**, putting entrepreneurs into contact with resources to create new businesses which potentially produce profits for those involved. The economic policy space has a **logic of visible success**, spending taxpayers' money in ways that are accountable but also create successes for politicians seeking re-election and to inspire new political ideas.

Each of the two groupings of the entrepreneurship programme are involved in different ways with the two different spaces. The main grouping active in the university institutional space is necessarily the academic side of the entrepreneurship group, in this case because they are the only ones either formally represented or who are able to contribute to core university goals, in terms of producing publications and delivering teaching. Likewise, it is mainly the entrepreneurship facing elements who are active in the entrepreneurial resource space, helping to create linkages between entrepreneurs and those with the resources entrepreneurs need to create and grow their high technology businesses. Both groupings are involved in the economic policy space, because on the one hand, the university is a significant actor in its own right in this space, and on the other, because economic policy-makers are ultimately concerned about improving access to innovation resources. The involvement of the different actors within the programme, and the different anchoring processes, are summarised in table 2 below.

Figure 2 TOP 'loose coupling' three elements of Twente's high-technology system

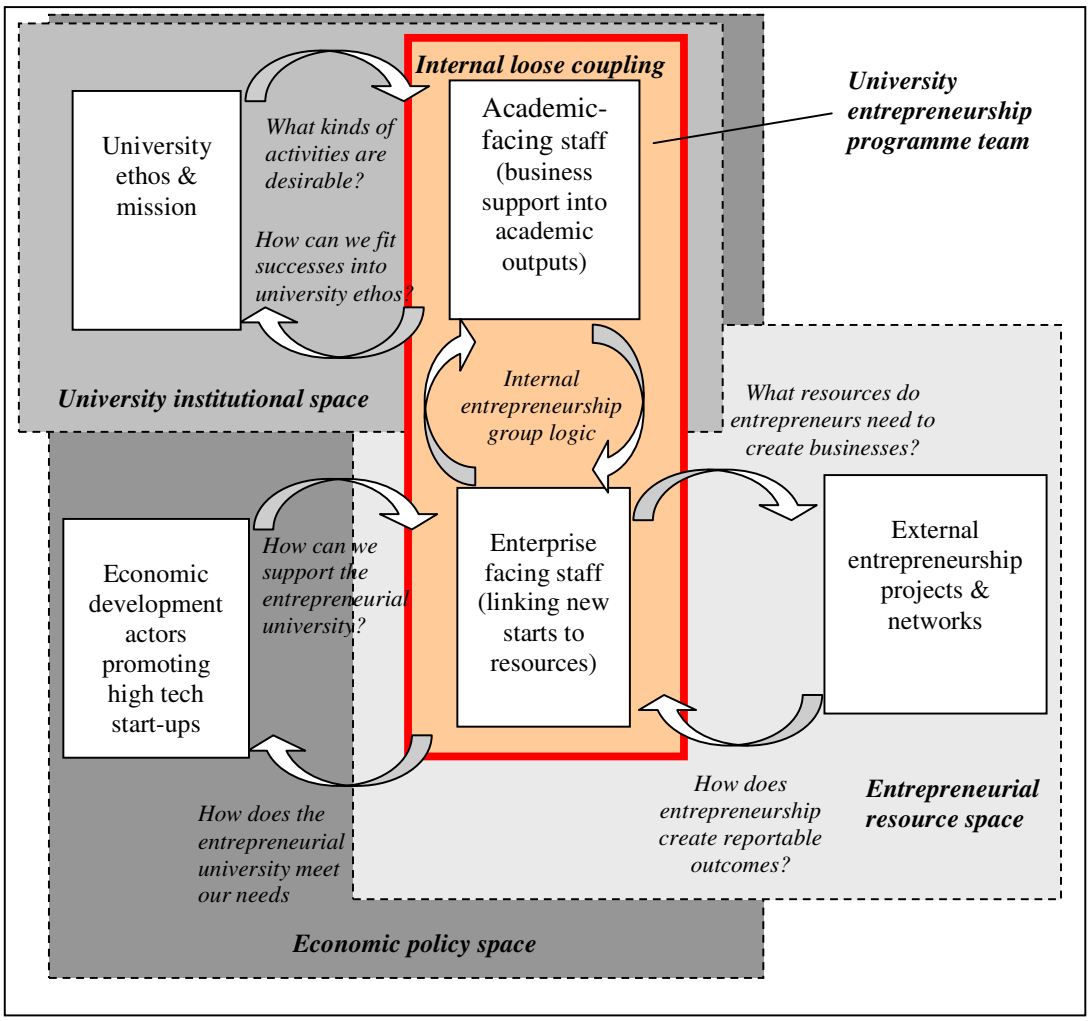


Table 2 Anchoring processes for the Twente entrepreneurship programme

[Table 2 goes about here]

8 CONCLUDING DISCUSSION

This paper has sought to respond to Dahlstrand's call for a better theoretical and empirical understanding of what constitutes good spin-off programmes, and trying to understand this not just in terms of making resources for innovation and entrepreneurship available to would-be entrepreneurs, but also allowing the networks by which those resources are made accessible to endure by anchoring them around the university. In this case study, we explored one entrepreneurship programme, the TOP programme, and explored how it has evolved over the quarter century of its life. What is clear is that that evolutionary process was as much driven by the need to configure the programme to a range of stakeholder interests. High-technology small firms are only a comparatively small component of those stakeholders whose interests must be balanced, although it is not clear from the research if this was a result of the programme's

success meaning that their needs were already well met, and they felt no need to vocally articulate their interests in the programme.

In this paper, we identified that there were three key stakeholder groups whose interests were material in the negotiations and developments by which the entrepreneurship programme was anchored in the university.

- High-technology small firms seeking to form around the university, and it is assumed they were reasonably satisfied given the comparative overall success of the programme.
- University senior managers, a small group evolving over time, who needed to be convinced, both negatively, that the programme was not a cost to the university, but also positively could deliver extra resources for the university.
- Regional economic development policy community in the east of the Netherlands, Overijssel and the Twente region, whose interest was in supporting proposals which harnessed high-technology entrepreneurship around the University of Twente to improve these regions' competitive performance.

In table 3, we summarise for each of those three spaces within which the entrepreneurship programme was articulated the logic governing success in that space, the positive programme qualities which supported program continuity, and the key actors within the programme responsible for delivering those stakeholder benefits.

Table 3 Positive programme qualities for anchoring UEPs

	Academic university space	**Entrepreneurial resource space**	**Regional economic development space**
Logic	Survival of university	Growth of businesses	Successful policies
Key actors	Academic facing	Enterprise facing	Both academic and enterprise facing
Positive programme qualities	Tying internal experts to the university centrally Diversification and winning new opportunities Generating good news stories for university/ TOP	Emphasising match-making and signposting Proposing stream of new support activities Working with existing entrepreneurs on new project ideas	Creating visible projects and outcomes, supporting new science parks Applying methodology in new settings; *Kansrijk Eigen Baas*, Venturelab

Part of the anchoring comes through the partitioning of the extended development periphery into two elements, internal and external to the university, with the TOP programme having elements on either side of that internal/ external divide. This second-order development periphery, the regional entrepreneurship system, helping entrepreneurs access firm formation resources, is of no interest to the university, but indeed to regional entrepreneurs and policy-makers, and therefore of a second-order interest to the university, providing that the academic facing elements of the programme can be successfully maintained within the university.

This is a case study of a single, and arguably exceptional, example of a UEP in terms of its longevity, volume of outputs, and returns to investment by policy-makers. Caution must therefore be exercised in seeking to draw more general conclusions about the anchoring of UEPs within their university settings to guarantee their long term survival. However, the case of the TOP programme demonstrates how what determines the success of an entrepreneurship programme is not exclusively restricted to how successfully the programme provides entrepreneurs with access to innovation resources. It is also dependent on how effectively the programme can anchor itself within the university, and also the extent to which the programme is valued by other external actors. This case study suggests that more research is needed into the relationships between UEPs as organisations and their host institutions.

There are also some interesting policy implications for those seeking to support start-up and spin-off programmes, which is that more thought needs to be given to the wider political context within which those programmes are being created. This implies that the most successful start-up and spin-off programmes will be those that are constructed to clearly meet the needs of a range of stakeholder groups. But stakeholder interests evolve over time, and a second important element of this case study is the need for flexibility by those programmes, to allow them to evolve in response to changing stakeholders' needs. The third element is the importance of the people that negotiate and mediate those networks; for both academic and enterprise facing programme staff, there is a need to have the ability to deal with multiple communities. For academics, the university and policy-makers, and for enterprise facing staff, policy-makers and entrepreneurs. Good entrepreneurship support programmes should therefore have the personnel and personnel systems to retain staff that work well with different communities and with one another, to provide the loose-coupling necessary to ensure the entrepreneurship programme retains its privileged place amongst the various interest groups.

This paper has sought to respond to Dahlstrand's call for a better theoretical and empirical understanding of what constitutes good spin-off programmes, rather than what high-technology small businesses need from those programmes. This paper has emphasised the importance of ensuring that there is a positive institutional setting for those programmes, allowing the networks which provide access to those resources to build up, and the programmes to maximise their potential. This implies that more research is needed to understand different kinds of institutional settings for UEPs, to develop institutional typologies and identify which kinds of entrepreneurship programmes work best within which kinds of institutional settings. This will allow a more nuanced tailoring of programmes to what will work best within particular contexts, and hopefully allow in the future more university entrepreneurship programmes to be celebrate their own silver jubilees.

Table 4 Anchoring processes for the Twente entrepreneurship programme

Anchoring process	**Key actors involved**	**Network within which anchored**	**Key stakeholder entrepreneurship programme needs**	**Programme response/ positive programme qualities**	**Costs & benefits for entrepreneurship programme**
Academic university space (logic of survival)	Academic facing	Central university decision-makers balancing missions and resource allocation	Prudent use of resources (not wasteful) Supports core missions (teaching & research) Generates additional funds (third-stream)	Tying internal experts to the university centrally Diversification and winning new opportunities Generating good news stories for university/ TOP	**+:** maintains knowledge-intensive allure of link to university base **-:** distraction in generating alluring new ideas rather than network-building
Entrepreneurial resource space (logic of growth)	Enterprise facing	Network of regional entrepreneurs and support organisations assisting firm start-up	Navigating messy/ confusing support network. Outputs of TOP creates entrepreneurship resources Academic perspective creates value perception	Emphasising match-making and signposting Proposing stream of new support activities Working with existing entrepreneurs on new project ideas	**+:** builds up regional network of resources for high-tech entrepreneurs **-:** risks turning programme into a business support activity, losing hybridity
Regional economic development space (logic of visible success)	Both academic and enterprise facing	Policy network including university, experts, province, plus EZ view of role of Twente nationally	Creation of new high-technology businesses Creation of new employment Creation of new policies and buildings to launch.	Creating visible projects and outcomes, supporting new science parks Applying methodology in new settings; *Kansrijk Eigen Baas*, Venturelab…	**+:** helps to build TOP into university physical fabric as 'experiment' -: risk of political change leading to later stranding of TOP idea.

BIBLIOGRAPHY

Barnett, R. (2003) *Beyond all reason: living with ideology in the university.* Buckingham: Society for Research into Higher Education; Open University Press.

Benneworth, P. S. (2007) "Seven samurai opening the ivory tower? University commercialisation communities of practise promoting economic development in less successful regions" *European Planning Studies* 15 (4) pp. 487-511.

Benneworth, P. S. & Charles, D. R. (2005) "University spin off companies and the territorial knowledge pool: building regional innovation competencies?" *European Planning Studies*, 13 (4) pp. 537-557.

Benneworth, P. S. & Henry, N. (2004) "Where is the value added in the cluster approach? Hermeneutic theorizing, economic geography and clusters as a multi perspectival approach" Urban Studies.

Benneworth, P. S. & Hospers, G.-J. (2007) "Urban competitiveness in the knowledge economy: Universities as new planning animateurs" *Progress in planning*, 67 (2) pp. 99-198

Bridgman, T. & Wilmott, H. (2007) "Academics in the 'knowledge economy': from expert to intellectual?" in A. Harding, A. Scott, S. Laske & C. Burtscher (eds) *Bright satanic mills: universities, regional development and the knowledge economy*, Aldershot: Ashgate

Buck Consultants International (2010) …

Brouwer, A. (2005) "Old firms in the Netherlands. The long-term spatial impact of firms' identities and embeddedness" *Ph.D. thesis* Utrecht: Royal Dutch Geographical Society

Chesborough, H. 2003, Open innovation, the new imperative for craetingf and profiting from Technology, Boston, Harvard Business School Press.

Clarysse, B., Wright, M., Lockett, A., Velde, E vd., and Vorhora, A. (2004) "Spinning out new ventures?: a typology of incubation strategies from European research institutions" *University of Gent Faculty of Economics and Business Studies* Working Paper 2004/ 228.

Cooke, P (2005) Regionally asymmetric knowledge capabilities and open innovation : exploring 'Globalisation 2' – a new model of industry organisation, Research Policy, 34, pp. 1128-1149

Cooke, P. (2007) "From biotechnology clusters to bioscience megacentres: related variety and economic geography" in C. Karlsson (ed.) *Handbook of research on innovation and clusters: cases and policies*, Cheltenham: Edward Elgar.

Dahlstrand, A.‐L. (1999) "Technology‐based SMEs in the Göteborg region: their origin and interaction with universities and large firms" Regional Studies 33 (4) pp 379‐389.

Dahlstrand, A.‐L. (2008) "University knowledge transfer and the role of academic spin-offs" in J. Potter (ed) *Entrepreneurship and Higher Education*, Paris: Organisation for Economic Co-operation and Development.

Dahlstrand, A. L. and Jacobsson, S. (2003) "Universities and technology-based entrepreneurship in the Gothenburg region" *Local Economy*, 18 (10) pp 80-90

Di Gregorio, D. and Shane, S. (2003) "Why do some universities generate more start-ups than others?" *Research Policy* 32 (2) pp 209-227.

Elgen, J., Gottschalk, S., & Rammer, C. (2004) "Location decisions of spin-offs from public research institutions" *Industry and innovation* 11 (3) pp. 207-223.

Gemeente Enschede (2005) Notitie ontwikkelingslocaties *Kennispark* Twente (Policy for the development zone 'Twente Knowledge Park'): Enschede: Gemeente Enschede.

HEFCE (2010) *HEIF grant allocations 2010*, Bristol: Higher Education Funding Council for England.

Jones-Evans, D. Klofsten, M. Andersson, E. & Pandya, D. (1999) 'Creating a bridge between university and industry in small European countries: the role of the Industrial Liaison Office' *R&D Management* 29 (1) pp 47-56

Lambooy, J.G. (1995) *Regionale Economische Dynamiek: Een Inleiding in de Economische Geografie*. Bussum: Countinho.

Lawton Smith, H., Glasson, J., Simmie, J., Chadwick, A. and Clark, G. (2003) Enterprising Oxford: the growth of the Oxfordshire high technology economy, Oxford: Oxfordshire Economic Observatory

Massey, D., Quintas, P. and Wield, D. (1992) Hi-technology fantasies, London: Routledge.

Meer, H v.d. H & Tilburg, J. v. (1980) Survey on the spin-off experience and potential of the Technical High School Twente, Enschede: THT.

MINEZ (2004) "Pieken in de delta": Den Haag: MINEZ

Pirnay, F. Surlemont, B. and Nlemvo, F. (2003) "Towards a typology of university spin-offs" *Small Business Economics* 21 pp 355-369

Potter, J. (2008) "Entrepreneurship and higher education: future policy directions" in J. Potter (ed) *Entrepreneurship and Higher Education*, Paris: Organisation for Economic Co-operation and Development.

Rappert, B., Webster, A. and Charles, D.R. (1999) 'Making sense of diversity and reluctance: academic relations for USOs and SMEs', *Research Policy*, 28 pp. 873-890.

Sijde, P. v.d., Karnebeck, S and Benthem, J. v., (2002a) "The impact of a university spin off programme: the case of HTSFs established through TOP" in R. Oakey, W. During, and S. Kauser, (eds) New technology based firms in the millennium: volume 2, London: Pergammon.

Sijde, P.C. van der, Vogelaar, G., Hoogeveen, A., Ligtenberg, H. & Velzen, M. van (2002b). Attracting high-tech companies: the case of the University of Twente and its region. Industry and higher education, 16(2), 97-104.

Slaughter, S. and L. L. Leslie (1997). Academic Capitalism: Politics, Policies, and the Entrepreneurial University. Baltimore, The Johns Hopkins University Press.

Slaughter, S., & Leslie, L. (2001) "Expanding and elaborating the concept of academic capitalism". *Organization*, 8(2), pp 154–161.

Wicksteed, B. (2000) *The Cambridge Phenomenon revisited*, Cambridge, UK: Segal Quince Wicksteed

Yencken, J. (2005) An Australian Model for Spin-off Companies in the Commercialisation of University and Other Public Sector Research: Thesis for PhD Degree. Melbourne: Swinburne University of Technology. PhD Thesis. Swinburne University ofTechnology.

Yin, R. (1994) Case Study Research: Design and Methods. Sage, Thousand Oaks.

Zomer, A. (2010) "Do academic spin-offs make academics heads spin" Minerva (*forthcoming*).

[1] The proposal emerged from a report written by Professor Burggraag (Delft) for the Ministry of Technological Innovation on how universities could contribute to a new Dutch innovation policy. Professor During of UT was secretary to the Burggraag group, and worked with Van den Kroonenberg at UT to ensure that the funds were spent on the establishment of TOP.

[2] The ESF subsidy was particularly attractive because it was linked to the number of participants in the programme, and financial engineering meant that more participants meant more profit for the university.

[3] In this period, one interview said that he believed that they needed to be covering 50-60% of their total cost from consultancy work in order to keep the office, and TOP, running successfully.

[4] This process was managed by an interim manager who came in with the remit to make *Transferpunt* 'profitable' (defined as covering 50% of its costs) and helping staff to win external (provincial and European Regional Development) funding.

[5] TNO (*Nederlands Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek* or the Dutch Organisation for Applied Technical Research) is the Dutch national applied research organisation, with its headquarters in Delft; it receives core scientific funding from the Dutch science ministry (MOCW) and invests that in research projects in the immediate pre-commercial phase. TNO employs around 5,000 employees of which around 4,000 are researchers.

[6] *Kansrijk Eigen Baas* was a project in a neighbouring rural region which was based on creating companies formed by teams from unemployed people, and was sponsored by Rabobank Oost-Gelderland. Venturelab is a project currently running at the time of wiriting, which provides coaching for entrepreneurs with an idea for a high growth business idea, sponsored by the Province Overijssel.

Exploring Strategic Innovation and New Product Development in Family Firms: a theoretical framework and an empirical study

Lucio Cassia[*], *Alfredo De Massis*[**], *Emanuele Pizzurno*[***]

Abstract

Strategic innovation and NPD are important dimensions of strategic entrepreneurship (Hitt *et al.*, 2007; Ireland *et al.*, 2003). This paper is focused on strategic innovation management and New Product Development (NPD) in the dominant and most significant form of organizational enterprises: family firms.

One of the most discussed issues in family business research is that there is no commonly accepted definition of what is meant by the term 'family business' (Chua *et al.*, 1999; Westhead and Cowling, 1998; Lansberg, 1988). In this study we follow Chua, Chrisman, and Sharma (1999) in defining a family business as "a business governed and/or managed with the intention to shape and pursue the vision of the business held by a dominant coalition controlled by members of the same family or a small number of families in a manner that is potentially sustainable across generations of the family or families." This definition is consistent with the fact that the term *family business* is typically used to define organizations in which the behavior of actors and the nature of relationships within them are influenced by the family vision that is oriented to trans-generational pursuance and controlled by a familial dominant coalition.

The firms that fit this definition play a crucial role in all the economies of the world (Neubauer and Lank, 1998; Aronoff and Ward, 1995; Churchill and Hatten, 1987). Studies in several countries suggest that family firms have a major impact on the growth and employment generation of the national economies (Morck et al., 2000; Neubauer and Lank, 1998; Poutziouris, et al., 1997; Gallo, 1995) and a percentage between 65 percent and 90 percent of firms in the world can be considered family businesses (Caselli and Gennaioli, 2003; Family Firm Institute, 2003; Shanker and Astrachan, 1996). And not only SMEs are family firms since 37 percent of all Fortune 500 firms can be considered family businesses (Jetha, 1993). The importance of family businesses is particularly visible in: (i) Europe, where they constitute a substantial part of the existing companies (nearly 85%) and play a pivotal role in the strength and dynamism of the European economy (European Commission, 2008); and (ii) Italy, where they are 93% of the national firms and 98% of the workforce in manufacturing companies fewer than 50 employees (European Commission, 2008).

Given that the family firm is the dominant organizational form today, it is surprising that only a few studies in the mainstream management literature have included the family as a variable and most of the management journals and books seem to have rather ignored it (Dyer, 2003; Schulze et al., 2001).

This is true, in particular, in the field of strategic innovation management and New Product Development (NPD) where a small number of researches have been published (Craig and Moores, 2006; Litz and Kleysen, 2001) about the managerial and organizational practices related to innovation in the specific and prevailing context of family firms. In the same field the new product development process within family businesses has been largely ignored and it requires more in-depth

[*] Full Professor, University of Bergamo (lucio.cassia@unibg.it)

[**] Assistant Professor, University of Bergamo (alfredo.demassis@unibg.it)

[***] Assistant Professor, Università Carlo Cattaneo - LIUC (epizzurno@liuc.it)

investigations (as suggested by Souder, 2003), considering the crucial role NPD plays as determinant of sustained company performance (Ernst, 2002; Cooper and Kleinschmidt, 2007).

We must question whether current strategic innovation and NPD management theory and practice can be generalized to the important population of family firms and how the presence of a family within a business enterprise may affect its strategic innovation and NPD activities.

To address this gap in the literature, this study attempts to explore strategic innovation and new product development within Italian family firms, outlining potential differences emerging between family and non-family enterprises. It provides an exploratory understanding of how "familiness" influences strategic innovation and NPD, and what impact the family has on the managerial factors affecting the success of NPD and the way the firm organizes and positions its activities and structures within its surrounding environment.

To this aim, a multiple case-study (Strauss & Corbin, 1998; Yin, 1994; Handler,1989) on eight Italian companies has been conducted, and the NPD process as well as its related managerial and organizational implications have been in-depth analyzed in four family firms and four non-family companies. The strength of case-study methodology is in that they are extremely suitable for exploring processes (Van Maanen, 1983) and answering "how" and "why" questions, they provide explanations rather than statistical information, causality can be investigated, and theory can be tested and generated (Eisenhardt, 1989; Wolcott, 1994).

The objective of the study can be structured into three main research questions:

1. What is the relationship between the presence of the family variable within a business enterprise and the managerial factors affecting the success of NPD activities?
2. How the managerial factors affecting the NPD process are faced in family businesses?
3. Which are the main differences (e.g., strengths and/or weaknesses) in dealing with the managerial factors affecting the NPD process between family firms and non-family enterprises?

The paper is thus organized into five main sections:

1. *Theoretical context:* description of the theoretical background and concepts of the study; it is structured in three distinct subsections providing an in-depth review of the previous literature on: (i) the relationship between the family variable and the management of a business; (ii) strategic innovation and NPD in family firms, focusing on the few contributions specifically related to family businesses; and (iii) the managerial factors affecting NPD success.
2. *Research questions, framework and methodology*: definition of the paper's research questions, the theory-based research propositions at the basis of the research framework and the adopted methodology;
3. *Empirical investigation*: description of the empirical study, structured in two subsections: (i) description of the empirical base; and (ii) discussion of the empirical findings and their implications for researchers and practitioners;
4. *Conclusion, limitations and future research directions*: discussion of limitations of the study and outline of directions for future research and theory development.

Keywords: strategic innovation management, new product development, strategic entrepreneurship, family firms.

PROFILES OF SOCIAL NETWORKING SITES USERS IN THE NETHERLANDS

Efthymios Constantinides
UNIVERSITY OF TWENTE (THE NETHERLANDS)
School of Management and Governance
P.O. Box 217 7500 AE Enschede, The Netherlands
e.onstantinides@utwente.nl

Maria del Carmen Alarcón del Amo
UNIVERSITY OF CASTILLA-LA MANCHA (SPAIN)
Faculty of Economics and Business. Department of Marketing.

Carlota Lorenzo Romero
UNIVERSITY OF CASTILLA-LA MANCHA (SPAIN)
Faculty of Economics and Business. Department of Marketing.

1. ABSTRACT

Online social networking has become a reality and integral part of the daily personal, social and business life. The extraordinary increase of the user numbers of Social Networking Sites (SNS) and the rampant creation of online communities presents businesses with many challenges and opportunities. From the commercial perspective, the SNS are an interesting and promising field: online social networks are important sources of market intelligence and also offer interesting options for co-operation, networking and marketing. For SMEs especially the Social Networking Sites represent a simple and low cost solution for listening the customer's voice, reaching potential customers and creating extensive business networks. This paper presents the results of a national survey mapping the demographic, social and behavioral characteristics of the Dutch users of SNS. The study identifies four different user profiles and proposes a segmentation framework as basis for better understanding the nature and behavior of the participants in online communities. The findings present new insights to marketing strategists eager to use the communication potential of such communities; the findings are also interesting for businesses willing to explore the potential of online networking as a low cost yet very efficient alternative to physical, traditional networking.

2. INTRODUCTION

The upshot of business networking, the Social Capital, is one of the basic ingredients of the innovation process (Bass, 1969; Goldenberg et al., 2002; von Hippel, 1994, von

Raesfeld et al, 1996) and the process of innovation diffusion (Rogers, 1995; Golder and Tellis, 1997). Research has identified and analyzed the importance and role of social networks in entrepreneurship (Wakkee et al, 2001 ; Groen 2005), new ventures (Heuven and Groen, 2006) and firm performance (Boshuzen, 2009) and researchers agree that efficient and extensive business networks are important elements of the SME expansion process.

The value of networking is well understood by businesses and particularly businesses in the early stages of their life cycle but the way networks are born and mature is changing; recent technological developments are reshaping the way professionals create, expand and maintain personal business networks. These developments are mainly related to advances in the area of Information and Communication Technologies (ICT).

Linkages between ICT, innovation and competitive success of SMEs have been documented in the literature (Lefebvre and Lefebvre, 1993; Street and Meister, 2004). An important development in the IS domain during the last fifteen years was the wide public adoption of the Internet and its establishment as communication and commercial platform. The global character of the Internet opened new prospects for businesses and SMEs in particular: improved trading relationships and improved market intelligence (Mehrtens et al., 2001) and access to new geographical markets have been the main motivators for SMEs to invest in Internet technologies.

The evolution the Internet to its current stage, commonly known as Web 2.0, has brought about more opportunities as well as challenges for businesses. One of the major opportunities is the wide availability of new online applications commonly described as Social Media and in particular new online networking environments known as Social Networking Sites (SNS) (Tredinnick, 2006; Boyd and Ellison, 2007; Constantinides et al, 2008). Next to opportunities the Web 2.0 created also business threats; SNS in combination with other Social Media have given consumers and customers in general more power and control over the marketing process (Wind and Mahajan, 2001; Rha et al, 2002; Bush, 2004; Urban 2006; Constantinides and Fountain, 2008). The challenge strategists are facing is not just the competition from other businesses but also a new form of competition from the consumers themselves: consumers using Social Media applications can now generate, edit and share online information about businesses, products and services and also create online communities and networks allowing where information flows beyond the control of businesses. This information is widely perceived by customers as more reliable than business communication and therefore peer opinion becomes a major influencer of buying behavior (Evans, 2008).

Businesses and especially SMEs must device ways to transform the Social Media and particularly the SNS from strategic threats to strategic opportunities (Constantinides et.al. 2008). Using SNS as marketing tools is a very attractive option for SMEs that often face budget limitations: these tools are low cost compared with traditional communication tools and for all intents and purposes very cost effective. The objective of this article is to provide marketers with behavioral facts about the users of SNS as a first step in the direction of engaging these instruments as business networking platforms and strategic marketing tools. A survey held in The Netherlands identifies the elements underpinning the SNS adoption process and use of these sites by customers. This is a first step towards developing the right SNS propositions and tools likely to attract online users and help marketers to achieve their communication or other objectives.

3. SOCIAL NETWORKING SITES (SNS)

There is a variety of definitions of the term Social Networking Sites. User participation and user generated content is a common element of many definitions (Tredinnick, 2006; Constantinides et al, 2008). According to Constantinides and Fountain (2008) online social networks (or Social Networking Sites) are one of the five application types of the Web 2.0 domain (Social Media) and defined as " applications allowing users to build personal web sites accessible to other users for exchange of personal content and communication". Boyd and Ellison (2007) define the SNS "as web-based services that allow individuals to (1) construct a public or semi-public profile within a bounded system, (2) articulate a list of other users with whom they share a connection and (3) view and traverse their list of connections and those made by others within the system". Social Networking Sites (SNS) such as Facebook, Hyves, MySpace, LinkedIn, Twitter, Second Life etc. are a relatively recent Internet phenomenon; nonetheless they are already used by millions of web users worldwide who have integrated SNS into their everyday life (Boyd and Ellison, 2007; Ofcom, 2008). According to data from ComScore Media Metrix (2008) this new form of human interaction through virtual social networks has become one of the most popular and faster growing Internet activities. Some SMS applications attract already tenths or even hundreds of millions of regular users.

There are already numerous SNS with various technological options supporting a wide range of interests and practices. While their main technological features are fairly consistent, various types of cultures emerge around SNS; some serve a diverse audience, while others attract people based on common language or race, nationality, etc. (Boyd and Ellison, 2008).

SNS are considered of great importance both for individuals and businesses, since they support both the maintenance of existing social ties and the formation of new connections between users (Donath and Boyd, 2004; Cliff, Ellison and Steinfield, 2006; Ellison, Heino and Gibbs, 2006; Ellison, Steinfield and Lampe, 2007; Lampe, Ellison and Steinfield, 2007; Boyd and Ellison, 2008). The connections between users in SNS can be important in facilitating other tasks of the group (Sproull and Kiesler, 1991; Preece and Maloney-Krichmar, 2003), decreasing bad behaviors (Donath, 1998; Reid, 1999) and building different types of social capital (Resnik, 2001; Ellison *et al*., 2006); these are only some of the potential benefits of social networking (Wellman, 2001).

Previous research on SNS has been mainly focused on the nature and the strategic importance of the SNS. Given that only recently SNS have been actively engaged in business marketing and active online social networking there is less attention so far on the users of these applications. More specifically there is little known about the adoption process of SNS and user behavior, personality and actual use of these tools. Identification of users profiles through market segmentation is the first step in the direction of mapping the online behavior of this category of consumers. The objective of this study is to identify and examine the basic parameters of the online behavior of SNS users and classify the SNS users on the basis of their socio-demographic and behavioral characteristics.

4. THEORETICAL BACKGROUND

The fast growth of the SNS domain and the increasing importance of the online social networks as part of the everyday life for hundreds of millions of people is increasingly

attracting the attention of academics and observers. Researchers have been studying the status and effects of SNS on society and business (Keen, 2007; Boyd and Ellison, 2007), their role in identity construction and expression (Boyd & Heer, 2006) but also on building and maintenance of social capital (e.g., Ellison, Steinfeld, & Lampe, 2007). Other issues discussed in the literature are the motives and personality of users (Subrahmanyam et al, 2008; Correa et al, 2009), the role of SNS as marketing instruments (Constantinides et al, 2008; Watters et al, 2009; Spaulding, 2010; Hogg, 2010) and trust / privacy issues(Gross & Acquisti, 2005; Hodge, 2006; Dwyer et al, 2007; Hoadley et al, 2010). Online network security and privacy is an issue extensively discussed in the literature (Gross et al. 2005; Boyd & Heer, 2006; George, 2006; Kornblum & Marklein, 2006; Hodge, 2006; Acquisti and Gross, 2006; Stutzman 2006 Dwyer, Hiltz, and Passerini, 2007; Lenhart & Madden, 2007; Preibuschet al., 2007).
An underlying theme of many of the articles mentioned is the potential role of online social networks as part of the business strategy. Looking to the practice one could argue that businesses are rushing to integrate SNS (and Social Media in general) into their communication strategies: according to a study of Barnes and Mattson (February 2010) 35% of the Fortune 500 companies have already active Twitter accounts and nearly 50% of the top 100 companies have such an account also. A study published on February 2010 by the Small Business Success Index (SBSI) [1] indicates that 75% of the surveyed small businesses in the USA have already a company page on a social networking site and 57% have built a network, either their own or through a SNS like LinkedIn. Similar findings indicating the start of a trend were reported in studies conducted earlier by McKinsey (2007a; 2007b) and Forrester Research (2008).
SNS have been identified in the literature as very important for both individuals and businesses, since they support the existing social ties and the formation of new connections and networks between users (Donath and Boyd, 2004; Cliff et al., 2006; Ellison et al, 2006; Ellison et al., 2007; Lampe et al., 2007; Boyd and Ellison, 2007). Connections between users have been found to be vital in facilitating other tasks of the group (Sproull and Kiesler, 1991; Preece and Maloney-Krichmar, 2003), eliminating the tendency to misuse the system (Donath, 1998; Reid, 1999) and building different types of social capital (Resnik, 2001; Ellison *et al*., 2006); the potential benefits of social networking are quite extensive (Wellman, 2001).
A number of researchers in the SNS domain are focused on the mapping of this terrain and the aptitude of the Social Media and Social Networks in particular as marketing tools for commercial organizations identifying several areas where SNS can play an important role as part of the marketing toolbox (Rogers et al., 1997; Bickart and Schindler, 2001; Subramani and Rajagopalan, 2003; Hennig-Thurau et al., 2004; Hoegg et al., 2006; Korica et al, 2006, Costantinides and Fountain, 2008; Deighton and Kornfeld, 2009).
Not only commercial organizations can profit from engaging SNS as part of their marketing strategy; Waters et al. (2009) analyzed the use of a social network (Facebook) as part of the communication strategy of non-profit organizations concluding that a well-planned social network-based communication strategy can be beneficial for non-profit firms as well.

[1] http://growsmartbusiness.com/

5. METHODOLOGY

The study was conducted by means of a survey of Dutch online users in the autumn of 2009. The Netherlands is an appropriate market for research of online issues due to high Internet penetration and sophistication of Internet users; according to the 2009 European commission's Digital Competitiveness Report[2] 83% of the Dutch population are regular internet users – connecting to the internet at least once a week - and 74% of the population has broadband connection; in both aspects The Netherlands is ranking nr 1 in Europe.
An online questionnaire by a panel of Internet users was used as a method of data collection. The panel consisted of 400 individuals, users of social networking sites from the whole country with ages ranging from 16 to 74 years. The non-probability method by quota sampling was used in order to ensure that the panel is representative of the Dutch population with regard to gender, age and area of residence.

The questionnaire was based on a combination of closed-ended, dichotomous and multi-chotomous questions, with single and multiple responses. The main aims of the questionnaire were, to obtain information about the Dutch consumer as to the experience and use of the Internet in general, the level of involvement and usage of social networking sites, the user motivations to participate in these sites, the types of profiles (public or private) preferred, the extend of network-based contacts, the ways people access SNS, the number of accounts in different SNS, and the socio-demographics of the users.

The analytical techniques used in this study were divided in two stages. A cluster analysis was used in the first stage in order to determine different clusters of social networking sites users; the criterion here was the level of individual participation in SNS.

In the second stage we analyzed the significant differences between the obtained clusters and the user profiles. These profiles were created on the basis of socio-demographic characteristics, aptitude as Internet users (based on the number of years of experience), intensity of Internet usage (based on the hours of usage per week), the extend of use of Internet tools in order to obtain information or generate content, the years of experience with SNS, the intensity (number of personal accounts, the frequency and hours of use) of interaction in SNS, the types of profiles (public or private) preferred, the size of personal networks (in the forms of "friends", "followers" etc), the way of accessing SNS, the motivations to participate in SNS and the types of activities carried out in SNS. The analysis of the data was done by means of the statistical program SPSS.

6. RESULTS

Boone and Roehm (2002) and earlier studies have indicated there are over 50 clustering methods that could be applied to market segmentation. Similar views are shared by

[2] http://ec.europa.eu/information_society/newsroom/cf/itemlongdetail.cfm?item_id=5146

Milligan and Cooper (1985) and Wedel and Kamakura (2000). However, none of the clustering techniques is generally superior across different data sets (Punj and Stewart, 1983; Arabie, Hubert and De Soete, 1996; Wedel and Kamakura, 2000).

Following the approach of Boone and Rohem (2002), the K-means criterion was selected because it has been frequently used as comparative standard in similar studies (Balakrishnan, Cooper, Jacob and Lewis, 1994, 1996; Hruschka and Natter, 1999). As K-means is a non-hierarchical clustering method, Ward and average linkage methods were selected as hierarchical clustering representatives .

Cluster analysis is intended to group the individuals of our sample into groups according to the level of their participation in SNS. With this analysis we identified four differentiated SNS user segments which we have identified as "Beginners", "Habitual Users" , "Outstanding Users" and "Experts".
As shown in Table 1, there is an association[3] between group allocation and gender, age, marital status, work situation, information-oriented activities, content generation oriented activities, number of accounts and use of these accounts in SNS, the amount of contacts and the reasons to participate in SNS. On the other hand, there is no relation between the variables related to group membership and the education level, duration of use of the Internet and SNS (most of them are users for more than 8 years), the number of hours spend on the Internet, the kind of profiles preferred (most users have a private profile) and the way to access SNS.

Profile description:

- *"Beginner"* This segment represents the majority of the population: 45% of the SNS users. This group, compared with the rest, is characterized by a limited activity in SNS. Most of them connect to SNS for sending private messages (80.6%), searching for people (79.5%), updating their profile (73.9%), and sharing or uploading photos (67.8%). The majority have accounts in one SNS only (58.3%) and the highest proportion of users have between 10 and 50 contacts (33.3%). The main reason for them to use SNS is to keep in touch with their friends and relations (51.1%).

  The socio-demographic analysis of Table 1 shows that the majority of Beginners are female (55%), between 25 and 34 years (46.7%), married (54.4%) and employed (63.3%). While Beginners engage in different information-oriented activities in the Internet (that can be described as passive) this is the group with lowest proportion of users who carry out this type of activities. Regarding the activities related to content generation (active participation), they are limited to expressing opinions and valuations (60%). In that respect the Beginners can be characterized as mostly passive SNS users.

- *"Habitual" user*: This segment includes 18.2% of total SNS users. Compared with the other clusters, Habitual users are characterized by the intensive use of SNS as channels to send private messages (97.3%), get information about things that interest them

[3] To determinate the existence of an association or relationship between group membership and each of the studied variables, the Chi-square test of Independence had been used. For the test of Independence, a chi-square probability of less than or equal to 0.05, for a confidence level of 95%, is commonly interpreted by applied workers as justification for rejecting the null hypothesis and therefore we can conclude that there is an association between the studied variables.

(97.3%), update their profile (95.9%), search for people (94.5%), communicate news or information they think might be interesting to other people (64.4%), search for job opportunities (53.4%) and engage in other activities that are more common among the other groups. While the highest proportion (37%) of Habitual users have one SNS account, this is the group with the highest percentage of individuals with more than two accounts (30.2%). The highest proportion of these users (35.6%) has between 10 to 50 contacts. Main reasons for using SNS are the ease of staying in touch with their friends and acquaintances (65.8%) and entertainment (58.9%).

Most users in this category are male (57.5%) between 25 and 44 years old (57.6%), married (43.8%) and employed (65.8%). Concerning the use of Internet in a passive way, the behavior of the this category is similar in some aspect to Beginners but they are much more involved in activities with an interactive character: Transfer files (57,5%), participation in chats (69.9%), receiving email alerts (82,2%) and creating virtual personalities(avatars) (42,5%). Regarding the content generating activities they are in their majority posting opinions and product valuations (84.9%), participate in forums (79.5%), send messages to distribution lists (64.4%), create/send files through the Internet (58.9%), and provide comments on other blogs (53.4%).

- *"Outstanding" user*: This segment includes 26.2% of the SNS users. Individuals in this segment, use mainly SNS to send private messages (98.1%), to search for people (97.1%), to update their profile (96.2%), to report about what they are doing (90.5%), to discuss about what people they know say or do (88.6%), to send public messages (78.1%) and to gossip (52.4%). Most individuals in this group are active members of a one SNS with a high proportion of them (40%) having more than 100 online contacts. Among the main reasons for using the SNS is staying in touch with their friends and acquaintances (77.1%), entertainment (60%) and invitations by others to participate (54.3%).

  Regarding the socio-demographic profile of this group, most are female (65.7%), and the highest proportion are between 25 and 34 years old (39%), married (37.1%), and employed (79.5%). With regard to the use of SNS the Outstanding user participates in passive activities (search for information) in ways similar to other groups. However, the active participation (generating online content) is not the expected in this segment since this activity in some aspects is lower than Habitual user's. Outstanding users prefer expressing opinions and valuations (71.4%) and participating in forums (64.8%).

- *"Expert" user*: This is the smallest segment representing 10.5% of SNS users but Experts tend to spend more hours online than any other segment and have the most active and engaged online social life. The segment has the highest percentages of users engaged in most categories of passive and active types of SNS activities than any other segment (sharing or uploading photos, discussing about what people say or do, getting information about things of interest and communicate ideas/thoughts. The overwhelming majority of them update their profile (97.6%), send private messages (97.6%), share links about interesting web sites (97.6%), report about what they are doing (97.6%), discuss about photos posted by their friends (95.2%), share mood (90.5%), send public messages (85.7%), gossip (83,3%), download applications (81%), communicate news or issues that they think might be interesting to other people (78.6%), tag friends' photos (76.2%), report about brands or products they use (76.2%),

write or comment about advertisements (76.2%), and download games (61.9%). Most Experts are active users of one SNS (38.1%) but they are also the segment with the highest proportion of owners of more than six SNS accounts (2.4%). Moreover, the highest proportion (45.2%) has more than 100 contacts on these sites. Finally, the main reasons that motivate them to use the SNS are usually to keep in touch with their friends and acquaintances (78.6%), entertainment (66.7%), because all their friends were users (57.1%), and because they were invited (52.4%).

Most Expert users are female (69%), between 16 and 24 years old (31%), although there are a high percentage of users between 35 and 44 years old (28.6%). Also many of these users are married (31%) and employed (45.2%). Concerning the use of Internet in a passive way they use it in a similar proportion to other groups, but also make use of peer to peer file sharing (61.9%), and visit web sites using avatars (54.8%). On the other hand, Expert users are the most active Internet users, as they generate content in a variety of ways. Specifically they express opinions and valuations (95.2%), provide comments on other blogs (83.3%), participate in forums (73.8%), publish content to their blog (66.7%), create/send files through the Internet (64.3%), and send messages to distribution lists (59.5%).

An extensive analysis of the study findings per segment is presented in Table 1

Table 1. SNS user segments

		Beginner 45%	Habitual 18.25%	Outstanding 26.25%	Expert 10.5%	χ^2 value	Sig.
Gender	Male	45.0%	57.5%	34.3%	31.0%	12.326	0.006
	Female	55.0%	42.5%	65.7%	69.0%		
Age	16-24	17.8%	8.2%	23.8%	31.0%	31.161	0.008
	25-34	25.6%	28.8%	39.0%	19.0%		
	35-44	21.1%	28.8%	20.0%	28.6%		
	45-54	16.7%	13.7%	10.5%	16.7%		
	55-64	13.9%	13.7%	4.8%	4.8%		
	65-74	5.0%	6.8%	1.9%	0.0%		
Education level	Not graduated from high school	3.3%	2.7%	1.9%	7.1%	18.204	0.110
	High school	27.2%	23.3%	21.0%	47.6%		
	Professional School/College	48.9%	56.2%	59.0%	35.7%		
	University	8.9%	9.6%	8.6%	7.1%		
	Postgraduate course	11.7%	8.2%	9.5%	2.4%		
Marital status	Unmarried living with my parents	14.4%	15.1%	25.7%	35.7%	33.377	0.004
	Unmarried living on my own	10.0%	4.1%	9.5%	7.1%		
	Married	54.4%	43.8%	37.1%	31.0%		
	Widows/Widower	0.0%	2.7%	1.9%	0.0%		
	Divorced	5.6%	9.6%	1.9%	7.1%		
	Unmarried living with partner	15.6%	24.7%	23.8%	19.0%		
Work situation	Self-employed	5.0%	6.8%	2.9%	11.9%	26.264	0.010
	Employee	63.3%	65.8%	70.5%	45.2%		
	Student	12.2%	6.8%	15.2%	26.2%		
	Housewife	6.1%	9.6%	3.8%	14.3%		
	Unemployed/Retire	13.3%	11.0%	7.6%	2.4%		
Length of Internet use	Less than 6 months	1.7%	1.4%	1.0%	0.0%	20.075	0.329
	Between 6 and 12 months	1.7%	0.0%	1.9%	0.0%		
	More than 1 year and less than 2	2.2%	0.0%	2.9%	2.4%		
	Between 2 years and less than 3	4.4%	2.7%	1.0%	7.1%		
	Between 3 years and less than 5	11.1%	12.3%	4.8%	7.1%		
	Between 5 years and less than 8	20.6%	16.4%	32.4%	28.6%		

	8 years or more	58.3%	67.1%	56.2%	54.8%		
Number of hours spend on the Internet	0-4 hours per week	42.8%	37.0%	26.7%	31.0%	11.488	0.074
	5-13 hours per week	40.0%	38.4%	51.4%	38.1%		
	14 or more hours per week	17.2%	24.7%	21.9%	31.0%		
Activities carried out to obtain information	Use e-mail	100.0%	100.0%	99.0%	100.0%	10.637	0.560
	Transfer network file (FTP)	40.6%	57.5%	46.7%	50.0%	31.293	0.008
	Use instant messaging	60.0%	69.9%	78.1%	85.7%	35.054	0.002
	Participate in chats	46.7%	69.9%	60.0%	78.6%	48.588	0.000
	Make phone calls over the Internet	32.8%	35.6%	36.2%	35.7%	17.785	0.274
	Consult forums for information	78.9%	90.4%	87.6%	90.5%	33.211	0.004
	Reading reviews about products, news,...	81.7%	94.5%	92.4%	92.9%	51.033	0.000
	Consult distribution lists	88.9%	95.9%	93.3%	95.2%	31.829	0.007
	Consult wikis	70.6%	91.8%	75.2%	88.1%	31.983	0.006
	Consult blogs	53.3%	86.3%	81.0%	83.3%	73.623	0.000
	Watch and listen to files by the Internet	80.6%	95.9%	91.4%	95.2%	41.479	0.000
	Make use of P2P file sharing	35.0%	45.2%	38.1%	61.9%	34.087	0.003
	Receive e-mail alerts and subscriptions	53.9%	82.2%	73.3%	83.3%	53.133	0.000
	Visit web sites using avatars	17.2%	42.5%	31.4%	54.8%	64.147	0.000
Activities carried out to generate content	Participate in forums	41.7%	79.5%	64.8%	73.8%	58.982	0.000
	Express opinions and valuations	60.0%	84.9%	71.4%	95.2%	43.245	0.000
	Send messages to distribution lists	23.3%	64.4%	38.1%	59.5%	84.587	0.000
	Incorporate content in wikis	7.8%	34.2%	9.5%	45.2%	81.150	0.000
	Publish content to my blog	11.1%	32.9%	36.2%	66.7%	84.393	0.000
	Provide comments on other blogs	17.8%	53.4%	46.7%	83.3%	113.802	0.000
	Create/Send files through the Internet	30.6%	58.9%	42.9%	64.3%	43.119	0.000
	Design/adapt products or services	16.7%	47.9%	22.9%	47.6%	44.182	0.000

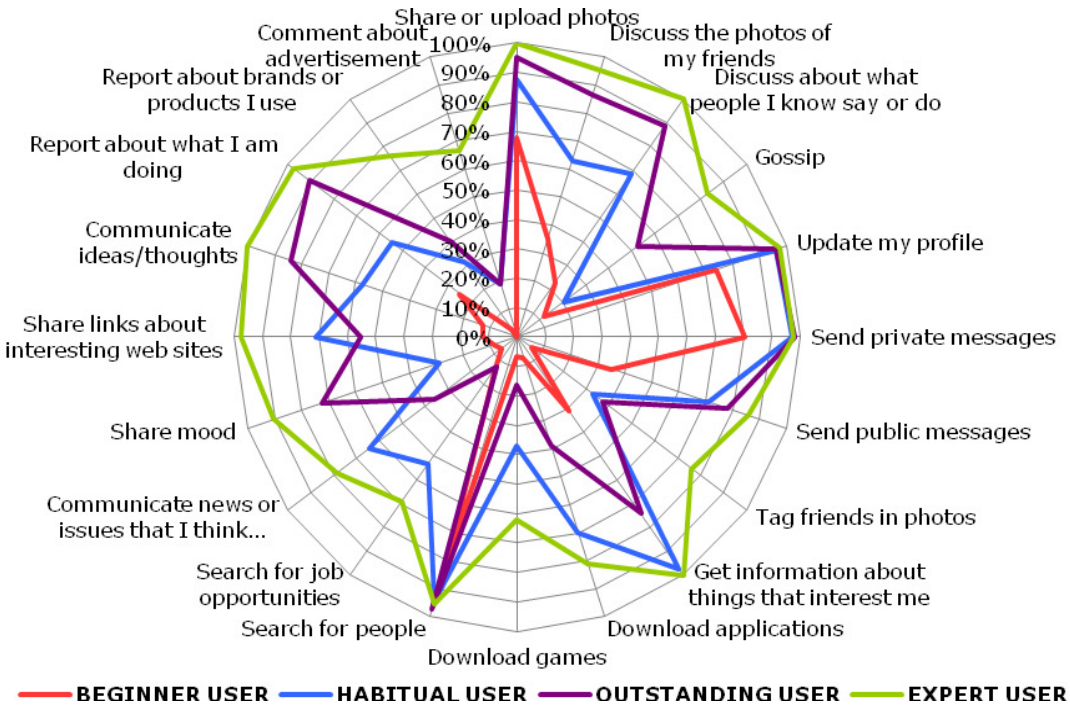
	through the Internet						
Antiquity of use of SNS	Less than 1 month	3.9%	5.5%	3.8%	2.4%	9.552	0.388
	Between 1 and 6 months	11.1%	12.3%	5.7%	7.1%		
	Between 6 months and 1 year	13.9%	6.8%	7.6%	16.7%		
	Over 1 year ago	71.1%	75.3%	82.9%	73.8%		
Number of SNS in which have account and use them	None	8.3%	6.8%	1.0%	7.1%	38.050	0.004
	One	58.3%	37.0%	53.3%	38.1%		
	Two	21.7%	26.0%	24.8%	28.6%		
	Three	8.9%	12.3%	13.3%	19.0%		
	Four	1.7%	11.0%	3.8%	2.4%		
	Five	1.1%	5.5%	3.8%	2.4%		
	Six	0.0%	1.4%	0.0%	2.4%		
Profile	Public	22.8%	21.9%	21.0%	26.2%	11.127	0.267
	Private in some and public in other	15.0%	26.0%	24.8%	28.6%		
	Private in some and public in other	49.4%	41.1%	47.6%	40.5%		
	I do not know	12.8%	11.0%	6.7%	4.8%		
Amount of contacts	Less than 10	23,3%	21.9%	7.6%	9.5%	39.523	0.000
	From 10 to 50	33.3%	35.6%	17.1%	26.2%		
	From 51 to 100	22.2%	23.3%	35.2%	19.0%		
	More than 100	21.1%	19.2%	40.0%	45.2%		
Way to access SNS	Computer	95.6%	91.8%	91.4%	85.7%	8.290	0.218
	Mobile phone	0.0%	0.0%	1.0%	0.0%		
	Both	4.4%	8.2%	7.6%	14.3%		
Reasons to participate in SNS	Entertainment	37.2%	58.9%	60.0%	66.7%	22.928	0.000
	Professional interest	14.4%	31.5%	10.5%	33.3%	20.767	0.000
	Because I was invited	45.0%	47.9%	54.3%	52.4%	2.542	0.468
	For novelty. It is fashionable	17.8%	21.9%	33.3%	42.9%	16.288	0.001
	Keep in touch with my friends and acquaintances	51.1%	65.8%	77.1%	78.6%	24.628	0.000
	Because all my friends were users	17.2%	27.4%	42.9%	57.1%	37.230	0.000
	Keep informed of events, parties	2.8%	6.8%	7.6%	23.8%	23.223	0.000
	Keep informed of new product reviews that interest me	2.8%	16.4%	3.8%	14.3%	20.630	0.000

	Make new friends	4.4%	20.5%	20.0%	40.5%	40.359	0.000
	Make new contacts/professional relations	13.3%	23.3%	12.4%	31.0%	11.257	0.100
	Know more about or have a closer relationship with certain people who I do not have a direct relation	6.1%	12.3%	11.4%	21.4%	9.558	0.023
	Search partner / to pull	2.8%	8.2%	2.9%	7.1%	5.149	0.161
Activities carried out in SNS	Share or upload photos	67.8%	87.7%	95.2%	100.0%	166.761	0.000
	Discuss the photos of my friends	35.0%	63.0%	86.7%	95.2%	193.979	0.000
	Discuss about what people I know say or do	22.8%	68.5%	88.6%	100.0%	237.343	0.000
	Gossip	11.7%	20.5%	52.4%	83.3%	136.313	0.000
	Update my profile	73.9%	95.9%	96.2%	97.6%	142.229	0.000
	Send private messages	80.6%	97.3%	98.1%	97.6%	104.939	0.000
	Send public messages	35.0%	71.2%	78.1%	85.7%	107.218	0.000
	Tag friends in photos	6.1%	32.9%	37.1%	76.2%	128.662	0.000
	Get information about things that interest me	31.1%	97.3%	74.3%	100.0%	212.546	0.000
	Download applications	7.2%	69.9%	39.0%	81.0%	190.838	0.000
	Download games	6.7%	37.0%	16.2%	61.9%	110.087	0.000
	Search for people	79.4%	94.5%	97.1%	95.2%	80.276	0.000
	Search for job opportunities	13.3%	53.4%	12.4%	69.0%	111.212	0.000
	Communicate news or issues that I think might be interesting to other people	6.7%	64.4%	36.2%	78.6%	181.179	0.000
	Share mood	8.3%	28.8%	72.4%	90.5%	229.661	0.000
	Share links about interesting web sites	12.3%	71.2%	55.2%	97.6%	208.315	0.000
	Communicate ideas/thoughts	12.8%	57.5%	83.8%	100.0%	249.435	0.000

	Report about what I am doing	25.0%	54.8%	90.5%	97.6%	226.902	0.000
	Report about brands or products I use	3.3%	31.5%	40.0%	76.2%	150.599	0.000
	Write or comment about advertisement	0.0%	19.2%	19.0%	66.7%	142.411	0.000

Differences between the segments are visible by depicting four main categories of SNS-related activities in spider diagrams. Figure 1 illustrates the differences in the intensity of various activities of the four segments related to the use of the SNS as information sources.

Figure 1. Activities carried out to obtain information in SNS (Passive use of SNS)



From the graph is evident that some activities like searching for people online, sending private messages and updating profiles enjoy high popularity among all four segments while large differences exist in other types of activities like reporting about products used and commenting about advertising are popular mainly among the Expert Users.

7. CONCLUSIONS

Understanding the market is the first and most basic step in order to communicate efficiently with it. This paper argues that the Social Networking Sites provide many opportunities to SMEs as a domain attracting an ever-increasing number of online customers. Segmenting this market is a first step towards better understanding it and it is the basis for developing effective marketing programs.
The classification of Dutch users of SNS resulted in four distinct segments: The Beginners, the Average Users, the Outstanding Users and the Expert Users. The results indicate that socio-demographic characteristics are not suitable segmentation criteria for this market; the best criteria are criteria related to behavior and motivation of SNS users when using such applications. The study reveals in this sense the specific behavioral characteristics of these segments and provides marketers with important information as to designing marketing programs making use of SNS. For SMEs in particular the segments identified provide a good insight on the possibilities to use SNS as part of their marketing strategy depending on the type of customers they want to reach.

The study provides information as to what SNS are popular in the Netherlands and identifies ways people use the SNS, mainly as platforms of networking but also as forums of criticism, complaints and product reviews. Such forums can deliver high quality customer information, customer insights and complains at much lower cost and much faster than traditional market research methods. Taping the online customer voice requires that businesses engage seriously in such an activity by creating the necessary organizational and budgetary facilities and infrastructure.

7. LITERATURE

Arabie, P.; Hubert, J. and De Soete, G. (1996). *Clustering and classification*. World Scientific Publishing, River Edge

Axelsson B., Easton G., (1992), Industrial Networks: a new view of Reality, Routlage, London

Balakrishnan, P. V.; Cooper, M. C.; Jacob, V. S. and Lewis, P. A. (1994). "A study of the classification capabilities of neural networks using unsupervised learning: a comparison with K-means clustering", *Psychometrika*, 59 (4), 509–525.

Balakrishnan, P.V.; Cooper, M.C.; Jacob, V.S. and Lewis, P.A. (1996). "Comparative performance of the FSCL neural net and K-means algorithm for market segmentation", *Eur J Oper Res*, 93 (2), 346–357.

Barnes N., Mattson E., (2007), Social Media in the Inc.500: The First Longitudinal Study, Center for Marketing Research of the University of Massachusetts Dartmouth

Bass F.M., (1969), A new product growth model for consumer durables, Management Science, vol 15, pp.215 - 227

Beer D., (2008) Social Network(ing) sites…revisiting the story so far: A response to Danah Boyd & Nicole Ellison, Journal of Computer-Mediated Communication, vol 13, pp 516 – 529

Bell J., (1995), The internationalization of small computer firms - a further challenge to "stage" theorie, European Journal of Marketing, vol 28, nr 8, pp. 60 – 75
Bickart B., Schindler R.M., (2001), Internet forums as influential sources of consumer information, Journal of Interactive Marketing, vol 15, nr 2, pp31-40
Boone, D. and Roehm, M. (2002). "Retail segmentation using artificial neural networks", *Int J Res Mark*, 19 (3), 287–301.
Boshuizen J., 2009, Join the club: Knowledge spillovers and the influence of social networks on firm entrepreneurship, doctoral dissertation, University of Twente, Enschede, the Netherlands
Boyd, D.M., Ellison N. B., (2007). Social network sites: Definition, history, and scholarship. *Journal of Computer-Mediated Communication*, *13*(1),
Burt, R.S. (1980) `Cooptive corporate actor networks: a reconsideration of interlocking directorates involving American manufacturing´, Administrative Science Quarteley, 25, pp. 557-582.
Bush, J., (2004), *Consumer Empowerment and Competitiveness*, (October), London: National Consumer Council.
Cliff, L., Ellison, N. & Steinfield, C. (2006) `A face(book) in the crowd: social Searching vs. social browsing´, Proceedings of the 2006 20th anniversary conference on Computer supported cooperative work.
Constantinides E., Fountain S. (2008): Web 2.0: Conceptual foundations and Marketing Issues, in: Journal of Direct, Data and Digital Marketing Practice, Vol. 9, No 3, pp. 231–244.
Constantinides E., Lorenzo C., Gómez-Borja M.A., 2008, Social Media: A new frontier for retailers?, European Retail Research, vol 22, pp. 1 - 27
Correa T., Hinsley A.W., de Zuniga H.G., 2010, Who interacts on the Web? The intersection of user's personality and social media use, Computers in Human Behavior, vol 26, pp. 246-253
Coviello N. E., Munro H.J., (1995), Growing the entrepreneurial firm: networking for international market development, European Joirnal of Marketing, vol 29, nr. 7, pp 49 – 61
Deighton J., Kornfeld L., (2009), Interactivity's unanticipated consequences for marketers and Marketing, Journal of Interactive Marketing, vol. 23, pp. 4-10
Donath, J. & Boyd, D. (2004). Public displays of connection. *BT Technology Journal*, 22 (4), 71-82.
Dwyer, C., S. R. Hiltz, et al. (2007). Trust and privacy concern within social networking sites: A comparison of Facebook and MySpace. Proceedings of the Thirteenth Americas Conference on Information Systems, Keystone.
Ellison, N.B., Heino, R. & Gibbs, J. (2006) `Managing impressions online: Self-presentation processes in the online dating environment´, Journal of Computer-Mediated Communication, 11(2).
Ellison, N. B., Steinfield, C., & Lampe, C. (2007). The benefits of Facebook "friends": Social capital and college students' use of online social network sites. Journal of Computer-Mediated Communication, 12, 1143–1168.
Forrester Research, (2008), Global Enterprise Web 2.0 Market Forecast: 2007 to 2013, Young G.O.

Gillin P., (2009), Secrets of the Social Media Marketing, Quill Driver Books, Fresno CA, USA
Goldenberg J., Libai B., Muller E., (2002), Riding the saddle: How cross-market communications can create a major slump in sales, Journal of Marketing, vol 66, pp. 1 – 16.
Golder P.N., Tellis G.J., (1997), Will it ever fly? Modeling the takeoff of new consumer durables, Marketing Science, vol 15, nr 3, pp. 256 - 270
Groen A.J., 2005, Knowledge intensive entrepreneurship in networks: Towards a multi-level / multi dimensional approach, Journal of Enterprising Culture, vol 13, nr 1, pp. 69 – 88
Gross R., Acquisti A., Heinz H.J., (2005), Information revelation and privacy in online social networks, Proceedings of the 2005 ACM workshop on Privacy in the electronic society, Alexandria, VA, USA
Heuven J., Groen A.J., 2006, The role of social networks in financing Technology-based Ventures, Academy of Management Conference, Atlanta, USA
Hoadley C., Xu H., Lee J., Rosson MB., 2010, Privacy as information access and illusory control; the case of the Facebook News Feed privacy outcry, Electronic commerce Research and Applications, vol 9, pp. 50-60
Hennig-Thurau, Gwinner K.P., Walsh G., Gremler D.D., (2004), Electronic word-of-mouth via consumer-opinion platforms: what motivates consumers to articulate themselves on the Internet?, Journal of Interactive Marketing, vol 18, nr 1, pp 38-52.
Hoegg R., Martignoni R., Meckel M., Stanoevska- Slabeva K., (2006), Overview of business models for Web 2.0 communities, University of St.Gallen - Alexandria Repository (Switzerland) http://www.alexandria.unisg.ch/EXPORT/DL/31412.pdf
Hogg T., 2010, Inferring preference correlations from social networks, Electronic commerce Research and Applications, vol 9, pp. 29-37
Hruschka, H. and Natter, M. (1999). "Comparing the performance of feedforward neural nets and K means for clustered based market segmentation", *Eur J Oper Res*, 114 (2), 346–353.
Johanson J., Mattsson L.G, (1988), Internationalization in industrial systems – a network approach, Strategies in Global Competition, Groom Helm, London, pp 287 – 314
Jones, S. (2002). The Internet goes to college. Washington D.C.: Pew Internet & American Life Project (http://www.pewinternet.org/pdfs/PIP_College_Report.pdf [June, 2008]
Keen A., (2007), The Cult of the Amateur: How today's Internet is killing our culture, Doubleday / Random House
Korica P., Mauer H., Schinagl W., (2006), The growing importance of r-communities on the Web, Proceedings of IADIS 2006 International Conference, Murcia, Spain
Lampe, C., Ellison, N. & Steinfeld, C. (2007) `Profile elements as signals in an online social network´, Conference on Human Factors in Computing Systems, (April), San Jose, CA, USA.
Lenhart, A., & Madden, M. (2007). Social networking websites and teens: An overview.Washington, DC: Pew Internet & American Life Project Retrieved August 9, 2007, from http://www.pewinternet.org/pdfs/PIP_SNS_Data_Memo_Jan_2007.pdf

Lefebvre L., Lefebvre E., (1993), Competitive positioning and innovative efforts in SMEs, small Business Economics, vol. 5, pp. 297 - 305
Lin N., Cook K., Burt R., 2006, Social Capital: Theory and research, Transaction Publishers, New Brunswick, New Jersey
McDougall P.P., Shane S., Oviatt B., (1994), Explaining the formation of international newe ventures: the limits of theories from international business research. Journal of Business Venturing, vol 9, pp 469 - 487
McKinsey, (2007a), How businesses are using Web 2.0, A McKinsey Global Survey, The McKinsey Quarterly, March 2007
McKinsey, (2007b), How companies can make the most of user-generated content, The McKinsey Quarterly, August 2007
Mehrtens J., Cragg P., Mills A., (2001), A model of Internet adoption by SMEs, Information and Management, vol 39, pp. 165 - 176
Milligan, G. W. and Cooper, M. C. (1985). "An examination of procedures for determining the number of clusters in a data set", *Psychometrika*, 50, 159–179.
Parsons T., (1964), The Social System, New York, The Free Press
Preece, J. & Maloney-Krichmar (2003) `Online Communities´, in Handbook of Humman-Computer Interaction, (Eds.) J. Jacko & A. Sears, pp. 596-620. Mahwah, NJ: Lawrence Erlbaum Associates Inc.
Punj, G.; Stewart, D. W. (1983). "Cluster analysis in marketing research, review and suggestions for applications", *J Mark Res*, 20 (2), 134–148.
Reaesfeld von A., de Ruyter K., Cabo P., 1996, Cooperation in New Service Development: a social Dynamic Approach, Advances in services Marketing and Management, vol 5, pp. 193 - 214
Rogers E., 1995, Diffusion of Innovations, Fourth edition, The Free Press
Rogers E.S., Chamberlin J., Ellison M.L., Crean T., (1997), A consumer-constructed scale to measure empowerment among users of mental health services, Psychiatric Services, vol. 48, nr 8, pp 1041 - 1047
Spaulding T.J., 2010, How can virtual communities create value for business, Electronic Commerce Research and Applications, vol 9, pp. 38-49
Sproull, L. & Kiesler, S. (1991) Connections: New ways of working in the networked organization. Cambridge, MA: MIT Press.
Subrahmanyam K., Reich S., Waechter N., Espinoza G., (2008), Online and offline social networks: Use of social networking sites by emerging adults, Journal of Applied Development Psychology, vol 29, pp. 420 - 433
Subramani M., Rajagopalan B., (2003), Knowledge-sharing and influence in online social networks via viral Marketing, Communications of the ACM, vol 46, nr 12, pp. 300 – 3007
Rha, J.-Y., Widdows, R., Hooker, N. H., and Montalto, C. P., (2002). E-consumerism as a tool for empowerment, *Journal of Consumer Education*, 19 (20) 61-69.
Tredinnick L., (2006), Web 2.0 and business: A pointer to the intranets of the future, Business Information Review vol 23, nr 4, pp. 228–234.
Von Hippel E., 1994, "Sticky information" and the Locus of problem solving: Implications for Innovation, Management Science, vol 40, nr 4, pp. 429 - 439
Urban G., (2005), Don't Just Relate - Advocate!: A Blueprint for Profit in the Era of Customer Power, Wharton School Publishing, USA

Wakkee I., Groen A.J., During, W., 2001. Global Startups: Definition and Identification in proceedings of the 9th annual HTSF conference, Vol. 2, Manchester, UK.
Waters R., Burnett E., Lamm A., Lucas J., 2009, Engaging stakeholders through social networking: How nonprofit organizations are using Facebook, Public Relations Review , Volume 35, Issue 2, June 2009, Pages 102-106
Wellman B., Salaff J., Dimitrova D, Garton L., Gulia M., Haythornthwaite C., 1996, Computer Networks as Social Networks: Collaborative Work, Telework, and Virtual Community, Annual Review of Sociology. Volume 22, Page 213-238, 1996
Wedel, M. and Kamakura, W. (2000). *Market segmentation, conceptual and methodological foundations*. Kluwer Academic Publishing, Norwell.
Wellman, B. (1999) `The network community: An introduction´, in Networks in the global village: Life in contemporary communities, (Ed.) B. Wellman, pp. 1-48. Boulder, CO: Westview Press.
Wind, J. and Mahajan, V. (2001), The Challenge of Digital Marketing, in J. Wind and V. Mahajan (Eds), Digital Marketing: Global Strategies from the world's leading experts (pp. 3-25), New York: John Wiley & Sons.

FEMALE HIGH TECHNOLOGY ENTREPRENEURS: AN EXPLORATION OF THEIR PRE-ENTREPRENEURIAL CAREERS AND MOTIVATIONS FOR VENTURE CREATION

Sarah Cooper
Centre for Entrepreneurship Research, University of Edinburgh Business School
University of Edinburgh, 50 George Square, Edinburgh,
Scotland, EH8 9JY
Tel: 0131 651 5247
Fax: 0131 668 3053
E-mail: sarah.cooper@ed.ac.uk

Alison Hampton
School of Marketing, Entrepreneurship and Strategy, University of Ulster
Shore Road, Newtownabbey
Northern Ireland, BT37 0QB
Tel: 028 9036 8308
Fax: 028 9036 8993
E-mail: a.hampton@ulster.ac.uk

and

Pauric McGowan
School of Marketing, Entrepreneurship and Strategy, University of Ulster
Shore Road, Newtownabbey
Northern Ireland, BT37 0QB Tel: 028 9036 8864
Fax: 028 9036 6015
E-mail: p.mcgowan@ulster.ac.uk

ABSTRACT

The changing business environment and its growing acceptance of women have influenced the motivations of women to consider entrepreneurship as an alternative career path. Women are well-represented as entrepreneurs in some sectors; however, they remain heavily under-represented in areas such as science, engineering and technology (SET). While studies have been conducted amongst female entrepreneurs in traditionally female sectors, such as retail and personal services, little attention has been paid the motivations and pre-entrepreneurial careers of women who establish ventures in technology-based areas. The pre-entrepreneurial career is important in influencing an entrepreneur's social, human and financial capital which plays a pivotal role in shaping the start-up venture and growth. Greater understanding of the motivations and pre-entrepreneurial pathways of women in technology might help identify ways of encouraging more women to consider taking that career-path. Research reported here addresses the gap in the literature by exploring the pre-entrepreneurial careers and start-up motivations of 18 female technology entrepreneurs in Northern Ireland, using data collected through an exploratory, interview-based study. Implications for theory, policy and practice are explored.

INTRODUCTION

Women represent a relatively untapped source of potential entrepreneurial talent within many areas of the economy. Nowhere is this more apparent than in sectors based on the exploitation of science, engineering and technology (SET) opportunities, areas important for innovation, employment and wealth creation. While the business environment is becoming more accepting of women, the nature of the that environment and the extent of its acceptance of women, particularly in SET fields, to some degree play a role in influencing whether or not women are encouraged or are forced to consider entrepreneurship as a career path. Trends show that the percentage of women deciding to become entrepreneurs is increasing; however, the number electing to start a business within the SET domain continues to lag significantly behind that of men choosing a similar path.

Studies of have explored the experiences of women entrepreneurs in traditionally female sectors (Carter et al. 2003), such as retail and personal services; however, little attention has been paid to exploring the pre-entrepreneurial careers and motivation of female technology entrepreneurs. The pre-entrepreneurial career influences the nature, wealth and diversity of the entrepreneur's human, financial and social capital, which combine to help shape the start-up business and have an impact on subsequent venture growth (Cooper 2006a). Against the background of the current recession entrepreneurs in technology-based sectors may play an important role in helping drive the economy back into more positive territory.

The under-representation of women entrepreneurs in SET fields, and the untapped potential of women educated in relevant disciplines who have gained experience in SET sectors as employees is leading governments to turn their attention to ways of encouraging more women to establish their own ventures. A greater understanding of the positive and negative motivations which lead women to take the entrepreneurial step and appreciation of the role that their education and prior work experience play should be of value to a number of stakeholders and help to identify ways of encouraging more women to consider taking the start-up career route. To enhance understanding and address the gap in the literature, the research reported here explores the pre-entrepreneurial careers and start-up motivations of 18 female technology entrepreneurs in Northern Ireland. Issues identified within the broader entrepreneurship literature, related to entrepreneurial motivations and the role of prior experience, are discussed prior to consideration of the research approach adopted for the study. Insights into these and other related areas were gained through a qualitative, interview-based, in-depth study of women who had established SET-based ventures in Northern Ireland. Data analysis was conducted using NVivo software to enrich and facilitate data analysis. Its use permitted retention of much of the richness of the original data, thus, the discussion draws heavily on the words of the entrepreneurs themselves, reflecting directly their experiences and views. The characteristics of the sample are discussed prior to presentation of the research findings. Implication of the research findings for theory, policy and practice are considered.

HIGH-TECHNOLOGY ENTREPRENEURSHIP AND THE FEMALE ENTREPRENEUR

A sizeable amount of entrepreneurship research and, more particularly, studies of female entrepreneurs have focused on their motivations for start-up (Carter et al 2003). Indeed, a number of studies have attempted to establish a link between the motivations for start-up and the performance of female-owned firms (Carter and Cannon 1988, Cromie & Hayes 1988, Goffee & Scase 1985). Although such work provides a basis for understanding, there has been relatively

little focus directed towards female entrepreneurs operating in male-dominated sectors such as those centred on the exploitation of technology-based opportunities (Anna et al 2000). Prior research among female entrepreneurs highlights a number of push and pull motives for start-up with some being the same as those of male entrepreneurs, and others being acknowledge as more gender-specific (Rosa et al 1996), such as those centred on aspects of the flexibility required to establish an effective home and work-life balance (Goffee & Scase 1985, Losocco & Leicht 1993). Two factors which appear to influence strongly the decision of women to follow an entrepreneurial career path are the 'sticky floor', responsibilities to their family, and the 'glass ceiling', which blocks advancement to more senior organisational positions (Welsh & Young 1984). Consequently, rather than being a choice entrepreneurship may be a last resort for women who face gender discrimination in employment.

At a generic level new venture creation is the culmination of entrepreneurial action by one or more individuals working together; some firms result from venturing activity by local, indigenous entrepreneurs whilst others are created by those who move into a region. The majority of entrepreneurs have worked for other employers prior to starting their own venture which enables them to draw on prior work experience and capitalise on social capital networks. The entrepreneur's previous work experience (Chandler 1996, Shane 2000) and types of opportunity to learn about business creation and the resources required for venture creation and growth, may influence the initial decision to found the firm and the breadth of experience on which they may draw (Harrison et al. 2004).

The establishment of a high-technology venture requires the entrepreneur to take into account a range of factors which influence the ease or difficulty of starting a new firm. The nature of the technology on which the firms is based exerts influences on the venture creation process (Oakey & Cooper 1991, Oakey 1995 which include variable barriers to entry into the market which will differ through time and vary between sectors (Oakey 1995). New sectors may be less competitive and the niche opportunities in newly emerging markets provide commercial opportunities of an appropriate scale for new firms. As markets develop entrepreneurs wishing to grow their ventures have the chance to do so within the same market sector. In mature sectors, dominated principally by large firms, there may also be niches which are unattractive to larger incumbents which provide an environment for the new entrant. Another option is for small and larger firms to join forces, pool resources and collaborate, particularly where a specialist small firm complements the activities of the larger venture, permitting it to concentrate on its core business (Cooper 2001).

The length of the product development cycle is a key aspect which influences the emergence and growth of technology-based firms as it exerts strong pressures, particularly financial, on the start-up venture and its founder(s) (Oakey & Cooper 1989, Malecki 1981, Markusen 1985). To start a software company and take a product to market may require several months, whereas it may take many years to bring a biotechnology-based product to market. The entrepreneur's skill lies in balancing resource needs, personal/team skills and use of resources to capitalise on the opportunity. Maximising access to and minimising ownership of resources is an important strategy for the start-up venture (Sahlman and Stevenson 1993) and here the use of personal and professional networks enables entrepreneurs to access resources not directly under their control (Hampton et al. 2009). Networks which provide access to prospective customers, supplier, investors or technical specialists are frequently developed as a result of entrepreneurs setting up ventures in the same sector or a closely related sector to that in which they have worked previously (Cooper & Park 2008). In such situations entrepreneurs are able to build on

previous connections, reputation and credibility developed through experience and a track record, to leverage vital resources.

Thus, "the technical entrepreneur has to tolerate risk… has to generate support for a technology about which few people know, imparting his philosophy, spirit, vision and enthusiasm for his enterprise to all concerned with it. Surrounded by uncertainty, the financier is persuaded to place his money over a 'black hole' capable of swallowing thousands or millions of pounds with no guarantee of a return, and personnel are recruited, often from positions within other organisations. Thus, the technical entrepreneur is a risk taker required to persuade others to put their faith, finance and careers in his hands" (Cooper 2006b). Those who embark on the entrepreneurial journey need the skills and knowledge as well as persistence and determination to drive innovation and overcome the barriers and challenges which will confront them on their entrepreneurial journey.

The evidence is that while many opportunities exist in technology-related areas the majority of these are pursued by men so the female technology entrepreneur is a much rarer species than her male counterpart. Moore & Buttner (1997) characterise the female entrepreneur as 'a woman, who has initiated a business, is actively involved in managing it, owns at least fifty per cent and has been in operation one year or longer'. Historically, little attention was afforded to female entrepreneurs until the early 1980s (Moore & Buttner 1997, Walker & Webster 2007), since when a greater focus has recognised women's credibility as capable business founders. There is still much work to be done in the domain (Carter et al. 2001, Henry & Kennedy 2003), which is particularly true in the context of female-led entrepreneurship and business growth within technology-based sectors (Winn 2004).

Many governments are keen to encourage more women to become entrepreneurs and are targeting start-ups which are seen as important components in employment creation and economic growth (Reynolds et al. 2004). The numbers of women engaged in enterprise have traditionally been much lower than those of men who are three to four times more likely to start new ventures (O'Reilly & Hart 2003). Entrepreneurial women are well-represented in some areas of the economy such as retail and personal services but remain heavily underrepresented in technology sectors, despite increasing numbers of women studying relevant degree subjects at university (Loscocco & Robinson 1991, Mayer 2006, NFWBO 1999). A sizeable proportion of the women who study SET subjects to degree level do not take up jobs in related sectors when they graduate; as a result they do not gain experience which would enable them to develop effective networks and be in a better position to identify SET new venture opportunities (Anna et al. 2000).

ENTREPRENEURIAL MOTIVATIONS AND THE ROLE OF PRIOR EXPERIENCE

Motivations for entrepreneurship

It is suggested that differences exist between the start-up motivations of male and female entrepreneurs, arising from the differences they attach to different motivators (Cromie 1987). Change in the business environment and its greater acceptance of women has, partly, influenced more women to pursue an entrepreneurial career. According to Orhan and Scott (2001) only a small number of entrepreneurial motivations are gender-based (Rosa et al 1996), with research pointing to those such as career advancement and flexibility to balance dual roles (Goffee & Scase 1985, Losocco & Leicht 1993). Some studies have attempted to establish a link between the motivations for start-up and the overall performance of female-owned firms (Carter & Cannon 1988, Cromie & Hayes 1988, Goffee & Scase 1985); indeed, this is an aspect which has

received considerable attention (Carter 2000a, b). Female entrepreneurship researchers have classified motivations into two categories: those which push women away from paid employment towards entrepreneurial careers and those which pull them towards business start-up (Alstete 2002, Brush 1990, Buttner & Moore 1997, Glancey et al. 1998). Orhan and Scott (2001), however, suggest that women are rarely motivated by just one factor and, instead, decide to pursue entrepreneurship on the basis of a number of inter-related factors.

Push factors: At a general level 'push' factors are negative influences, such as redundancy, job insecurity, poor job prospects, and animosity in the workplace, which push individuals away from paid employment or other activities towards an entrepreneurial career (Gilad & Levine 1986); however, Catley and Hamilton (1998) suggest that entrepreneurship, rather than being a choice, is a last resort for women who, because of their gender, face discrimination in employment (Deakins & Whittam 2000). Two factors, more than any others, appear to influence the uptake of entrepreneurship by women, their family responsibility (known as the 'sticky floor' concept) and the 'glass ceiling' which prevents them from rising through the ranks of many organisations. Research suggests that the necessity of earning a living and being able to 'look after their children', are push factors which commonly drive women into developing their own business (Alstete 2002, Orhan & Scott 2001) as entrepreneurship is viewed as making it possible to balance home and work-life situations (Carter & Anderson 2001). Some suggest that entrepreneurship is the only way in which women with family and domestic commitments can balance work and home-life roles (Cromie 1987, Fielden et al 2003). Several authors have highlighted the effect of the "glass ceiling" especially in the context of executive women who have been impeded from obtaining job progression to more senior positions (Carter & Cannon 1988, Welsh & Young 1984). Entrepreneurship is often considered an "easier way" to meet their personal need for achievement, success and self actualisation, than trying to move up a restricted corporate ladder (Moore & Buttner 1997) where organisational selection criteria, based on gender, age and level of experience, can influence the speed with which career movement is possible (Cromie & Hayes 1988). On a similar theme, Maclaran et al. (1997) use the term "glasshouse" to encapsulate the assumptions and misconceptions which constitute barriers to the advancement of women, restricted, contained and controlled by their environment and the *status quo* of male cultures.

'Pull' factors: At a general level 'pull factors are positive influences, such as the desire for independence, wealth, social status and power (Alstete 2002, Orhan & Scott 2001), which attract individuals towards entrepreneurship to fulfil ambitions and realise other desirable outcomes. Some suggest that pull factors tend to be more dominant than push factors for entrepreneurs (Keeble et al. 1992, Orhan & Scott 2001) as they are largely determined by choice (Orhan & Scott 2001) and entrepreneurial aspirations (Deakins & Whittam 2000). The central reason that both men and women start their own businesses is for independence, the challenge of business ownership and control (Brush & Hisrich 1988, Carter & Cannon 1992, Goffee & Scase 1985, Simpson 1991).

Some research has pointed to the possibility that women may not, generally, be motivated in the same way as men (Galloway et al. 2002). Evidence suggests that a sizeable number of women enter into entrepreneurship for flexibility and independence as they seek a greater balance between their working and their personal lives. According to McKay (2001), older women seek entrepreneurship for independence, as the perception of 'working women' has now

changed. These women may have experienced intense pressure during their younger lives to give up work and put family needs first ahead of their own personal goals, supporting their husband's career and/or bringing up a family. Thus, entrepreneurship is a route via which they can gain late recognition and reward. More recently research has considered that a growing number of women are motivated by professional freedom, self-direction and dynamic challenges (De Martino & Barbato 2003).

The importance of financial gain is often suggested as a motivating factor in deciding to move from paid employment (Baumol 1990) and that this will encourage some to accept the risk of giving up the security of a job in hope that it will pay off and reap financial benefits (Campbell 1992, Praag & Cramer 2001). Marlow (2002), however, suggests that this is not usually the case with female entrepreneurship as, typically, it is linked to low profit and growth aspirations. Rosa et al. (1996) suggest that women do not enter business for financial gain, but to pursue intrinsic goals such as independence and flexibility, to balance family and work commitments.

Despite evidence suggesting that women have strengths in business, some have questioned female motivations for entering into business, in particular their need for achievement and their risk-taking propensity: it is suggested that women are more motivated by the social contribution their business can make (Orhan & Scott 2001) and take a more customer-centred approach. Still and Timms (2000a, b) suggest that women's objectives are to do something worthwhile, thus, taking a more client-focused approach compared with their male counterparts (Brush 1992). Minniti et al. (2005) propose that the likelihood of failure has a major impact on a woman's decision whether to pursue entrepreneurial ambitions. With specific reference to Northern Ireland, the location of this research, the GEM report has acknowledged that fear of failure is a major an obstacle to business creation (O'Reilly & Hart 2005). Yet research by Hisrich and Brush (1986) claims that a 'fear of failure culture' is not as important to women; however, what is important, is the opinion of society and family regarding their pursuit of an entrepreneurial career.

Typically, there are likely to be a range of push and pull factors operating together. According to Walker (2000) push factors are becoming more prominent motivators for female entrepreneurs, and what has been seen in other research is the way in which it is a push factor which typically pushes entrepreneurs over the proverbial 'edge', to pursue an idea which has been attractive for some time, turning latent entrepreneurial interest into entrepreneurial action. In doing so, the personal and professional background of the entrepreneur play a key role in shaping the business which emerges. The following discussion explores the motivations of a group of female SET entrepreneurs and the relationship between their human and social capital at the point of starting their venture.

RESEARCH METHOD

Entrepreneurship research lends itself to approaches which provide opportunities for discovery, exploration and theory building. Some suggest moving beyond conventional methods and adopting new approaches (Carson & Coviello 1995, Chell & Haworth 1992, Hofer & Bygrave 1992). Given the infancy of the research area and exploratory nature of the subject, a qualitative methodology was adopted for this study (Carson et al. 2001, Hill et al. 1999, Hirschman 1986, Miles & Huberman 1994). The paper draws on the findings from a sample of 18 respondents, who were female owner-managers of technology-based businesses operating in Northern Ireland (Table 1a and 1b). Over the previous 12 months, five nascent (pre-start phase) entrepreneurs had

been actively involved in starting new businesses which they at least part owned (Hart 2007) and five women were 'new venturers', who had been operating their businesses for five years or less, with a limited market/product range (Carson & Cromie 1991, Hart 2007). The final eight women owned and ran 'established companies', which had operated for more than five years. Table 1a provides further details of the SET-based businesses which the women operated in Northern Ireland. This study used a convenience sample which generated information-rich case studies, providing valuable insightful into the phenomena being studied (Neuman 1997).

Data were collected using a two-stage process with 12 months between interviews. Unstructured, in-depth interviews were undertaken, with an emphasis on "informal", exploratory discussion as opposed to asking a series of specific and highly structured questions. Themes were identified to guide the interviewer and the relative informality of approach facilitated exploration of issues. The first round of interviews concentrated on business start-up while the second sought greater depth regarding the significance of motivations to purse an entrepreneurial career. There was an emphasis on understanding issues associated with motivations either 'push' or 'pull' factors, as well as the pre-entrepreneurial background of these females to enter into a pre-dominantly 'male' industrial sector. Insights into the reasons for start-up emerged as they spoke in their own words (Carson et al. 2001, O'Donnell & Cummins 1999). Data were analysed concurrently (Merriam 1988), as interviews were conducted in three sets, each comprising six companies. Interviews at each stage in the primary research lasted an average of one and a half hours and were digitally recorded and transcribed.

Given the potentially messy and chaotic nature of qualitative data, a methodical and systematic approach to analysis was required (Easterby-Smith et al. 1991, Miles & Huberman 1994, Tesch 1990). Technology was used in the form of NVivo software to make the process of coding and analysis more efficient (Catterall & Maclaran 1996, Dey 1993). To generate confidence in the research findings once the data had been transcribed and analysed results were referred back to the interviewees for clarification, amplification, corroboration and amendment, if necessary (Guba & Lincoln 1994, Hirschman 1986).

RESEARCH FINDINGS AND DISCUSSION

When starting a new venture, the entrepreneur must identify a market opportunity and bring together the necessary human, financial, intellectual and physical resources. Their ability to spot a viable opportunity will be influenced by factors linked to their knowledge, skills and personal/professional motivations. To understand better how the female technology entrepreneur is shaped by her pre start-up experience and personal context, and the impact these have on her business, the discussion begins by exploring the personal situation of the women when they decided to start their firm. The discussion then explores their motivations for establishing their ventures and considers how their personal and professional backgrounds helped shape the firms they created (Table 1).

Personal Context at Start-up

Age: The amount of experience and level of skills required to start a venture may differ between sectors and even within sectors, placing barriers in the path of the would-be entrepreneur. There are notable examples of successful, young entrepreneurs, including Gates and Branson; however, the majority of technology entrepreneurs establish their business after at least several years as employees (Cooper 2006a, Harrison et al. 2004).

Table 1a: Characteristics of the female entrepreneur (FE) and her business

FE	Age at start	Marital status (no. of children)	Highest level of education	Business sector	Business activity Product = P Service = S	Years in business	No. of emps	Sector employed in pre start-up	Position in firm where employed	Lone (L) or team (T) start (current)	Skills of initial team compared with FE
AA	29	Married (2)	HND - Computers and Business	Technology	Computer Software Design (P)	12	20	IT	Member of Senior Mgt Team	L (L)	-
BJ	36.5	Married (1)	UG - Computer Science	Technology	E-commerce Solutions (S)	2.5	3	Banking	Business Account Manager	T (T)	Different
CK	30	Married (4)	UG - Business Studies	Technology	Computer Software Design (P)	5	18	Electronics	General manager in the family business	T (T)	Different
DR	29	Married (7)	UG – Politics	Technology	Data Cabling Provider (S)	15	17	Telecoms	Sales Executive	T (T)	Different
ER	42	Single (0)	UG - Computer Science	Technology	Software Development (P)	12	6	Software	Senior Manager	L (T)	-
FS	32.5	Married (0)	UG - Archaeology	Technology	Software Development (P)	4.5	14	IT	IT Consultant	T (T)	Similar
GM	30	Married (4)	O-Levels (GCSE's)	Technology	Data Management (S)	3	5	Care worker	-	T (T)	Different
HH	34	Married (3)	UG - Electrical & Electronic Engineering	Technology	Software Development (P)	14	6	IT Consultancy	Senior Consultant	L (L)	-
IC	36	Married (2)	PG– MBA	Technology	Software Development (P)	4	15	Telecoms	Business Development Manger	T (T)	Different
JB	23	Single (0)	UG - Bio-medical Science	Science	Clinical Analysis (S)	15	12	Bio-medical Science	Microbiologist	L (T)	-
KM	37	Married (2)	UG– Nursing	Science	Clinical Analysis (S)	8	26	Clinical Analysis	Clinical Manager	T (T)	Different
LP	33	Married (1)	UG - Electrical & Electronic Engineering	Technology	Software Development (P))	10	20	Education	IT Manager	T (T)	Different
MR	47	Widowed (1)	UG - Art and Design	Engineering	Bespoke Components (P)	9	3	Self employed in Catering Business	Owner/Manager	L (L)	-
NS	39	Married (2)	UG - Occupational Therapy	Science	Design Clinical Devices (P)	0	0	Occupational Therapy	Occupational Therapist	T	Different
OH	26	Co-Habit (0)	PG - Electrical and Mechanical Engineering	Engineering	Electro Magnetic Component (P) Manufacture	0	0	Engineering	Engineer	T	Similar
PT	27	Single (0)	PhD - Bio-medical Science	Science	Design Microbiological Devices (P)	0	0	Bio-medical Science Research	Research Associate	T	Different
QG	28	Married (0)	PhD - Bio-medical Engineering	Science	Design Medical Devices (P)	0	0	Bio-medical Research	Research Associate	T	Different
RC	26	Single (0)	PG - Electrical and Mechanical Engineering	Engineering	Design Electrical Engineering (P) Devices	0	0	Engineering	Engineer	T	Similar
	32.5			AVERAGE		6	9				

Source: Developed by profiling the interviewees

The average age of the women at start-up was 32.5 years (Table 1); the youngest was 23 and the oldest 47. Only two of the women were in their 40s. Interestingly, four of the five nascent entrepreneurs were under 30 years of age and so may have been encouraged to become entrepreneurs at a relatively early age by the changing culture towards women in business. A study of technology entrepreneurs in the United Kingdom (UK), who happened to be men, revealed a mean of 35 years at start-up and a range of 20 to 55, with a little under a third of entrepreneurs in their 40s (Cooper 2006a) so these findings suggest that this sample of women represent quite early entrants into the entrepreneurship space. This raises a question as to whether some of the women were pushed into entrepreneurship by barriers in their career path, an issue explored later in the discussion. It is important to note that MR had begun her entrepreneurial career at a younger age than that indicated in Table 1 as she had three businesses prior to this start-up.

***Family situation and marital status*:** The work of Cohen, (1997), Johnson and Storey, (1993) and Goffee and Scase, (1985) suggest that there is no dominant trend for female entrepreneurs to be married. The majority of women in the sample were married (12) and one was a widow (Table 1). The majority of these 13 women had children (11), with numbers ranging from one to seven. While seven of the participants had no children, four of these women were nascent entrepreneurs and were four of the youngest in the study. It is apparent from this study that many of the women started their business once they were married and some had children. For some of the respondents the fact that they were married made business start-up possible because their husband's income reduced the financial risk. Indeed, Table 1 indicates that majority of female entrepreneurs had two full-time incomes in the household. A typical comment by nascent entrepreneur QG supported this view: *"I have a husband! It would be a huge financial risk, but I am fortunate that I am not the breadwinner in the house, so we could survive. God forbid that anything should happen but it wouldn't be the end of the world if it didn't work out, though it is a risk"*. HH, who ran an established firm, noted: *"From a money point of view…I had two young boys, I was married, we'd a mortgage, and my husband was just a newly trained teacher so he certainly wasn't the huge breadwinner…but we had another income and I thought well, if things don't work out by September I will always get another job"*. Of the 11 entrepreneurs with children, only one woman (AA) set-up her business prior to having a family, seven decided to set-up after the birth their children and three combined having their family and setting up their venture.

Venture Start-up Motivations and Triggers

It was evident that many of the women had given up a good, well-paid and secure job, to start their venture. LP recognised that if she wanted to build a successful business she had to sacrifice other things in her life. The extent of some women's 'sacrifice' was clear from AA's comment: *"…they (previous company) offered me a directorship and all sorts of things and I was really quite young then…I'd had a successful career…I was earning a big salary and had all my perks…but I decided I'd had enough"*.

'Push Factors': The 'push' factors identified confirmed that some women had become entrepreneurs as a result of a lack of good job prospects, the 'glass ceiling' effect, and necessity. The lack of suitable job prospects in Northern Ireland was identified mainly by women who had set up their firms more than five years earlier. These women pointed to a lack of scope for them to be employed in quality, high-powered positions which were challenging, given the level of

skills and knowledge they possessed. They had responded to both the metaphorical 'glass ceiling' which they perceived restricted their career path in the SET domain, and also the nature of the Northern Irish employment market for women in SET. AA commented, *"I knew I had acquired a lot of skills…and to be honest with you I couldn't see a job in this region that would allow me to progress"* and MR noted, *"I came back here and all I was really qualified to do was to be a designer…but women in that business in Northern Ireland were not part of the scene nine years ago"*. ER's experience illustrated an effect of the 'glass ceiling': *"I was working for a company where three companies were actually going to merge into one, there were too many managers…and the chap who became MD…he was elderly, old school and he didn't like women managers…he made three senior managers redundant and two of them were the only senior women managers he had…and I was one of them"*.

The need to 'earn a living' also emerged as an important factor following redundancy, which in some cases acted not only as a trigger to become an entrepreneur but also what made start-up possible; for example, both BJ and GM used voluntary severance/redundancy payments to set up their ventures. ER sat tight in her job and kept quiet about the 'glass ceiling' which she encountered because she knew that her redundancy package was critical to the start-up of her business.

The need to survive was an important motivation as GM explained, *"We just had to do it because we needed to pay our mortgage"*. Similarly DR claimed that she and her husband were, *"…accidental business people, we just had to put cornflakes on the table because I didn't work"*. Necessity to survive is acknowledged in the entrepreneurship literature, but its relevance is sometimes questioned in the case of female entrepreneurs in general, because it is often assumed that they are not the 'sole breadwinner'. This implies an, arguably, somewhat dated view of women as subservient and supported, which this research suggests is not generally the case today, when many women are equally as responsible for supporting and providing for the home. It also tends to overlook women who do not have partners, which is the case with a number of women in this sample. It is relevant to mention here, also, that some of the women had been able to take the entrepreneurial step because of their husband's income acting as a safety net, so the picture is not 'cut and dried' across this group of SET entrepreneurs.

By contrast with findings of female entrepreneurship research cited earlier only two of the women in this study pointed to having set-up in business because of their role as primary carer for their children. GM reflected on what had motivated her, *"We thought…I would have more of a structured life, nine to five and come home. With four children, four boys, I thought this could give me more time to be with the boys"*. BJ looked for similar personal benefits, *"The reason we wanted our own business, was for me – a strong part of that was for me and my daughter…she had been at nursery since she was four months old. I dropped her off every day at a quarter to eight and picked her up at a quarter to six…at this stage she was primary one…I felt there had to be more to life and I had to spend more time with her"*. For this minority of women who sought an improved work-life balance the reality, however, was that their businesses had taken off and had come to dominate family life, as GM reflected, *"… in some ways in gives me less time with the boys … we wanted to be our own bosses but we thought we would have more time to ourselves … but at the moment we don't have"*.

'Pull Factors': Two core reasons are suggested for women in general to enter entrepreneurship, social contribution (Orhan and Scott 2001) and independence (McKay 2001), whilst in the wider entrepreneurship literature recognition of an opportunity, self fulfilment and wealth are pull

factors primarily believed to motivate male entrepreneurs. Many interviewees cited pull factors which included social contribution and independence, so findings supports the importance of these factors, but they also identified the additional pull factors of recognition of an opportunity in the market, self-fulfilment and wealth which, although 'male motivators' are seen here to influence these female SET entrepreneurs.

Considering first the more traditional 'female motivators', a common theme to emerge amongst the women, especially those in science-based ventures set up to 'do good', was a desire to contribute something to society which would impact positively on peoples' lives. NS was typical, *"What's so special is, it's going to make such a difference to the quality of life for people who are so physically disabled and for me that's really, really important"*.

For women who operated businesses in a more commercial setting, the main reason for start-up was different. Wealth and personal gain was more important, and the potential to become 'rich' was a strong motivating factor for risking the security of a steady job. However, in many instances this was combined with additional reasons such as job dissatisfaction and spotting a market opportunity. Reflecting this position KM stated, *"I have to be very honest…I wanted to make a whole lot of money because I could see from where I was working, that I was working exceptionally hard for someone else for not an adequate reward…so that was my prime motivation"*. On a related note, JB commented, *"I think I realised at some point, it had always been my idea to build up and sell out… make some money because I put very, very little in cash terms into the business to start with"*. Thus, although the literature suggests that financial gain is not a prime motivator for female entrepreneurs (Rosa et al. 1996) this research suggests that some women are motivated by financial gain. In addition, these women sought intrinsic goals such as independence (Rosa et al. 1996) along with the challenge of business ownership and control (Carter & Cannon 1992, Simpson 1991, Brush & Hisrich 1988, Goffee & Scase 1985).

This level of independence meant a certain amount of flexibility. Both AA and ER were drawn to entrepreneurship, by the lure of flexibility. However, this was not linked to family responsibilities but to a desire for a flexible lifestyle, as ER's reflection highlighted, *"One of the reasons for going out on my own was that I only wanted to work three days a week, I wanted a bit of time off to myself"*. A related factor was the desire for self-fulfilment, and the need to achieve (Hisrich & Peters 1986). The quest for self-fulfilment and achievement are reflected in IC's comment, *"I'd been out trekking around the world for about 12 years….to bring back the experience that I was building up in an Irish setting…back to this sort of little microcosm of X (town established in), was pretty useful and I just found it really fulfilling…"*.

Building on comments earlier about opportunity spotting, some of the women were motivated by opportunities they recognised in the marketplace. NS observed, *"The idea came from a real situation that I worked in and I could see the potential"*. DR commented that her husband had been working in the market, getting experience when she realised it had potential. She remarked: *"We had no notion of starting a business…we were at a crossroads wondering what we would do next…but we were not thinking in terms of starting our own business…it was more a case of here's a job I can do…and it dawned on me that there was great potential there if there was a bit of structure"*.

Prior Knowledge and Experience

***Education*:** Education is important in the development of entrepreneurial human capital as it has an impact on the individual's knowledge, skills and attitudes. The establishment of a technology-based venture requires different types of knowledge, associated with both the business/market

and technology dimensions of the enterprise. The women in this study were, generally, highly educated; all but two of them held at least an undergraduate degree and four had postgraduate degrees, two of these a PhD (Table 1). Of the two women who did not have a degree one had a vocationally-oriented HND in Computing and Business which provided a good background for her software design business and the other, who left school with O levels post-16, ran a data management business. Most of the women educated to degree level held degrees which were either directly related to their business or an aspect of the degree was related to the venture's SET focus. Whilst the numbers of women now studying for SET degrees is increasing HH reflected on her university experience some years earlier: *"I graduated in 1977…at that stage, I was the only one (female) in my year for three years, while I was at Queen's"*.

These findings contrast with those of Cooper's study of technology entrepreneurs (2006a) which revealed that more than 50% of the male founders did not hold degree, but around two-thirds had worked in a related sector prior to start-up. One interpretation of this could be that to gain credibility in a male-dominate field, women have to be equally if not better qualified than their male counterparts to secure an employment position from which they can go on to found a business and compete against men in a similar field.

Prior work experience: Education is important because it lays the foundations of an individual's career, but for the would-be entrepreneur the experience which they acquire post secondary or tertiary education is also important because it influences the potential to develop further technical know-how and also business/market awareness/networks. From analysis of Table 1 it is evident that the vast majority of these women worked in sectors which enabled them to develop both technical and business capability. The findings align with those of Mukhtar et al. (1998) which pointed to the role of prior industry experience in the development and survival of technology-based ventures.

More than half of the women worked in sectors where women had been in the minority (Table 1) so many of these women had become accustomed to working in male-dominated environments. HH noted: *"I would have been one of the few girls employed, certainly within engineering at that stage"*. ER's experience highlighted just how rare women were in the software sector where she worked prior to starting her own software development business, *"I was working in an office with about twenty-five men in it and I was the only woman and you just have to learn…not to expect anything extra and to work hard"*.

Despite the predominance of men the gender issue did not appear to have had much effect on these women's decision to start and grow a business within these sectors. Indeed, the majority of the women had never considered gender to be an issue or believed it had had an impact on their entrepreneurial experience. However, this may be because by studying for a degree in largely 'male-dominated' subject areas and pursing prior careers in 'male-dominated' sectors they had already confronted and challenged gender stereotypes. These findings contrast with those of Beaver (2002), Brush (1992) and Hisrich and Brush (1984), but support results of US work which found that women are increasingly breaking with traditional perceptions and are gaining recognition in areas such as high technology (Langowitz & Morgan 2003).

Experience in a relevant field prior to start-up provides would-be entrepreneurs with the chance to identify opportunities and understand better the commercial context within which their business will operate (Cooper & Park 2008). These women entrepreneurs were generally at an advantage when it came to spotting businesses opportunities as most had a fairly thorough understanding of the market within which they were to operate their new venture (Table 1),

developed through varying years of experience. ER reflected: *"I'd been working for 20 years in computers before I went out on my own. Quite often a couple of years working for someone else in the same area can be very helpful. To go out and start a business straight from university is very difficult"*. FS recalled how she had identified a suitable opportunity, *"I was working in data base consultancy for ten years and I was having a lot of difficulty in sourcing certain tools and software…and basically I knew how to do it so I did and set up on my own"*.

Given their age at start-up these women most had worked for at least one employer and consequently had benefitted from, in many cases, a fairly sustained period of pre-entrepreneurial employment experience on which they were able to capitalise: others, including GQ and PT were quite recent graduates. Drawing on multiple sources of learning, NS talked of how she had developed a piece of technology to meet an indentified need: *"I knew from my experience of disability and working in paediatrics, and my experience of learning difficulties, I could see a range of clinical scenarios that this (device) could be applicable to"*.

Some of the women had used some of their period of pre start-up employment very strategically. For example, AA returned to Northern Ireland after a period working away with the intention of starting her own business: *"I decided I would take it (the job) despite it being a third of the salary I had in London, because it would give me an opportunity to a) keep my hand in and learn some new skills because I hadn't been involved in all aspects of IT, and b) it would give me a chance to see what was going on and to meet people and develop my networks in NI…so it would be a learning year, I could do the job fairly easily and I could also find out what was going on"*.

For those with a predominantly a technical background, largely as a result of their education, working for someone else prior to starting their firm helped them develop skills which proved invaluable when starting their own business. By working for a larger company ER developed knowledge and skills in, *"Man-management, people management, personnel management, budgeting, financial control in general and a bit of marketing…'cause in a small organisation, you have to do it all!"*. The financial side of the business often poses a challenge to the start-up entrepreneur: HH reflected, *"I didn't do any formal accounts training in X (previous employer) but I built up such a knowledge of balance sheets and profit and losses, in an informal way that set me up very well with a lot of business background…which I wouldn't have had if I had left and set up directly on my own"*. Entrepreneurs from a technical domain often find it hard to secure the first customer and experience difficult in closing sales, without which any business will ultimately fail. DR was grateful for her pre-start experience which had also enabled her to envision her venture beyond start-up, showing a potential path to help grow her business: *"It taught me a lot about the art of selling, you know making calls, getting stuff across, making appointments and, actually closing a sale. Very raw but I was able to see a larger business structure and processes"*. MR was the only women with prior start-up experience. She reflected, *"Before I set up this business I had three businesses so my past experience certainly helped in getting this business going day-to-day"*.

Team composition and expertise: While the focus of this research is on the female entrepreneur, in 13 of the 18 cases the women had started their venture with others, and of the five who started on their own two had been joined by team members subsequently, bringing complementary skills and experience (Table 1). In only two of the 13 team starts did the fellow team members have the same skills as the female entrepreneur; in the majority of cases the background and experience of the women were complemented by their fellow founders who added a different dimension to the

skills and experience portfolio. The dominance of team start-ups in technology-based firm research has been noted in a number of studies, and there is evidence that team-based start-up perform better than lone starts (Cooper 2006a, Oakey 1995). Two women, who started ventures with a partner, identified their distinctive competences and division of labour. BJ noted *"…because X (partner) and I have very different skills sets it works very well together, he's PCs to his ears but that's not necessarily what I'm about – yes I understand and I do them, but I'm more into the customer relationship side of things"*, while DR indicated, *"…it is me that runs the firm here, X (husband) has the technical expertise. That is the most potent business you get developing when the partnership is working and both partners have different skill sets"*., Interesting, in both of these example the partner is male and takes the technical lead while the female entrepreneur leads the management/customer side of the business.

Reputation and networks: An added benefit of starting a venture in the same field is "reputational capital" (Slatter 1992), which in the case of a woman entering a 'man's world' was of even greater value. Reputation and good professional relationships helped to cultivate important networks which the women had utilised as they started and grew their businesses. Some, including QG, learned from their contacts about what start-up involved: *"We did speak to a few people, like accountants and other people we knew. We did get outside advice and X (a contact from pre-entrepreneurial employment), has his own spin-out company and was able to give us some information about what we would have to consider if we were to establish a company. We did, therefore, take advice from certain people, with X being the key person, and also other people I used to work with"*. Relationships developed prior to start-up also were actual and potential sounding boards for possible business developments, as AA highlighted, *"There is nobody that I have worked with, prior to setting up, that I would feel I couldn't lift the phone to and ask them or tell them what I'm doing and trust them enough to sort of confide in them, to see what they think"*. The scope to call on the connections of those already in business was also valuable as ER noted, *"Because you would hope that they (network members/contacts from previous employment) would have come across who it was that you were talking about and advise you"*.

CONCLUSIONS

In the absence of a detailed understanding of the female technology entrepreneur, this paper has sought to extend our knowledge of the types of women who have been attracted by an entrepreneurial career in the male-dominated SET arena in Northern Ireland, a part of the United Kingdom (UK) where rates of female engagement in venturing, let alone technology venturing, are around a third lower than the rest of the UK (Hart 2007). It has also focused on their motivations for pursuing such a career path. The above findings have shed some light on the career development paths which this group of entrepreneurial women have taken to start-up. The path to entrepreneurship of some of these women could be described as fairly pioneering. They enrolled in SET degree programmes when women were rare on such courses; they worked in male-dominated SET career roles when there were very few women in technical positions in the workplace, and they established their own firms at a time when, and in a socio-cultural context where, female entrepreneurship was not common. The fact that four of the most recent entrepreneurs were among the youngest in the sample suggests that perhaps the environment for entrepreneurship might be becoming more accepting of female entrepreneurs who are relatively new to the sector. The flow of women into SET entrepreneurship is still constrained by the

relatively low numbers who have studied for degrees which help open up the potential of an entrepreneurial career path. The fact that more women are now pursuing degree in these fields does mean that there are more potential female entrepreneurs being produced by our universities, only time will tell how many women decide to pursue that career path.

An important finding for our understanding of the female entrepreneur is the strikingly high level of educational attainment evident amongst the women in the sample, whether they were the younger or older women in the sample. These findings show a much higher level of attainment than some other studies of male technology entrepreneurs and as was suggested earlier, they raise the question as to why this might be the case. It could be that in order to secure employment in technical roles, which lay the foundation for an entrepreneurial career, women need to demonstrate higher levels of achievement than male candidates. It could also be that highly intelligent and talented women find that they are not able to advance to positions to which they aspire within employment, and therefore have little option other than to leave employment, as was suggested was the case by a number of the interviewees.

In common with other studies of SET entrepreneurs, prior work experience proved vital in helping these women prepare to start their own ventures, whether it was the knowledge gained, the skills developed or the networks which they were able to cultivate, there was widespread agreement and evidence of the importance of this phase of these women's careers. Those who start a business very soon after leaving university lack the depth of experience gained through the entrepreneurial apprenticeship. Many university SET degrees now include some element of enterprise education or business planning so this will help to fill some of the knowledge gaps, and degrees with work placements help to provide a window into the workplace (Lucas et al. 2009). It was evident that even the women with more professional experience prior to start-up tended to form a start-up team, which is in line with findings of previous research.

Previous work on the motivations of female entrepreneurs for opting to start their own firms have highlighted push and pull motives, and some of these were evident in this sample of women, with both types of factors often operating together. Necessity emerged as a key factor, with purely opportunity driven firms in the minority. There has been an increasing focus on the importance of the search for work-life balance as more women seek to pursue career paths which do not put the happiness of their family life in jeopardy. Even though many of the women had children only a small minority citied work-life balance as a motivating force, and for those who did, what was clear was that running an SET business did not permit time for the family in the way which had been envisaged – the image was illusory. This points to the challenge of running a professional business which needs to deliver to tight deadlines and requirements: some types of firm might be able to put things off until tomorrow, most SET firms do not fall into that category. Interestingly, quite a number of the women mentioned financial motivations, which is a finding more typical of male entrepreneurs. This is an area where these SET women were more like their male counterparts than female entrepreneurs in general.

It would be interesting to undertake a similarly study in ten years time to find out what the profile of the female SET entrepreneur looks like then. It would appear that the age at which some women are seeking to set up their first firm is reducing, and while this is positive it is important to understand more about how the lack of commercial workplace experience might have an impact on the development of their enterprise. There may be a role for universities and enterprise agencies to provide business support and training in aspects which the younger entrepreneur may lack. Also, linking young entrepreneurs to mentors may help younger entrepreneurs along the entrepreneurial pathway. Some of these women were pioneers in SET

fields when they were very much swimming against the tide of convention, when there were few role models for them to look to for inspiration and a sense of what could be achieved by a woman in a predominantly 'man's world'. Some of them represent valuable role models for the current and next generation of entrepreneurial women, and have important lessons which they can share. Given the increasing number of successful female entrepreneurs there is scope to use these women as mentors or more broadly to profile their cases as role models to encourage those who are considering entrepreneurship. While some of these women became entrepreneurs out of necessity they have demonstrated their abilities to develop and build successful ventures and in so doing have the potential to inspire more women to look at entrepreneurship as a positive rather than negative career response.

REFERENCES

Alstete, JW (2002) 'On becoming an entrepreneur: An evolving typology', *International Journal of Entrepreneurial Behaviour and Research*, 8, 4, 222-234.

Anna, AL, Chandler, GN, Jansen, E and Mero, NP (2000) 'Women business owners in traditional and non-traditional industries', *Journal of Business Venturing*, 15, 3, 279-303.

Baumol, WJ (1990) 'Entrepreneurship: Productive, unproductive and destructive', *Journal of Political Economy*, 98, 893-921.

Beaver, G (2002) 'Female entrepreneurship', in *Small business, entrepreneurship and enterprise development*, Harlow: Pearson Education Ltd.

Brush, C (1990) 'Women and enterprise creation: barriers and opportunities', in Gould, S. and Parzen, J. (Eds) *Enterprising Women: Local Initiatives for Job Creation*, Paris: OECD, 37-58.

Brush, CG (1992) 'Research on women business owners: Past trends, a new perspective and future directions', *Entrepreneurship Theory and Practice*, 16 (4), 5-30.

Brush, CG and Hisrich, RD (1988) 'Women entrepreneurs: strategic origins impact on growth', in Kirchoff, BA, Long, WA, McMullan., WE, Vesper, KH and Wetzel, WE Jr. (Eds) *Frontiers of Entrepreneurship Research,* Wellesley, MA: Babson College, 612-625.

Campbell, CA (1992) 'A decision theory model for entrepreneurial acts', *Entrepreneurship Theory and Practice*, 17, 1, 21-27.

Carson, DJ and Coviello, N (1995) 'Researching the marketing/entrepreneurship interface', paper presented at the AMA Marketing/Entrepreneurship Symposium, Melbourne.

Carson, D and Cromie, S (1991) 'Marketing information: Its collection and utilisation by small firms', The Proceedings of the 36th ICSB World Conference, Austria, 51-58.

Carson, D, Gilmore, A, Perry, C and Gronhaug, K (2001) *Qualitative marketing research*, London: Sage.

Carter, NM, Gartner, WB, Shaver, KG and Gatewood, EJ (2003) 'The career reasons of nascent entrepreneurs', *Journal of Business Venturing*, 18, 13-39.

Carter, S (2000a) 'Improving the numbers and performance of women-owned business: Some implications for training and advisory services', *Education and Training*, 42, 4/5, 326-334.

Carter, S (2000b) 'Gender and enterprise', 166-181 in Carter, S. and Jones-Evans, D. (Eds) *Enterprise and the small business: Principles, practice and policy*, Harlow, London: Prentice Hall.

Carter, S and Anderson, S (2001) 'On the Move: Women and Men Business Owners in the United Kingdom', National Foundation for Women Business Owners, Washington DC and IBM, New York.

Carter, S and Cannon, T (1988) 'Female entrepreneurs: A study of female business owners, their motivations, experiences and strategies for success', London: Department of Employment Report.

Carter, S. and Cannon, T. (1992) *Women Entrepreneurs*. London: Academic Press.

Carter, S, Anderson, S and Shaw, E (2001) 'Women's Business Ownership: A Review of the Academic, Popular and Internet Literature', Report to the Small Business Service, Glasgow.

Catley, S and Hamilton, RT (1998) 'Small business development and gender of owner', *Journal of Management Development*, 17, 1, 75-82.

Catterall, M and Maclaran, P (1996) 'Using computer programs to code qualitative data', *Marketing Intelligence and Planning*, 14, 4, 29-33.

Chandler, G (1996) 'Business similarity as a moderator of the relationship between pre-ownership experience and venture performance', *Entrepreneurship: Theory and Practice*, 20, 3, 51-65

Chell, E and Haworth, JM (1992) 'The development of a research paradigm for the investigation of entrepreneurship: some methodological issues', Proceedings of the UIC/AMA Research Symposium on Marketing and Entrepreneurship, INSEAD, France, June, 1-15.

Cohen, L (1997) 'Women in transition: From employment to self-employment', Unpublished PhD Thesis, Sheffield Business School, Sheffield Hallam University.

Cooper, SY (2001) 'Inter-organisational relationships and firm size', 153-176 in Tayeb, M. (ed.) *International business partnerships: Issues and concerns*, London, Macmillan.

Cooper, SY (2006a) 'Knowledge and expertise for high technology entrepreneurship: a tale of two sectors', *International Journal of Knowledge Management Studies,* 1, 1/2, 59-78.

Cooper, SY (2006b) 'Technical Entrepreneurship', in Carter, S. and Jones-Evans, D. (eds), *Enterprise and small business: Principles, practice and policy,* 2nd edition, London: Pearson Education.

Cooper, SY and Park, JA (2008) 'The impact of 'incubator' organisations on opportunity recognition and technology innovation in new, entrepreneurial high-technology ventures', *International Small Business Journal,* 26, 1, 39-63.

Cromie, S (1987) 'Motivations of aspiring male and female entrepreneurs', *Journal of Occupational Behaviour*, 8, 3, 251-261.

Cromie, S. and Hayes, J. (1988) 'Towards a typology of female entrepreneurs', *Sociological Review*, 36, 1, February, 87-113.

De Martino, R and Barbato, R (2003) 'Differences between women and men MBA entrepreneurs: Exploring family flexibility and wealth creation as career motivations', *Journal of Business Venturing*, 18, 6, 815-832.

Deakins, D and Whitton, G (2000) 'Business start-up: Theory, practice and policy', in Carter, S and Jones-Evans, D (eds) *Enterprise and small business principles, practice and policy*, London: Prentice-Hall.

Dey, I (1993) *Qualitative data analysis: A user-friendly guide for social scientists*, London: Routledge.

Easterby-Smith, M and Thorpe, R (1991) *Qualitative Methods*, London: Management Research, Sage Publications, 71-133.

Fielden, S, Davidson, M, Dawe, AF and Makin, P (2003) 'Factors inhibiting the economic growth of female-owned small businesses in the North West of England', *Journal of Small Business and Enterprise Development*, 10, 2, 152-156.

Galloway, L, Brown, W and Arenius, P (2002) 'Gender-based differences in entrepreneurial behaviour: A comparative examination of Scotland and Finland', *Entrepreneurship and Innovation*, May, 109-119.

Gilad, B and Levine, P (1986) 'A behaviour model of entrepreneurial supply', *Journal of Small Business Management*, 24, 45-51.

Glancey, K, Greig, M and Pettigrew, M (1998) 'Entrepreneurial dynamics in small business service firms', *International Journal of Entrepreneurial Behaviour and Research*, 4, 3, 249.

Goffee, R and Scase, R (1985) *Women in Charge: The Experience of Female Entrepreneurs*, London: Allen and Unwin.

Guba, EG and Lincoln, YS (1994) 'Competing paradigms in qualitative research', Chapter 6 in Denzin, N and Lincoln, YS (eds) *The handbook of qualitative research*, London: Sage Publications.

Hampton, A, Cooper, S and McGowan, P (2009) 'Female entrepreneurial networks and networking activity in technology-based ventures: an exploratory study', *International Small Business Journal*, 27, 2, 193-214.

Harrison, R, Cooper, S and Mason, C (2004) 'Entrepreneurial activity and the dynamics of cluster development: the case of Ottawa', *Urban Studies,* 41, 5/6, 1045-1070.

Hart, M (2006) *Global Entrepreneurship Monitor: Northern Ireland*, Belfast and London: Invest NI and London Business School.

Hart, M (2007) *Global Entrepreneurship Monitor: Northern Ireland*, Belfast and London: Invest NI and London Business School.

Henry, C and Kennedy, S (2003) 'Female entrepreneurship – In search of a new Celtic tiger', 203-224 in Butler, J (ed) *New perspectives on women entrepreneur,* Hong Kong: Information Age Inc.

Hill, J, McGowan, P Drummond, P (1999) 'The development and application of a qualitative approach to researching the marketing networks of small firm entrepreneurs', *Qualitative Market Research: An International Journal*, 2, 2, 71-81.

Hirschman, EC (1986) 'Humanistic inquiry in marketing research: Philosophy, method and criteria', *Journal of Marketing Research*, 23, 237-249.

Hisrich, RD and Brush, C (1984) 'The women entrepreneur: Management skills and business problems', *Journal of Small Business Management*, 22, No.1, 30-37.

Hisrich, RD and Brush, C (1986) *The women entrepreneur: Starting financing and managing a successful new business*, Lexington, MA: Lexington Books.

Hisrich, RD and Peters, MP (1998) *Entrepreneurship*. (4th Edition), Boston, Irwin: McGraw-Hill.

Hofer, CW and Bygrave, WD (1992) 'Researching entrepreneurship', *Entrepreneurship Theory and Practice*, Spring, 16, No.3, 91-100.

Johnson, S and Storey, DJ (1993) 'Male and female entrepreneurs and their businesses – A comparative study', in Allen, S and Truman, C (eds) *Women in business: Perspectives on women entrepreneurs*, London: Routledge.

Keeble, D, Bryson, J and Wood, P (1992) 'The rise and fall of small service firms in the United Kingdom', *International Small Business Journal*, 11, 1, 11-22.

Kerr, B and Robinson Kurpius, SE (2004) 'Encouraging talented girls in math and science: effects of a guidance intervention', *High Ability Studies,* 15, 1, 85-102.

Langowitz, NS and Morgan, C (2003) 'Women entrepreneurs: breaking through the glass barrier', 101-119 in Butler, J (ed) *New Perspectives on women entrepreneurs*. Greenwich: Information Age Inc.

Loscocco, KA and Robinson, J (1991) 'Barriers to women's small-business success in the United States', *Gender and Society,* 5, 4, 511-32.
Losocco, KA and Leicht, KT (1993) 'Gender, work-family linkages and economic success among small business owners', *Journal of Marriage and the Family*, 55, 875-887.
Lucas, WA, Cooper, SY, Ward, A and Cave, F (2009) Industry placement, authentic experience and the development of venturing and technology self-efficacy, *Technovation*, 29, 738-752.
Maclaran, P, McGowan, P and Hill, J (1997) 'Marketing education for small firm entrepreneurs: A worked based learning approach', *Marketing Education Review*, 7, 3, Fall, 39-46.
Malecki, EJ (1981) 'Product cycles, innovation cycles, and regional economic change', *Technological Forecasting and Social Change*, 19, 291-306.
Markusen, A (1985) *Profit Cycles, Oligopoly, and Regional Development*, Cambridge MA: MIT Press.
Marlow, S (2002) 'The myth of the entrepreneurial economy: Employment, innovation and small firms - Work employment and society', *International Small Business Journal*, 20 (1), 111-113.
Marlow, S and Strange, A (1994) 'Female entrepreneurs: success by whose standards?', in Tanton, M (ed) *Women in management: A developing presence*, London: Routledge.
Mayer, H (2006) 'Economic trends and location patterns of women high-tech entrepreneurs', 298-309 in A Zacharakis et al. (eds) *Frontiers of entrepreneurship research*, Wellesley, Babson College.
McKay, R (2001) 'Women entrepreneurs: moving beyond family and flexibility', *International Journal of Entrepreneurial Behaviour and Research*, 7, 4, 148-165.
Merriam, SB (1988) *Case study research in education: A qualitative approach*, California: Jossey-Bass.
Miles, MB and Huberman, AM (1994) *Qualitative Data Analysis: An Expanded Sourcebook,* 2nd Edition, London: Sage.
Minniti, M, Arenius, P and Langowitz, N (2005) *2004 Report on Women and Entrepreneurship.* MA, USA: Centre for Women's Leadership.
Moore, DP and Buttner, EH (1997) *Women entrepreneurs: Moving beyond the glass ceiling*, Thousand Oaks, CA: Sage.
Mukhtar, SM (1998) 'Business characteristics of male and female small and medium enterprises in the UK: implications for gender based entrepreneurianism and Business Competence Development', *British Journal of Management*, 9, 41-51.
Neuman, WL (1997) *Social research methods: Qualitative and quantitative approaches*, Needham Heights, Boston: Allyn and Bacon.
NFWBO (1999) *Characteristics of women entrepreneurs worldwide are revealed.* Washington, DC: National Foundation for Women Business Owners.
O'Donnell, A and Cummins, D (1999) 'The use of qualitative methods in researching networking in SMEs', *Qualitative Market Research: An International Journal*, 2, 2, 82-91.
O'Reilly, M and Hart, M (2003) *Global Entrepreneurship Monitor (GEM),* Northern Ireland 2002 GEM Report, Invest NI: Belfast.
O'Reilly, M and Hart, M (2005) *Global Entrepreneurship Monitor (GEM),* Northern Ireland, 2004 GEM Report, Invest NI: Belfast.
Oakey, R, Mukhtar, SM and Kipling, M (1998) 'Student perspectives on entrepreneurship: Observations on the propensity for entrepreneurial behaviour', Proceedings of the Enterprise and Learning Conference, University of Aberdeen.

Oakey, RP (1995) *High-technology new firms: Variable barriers to growth*, London: Paul Chapman.
Oakey, RP and Cooper, SY (1989) 'High technology industry, agglomeration and the potential for peripherally sited small firms', *Regional Studies*, 23, 4, 347-360.
Oakey, RP and Cooper, SY (1991) 'The relationship between product technology and innovation performance in high technology small firms', *Technovation*, 11, 2, 79-92.
Orhan, M and Scott, D (2001) 'Why women enter into entrepreneurship: An explanatory model', *Women in Management Review*, 16, 5, 232-243.
Praag, CM and Cramer, JS (2001) 'The roots of entrepreneurship and labour Demand: Individual ability and low risk', *Economics*, 68, 269, 45-62.
Reynolds, PD, Bygrave, W, Autio, E, Cox, LW and Hay, M (2004) Global Entrepreneurship Monitor 2003, Executive Report, Babson College/Ewing Marion Kauffman Foundation, London Business School.
Rosa, P, Carter, S and Hamilton, D (1996) 'Gender as a determinant of small business performance: Insights from a British study', *Small Business Economics*, 8, 463-478.
Sahlman, W.A. and Stevenson, H.H. (eds) (1993) *The Entrepreneurial Venture*, Boston, Mass., Harvard Business School Publications.
Shane, S (2000) 'Prior knowledge and the discovery of entrepreneurial opportunities', *Organizational Science*, 11, 4, pp 448-469.
Simpson, S (1991) 'Women entrepreneurs', Chapter 9 in Firth-Coznes, J and West, M (eds) *Women at Work - Psychological and Organisational Perspectives*, Philadelphia, P.A: Open University Press.
Slatter, S (1992) *Gambling on growth- How to manage a high-tech firm*, Chichester: John Wiley & Sons.
Still, LV and Timms W (2000a) 'Women's business: The flexible alternative work style for women', *Women in Management Review*, 15, 5/6, 272-282.
Still, LV and Timms W. (2000b) 'I want to make a difference: women small business owners: Their businesses dreams, lifestyles and measures of success', Paper to ICSB World Conference 2000, Entrepreneurial SME's Engines for Growth in the Millennium, June, Brisbane.
Tesch, R (1990) *Qualitative research: Analysis types and software tools,* Lewes: Falmer Press.
Walker, E (2000) 'Women in small business: A current perspective', Paper to the 23rd ISBA National Small Firms Policy and Research Conference, November, Robert Gordon University, Aberdeen.
Walker, E and Webster, B (2004) 'Gender issues in home-based businesses', *Women in Management Review*, 19, 8, 404-412.
Welsh, H and Young, E (1984) 'Male and female entrepreneurial characteristics and behaviours: A Profile of Similarities and Differences', *International Small Business Journal*, 2, 4, 11-20.
Winn, J. (2004) 'Entrepreneurship: Not an easy path to top management for women', *Women in Management Review*, 19, 3, 143-153.

LEARNING ENTREPRENEURSHIP BY ENTREPRENEURIAL LEARNING?

HTSF Doctoral Workshop and Conference 2010

Drs. ing. L.E.P.T. (Luc) de Krosse
Senior Lecturer Saxion University of Applied Sciences
PhD-Student University of Groningen
Prof. dr. J.J. (Jos) van der Werf, University of Groningen and Saxion University of Applied Sciences
Ir. J.D. (Han) van der Meer, Saxion University of Applied Sciences
Prof. dr. P.L.C. (Paul) van Geert, University of Groningen

Department of Communication, Informationtechnology & Informationmanagement
Knowledge Center of Innovation & Entrepreneurship
Saxion University of Applied Sciences, the Netherlands
Handelskade 75
7417 DH Deventer (Netherlands)
Phone: +31 0570603677
Mobile phone: =31 0617800384
E-mail: l.e.p.t.dekrosse@saxion.nl

Abstract
That entrepreneurship and entrepreneurial education is a relevant topic nowadays is evident (van Praag, 2006; van der Sluis, 2007; The Oslo Agenda for Entrepreneurship Education in Europe, 2006). This is confrontating universities of applied sciences in the Netherlands with a great challenge, namely to educate more and better entrepreneurs. Main goal of universities of applied sciences is to prepare students to become successful in their profession. Specific for entrepreneurial education programmes we can state that it is their purpose to prepare students to become successful entrepreneurs. From literature it seems that motives and competencies are the most important objectives for educators to focus upon. But are they achieving these goals? Are students, after attending an entrepreneurial education program, more motivated to become entrepreneurs and are they more competent to become successful than before? This research intends to answer the questions whether there is an effect on the development of relevant motives and competencies, whether there is an influence of the learning environment on these effects and whether there are certain causes for the reason that one program has minimum or no effects and other programs have greater effects. For answering these questions every entrepreneurial program will be positioned in a didactic model and all students of the entrepreneurial programs will be asked to make a self-assessment before and after attending the program. After this it should be clear what kind of educational programs are more effective than others. For answering the final question, which are the causes of the differences in effects of the different kinds of program, it will be necessary to interview the responsible developers and teachers.

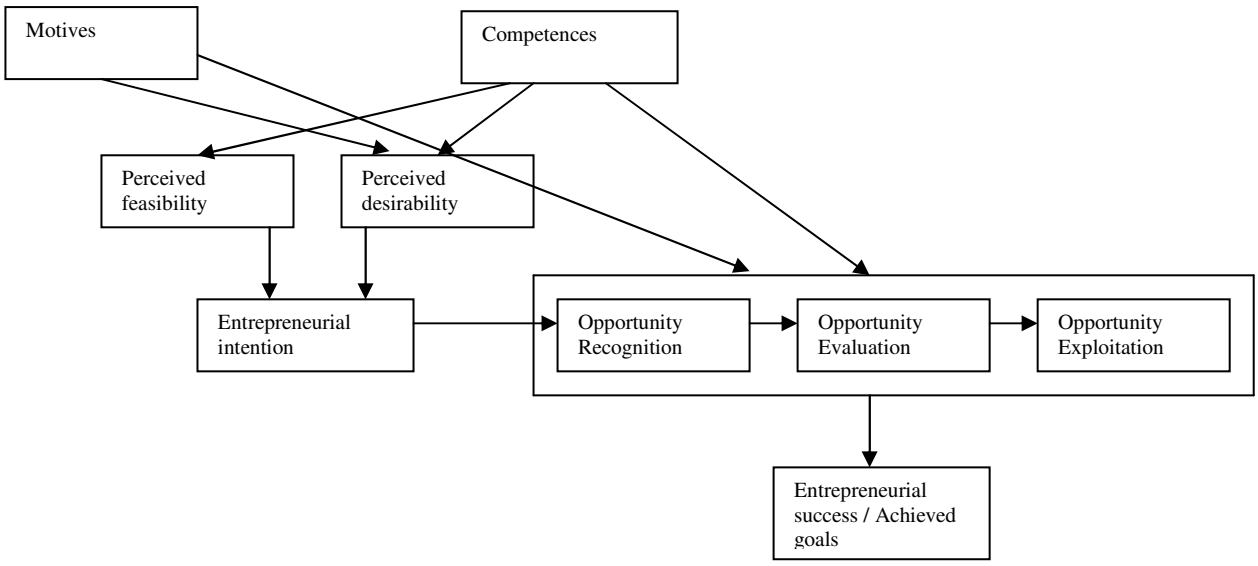
Introduction
Why are so few people choosing to become entrepreneurs and starting their own business after leaving school? In conversations many people say they have a latent desire to become self-employed. Because then you can do what you love to do without suffering from a boss or organization who is telling you what to do and in what way you should do it (previous research at Saxion University of Applied Sciences shows that 55% of their students is interested in becoming an entrepreneur). Ultimately, only a very small percentage actually take the step towards an entrepreneurial life (previous research at Saxion University of Applied Sciences shows that only 4% of the students can be regarded as a student-entrepreneur).
And if chosen for a life as entrepreneur it than appears that only a small part of them is becoming really successful. Much of these newly started entrepreneurs are stopping after a shorter or longer time (whether because of bankruptcy or for other reasons) and a lot of others are not becoming successful at all. So *why does one entrepreneur succeed and does another fail*?
The first question (*why are so few people choosing to become entrepreneurs*) has much to do with motives that people have to (continue to) do what they ultimately are doing and with their creativity, self-confidence and willpower. Maybe starters do have motives that non-starters do not have or in a lesser extent.
The second question (*why does one entrepreneur succeed and does another fail)* has a lot to do with durability, and hence the strength of the motives. Are these motives stay intact throughout the lifetime of the business start-up or are their other motives which are working against the urge to stay in business? Also this second question has something to do with the degree of skills necessary to perform successful entrepreneurial behaviour.
If one wants to encourage more people to start their own business and one wants to ensure that it can be a successful business, one should be trying to stimulate and develop relevant motives and competences.

That entrepreneurship as a theme is relevant to the development of society and economy seems to be obvious. Research shows that entrepreneurship is important for economic growth, dynamism, innovation, employment and welfare in general (van Praag, 2006; van der Sluis, 2007). Some claim that entrepreneurship in the Netherlands is lagging behind and that no entrepreneurial culture prevails (Westhof, 2005; van Praag, 2006). Westhof and van Praag believe that it is of great importance to stimulate entrepreneurship. But how to stimulate entrepreneurship? It is obvious that a connection is made with the development of motives and competences, or in other words, with education. It is therefore not surprising that entrepreneurship and entrepreneurship education are high on the agendas of policy makers and researchers as is illustrated by "The Oslo Agenda for Entrepreneurship Education in Europe" (2006). The call for more and better entrepreneurs is nowadays louder than ever before. This means a major challenge for Universities of Applied Sciences in the Netherlands to actually educate more and better entrepreneurs.
It can be argued that the general objective of Universities of Applied Sciences is to prepare students to successfully perform their later working life. Specifically for entrepreneurship education the objective is to prepare students to successfully perform the entrepreneurial tasks. In addition to this primary objective there is the desire to stimulate more students to choose for the entrepreneurial life.
Important questions for Universities of Applied Sciences are: what determines whether a person chooses a life as an entrepreneur and what determines whether someone can perform the entrepreneurial tasks successfully. The first question is about the motives that makes someone wants to become an entrepreneur. The second question is about the competences that makes someone able to perform the entrepreneurial tasks successfully.
As shown from the literature motives and competences are determining the entrepreneurial intention and the entrepreneurial success.

Motives
When talking about motives, we are talking about how strong your wish is to become and stay an entrepreneur. Motives can be divided into internally and externally driven motives. Internally driven motives to become an entrepreneur comes from within. The following internally driven motives are the most important ones according to literature (Shane and Venkataraman, 2000; Driessen, 2005; Shane, 2003; van Auken, 2006; Stigter, 2001; Mitchell, 2004; Snel, 2004; Gibb, 2005; Snel, 2006; Benz, 2006): Need for Achievement / Ambition, autonomy, recognition, more opportunities to develop and use ones own competences, more opportunities to use ones own creative talents in the realization of something new or of their own ideas, and the desire to have interesting work. The choice to become an entrepreneur can can also be motivated by externally driven motives. Most important externally driven motives according to literature (Driessen, 2005; van Auken, 2006; van Praag, 2006) are: (the threat of) unemployment, job dissatisfaction, working life / family life – balance, favourable economic conditions, market niche, personal assets and income. Because internally driven motives are much more stronger than externally driven motives (Choo; Guerrero, 2006) and because education at Universities of Applied Sciences have only little or no influence on the latter, only the internally driven motives will be part of this research.
Motives play a role not only in entrepreneurial intention but also whether one becomes successful after the launch of the company. The afore mentioned motives that serve as food for entrepreneurial intention are staying important during the entire duration of the company. Once these motives weaken or disappear also the intention of continuing will decline and hence the chance of success.

Competences
Also the presumed and required competences have a positive impact on the perceived desirability and the perceived feasibility (and hence the entrepreneurial intention and the entrepreneurial success) to starting a business. The following skills and knowledge are important according to literature (Shane, 2003; Gibb, 2005; Guerrero, 2006; Zampetakis, 2006; Linan, 2008): ability to recognize opportunities, the ability to solve problems using creativity, leadership skills, ability to think strategically, ability to take intuitive decisions in uncertain situations, communication skills, ability to develop new products and services, sales skills, ability to be convincing, negotiation skills, planning skills, ability to function in a team, ability to handle conflicts, and networking skills, and knowledge and understanding of (market)environment, people, production, marketing and finance.

The Entrepreneurial Model
Motives and competences have, in addition to the influence from the environment, a major influence on both the entrepreneurial intention and the entrepreneurial success. An entrepreneurial education program at Universities of Applied Sciences should therefore aim, at a greater or lesser extent, for the achievement of a positive development of these motives and competences as learning outcomes.
The above discussion is leading us to the following Entrepreneurship Model



The educational model
Besides the substantive focus on the various aspects of entrepreneurial motives and competences, it is also didactics that play a key role in achieving the main objectives of entrepreneurial education programs at Universities of Applied Sciences. The applied didactics can be distinguished by their structure and their focus.

Learning environment and learning outcomes
The above raises the question whether and in what way the entrepreneurial motives and entrepreneurial competences can be best educated at Universities of Applied Sciences. About this, people can have very different opinions. First it can be questioned whether motives could be influenced through education along with the question whether it is desired to do so. This may lead to the situation that one program is aiming at developing both motives and

competences, while another program is limited to aiming at developing competences. Second it can be questioned, because different educators can have different preferences for certain didactics. This may lead to the situation that one program is targeting a more traditional educational design with a focus on knowledge reproduction, while another program is focusing on a more constructivist educational design with a focus on knowledge construction. Whatever choices are made, the question remains whether the intended learning outcomes are achieved.

Entrepreneurial education

That entrepreneurship can be taught and developed, under the condition of a proper environment, is, according to Gibb (2005) now widely accepted. Also Lobler (2006) comes up with the same view, and presents a constructivists learning theory as a basis for designing entrepreneurship education. Both authors are choosing for a constructivist approach to entrepreneurship education as an ideal didactic model. Learning by doing, experiential learning, authentic tasks, trial and error and especially starting up ones own business are used as exaples of effective ways to educate and learn entrepreneurial behaviour, skills and knowledge.

From literature it seems that the combination of the traditional learning model with a focus on knowledge reproduction, and the combination of the constructivist learning model with a focus on knowledge construction, are most common. And it seems that the latter combination is most suited to entrepreneurship education. But from literature it is also known that this not necessarily have to be the case. Maybe it will be quite possible for other combinations to be designed and implemented.

The question remains whether there are multiple ways that are leading to the achieved objectives. Are all existing and various programs leading to the achieved objectives? And if not, what makes one program better than another? Several causes can be mentioned for this. For example the didactics (or the lack thereof) and the context within the designed program should be implemented in (frameworks, bureaucracy, teacher qualities, etc.).

Problem definition

Main goal of Universities of Applied Sciences is to prepare students to become successful in their profession. Specific for entrepreneurial education we can state that it is the main objective to prepare students to become successful entrepreneurs. From literature it seems that motives and competencies are the most important goals for educators to focus upon. But are they achieving this goals?

Research questions

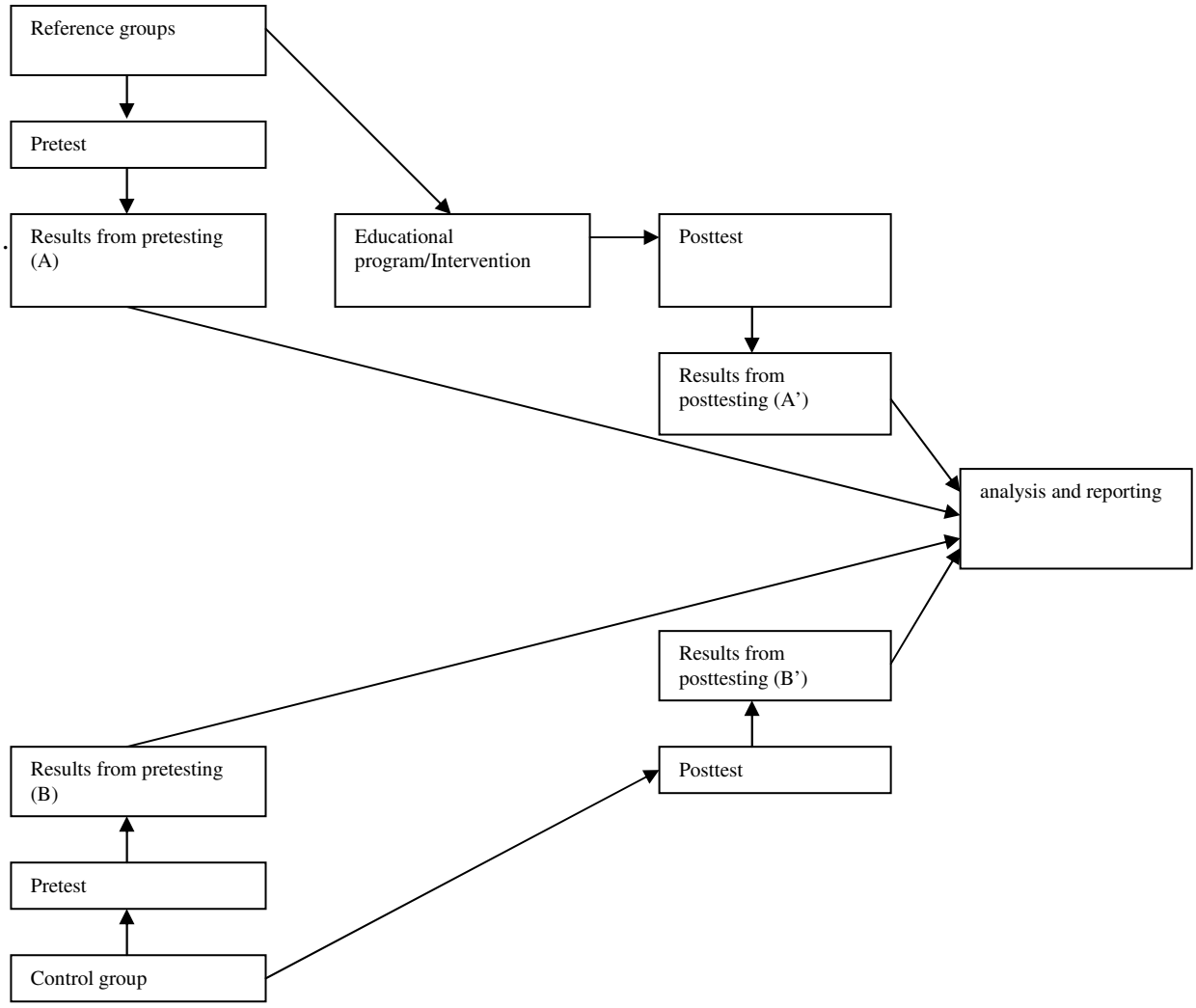
First question is whether, and to what extend, the learning environment (didactic principles) has influence on the learning results (effects on the developing of motives and competencies)? Following question is whether the differences between the original programdesign, the perceived program by students, the perceived program by teachers and the desirable program, are influencing the learning results (effects on the developing of motives and competencies)? Finally it is important to find out what are the causes of the differences mentioned above.

Theoretical framework proposition

For answering the first question it is necessary to make a selection of relevant educational programs (that is, programs which are aiming at developing relevant entrepreneurial motives and entrepreneurial competencies) and position them into a didactic framework. After this it is necessary to measure the effectiveness of the different programs using an student-selfassessment before and after attending the program.

For answering the second question it will be necessary to let students, teachers and developers position the program afterwards.
The third question will be answered after interviewing the responsible developers/teachers afterwards.

Research design
To answer the effects-question it will be necessary to make use of a quasi-experimental research where there is a measuring before and after the program among students of the treatment programs and students of control programs.



Supervision
Prof. dr. P.L.C. van Geert (University of Groningen, Netherlands)
Prof. dr. J.J. van der Werf (University of Groningen, Netherlands)
Ir. J.D. van der Meer (Saxion University of Applied Sciences, Netherlands)

Phase
After completing literature research the research is now in the phase that I am searching for relevant entrepreneurial education programs and studying statistics and methodology literature in favour of using the right tools to perform this research.

Contribution to the body of research

This research is contributing to the body of research on entrepreneurial education. Main achievement will be a clear insight in the relationship between didactics, educational environment and the effectiveness of different entrepreneurial education programs. This can be the start of further research but above that it can give educators knowledge and tools to develop more effective entrepreneurial education programs.

References

Ajzen I.; 1987; *Attitudes, traits, and actions: Dispositional prediction of behavior in social psychology*; Advances in Experimental Social Psychology, 20, 1-63

Ajzen I.; 1991; *Theory of planned behaviour*; Organizational Behavior and Human Decision Processes, 50, 179-211

Auken van H., Fry F.L. and Stephens P.; 2006; *The Influence of role models on entrepreneurial intentions*; Journal of Developmental Entrepreneurship, 11(2), 157-167

Auken van H., Stephens P., Fry F.L. and Silva J.; 2006; *Role model influences on entrepreneurial intentions: A comparison between USA and Mexico*; International Entrepreneurship and Management Journal, 2, 325-336

Bandura A.; 1986; *The Social Foundations of Thought and Action*; Englewood Cliffs: Prentice Hall

Baron, R.A. en Markman, G.D; 2000; *Beyond social capital: How social skills can enhance entrepreneurs' success;* Academy of Management Executive, 14, 106-116

Benz M.; 2006; *Entrepreneurship as a non-profit-seeking activity*; International Entrepreneurship and Management Journal

Bosma, N., Praag van M. and Wit de G.; 2000; *Determinants of Succesful Entrepreneurship;Zoetermeer;* Scales

Bosma, N., Jones K., Autio E. and Levie J.; 2007; *Global entrepreneurship monitor: 2007 Executive Report;* Babson College and London Business School

Brysbaert M.; 2006; *Psychologie*; Academia Press, Gent

Chattopadhyay R. and Ghosh A.; 2002; *Predicting Entrepreneurial Succes: A Socio-psychological Study*; Journal of Entrepreneurship, 11, 1

Choi Y.R. and Shepherd D.A.; 2004; *Entrepreneurs' Decisions to Exploit Opportunities*; Journal of Management, 30, 377-395

Choo S. and Wong M.; *Entrepreneurial Intentions: Triggers and Barriers to New Venture Creations in Singapore*; Singapore Management Review, 28(2), 47-64

Ciavarella M.A, Buchholtz A.K., Riordan C.M., Gatewood R.D. and Stokes G.S.; 2004; *The Big Five and venture survival: Is there a linkage?*; Journal of Business Venturing, 19 (2004), 464-483

Dierick S., Dochy F. and van de Watering G.; 2001; *Assessment in het hoger onderwijs, over de implicaties van nieuwe toetsvormen voor de edumetrie*; Tijdschrift voor Hoger Onderwijs, 19 (1), 2-18

Douglas E.J. and Shepherd D.A.; 2002; *Self-Employment as a Career Choice: Attitudes, Entrepreneurial Intentions, and Utility Maximization*; Baylor University; Entrepreneurship Theory and Practice, 81-90

Driessen, M.P.; 2005; *E-Scan Ondernemerstest, beoordeling en ontwikkeling ondernemerscompetentie;* 's-Graveland; Entrepreneur Consultancy BV

Entwistle N.J.; 1991; *Approaches to learning and perceptions of the learning environment; introduction to the Special Issue*; Higher Education, 22, 201-204

European Commission; 2006; *The Oslo Agenda for Entrepreneurship Education in Europe: Fostering Entrepreneurial Mindsets through Education and Learning*; Oslo

Gatewood E.J., Shaver K.G. and Gartner W.B.; 1995; *A longitudinal study of cognitive factors influencing start-up behaviors and success at venture creation*; Journal of Business Venturing, 10, 371-391
Gibb A.; 2005; *Towards the Entrepreneurial University*; National Council for Graduate Entrepreneurship, policy paper 003
Guerrero M., Rialp J. and Urbano D.; 2006; *The impact of desirability and feasibility on entrepreneurial intentions: A structural equation model*; International Entrepreneurship and Management Journal
Hansemark O.C.; 2003; *Need for achievement, locus of control and the prediction of business start-ups: a longitudinal study*; Journal of Economic Psychology, 24 (2003), 301-319
Kaldeway J.; 2004; *Leerstijlen: een poging tot synthese*; Tijdschrift voor Hoger Onderwijs, 22 (1), 26-37
Kaldeway J.; 2005; *Leerstijlen in wisselwerking met omgevingsvereisten: een habitus-veldbenadering*; Tijdschrift voor Hoger Onderwijs, 23 (4), 205-220
Kirschner P.A., Sweller J and Clark R.E; 2006; *Why Minimal Guidance During Instruction Does Not Work: An Analysis of the Failure of Constructivist, Discovery, Problem-based, Experiental, and Inquiry-Based Teaching*; Educational Psychologist, 41(2), 75-86
Klyver K., Hindle K. And Meyer D.; 2007; *Influence of social network structure on entrepreneurship participation – A study of 20 national cultures*; International Entrepreneurship and Management Journal
Krueger N.; 1993; *Impact of Prior Entrepreneurial Exposure on Perceptions of New Venture Feasibility and Desirability*; Entrepreneurship Theory and Practice, 18(1), 5-21
Krueger N.F. and Brazeal D.V.; 1994; *Entrepreneurial Potential and Potential Entrepreneurs*; Baylor University
Krueger JR N.F., Reilly M.D. and Carsrud A.L.; 2000; *Competing models of entrepreneurial intentions*; Journal of Business Venturing, 15, 411-432
Kuhn D.; 2007; *Is Direct Instruction an Answer to the Right Question?*; Educational Psychologist, 42(2), 109-113
Linan F.; 2008; *Skill and value perceptions: how do they affect entrepreneurial intentions?*; International Entrepreneurship and Management Journal, 4, 257-272
Lobler, H.; 2006; *Learning entrepreneurship from a constructivist perspective;* Technology Analysis & Strategic Management, 18, 19-38
Lobler, H., Maier M. and Markgraf D.; 200x; *Evaluating the constructivist approach in Entrepreneurship Education*; University of Leipzig, Department of Marketing
Meer, J.D. van der; 2007; *Kennisinnovatief ondernemerschap,; stabiliteit, dwarsverbanden en fijnafstemming;* lectorale rede Saxion Hogescholen
Mitchell B.C.; 2004; *Motives of Entrepreneurs: A Case Study of South Africa*; Journal of Entrepreneurship, 13, 2
Nandram, S.S. en Samsom, K.J.; 2000; *SuccesvolOndernemen: eerder een Kwestie van Karakter dan van Kennis;* Breukelen; Universiteit Nyenrode
Parry, S.B.; 1996; *The quest for competencies*; Training, July, 48-56
Praag van M.; 2006; *Entrepreneurship and Human Capital*; Amsterdam Center for Entrepreneurship, University of Amsterdam
Raposa M.L.B., Ferreira J.J.M., Paco do A.M.F. and Rodrigues R.J.A.G.; 2008; *Propensity to firm creation: empirical research using structural equations*; International Entrepreneurship and Management Journal
Shane S.; 2000; *Prior Knowledge and the Discovery of Entrepreneurial Opportunities*; Organization Science, 11(4), 448-469
Shane S. and Venkataraman S.; 2000; *The promise of entrepreneurship as a field of research*; Academy of Management Review, 25(1), 217-226

Shane, S., Locke E.A. and Collins C.J.; 2003; *Entrepreneurial motivation;* Human Resource Management Review, 13, 257-279
Simons P.R.; 2007; *Leren en instructie: in de ban van het nieuwe leren*; Tijdschrift voor Hoger Onderwijs, 25 (3), 187-197
Sluis van der J.; 2007; *Succesful Entrepreneurship and Human Capital*; Amsterdam; no. 402 of the Tinbergen Institute Research Series; Universiteit van Amsterdam
Snel D. and Bruins A.; 2004; *Oudere versus jongere starters*; Zoetermeer; EIM Onderzoek voor Bedrijf & Beleid
Snel D. and Meijaard J.; 2006; *Met ervaring aan de start: over debutanten, weerondernemers en meerondernemers*; Zoetermeer; EIM Onderzoek voor Bedrijf & Beleid
Stigter H.W.; 2001; *Het voorbereidingsproces: van start tot finish?: onderzoek naar de overeenkomsten en verschillen in het voorbereidingsproces van starters, potentiele starters en stoppers*; Zoetermeer; EIM
Struyven K.; 2005; *The effects of student-activating teaching/learning environments on students' perceptions, student performance and pre-service teachers' teaching*; proefschrift Katholieke Universiteit Leuven
Struyven K., Dochy F. and Janssens S.; 2006; *Leidt de activerende onderwijssetting tot diepere leerbenaderingen bij studenten? Studentactiverende versus leerkrachtgestuurde instructie*; Tijdschrift voor Hoger Onderwijs, 24 (1), 34-46
Trigwell K. and Prosser M.; 1991; *Improving the quality of student learning: the influence of learning context and student approaches to learning on learning outcomes*; Higher Education, 22, 251-266
Veciana J.M., Aponte M. and Urbano D.; 2005; *University Students' Attitudes Towards Entrepreneurship: A Two Countries Comparison*; International Entrepreneurship and Management Journal, 1, 165-182
Westhof F.M.J.; 2005; *Aandacht voor ondernemerschap in HAVO en VWO*; Zoetermeer; EIM Onderzoek voor Bedrijf & Beleid
Zampetakis L.A. and Moustakis V.; 2006; *Linking creativity with entrepreneurial intentions: A structural approach*; International Entrepreneurship and Management Journal, 2, 413-428

Why Does Dave Spend Ten Times More Time on Interaction with Industry than Paul? Toward a Model of Social Capital Activation for Entrepreneurial Academics

Kristina Dervojeda, Jeroen Kraaijenbrink, Aard Groen

WORK IN PROGRESS

ABSTRACT

This paper focuses on academics that are looking for entrepreneurial ways to pursue their teaching, research and commercialization interests, in particular by actively engaging in university-industry interactions. The paper aims to improve our knowledge of why some academics exploit their social networks with industry more actively than others. We develop a conceptual model that aims to explain a mechanism behind social capital activation, and to identify factors that are likely to have the highest predictive power. We theorize on how academic's motivation, perceived social influence and perceived ability unite into readiness to activate social capital, and under what circumstances this readiness is likely to result in actual behavior. Specifically, the objective of this paper is to further develop the model constructs and to operationalize them into a set of measurable items. For each of the readiness constructs, we present a set of composite variables, as well as corresponding observable variables. We conclude with implications of our analysis for theory and practice, and set directions for future research.

Keywords:
university-industry interactions, social capital, social network, academic entrepreneurship, entrepreneurial career

INTRODUCTION

Dave and Paul are academics from the same university, the same department and the same scientific domain. They hold the same hierarchical position and both have established social networks with industrial partners. Despite these commonalities, a significant difference can be observed with regard to how actively Dave and Paul exploit their networks with industry. While for Paul, interaction with industry constitutes about 2% of his time at the university, the time spent by Dave is ten times higher and reaches 20%.

Both Dave and Paul demonstrate behavior of 'entrepreneurial academics', but to a different extent. The term 'entrepreneurial academic' here refers to researchers in public sector organizations who are looking for entrepreneurial ways to pursue their teaching, research and commercialization interests, in particular by actively engaging in university-industry interactions (Gulbrandsen, 2005; Meyer, 2003). The example of Dave and Paul illustrates the common findings of existing research which show that there is a considerable heterogeneity among academics in terms of the degree of exploitation of their social networks with industry (Agrawal & Henderson, 2002; Balconi, Breschi, & Lissoni, 2004; Cukierman, Fontana, Sarfatti, & Nuova, 2007; D'Este & Patel, 2007). The reasons behind this heterogeneity are, however, underexplored,

both theoretically and empirically, and thus represent a gap in the current literature on university-industry interactions.

Academics engaged in interaction with industry are entrepreneurs in the literal sense of the word, i.e. persons who add value by brokering the connection between others (Burt, 1992; see also Martinelli, 1994 quoted in Burt, 1997, p. 342). Academics interacting with industry operate in networks that are rich in structural holes. Those structural holes provide opportunities for entrepreneurial behavior, and those opportunities are defined by a hole in the social structure around those academics. As suggested by Burt (1997), networks rich in the entrepreneurial opportunities of structural holes are entrepreneurial networks, and entrepreneurs are people skilled in building the interpersonal bridges that span structural holes.

Entrepreneurial networks of academics form the foundation of their social capital with industry (Batt, 2008; Bowey & Easton, 2007; Lin, 2001). However, simply because an academic has social capital available for use does not mean that he or she will use it immediately (Foley & Edwards, 1999). Existing research suggests that there is a difference between the possession and the 'activation' (or actual exploitation) of social capital (Adler & Kwon, 2002; Anderson, 2008; Burnett, 2006; Foley & Edwards, 1999; Hebert, Lee, Sun, & Berti, 2003). It is reasonable to assume that a certain mechanism exists that determines when and to what extent the existing social networks are exploited. Understanding such mechanism would allow to explain why Dave spends ten times more time on interaction with industry than his colleague Paul. Similarly, would it allow to explain why some academics actively exploit their networks with industry while others do not. Yet, to our knowledge, no comprehensive model exists that explains the antecedents of social capital activation. While scientists have already made a strong case on the effects of social capital, the questions related to its causes still remain unanswered (Glaeser, 2001). Consequently, this fundamental idea has not yet been thoroughly explored.

The current paper aims to contribute to our knowledge by developing a conceptual model of social capital activation for entrepreneurial academics and by operationalizing the model constructs into a set of measurable items, thus preparing the basis for the empirical analysis.

The paper is likely to be of scientific relevance for university-industry interaction, social capital and entrepreneurship research. University-industry interaction researchers would benefit from a better understanding of the reasons behind a considerable heterogeneity among academics in terms of the degree of exploitation of their social networks with industry. Social capital researchers would benefit from a better understanding of antecedents of social capital activation. Finally, given the anticipated beneficial effects of social capital for upcoming and actual entrepreneurs (Audretsch, 2006), a model of social capital activation would also benefit entrepreneurship research. The proposed model aims to provide new insights into the processes by which entrepreneurial academics identify opportunities and how they formulate and implement resulting actions.

The paper has practical implications for several audiences. Firstly, academics themselves will benefit from a better understanding of how their intentions to interact with industry are formed, and under what circumstances those intentions are likely to result into actual behavior. The lens provided to them by this research offers an opportunity to understand why they made certain choices in their academic career with regard to their engagement in interactions with industry and how their career is likely to develop in the future. Secondly, policy makers will benefit from a better understanding of areas that might allow to influence the targeted behaviors of entrepreneurial academics. It is crucial to design policies that would be more humanized and targeted at specific audiences, including academics that are currently not engaged in interactions

with industry. Finally, university administrators will be better equipped to adjust their current strategies and measures with regard to university-industry interactions.

The remainder of this paper is organized as follows. In the next section, we address the definitions of social capital and social capital activation. The third section presents the proposed conceptual model for social capital activation. Based on the literature, we first derive factors that are likely to be a part of the model and identify causal relationships between them. We also look at the underlying psychological, economic and social dynamics that justify the selection of factors and proposed causal relationships. In the fourth section, we further develop the model constructs and operationalize them into a set of measurable items. We conclude with the implications for research and practice, and the future research needs.

ON SOCIAL CAPITAL ACTIVATION

In this section, we aim to touch upon the essence of social capital activation. Before starting to theorize on a mechanism behind social capital activation, it is crucial to understand what social capital activation actually means, what kind of effects it produces and what its relation is with social capital itself. We will also examine questions on the distinction between the possession and activation of social capital and the key assumptions that will form the basis of our theory development.

Social capital: in the middle of the battlefield

First of all, social capital itself needs to be defined. Long debates of scientists on the essence of social capital and its ultimate definition have resulted in actual paradigm wars. While one branch of authors associates social capital with the formal *structure* of the ties that form social network (see, for example, Burt, 2000), the second branch focuses on the *content* of those ties and refers to the resources (e.g., information) that individuals are able to exchange via their networks of relations (see, for example Lin, 2001; Portes, 1998). Furthermore, some authors view social capital as a quality of groups (see, for example, Fukuyama, 1995; Putnam, 1995), while others conceive social capital as individual's social relationships (see, for example, Borgatti, Jones, & Everett, 1998). It is not our intention here to thoroughly examine these clashes of sociology titans. Nor is it our intention to take one of the opposing sides. Rather than sustaining paradigm wars, we would like to support Weick (1999) and Adler & Kwon (2002) in their attempt to encourage dialogue across different perspectives. We suggest there is no reason for conflict between structure-based and content-based views of social capital, nor is it a 'scientific sin' to conceive social capital from individual or group perspectives. Each perspective gives us somewhat different picture about social capital (Turner, 2000) and thus enriches our knowledge of the subject in question.

In the context of this study, we employ the definition by Bourdieu (1985, p. 248) who conceives social capital as a durable network of more or less institutionalized relationships of mutual acquaintance and recognition in which actual or potential resources are embedded. This definition can be considered universal as it emphasizes the need to look at both structure and content of social networks and does not contradict with either individual- or group-based views of social capital. Hence social networks will be viewed as the foundation of social capital. Two primary social network variables that have been argued to form actor's social capital refer to network size and tie strength (Gabbay & Leenders, 2001 quoted in Anderson, 2008) which refer to the

structural characteristics of social networks. Although we will be constantly referring to resources that are embedded in social networks and exchanged during social interaction, we do not aim at measuring those resources directly and we will not view them as direct components of social capital. Tracing and measuring (information) resources that are embedded in social networks and exchanged during social interaction represents a highly challenging if not utopian task. Therefore social network researchers do not measure the amount and diversity of information that flows through networks, but instead assume that structure determines information channels, and employ social network characteristics as proxies for information transfer (Seibert et al., 2001 quoted in Anderson, 2008, p. 53). For the purpose of this study, we suggest using a similar approach.

A definition of social capital activation

For social capital activation, we use the definition proposed by Smith (2005, p. 4), who views it as *the point at which mobilizable resources are shared – "when one or more actors provide instrumental or expressive aid to others, beginning or continuing a series of non-negotiated or reciprocal exchanges"*. Consequently, social capital activation from social network perspective is the point at which the first or sequential reciprocal exchange of resources occurs between interaction partners (nodes) via a network of relationships. From the perspective of entrepreneurial academics, it would be the point at which the first or sequential reciprocal exchange of (information) resources occurs between the academic and the industrial partner via a social network of relationships. A social interaction here refers to any form of communication (e.g., face-to-face, phone, e-mail, skype, videoconferencing, regular mail etc.) and implies a bi-directional flow of (information) resources between interaction partners. Both actors have an effect upon one another, and this idea of a two-way effect is essential in the concept of interaction (Pinar, Reynolds, Slattery, & Taubman, 2000).

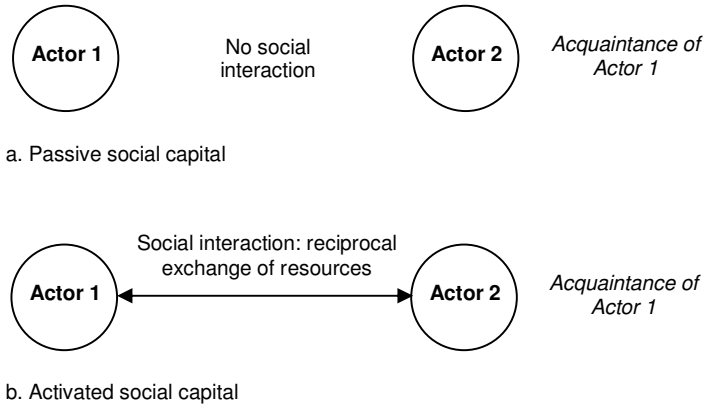


FIGURE 1: Passive (a) and activated (b) social capital

Consequently, at moments when reciprocal exchange of resources does not occur between nodes via a network of relationships, social capital will be considered passive. In other words, passive social capital refers to networks that might be exploited (or activated) should the necessity occur. In the context of university-industry interactions, social capital of an academic will be considered activated only at moments when actual interaction occurs. Between interactions with industry, social capital of an academic will be considered passive. Figure 1 illustrates the distinction between passive and activated social capitals. As can be seen from the figure, Actor 1 and Actor 2

know each other. Therefore, we can only speak of passive social capital if Actor 1 and Actor 2 have already established a social relationship. Later in this section, we will touch upon the question of when we consider a social relationship to be established. Furthermore, social capital activation is always preceded by presence of passive social capital.

As a result, an individual's social capital represents a sum of his or her passive and activated social capitals. Given that social capital is considered activated only at the moments of actual interaction, most of our social capital is passive at any given moment of time.

Effects of social capital activation

Social capital activation and lack of social capital activation can produce various effects. First, social capital activation allows to earn back one's investments with regard to social capital formation (i.e. creation and maintenance of social capital). Like other forms of capital (e.g. economic, cultural), social capital is a long-lived asset into which other resources can be invested. These investments are expected to lead to a future flow of benefits such as superior access to information, power, and solidarity (Adler & Kwon, 2002). In the context of this study, examples of such investments refer to time and financial resources spent by an academic on attending conferences and other networking events with industry participation that may have led to formation of contacts with industry. Lack of social capital activation, on the contrary, implies low return on investment since the acquired asset is not used and thus is not likely to produce considerable benefits.

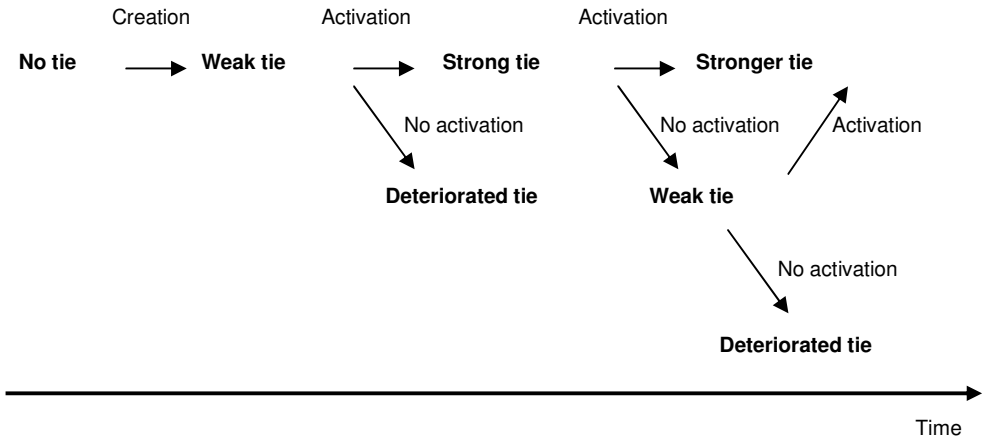


FIGURE 2: Evolution of a network tie as a result of (lack of) social capital activation

Second, continuous activation of social capital with a particular partner is likely to strengthen the tie with that partner. On the contrary, if social capital does not get activated, social connections are likely to deteriorate over time (Adler & Kwon, 2002). Consequently, social capital needs to be exploited in order not to loose existing connections. Figure 2 illustrates the evolution of a network tie depending on whether it is activated or not. For example, after an academic got acquainted with an industrial partner during a networking event, a relationship was established and contact information was exchanged. The initial tie is weak, and its strength in the future depends on how often the academic and the industrial partner will interact with each other. Continuous exploitation of this contact is likely to strengthen the tie with time, whereas lack of activation of

this tie is likely to lead to its deterioration. By deterioration we mean situations when people do not consider each other as acquaintances anymore. We suggest that the weaker the tie, the less time is needed for that tie to deteriorate if it does not get activated. Consequently, a lifespan of a tie can vary from several weeks for extremely weak ties to decades for extremely strong ties.

Finally, a stronger social tie is likely to lead to cost-effective exchange of more complex information and tacit knowledge in the future, whereas weak ties facilitate the cost-effective search for codifiable information and explicit knowledge (Hansen, 1988 quoted in Adler & Kwon, 2002). Figure 3 illustrates the influence of social capital activation on tie strength and the type of exchanged information. While tie strength represents a structural characteristic of a network, the type of exchanged information refers to a content-related characteristic. Consequently, this figure brings together both structure and content of social capital mentioned above.

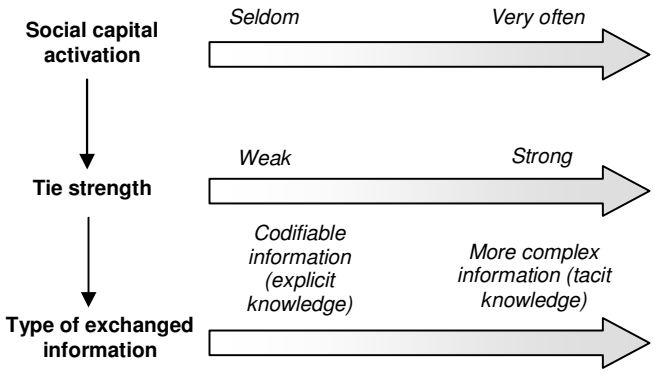


FIGURE 3: Influence of social capital activation on tie strength and the type of exchanged information

CONCEPTUAL MODEL OF SOCIAL CAPITAL ACTIVATION

In this section, we provide arguments for developing a new conceptual model. We demonstrate that although existing models provide some valuable building blocks and highlight possible relationships among constructs, those models can only partially explain under what circumstances social capital gets activated. We then identify the factors that are likely to have the highest predictive power and theorize on expected relationships between them.

Why a new conceptual model

Little theoretical, let alone empirical work has been done to examine the antecedents of social capital activation. To our knowledge, at this moment, two models exist that explicitly try to explain the subject in question. These models refer to Glaeser's economic model of investment in social capital (2001) and Adler and Kwon's conceptual model of social capital (2002).

Glaeser's model develops the idea of social capital formation (both creation and activation of social capital) from an economic perspective. The model focuses on market and non-market

returns of social capital formation, and takes into account variables such as age, occupation and opportunity cost of time. Although Glaeser's model provides some valuable insights into the formation of social capital of individuals in general, the model can hardly be employed to explain the heterogeneity of networking behaviors of individuals in the same occupation and of comparable age, which is necessary for the purpose of the current study.

In their conceptual paper "Social capital: Prospects for a new concept", Adler and Kwon (2002) offered a comprehensive model of social capital. The model captures the nature of social capital, its sources, its benefits and risks and the contingencies that influence its value. Although the notion of social capital activation was introduced in the paper, it was not the primary focus of the model. As a result, Adler and Kwon's model sketches the contours of social capital activation, but does not provide a comprehensive explanation for this specific phenomenon. Questions regarding the relationships among the constructs and the exact circumstances under which social capital gets (or doesn't get) activated, as well as operationalization of constructs and actual measurement still remain unanswered. Consequently, although the foundation for the theory on social capital activation has already been laid, we argue that this theory is underdeveloped.

One of our key assumptions is that social capital activation is an immediate effect of behavior. Consequently, when trying to explain the mechanism behind social capital activation, it is reasonable to consult existing behavioral theories, including entrepreneurship theories (for example, Ajzen's Theory of Planned Behavior (Ajzen, 1991); Shapero's Model of Entrepreneurial Event (Shapero, 1982)).

Commonly accepted models of entrepreneurial behavior look exclusively at planned behaviors. However, we argue that social capital activation can result from both proactive (planned) and reactive (unplanned) behavior. For example, if an industry representative proactively initiates an interaction with an academic and reciprocal exchange of (information) resources occurs between both nodes, academic's social capital can still be considered activated. In this example, academic's behavior is reactive. Therefore, to understand a mechanism behind social capital activation, it is necessary to build a model that can explain both proactive and reactive behaviors leading toward social capital activation.

Furthermore, Ajzen's Theory of Planned Behavior and Shapero's Model of Entrepreneurial Event represent so called intentions models, i.e. the models that emphasize the role of intentions as the key predictor of entrepreneurial behavior. However, empirical evidence suggests that relatively low intention – behavior correlations are often reported for (socially) desirable behaviors. This bias has produced unrealistically high estimates of intentions to engage in behavior, as well as inconsistencies between intentions and actions (see Ajzen, Brown, & Carvajal, 2004, Sheeran, 2002 quoted in Ajzen, Czasch, & Flood, 2009, p. 1356). Given that academics' engagement in interaction with industry is likely to be viewed as socially desirable behavior (for example, in departments where interaction with industry is centrally encouraged), inclusion of intentions as a separate predictor in our model might jeopardize the model's predictive power. Consequently, there is a need to look for predictors with a more straightforward effect.

Although these models provide some valuable building blocks and highlight possible relationships among constructs, we argue that those models can only partially be employed for the needs of the current study. In this paper, we aim to contribute by identifying factors with the highest predictive power, as well as by improving our knowledge on questions regarding the relationships among the constructs, operationalization of the constructs and actual measurement.

Proposed Conceptual Model in Brief

Figure 4 presents a proposed model for social capital activation. According to the model, social capital activation represents a result of a three-stage process that starts with the presence of passive social capital (1) that creates readiness (2) of an individual to activate social capital. This readiness leads to the actual activation only in the presence of a trigger (3). The readiness to activate social capital represents a joint effect of three factors: individual motivation, perceived social influence and perceived ability. Readiness to engage in interaction is therefore viewed as a combination of three factors. As a general rule, the larger the passive social capital, the greater the readiness of an individual to activate it, the higher the chance of a trigger to occur, the higher should be the level of social capital activation. The model also suggests two feedback loops: higher level of social capital activation is expected to reinforce the current passive social capital and increase the readiness to activate social capital in the future. In the remainder of this section, both the building blocks of the model and the relationships between them will be explained in detail.

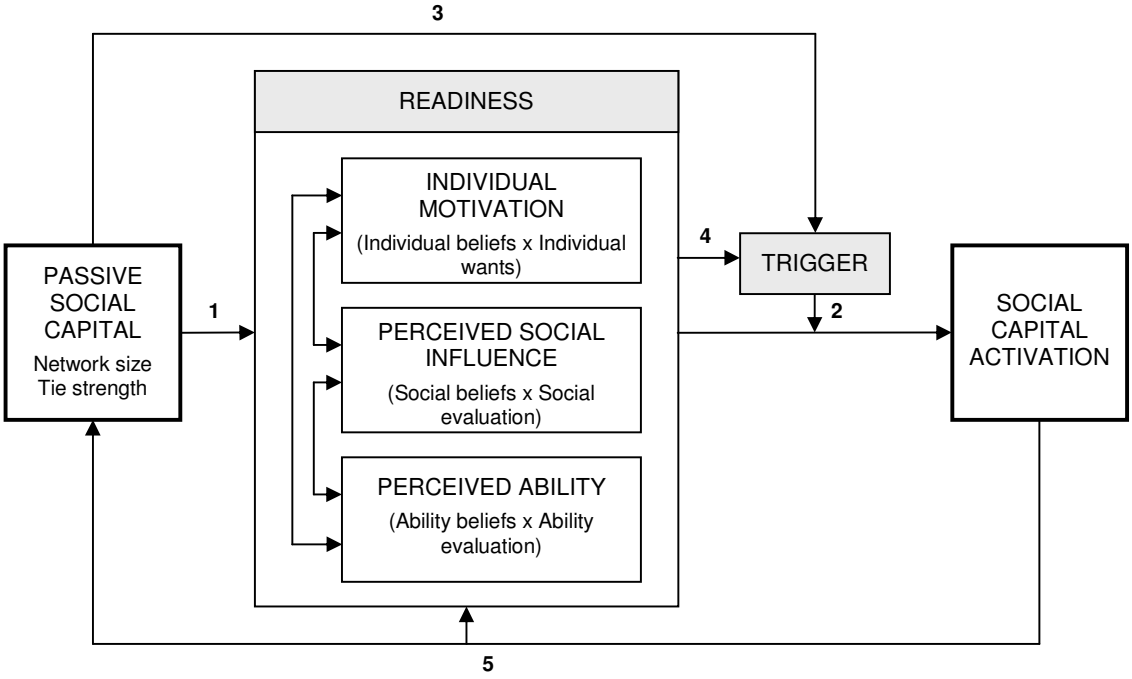


FIGURE 4: Conceptual model of social capital activation

Most building blocks of the proposed model have already been (partially) used by other authors. In some cases, those blocks were labelled differently. Given that existing literature contains various labels for the same notions and that this model does not build on one specific theoretical framework, but combines various existing frameworks, we have chosen labels that seem most straightforward. When applicable, we will aim at inserting references to authors who use similar notions that are labelled differently.

Social Capital Activation is Always Preceded by Presence of Passive Social Capital

Social networks create opportunities for exchange of resources through social interactions, and thus are likely to play a crucial role in social capital activation (Adler & Kwon, 2002). We suggest that passive social capital influences the readiness of an academic to engage in interaction with industry. When referring to passive social capital, we mean network size and tie strength (Gabbay & Leenders, 2001 quoted in Anderson, 2008). Empirical evidence shows that, in general, academics have at least one industrial acquaintance, and the average number of acquaintances varies from 4 to 10 (Balconi, Breschi, & Lissoni, 2004). We suggest that, in general, knowing more industrial partners creates higher predisposition of academics to interact with industry.

Proposition 1a: The higher the number of industrial partners in a network, the higher should be the readiness of an academic to engage in interaction with industry.

Furthermore, existing research on university-industry interactions distinguishes between interactions with high, intermediate and low relational involvement. Links with high relational involvement refer to situations where individuals and teams from academic and industrial contexts work together on specific projects and produce common outputs. These arrangements include collaborative R&D projects (joint research). By contrast, scientific publications and the licensing of university-generated IP represent links with low relational involvement since they do not necessarily imply relationships between academics and industry representatives. Finally, links based on 'mobility' when individuals move between academic and industrial contexts represent intermediate relational involvement since some links with previous colleagues are often maintained after the move (Perkmann, Walsh, & Campus, 2007, p. 263). These differences in relational involvement lead to the formation of different types of ties: strong, intermediate and weak. We suggest that the presence of stronger ties with industry predisposes academics to interact with industry in the future.

Proposition 1b: The stronger the academic's ties with industrial partners, the higher should be the readiness of an academic to engage in interaction with industry.

Readiness Represents a Joint Effect of Individual Motivation, Perceived Social Influence and Perceived Ability

To act either proactively or reactively, a person has to demonstrate a certain readiness to perform a given behavior (see, for example Ajzen, 1991). Therefore, social capital activation can be considered a result of reactive (unplanned) behavior only to the extent that it might be caused by factors that are beyond individual's control, while an individual is still potentially ready for this behavior. Thus, an academic researcher is expected to be potentially ready to engage in an interaction with industry; otherwise social capital activation is much less likely to occur.

Proposition 2a: The academic's level of social capital activation is positively associated with the readiness of an academic to engage in interaction with industry.

We argue that academic's readiness to activate social capital is a joint effect of three factors: individual motivation, perceived social influence and perceived ability. Unlike commonly accepted models of planned behavior (for example, Ajzen's Theory of Planned Behavior (Ajzen, 1991); Shapero's Model of Entrepreneurial Event (Shapero, 1982)), we suggest that readiness to

activate social capital represents a higher-order factor. In addition, these factors are not expected to have equal weight on the level of social capital activation.

(1) *Individual motivation* refers to academic's willingness to engage in interaction with industry (comparable to Shapero's perceived desirability (Shapero, 1982)). It is assumed to have two components: individual beliefs and individual wants. Individual beliefs refer to academic's own beliefs with regard to the consequences of social capital activation with industry (comparable to Ajzen's notion of behavioral beliefs, see Ajzen, 2006). Individual wants refer to academic's desire to have or not to have those consequences (for extensive discussions on wants and beliefs as basic building blocks of individual's motivation see, for example, Goldman, 1970; for extensive discussions on wants and beliefs as basic building blocks of individual's motivation see, for example, Smedslund, 1997).
(2) *Perceived social influence* refers to the academic's own estimate of the social influence with regard to engaging in an interaction with industry (see, for example, sociological literature on embeddedness Granovetter, 1985; Kenney & Richard Goe, 2004). The two components it is assumed to have are social beliefs and evaluation of social influence. Social beliefs refer to the academic's beliefs with regard to how other people in his or her direct environment would like him or her to behave (comparable to Ajzen's notion of normative beliefs, see Ajzen, 2006). Evaluation of social influence implies academic's evaluation of the importance of what these people think and do for his or her own behavior (comparable to Ajzen's notion of subjective norm, see Ajzen, 2006).
(3) *Perceived ability* demonstrates the extent to which an academic feels able to engage in interaction with industry (comparable to Shapero's perceived feasibility (Shapero, 1982)). It is assumed to have two components: ability beliefs and ability evaluation. Ability beliefs refer to the academic's beliefs about the power of situational and internal factors that can facilitate or inhibit interactions with industry (comparable to Ajzen's notion of control beliefs, see Ajzen, 2006). Ability evaluation implies academic's evaluation of how confident he or she feels about being able to engage or not to engage in interactions with industry (comparable to Bandura's self-efficacy (Bandura, 1982, , 1997); Ajzen's perceived behavioral control (Ajzen, 2006); controllability of behavior (Francis et al., 2004)).

Individual motivation. There is still a lack of agreement in existing literature on motives that drive academics to engage in networking with industry. Traditionally scientists suggested that a primary general motive of academic researchers refers to recognition within the scientific community (see, for example, Merton, 1957). This conventional belief, however, has been recently put into question. For example, Gulbrandsen (2005, p. 9) found that active engagement of academic researchers in university-industry interactions "made them 'stand out' in a slightly negative manner from their colleagues,…[and] they felt suspected of shrinking their academic duties". These researchers seem to feel excluded from academic membership for 'selling themselves' to industry. Neither do they feel 'at home' within the community of their industrial partners. It is important to emphasize, however, that such situations are more likely to occur in research groups, where university-industry interactions are more the exception than the rule. Nevertheless, the findings of Gulbrandsen (2005) show that it is not necessarily desire for recognition that drives scientists to engage in university-industry interactions.

Existing literature also suggests that academics may be attracted by personal financial gain and/or desire to obtain additional funding for graduate students and laboratory equipment (D'Este & Patel, 2007; Meyer-Krahmer & Schmoch, 1998; Mulkay & Turner, 1971; Siegel, Waldman,

Atwater, & Link, 2004). The abovementioned arguments confirm the hypothesis "that scientists are motivated by the same kinds of extrinsic rewards as 'everybody else', namely position and money" (Hangstrom, 1965, p. 52; quoted in Gustin, 1973, p. 1120). A number of authors, however, have criticized this hypothesis providing alternative explanations for the motives of academic researchers such as "naïve individualism" (Hagstrom, 1965), "the need to engage in the charismatic activity" (Gustin, 1973), as well as the need "to contribute with something practical" (Gulbrandsen, 2005). It has also been suggested that a 'central driving force' for entrepreneurial academics refers to benefits related to their teaching duties, e.g. an opportunity to prepare student assignments based on cases from industry, going on field trips to the premises of their industrial partners, and getting access to "practical problems that are suitable for student work" (Gulbrandsen, 2005, p. 11).

We have already emphasized before that academics do not represent a homogenous population. Neither do they have homogeneous motives to engage in university-industry interactions. Despite these differences in motives, the presence of individual motivation itself is necessary for social capital activation to occur. Furthermore, existing research suggests that academic career cycle (academic hierarchical position,) is also likely to correlate directly with the inclination of researchers to engage in university-industry interactions (Bercovitz & Feldman, 2008; D'Este & Patel, 2007; Landry, Amara, & Ouimet, 2005).

Perceived social influence. Existing literature suggests that among the main elements of the environment that are likely to have the greatest influence on behavior of academics, the research department/laboratory within which this academic is active is likely to have the highest impact (Cukierman, Fontana, Sarfatti, & Nuova, 2007; D'Este & Patel, 2007; Magnusson, McKelvey, & Versiglioni, 2008). Bercovitz and Feldman (2008) and Louis et al. (1989) emphasized the importance of local group norms and culture for academic researchers engaged in university-industry interactions (Goktepe-Hultan, 2008).

Furthermore, dating back to Durkheim, scientists have argued that the constraint on the beliefs of group's members is an increasing function of the degree of consensus of views within the group (see, for example, Martin, 2002 quoted in Stuart & Ding, 2006, p. 108). This proposition supports the evidence from the experimental studies showing the forceful influence of a group's consensus on an individual's (un)willingness to deviate from the majority view. This leads us to expect that academics who are trained at university departments in which the traditional norms represent the consensus view are less likely to participate in interactions with industry than their 'non-traditional' colleagues (Stuart & Ding, 2006, p. 108).

Existing literature lacks consensus with regard to the role of other researchers from the same environment. Some scientists argue that academics adopt the behavior of local colleagues (e.g. peers or supervisors, as well as industrial partners or collaborators), i.e. these colleagues act as role models and, together with the decisions taken within the research group, influence the behavior of individual academics (see, for example, Bercovitz & Feldman, 2008, p. 74; see, for example, Goktepe-Hultan, 2008; Stuart & Ding, 2006). For example, Bercovitz and Feldman (2008) argue that academics will be more likely to engage in interaction with industry when they observe academics with similar characteristics in their departments interacting with industry, as in academic communities, peer groups commonly form based on professional rank within departments. Other scientists suggest that entrepreneurial role models only weakly predict future entrepreneurial activity (Carsrud et al., 1987, Krueger, 1993, Scherer et al., 1989, Scott and Twomey, 1988 quoted in Krueger, Reilly, & Carsrud, 2000).

Furthermore, leaders are expected to influence behavior in organisations both by building culture and by acting as role models. The observable behavior of those in leadership roles shapes organisational culture by signalling what actions are expected, valued, and likely to be rewarded (House, 1977, Schein, 1985 quoted in Bercovitz & Feldman, 2008) In academic departments, the department chair is the leader. The chair plays a direct and powerful role in. among others, reviewing and evaluating individual performance related to promotion and tenure (Bercovitz & Feldman, 2008, p. 74). If the chair is active in interactions with industry, then he or she sends a signal that interaction with industry is a valid activity. In this case, other members of the department might be more likely to engage in interaction with industry.

Existing research also suggests that the influence of the chair on the behavior of academics is likely to vary depending on their hierarchical position (Bercovitz & Feldman, 2008). When measuring perceived social influence and its effect on social capital activation, we therefore suggest using hierarchical position as a control variable.

Perceived ability. As argued by Lewin (1951), the individual's behavior is not a function of the way the world actually is, but the way the individual believes it to be (quoted in Goldman, 1970, p. 135). Consequently, it might be reasonable to analyse individual's ability to engage in interaction with industry through the prism of the individual's perceptions with regard to his or her abilities.

Existing literature suggests a number of skills that academics need to possess in order to succeed in interactions with industry. First, academics need to demonstrate 'integration skills' which refer not only to the capacity to operate with a wide range of bodies of knowledge (i.e. basic science and applied research), but also "the capacity to balance and align conflicting interests arising from the distinct system of incentives between academia (governed by "open science" norms) and industry (governed by "proprietary technology" norms)" (D'Este & Patel, 2007, p. 1297; see also Magnusson, McKelvey, & Versiglioni, 2008). In addition, another difference refers to the attitude of academics and industry representatives toward timing issues and production of deliverables. In academia, people tend to think in a scale of 4-5 years and strive to publish the results of their research, i.e. make them publicly available; whereas industry people tend to think in a scale of a couple of months, and are more result-oriented. In order to cooperate successfully, academics, therefore, need to accept the high pace of industrial world and have to be ready to deliver results in a quick manner. A larger number of active interaction channels should make a more significant contribution to the accumulation of the necessary integration skills (D'Este & Patel, 2007). Furthermore, formal training as well as work experience outside the university also appear to reduce the knowledge gap regarding integration skills (Magnusson, McKelvey, & Versiglioni, 2008).

Social Capital Activation is a Function of Readiness Moderated by a Trigger

The presence of passive social capital and the readiness to activate it do not guarantee actual behavior, and a *trigger* is needed (Triandis, 1967, Katz, 1989 quoted in Krueger & Carsrud, 1993). The trigger here refers to an event, action or occasion that serves as a reason for behavior to occur. We will consider behavior as being proactive (planned) in cases when a triggering event, action or occasion makes an individual initiate an interaction. For example, if an academic proactively approaches an industry representative because a large governmental program has issued a new call for tenders, and reciprocal exchange of (information) resources occurs between both nodes, then this behavior will be considered as planned, with a new call for tenders as a

trigger for an academic to initiate an interaction. Accordingly, we will consider behavior as being reactive (unplanned) when the initiative to start an interaction came from an interaction partner. For example, if an industry representative has a project that might require academic expertise. The initiative of an interaction partner in this case serves as a trigger for an academic to engage in interaction.

Proposition 2b: The readiness to activate social capital will lead to the actual social capital activation only in the presence of a trigger.

The trigger here corresponds to the notion of precipitating ('displacing') event in Shapero's Model of Entrepreneurial Event (Shapero, 1982 quoted in Krueger & Carsrud, 1993).

Causal Relationship between Passive Social Capital and Trigger

The structural hole argument suggests that structural characteristics of social capital are likely to have influence on (1) assurance that a person will be informed of opportunities (access); (2) likelihood that the person is the first to see new opportunities created by needs in one group that could be served by skills of other groups (timing); and (3) assurance that the person will be included in those new opportunities (referral) (Burt, 1997, p. 342). All three situations correspond to the trigger in our model. It is therefore reasonable to suggest that there is a causal relationship between passive social capital and a trigger.

Proposition 3: The higher the passive social capital, the higher is the chance for a trigger to occur.

Causal Relationship between Readiness and Trigger

We suggest that higher readiness increases the likelihood of a trigger. For example, one of the typical scenarios of initiating university-industry interactions refers to situations when the academic researcher is approached by industry with an offer. In this case, the action of the industrial partner should be considered a trigger. It would be reasonable to assume that the likelihood of occurrence of such trigger increases as a result of increase in the following factors:

(1) academic's individual motivation to engage in such interactions (previously communicated to the industrial partner); and/or
(2) social influence in the academic's department (previously communicated to the industrial partner); and/or
(3) academic's previous experience and presence of necessary skills (previously communicated to/experienced by the industrial partner).

Proposition 4: The higher the academic's readiness to engage in interaction with industry (as a joint effect of individual motivation, perceived social influence and perceived ability), the higher the chance of a trigger to occur.

Feedback Loop from Social Capital Activation back to Passive Social Capital

As emphasized by Turner (1988), too often in sociology, simple causal models are employed (Duncan, 1966; Blalock, 1964) that suggest one-way causal chains among empirical indicators of

independent, intervening and dependent variables. However, actual social processes are much more complex and involve feedback loops, reciprocal causal effects, lag effects, threshold effects etc. Therefore, we suggest viewing the mechanism behind social capital activation as a complex process of cyclical nature.

A certain causal path can be traced from the feedback related to social capital activation back to the academic's passive social capital. Thus, positive experience from social capital activation is likely to increase passive social capital by increasing tie strength and/or the number of partners with whom this academic could interact in the future.

Proposition 5a: Experience from academic's interaction with industry is positively associated with passive social capital for the future expressed by the tie strength and/or the number of partners with whom this academic could interact in the future.

Feedback Loop from Social Capital Activation to Readiness to Activate Social Capital in the Future

Existing research also suggests that there is likely to be a relationship between the past behavior of an academic and his or her inclination to engage in knowledge transfer activities between university and industry (Bercovitz & Feldman, 2008; D'Este & Patel, 2007). This past behavior generates a 'strong imprint' leading towards continuous knowledge transfer practices (D'Este & Patel, 2007). These findings confirm the theory of reinforcement learning suggesting that an academic will prefer actions that he or she has tried in the past and found to be effective in producing reward (Sutton & Barto, 1998).

Positive experience from particular interactions is likely to increase the individual's readiness in a number of ways:

(1) by increasing the academic's motivation to engage in similar interactions in the future; and/or
(2) by improving the attitude of the department toward interactions with industry; and/or
(3) by increasing the academic's perceived ability to be able to participate in similar interactions in the future.

At the same time, negative experience is likely to lead to reverse effects such as decreased motivation, doubts about own skills, as well as weaker ties with particular partners.

Proposition 5b: Experience from academic's interaction with industry is positively associated with the academic's readiness to activate social capital in the future.

OPERATIONALIZATION OF CONSTRUCTS

In the context of this study, interaction with industry represents a category of behavior, not a single action. Therefore, when operationalizing constructs, there is a need to develop measures that characterize the whole category of behavior, and not an individual action.

The development of scales associated with the study represents the result of qualitative research including in-depth interviews with academics and a thorough review of the literature. The scales will be piloted and pre-tested before being used. Initially, the constructs will be scaled using the

results of qualitative research. These judgments will then be verified by checking internal correlations with specific measures collected in the survey and confirmatory factor analysis. The reliability indices will be calculated and final adjustments will be made to the content of the scale items (for a similar approach see Binney, Hall, & Shaw, 2003).

In the remainder of this section, we first define the target population of the study and then operationalize the model constructs into observed measures. Annex A contains the proposed questionnaire outline.

Target population

The target population of the current research includes the academics from the high-tech fields of science and engineering, that usually are most predisposed to interaction with industry. Geographically, the study will focus on the academics working in the Netherlands. The desired sample size for the online questionnaire is 1000 respondents. With a projected response rate of 30-40%, this approach is likely to result in about 300 responses suitable for further analysis. The final sample of 300 respondents should be considered large and acceptable for the current model (see Kline, 2004). Ideally, a selected sample should reflect a mix of the following demographic criteria:

(1) Hierarchical position;
(2) Main scientific orientation;
(3) Scientific domain;
(4) Affiliated institution;
(5) Gender;
(6) Nationality (Foreign / Local).

Social Capital Activation

Social capital activation for a single action is a dichotomous variable (i.e. social capital is either passive or active). However, when measuring the *level* of social capital activation as a result of a category of behavior, we suggest employing the total time that an academic spends on interactions with industry per year. The total duration of interactions with industry per year represents an aggregated measure of the level of social capital activation that neutralizes the effects of a wide variety of random factors related to individual interactions. These factors include, among others, type of interaction, type of industrial partner, tie strength and type of exchanged information. The current paper is based on the assumption that the more time is spent on interactions in total, the more (information) resources are expected to be exchanged between an academic and his or her industrial partners, and as a result the more actively his or her social capital was used.

Passive Social Capital

Passive social capital refers to networks that might be exploited or activated should the necessity occur. Two primary social network variables that have been argued to form actor's social capital refer to network size and tie strength (Gabbay & Leenders, 2001 quoted in Anderson, 2008).

Network size is typically measured in one of the two ways: actual or effective network size. *Actual network size* represents the number of contacts an actor has (sometimes also called

'degree' or 'degree centrality'). *Effective network size* reduces the actual network size by the extent to which the actor's contacts know one another. Effective network size incorporates a fundamental assumption of structural hole theory (Borgatti, Jones, & Everett, 1998) implying that people who are connected to one another offer less information benefits (Burt, 1992). That is, the amount and diversity of information available from an actor's social network is expected to be less to the extent that the actor's contacts know one another, because those connected people are likely to possess more information in common, and thus less unique information in general. An actor's effective network size is thus larger when the people he or she is connected to do not know one another (Anderson, 2008, p. 53). For the needs of the current study, we suggest measuring actual network size ('degree' or 'degree centrality') because of a number of reasons. First, the number of industrial acquaintances measured in this study refers to people from different organizational entities. As a result, the amount and diversity of information they possess is already likely to be significantly higher than in situations when people work within the same organization. Furthermore, empirical evidence suggests that academics are likely to have from 4 to 10 industrial partners (Balconi, Breschi, & Lissoni, 2004); consequently, for most academics, the number of industrial partners in their networks is already relatively low. Finally, the current study aims to measure network size with regard to the whole category of behavior, and not one interaction. Therefore, it might be highly challenging for the respondents to provide exact information on their effective network size, and the reliability of obtained data would need to be put under question. The first hypothesis that needs to be tested can be formulated as follows:

Hypothesis 1: The higher the number of industrial partners in the academic's network, the more time he or she is likely to spend on interactions with industry.

Another important variable refers to tie strength. While weak ties facilitate cost-effective search for codifiable (explicit) information, strong ties are beneficial for cost-effective exchange of more complex information and tacit knowledge in the future (Hansen, 1988 quoted in Adler & Kwon, 2002). In the theoretical section, we suggested that the presence of stronger ties with industry predisposes academics to interact with industry, as it implies higher intensity of interactions. For the purpose of this study, we suggest measuring the number of industrial partners with whom an academic has strong ties (for a similar approach see Anderson, 2008; for a similar approach see Gabbay & Zuckerman, 1998). This leads us to the following hypothesis:

Hypothesis 2: The higher the number of industrial partners with whom an academic has strong ties, the more time he or she is likely to spend on interactions with industry.

Readiness to activate social capital

Table 1 presents the proposed operationalization of factors forming readiness to activate social capital.

TABLE 1: Proposed operationalization of readiness constructs

Constructs	Operationalization[1]	Authors
Individual motivation	(1) Contribution with something practical	(Gulbrandsen, 2005)
	(2) Recognition within the scientific community	(Merton, 1957; Siegel, Waldman, Atwater, & Link, 2004)

[1] Most of the variables employed in this study can not be directly observed, but still will be directly measured using a 7-point scale. These variables are expected to deduce into the proposed latent variables.

Constructs	Operationalization[1]	Authors
	(3) Support to teaching duties (e.g. preparing student assignments based on cases from industry, going on field trips to the premises of industrial partners, getting access to practical problems that are suitable for student work)	(Gulbrandsen, 2005)
	(4) Access to industry skills and facilities	(D'Este & Patel, 2007)
	(5) Keeping abreast of industry problems	(D'Este & Patel, 2007)
	(6) Promotion on a career ladder	(Goktepe-Hultan, 2008)
	(7) Obtaining additional funding for research group, graduate students or laboratory equipment	(Siegel, Waldman, Atwater, & Link, 2004)
Social influence	(1) Boss's opinion	(Bercovitz & Feldman, 2008, p. 74; Goktepe-Hultan, 2008; Stuart & Ding, 2006)
	(2) Opinion of peer colleagues	(Bercovitz & Feldman, 2008, p. 74; Cukierman, Fontana, Sarfatti, & Nuova, 2007; D'Este & Patel, 2007; Goktepe-Hultan, 2008; Magnusson, McKelvey, & Versiglioni, 2008)
	(3) Opinion of academic research partners	(Cukierman, Fontana, Sarfatti, & Nuova, 2007; D'Este & Patel, 2007; Goktepe-Hultan, 2008; Magnusson, McKelvey, & Versiglioni, 2008)
	(4) Boss's behavior	(Bercovitz & Feldman, 2008, p. 74; Goktepe-Hultan, 2008; Stuart & Ding, 2006)
	(5) Behavior of peer colleagues	(Bercovitz & Feldman, 2008, p. 74; Cukierman, Fontana, Sarfatti, & Nuova, 2007; D'Este & Patel, 2007; Goktepe-Hultan, 2008; Magnusson, McKelvey, & Versiglioni, 2008)
	(6) Behavior of academic research partners	(Bercovitz & Feldman, 2008, p. 74; Cukierman, Fontana, Sarfatti, & Nuova, 2007; D'Este & Patel, 2007; Goktepe-Hultan, 2008; Magnusson, McKelvey, & Versiglioni, 2008)
Perceived ability	(1) Balancing conflicting interests of incentive systems	(D'Este & Patel, 2007)
	(2) Operating with a wide range of bodies of knowledge	(D'Este & Patel, 2007)
	(3) Good understanding of industry needs	(Interviews)
	(4) Working according to industry standards	(Interviews)

Individual motivation

Table 2 presents the proposed operationalization of individual motivation.

TABLE 2: Proposed operationalization of individual motivation

Construct	Variable name	Composite variable (individual belief x individual want)	Individual beliefs (1 to 7)	Individual wants (-3 to +3)

Construct	Variable name	Composite variable (individual belief x individual want)	Individual beliefs (1 to 7)	Individual wants (-3 to +3)
Individual motivation	IM1	(1) Motive of contribution with something practical	Belief that interaction with industry leads to contribution with something practical	Desire to contribute with something practical
	IM2	(2) Motive of recognition within the scientific community	Belief that interaction with industry leads to recognition within the scientific community	Desire to get more recognition within the scientific community
	IM3	(3) Motive of supporting teaching duties	Belief that interaction with industry provides support to teaching duties	Desire to support teaching duties
	IM4	(4) Motive of getting access to industry skills and facilities	Belief that interaction with industry provides access to industry skills and facilities	Desire to get access to industry skills and facilities
	IM5	(5) Motive of keeping abreast of industry problems	Belief that interaction with industry allows to keep abreast of industry problems	Desire to keep abreast of industry problems
	IM6	(6) Motive of getting promotion on a career ladder	Belief that interaction with industry leads to promotion on a career ladder	Desire to get promoted on a career ladder
	IM7	(7) Motive of obtaining additional funding for research group, graduate students or laboratory equipment	Belief that interaction with industry leads to additional funding	Desire to obtain additional funding

The questions on beliefs of an academic with regard to the consequences of interaction with industry need to cover about 75% (Francis et al., 2004) of all possible motives of academics to interact with industry. Respondents will be asked to assess the strength of their beliefs using 7-point unipolar scales (1 to 7) and the strength of corresponding wants using 7-point bipolar scales (-3 to +3). The format of these scales is based on work with the semantic differentials which found 7 points to be optimal (Francis et al., 2004). Consequently, the initial possible range of scores for composite variables will be from -21 to +21. These scores will then be transformed into scores from a 7-point unipolar scale (1 to 7)[2] to use them as an input for the Confirmatory Factor Analysis. Such approach is likely to increase the normality of data.

The empirical analysis also aims to identify which motives weight more heavily on the level of social capital activation.

[2] The range from -21 to +21 will be split into 7 intervals (i.e. -21 to -16 = 1; -15 to -10 = 2 etc.) and scores from 1 to 7 will be assigned to each composite variable

Perceived social influence

Table 3 presents the proposed operationalization of perceived social influence.

TABLE 3: Proposed operationalization of perceived social influence

Construct	Variable name	Composite variable (individual belief x individual want)	Social beliefs (1 to 7)	Social influence evaluation (-3 to +3)
Perceived social influence	PSI1	(1) Influence of boss's opinion with regard to interaction with industry	Belief that the academic's boss thinks he or she should interact with industry	Importance of boss's opinion
	PSI2	(2) Influence of opinion of peer colleagues with regard to interaction with industry	Belief that academic's peer colleagues think he or she should interact with industry	Importance of opinion of peer colleagues
	PSI3	(3) Influence of opinion of academic research partners with regard to interaction with industry	Belief that academic's research partners think he or she should interact with industry	Importance of opinion of academic research partners
	PSI4	(4) Influence of boss's behavior with regard to interaction with industry	Belief that boss interacts with industry	Importance of boss's behavior
	PSI5	(5) Influence of behavior of peer colleagues with regard to interaction with industry	Belief that peer colleagues interact with industry	Importance of behavior of peer colleagues
	PSI6	(6) Influence of behavior of academic research partners with regard to interaction with industry	Belief that research partners interact with industry	Importance of behavior of academic research partners

The questions on social beliefs of an academic need to cover about 75% (Francis et al., 2004) of all possible relevant social influences. Respondents will be asked to assess the strength of their beliefs using 7-point unipolar scales (1 to 7) and to provide the corresponding evaluation using 7-point bipolar scales (-3 to +3). The format of these scales is based on work with the semantic differentials which found 7 points to be optimal (Francis et al., 2004). Consequently, the initial possible range of scores for composite variables will be from -21 to +21. These scores will then be transformed into scores from a 7-point unipolar scale (1 to 7)[3] to use them as an input for the Confirmatory Factor Analysis.

We expect that individuals will be more likely to engage in interaction with industry when they observe individuals with similar characteristics in their departments interacting with industry. (Bercovitz & Feldman, 2008, p. 74) Therefore, the following hypotheses will need to be tested:

[3] The range from -21 to +21 will be split into 7 intervals (i.e. -21 to -16 = 1; -15 to -10 = 2 etc.)

Hypothesis 3: Academics in departments where the chair is actively involved in interactions with industry are likely to spend more time on interaction with industry.

Hypothesis 4: Academics in departments where peer colleagues are actively involved in interactions with industry are likely to spend more time on interaction with industry.

Hypothesis 5: Academics whose academic research partners are actively involved in interactions with industry are likely to spend more time on interaction with industry.

Perceived ability

Table 4 presents the proposed operationalization of perceived ability.

TABLE 4: Proposed operationalization of perceived ability

Construct	Variable name	Composite variable (individual belief x individual want)	Ability beliefs (1 to 7)	Ability evaluation (-3 to +3)
Perceived ability	PA1	(1) Perceived ability to balance conflicting interests of incentive systems	Belief that interaction with industry requires balancing conflicting interests of incentive systems	Level of ability to balance conflicting interests of incentive systems
	PA2	(2) Perceived ability to operate with a wide range of bodies of knowledge	Belief that interaction with industry requires operating with a wide range of bodies of knowledge	Level of ability to operate with a wide range of bodies of knowledge
	PA3	(3) Perceived ability to understand industry needs	Belief that interaction with industry requires understanding industry needs	Level of ability to understand industry needs
	PA4	(4) Perceived ability to work according to industry standards	Belief that interaction with industry requires working according to industry standards	Level of ability to work according to industry standards

The questions on ability beliefs of an academic need to cover about 75% (Francis et al., 2004) of all possible relevant abilities with regard to interaction with industry. Respondents will be asked to assess the strength of their beliefs using 7-point unipolar scales (1 to 7) and to provide the corresponding evaluation using 7-point bipolar scales (-3 to +3). The format of these scales is based on work with the semantic differentials which found 7 points to be optimal (Francis et al., 2004). Consequently, the initial possible range of scores for composite variables will be from -21 to +21. These scores will then be transformed into scores from a 7-point unipolar scale (1 to 7)[4] to use them as an input for the Confirmatory Factor Analysis.

The empirical analysis also aims to identify which type of ability weight more heavily on the level of social capital activation.

[4] The range from -21 to +21 will be split into 7 intervals (i.e. -21 to -16 = 1; -15 to -10 = 2 etc.)

Trigger

Table 5 presents the proposed operationalization of a trigger. The trigger here refers to an event, action or occasion that serves as a reason for an interaction to occur. The questions on triggers for an interaction to occur need to cover about 75% (Francis et al., 2004) of all possible triggers. Respondents will be asked to assess the frequency of triggers using 7-point unipolar scales (1 to 7). These scores will be used as an input for the Confirmatory Factor Analysis.

TABLE 5: Proposed operationalization of trigger

Construct	Variable name	Question	Response options
Trigger	TR1	I spot ideas that might be potentially interesting for industry.	(range 1 to 7; 1 = never; 7 = very often)
	TR2	The results of my research can be practically applied.	(range 1 to 7; 1 = never; 7 = very often)
	TR3	I am obliged to share the results of my research with industrial partners.	(range 1 to 7; 1 = never; 7 = very often)
	TR4	I have ideas for future projects that imply interaction with industry.	(range 1 to 7; 1 = never; 7 = very often)
	TR5	Industry representatives approach me directly.	(range 1 to 7; 1 = never; 7 = very often)
	TR6	I meet industry representatives at networking events.	(range 1 to 7; 1 = never; 7 = very often)

EMPIRICAL ANALYSIS

The current research studies theoretical constructs that cannot always be observed directly. These abstract phenomena (i.e., individual motivation, perceived social influence, perceived ability, trigger) represent latent variables, or factors. Therefore, it is necessary to (1) statistically test the a priori postulated relations between the proposed observed measures and the underlying factors (*measurement model*); and (2) to specify the relations between the latent variables (*structural model*), i.e. to construct a full latent variable model. The objective for the second type of analysis is to hypothesize the impact of one latent construct on another in the modeling of causal direction (Byrne, 2001). Consequently, for a comprehensive empirical analysis, we aim at confirming the complete model comprising both a measurement model and a structural model: the measurement model depicting the links between the latent variables and their observed measures, and the structural model depicting the links between the latent variables themselves. For this purpose, we will need to employ SEM techniques.

Structural equation modeling (SEM) is a statistical methodology that takes a confirmatory (i.e., hypothesis-testing) approach to the analysis of a structured theory bearing on some phenomenon. The procedure conveys the following important aspects: (1) the causal processes under study are represented by a series of structural (i.e., regression) equations, and (2) these structural relations can be modeled pictorially to enable a clearer conceptualization of the theory under study. The hypothesized model can then be tested statistically in a simultaneous analysis of the entire system of variables to determine the extent to which it is consistent with the data. If goodness-of-fit is adequate, the model argues for the plausibility of postulated relations among variables; if it is inadequate, the tenability of such relations is rejected. Most other multivariate procedures are

essentially descriptive by nature (e.g., exploratory factor analysis), so that hypothesis testing is difficult, if not impossible. (Byrne, 2001, p. 3)

In the context of this study, it might be interesting to empirically examine the higher-order structure of a CFA measurement model. In higher-order factor analysis, the focus is on the intercorrelations among the factors. These factor correlations represent the input matrix for the higher-order factor analysis. Higher-order CFA tests a theory-based account for the patterns of relationships among the first-order factors. These specifications imply that higher-order factors have direct effects on lower-order factors, and these direct effects and the correlations among higher-order factors are responsible for the covariation of the lower-order factors (Brown, 2006, p. 321).

The latent structure of our questionnaire is predicted to be characterized by three first-order factors that represent three distinctive antecedents of social capital activation: individual motivation, perceived social influence and perceived ability. The three factors are presumed to be intercorrelated. One higher-order factor is predicted to account for the three correlations among the first-order factors: readiness. The conceptual basis for this specification is that readiness is believed to act either proactively or reactively, a person has to demonstrate a certain readiness to perform a given behavior (see, for example Ajzen, 1991). Readiness therefore represents a *second-order factor* or a factor that accounts for the correlations among first-order factors.

The CFA-based higher-order factor analysis typically includes the following steps:

(1) developing a good-fitting first-order CFA solution;
(2) examining the magnitude and pattern of correlations among factors in the first-order solution;
(3) fitting the second-order factor model, as justified on conceptual and empirical grounds.

CONCLUSIONS AND IMPLICATIONS FOR RESEARCH AND PRACTICE

In this section, we present the key conclusions of the paper, point out the main limitations and set directions for future research.

Back to Dave and Paul

The proposed theoretical model offers the following explanation of why Dave spends ten times more time on interaction with industry than Paul. First of all, passive social capitals of academics are expected to be considerably different. Dave is likely to have a higher number of industrial partners in his network than Paul. In addition, the number of industrial partners with whom Dave has strong ties is likely to be higher than that of Paul. These anticipated differences in passive social capitals are expected to lead to different levels of readiness to activate social capital. Dave is likely to be more motivated to engage in interaction with industry than Paul. People around Dave are more likely to interact with industry than those around Paul. Finally, Dave is likely to have a higher ability to interact with industry than Paul. These different levels of readiness to activate social capital accompanied by different levels of passive social capital are expected to lead to a considerably higher number of triggers for Dave to engage in interaction with industry than for Paul. This means greater assurance for Dave to be informed of opportunities to work with industry, higher probability for Dave to be the first person to see new opportunities created

in industry that could be served by academia, and greater assurance that Dave will be included in those new opportunities. All these factors together are likely to lead to social capital activation for Dave considerably more often than for Paul. Furthermore, following the idea of a reinforcing cycle, this difference is likely to be sustained or grow even more in the future.

Limitations of the Model

The presented model has a number of limitations. First, the model builds on the principle of aggregation and therefore does not allow predicting a specific behavior in a given situation. Nor does the model explain the differences between behaviors across situations. However, since the model aims at deriving general behavioral patterns related to social capital activation, it is crucial to employ the principal of aggregation. Second, the model builds on the assumption that the individual is always aware about the his or her motivation, ability and social influence around and that individual's behavior can be explained by examining individual's perceptions with regard to the antecedents of his or her behavior. However, it might not always be the case. It might be reasonable to assume that individual's behavior might also be influenced by factors that he or she is not aware of or does not consider important. To address this limitation when empirically testing the model, we suggest including several relevant control variables that are not related to the individual's perceptions (e.g. researcher's origin (local or foreigner); nature of research (basic or applied); academic excellence).

We have not included factors like personality traits in our model. As argued by Ajzen (1991, p. 180), the low empirical relations between general personality traits and behavior in specific situations have led theorists to claim that the trait concept is unsound (see also Mischel, 1968 quoted in Ajzen, 1991, p. 180). Therefore, predicting entrepreneurial behavior of academic researchers by modelling their personality traits is likely to result in disappointingly small explanatory power. As a result, these factors do not form a part of this model.

In addition, existing literature suggests that factors like academic excellence and the nature of research (basic or applied) are also likely to have significant influence on the level of activity of academics in university-industry interactions (see, for example, Lazega, Mounier, Jourda, & Stofer, 2006; see, for example, Zucker & Darby, 1996). Our model is based on the assumption that not all academically excellent researchers doing applied research are equally active in interactions with industry, and the main objective of the model is then to explain this difference in behavior. Given that this target group represents a tiny fraction of all researchers in academia, it is important not to overlook other groups of academics, including ones doing basic science and demonstrating lower academic excellence. As mentioned before, when empirically testing the model, we suggest including academic excellence and the nature of research (basic or applied) as control variables.

Future Research Needs

There is a need to test the proposed model in practice. The current model needs to be tested in both high-tech sectors (e.g. Nanotechnology, Biotechnology[5] and ICT) that are most predisposed

[5] Medical schools represent a key venue for academic activity with commercial potential. Medical schools account for the majority of university invention disclosures (Mowery and Ziedonis, 2002 quoted in Bercovitz & Feldman, 2008, pp. 70-71)

to interaction with industry, and other sectors, where interaction between academia and industry is less likely to occur.

Furthermore, we need to broaden our attention beyond the groups of academic researchers that are actively engaged in university-industry interactions (that fit well with the description of "entrepreneurial academics" by Meyer, 2003) to thoughtfully consider other key types of publics: socially inactive researchers with high potential, uninvolved but aware, and unaware researchers (for detailed descriptions of different types of publics see Hallahan, 2000). These groups of researchers have been largely overlooked by both theorists and practitioners.

In addition, cultural norms across scientific fields may also be critical in shaping faculty involvement in entrepreneurial activities (Cukierman, Fontana, Sarfatti, & Nuova, 2007). As Kenney and Goe (2004) suggested, academic researchers belonging to the same scientific discipline have a common set of perceptions and practices that are likely to influence their degree of engagement in interaction with industry (quoted in Cukierman, Fontana, Sarfatti, & Nuova, 2007). Consequently, it is necessary to examine the extent to which certain behavioral patterns are consistent across different disciplines by considering a number of differentiated research communities. Future research should also control for factors such as main type of research (basic or applied), academic excellence of the affiliated institution and well as whether the academic researcher is foreign born or not.

Ideally it would be necessary to test the proposed model at various points in time in order to be able to check the proposed causal relationships. In practice, however, such approach might be quite a challenge, and thus might be replaced by a more feasible alternative of a one-time comprehensive survey.

ANNEX A: DRAFT VERSION OF THE QUESTIONNAIRE

SECTION 1: ABOUT YOUR BACKGROUND

Please fill in the relevant details in the fields below.

1.1 Hierarchical position [drop down menu; single choice]
Full professor (Hoogleraar)
Associate professor (Universitair Hoofddocent)
Assistant professor (Universitair Docent)
Postdoc (Onderzoeker)
PhD candidate (Promovendus)

1.2 Main scientific orientation [single choice]
Basic
Applied

1.3 Scientific domain [single choice]
Biomedical Engineering / Technical Medicine
Information Technology / Telematics
Nanotechnology
Other (please specify)

1.4 Affiliated institution [single choice]
Delft University of Technology
Eindhoven University of Technology
University of Twente
Other (please specify)

1.5 Gender [single choice]
Female
Male

1.6 Nationality [single choice]
Local
Foreign

1.7 Please check all the activities related to interaction with industry that you were involved in during the last year. [multiple choice]
Attendance of *industry sponsored meetings*
Attendance of *conferences* with industry and university participation
Consultancy work (commissioned by industry, not involving original research)
Contract research agreements (commissioned by industry and undertaken only by university researchers)
Setting up *spin-off* companies
Creation of *physical facilities* with industry funding (including campus laboratories, incubators and cooperative research centers)
Postgraduate training in company (e.g. joint supervision of PhDs)
Training company employees (trough course enrolment or personnel exchanges)
Joint research agreements (involving research undertaken by both parties

Last year I was not involved in any of these activities

Questions in the remainder of this questionnaire refer to interactions between you and your industrial acquaintances. We would like to encourage you to proceed with filling in the questionnaire even if you have not interacted with industry during the last year.

The aim of this questionnaire is to identify general behavioral patterns with regard to interactions between people from academia and their industrial acquaintances. Therefore, questions are not tailored to specific types of interactions. When answering the questions, please consider your engagement in *all* the activities that you checked in question 1.7.

SECTION 2: SOCIAL CAPITAL

2.1 How many industrial acquaintances [pop up tip text: companies] do you currently have in your social network? Please provide the total number in the box below [open question]

2.2 With how many of your industrial acquaintances [pop up tip text: companies] do you have close relations [pop up tip text: regular communication, exchange of complex information and tacit knowledge]? Please provide the total number in the box below [open question]

2.3 How much time did you spend on interactions with industry *last year*? Please provide the *percentage* of the total time spent on your work in academia. [open question]

SECTION 3: INDIVIDUAL MOTIVATION

Please answer each of the following questions by selecting the score that best reflects your opinion.

[Individual beliefs]

3.1 Interaction with industry allows to contribute with something practical.	Strongly disagree	1	2	3	4	5	6	7	Strongly agree
3.2 Interaction with industry brings more recognition within the scientific community.	Strongly disagree	1	2	3	4	5	6	7	Strongly agree
3.3 Interaction with industry supports teaching duties [pop up tip text: e.g., allows preparing student assignments based on cases from industry, going on field trips to the premises of industrial partners, getting access to practical problems that are suitable for student work].	Strongly disagree	1	2	3	4	5	6	7	Strongly agree
3.4 Interaction with industry provides access to industry skills and facilities.	Strongly disagree	1	2	3	4	5	6	7	Strongly agree

3.5 Interaction with industry allows to keep abreast of industry problems.	Strongly disagree	1	2	3	4	5	6	7	Strongly agree
3.6 Interaction with industry is helpful for the promotion on a career ladder.	Strongly disagree	1	2	3	4	5	6	7	Strongly agree
3.7 Interaction with industry leads to additional funding for research group [pop up tip text: including funding for graduate students or laboratory equipment].	Strongly disagree	1	2	3	4	5	6	7	Strongly agree

[Individual wants]

3.8 I … to contribute with something practical.	do not want at all	-3	-2	-1	0	1	2	3	very much want
3.9 I … to get more recognition within the scientific community.	do not want at all	-3	-2	-1	0	1	2	3	very much want
3.10 I … to support my teaching duties.	do not want at all	-3	-2	-1	0	1	2	3	very much want
3.11 I … to get access to industry skills and facilities.	do not want at all	-3	-2	-1	0	1	2	3	very much want
3.12 I … to keep abreast of industry problems.	do not want at all	-3	-2	-1	0	1	2	3	very much want
3.13 I … to get promoted on a career ladder.	do not want at all	-3	-2	-1	0	1	2	3	very much want
3.14 I … to obtain additional funding for my research group.	do not want at all	-3	-2	-1	0	1	2	3	very much want

SECTION 4: PERCEIVED SOCIAL INFLUENCE

Please answer each of the following questions by selecting the score that best reflects your opinion.

[Social beliefs]

4.1 My boss [pop up tip text: head of research group/laboratory/department/university] thinks … interact with industry.	I should not	-3	-2	-1	0	1	2	3	I should
4.2 My peer colleagues think … interact with industry.	I should not	-3	-2	-1	0	1	2	3	I should
4.3 My academic research partners think I … interact with industry.	I should not	-3	-2	-1	0	1	2	3	I should
4.4 My boss … interact with industry.	does not	-3	-2	-1	0	1	2	3	does
4.5 My peer colleagues … interact with industry.	do not	-3	-2	-1	0	1	2	3	do
4.6 My academic research partners … interact with industry.	do not	-3	-2	-1	0	1	2	3	do

[Social influence evaluation]

4.7 My boss's approval of my behavior is important to me.	Not at all	1	2	3	4	5	6	7	Very much

4.8 What my peer colleagues think I should do matters to me.	Not at all	1	2	3	4	5	6	7	Very much
4.9 What my academic research partners think I should do matters to me.	Not at all	1	2	3	4	5	6	7	Very much
4.10 Doing what my boss does is important to me.	Not at all	1	2	3	4	5	6	7	Very much
4.11 Doing what my peer colleagues do is important to me.	Not at all	1	2	3	4	5	6	7	Very much
4.12 Doing what my academic research partners do is important to me.	Not at all	1	2	3	4	5	6	7	Very much

SECTION 5: PERCEIVED ABILITY

Please answer each of the following questions by selecting the score that best reflects your opinion.

[Ability beliefs]

5.1 Interaction with industry requires to balance conflicting interests of incentive systems between academia and industry.	Strongly disagree	1	2	3	4	5	6	7	Strongly agree
5.2 Interaction with industry requires to operate with a wide range of bodies of knowledge [pop up tip text: e.g. basic science vs. applied research; multiple disciplines].	Strongly disagree	1	2	3	4	5	6	7	Strongly agree
5.3 Interaction with industry requires to have a good understanding of industry needs.	Strongly disagree	1	2	3	4	5	6	7	Strongly agree
5.4 Interaction with industry requires to work according to the industry standards [pop up tip text: e.g. quick delivery of results].	Strongly disagree	1	2	3	4	5	6	7	Strongly agree

[Ability evaluation]

5.5 Balancing conflicting interests of incentive systems between academia and industry is …	very difficult for me	-3	-2	-1	0	1	2	3	very easy for me
5.6 Operating with a wide range of bodies of knowledge [pop up tip text: e.g. basic science vs. applied research; multiple disciplines] is …	very difficult for me	-3	-2	-1	0	1	2	3	very easy for me
5.7 Understanding industry needs is …	very difficult for me	-3	-2	-1	0	1	2	3	very easy for me
5.8 Working according to the industry standards is …	very difficult for me	-3	-2	-1	0	1	2	3	very easy for me

SECTION 6: TRIGGER

Please answer each of the following questions by selecting the score that best reflects your opinion.

6.1 I spot ideas that might be potentially interesting for industry.	Never	1	2	3	4	5	6	7	Very often
6.2 The results of my research can be practically applied.	Never	1	2	3	4	5	6	7	Very often
6.3 I am obliged to share the results of my research with industrial partners.	Never	1	2	3	4	5	6	7	Very often
6.4 I have ideas for future projects that imply interaction with industry.	Never	1	2	3	4	5	6	7	Very often
6.5 Industry representatives approach me directly.	Never	1	2	3	4	5	6	7	Very often
6.6 I meet industry representatives at networking events.	Never	1	2	3	4	5	6	7	Very often

REFERENCES

Adler, P. S., & Kwon, S.-W. (2002). Social capital: Prospects for a new concept. *Academy of Management Review*, 17-40.

Agrawal, A., & Henderson, R. (2002). Putting patents in context: Exploring knowledge transfer from MIT. *Management Science*, 44-60.

Ajzen, I. (1991). The theory of planned behavior. *Organizational behavior and human decision processes, 50*(2), 179-211.

Ajzen, I. (2006). Constructing a TpB Questionnaire: Conceptual and Methodological Considerations. 2002. *Revised January*.

Ajzen, I., Czasch, C., & Flood, M. G. (2009). From intentions to behavior: Implementation intention, commitment, and conscientiousness. *Journal of Applied Social Psychology, 39*(6), 1356-1372.

Anderson, M. H. (2008). Social networks and the cognitive motivation to realize network opportunities: a study of managers' information gathering behaviors. *Journal of Organizational Behavior, 29*(1).

Audretsch, D. B. (2006). *Entrepreneurship, innovation and economic growth*: Edward Elgar Publishing.

Balconi, M., Breschi, S., & Lissoni, F. (2004). Networks of inventors and the role of academia: an exploration of Italian patent data. *Research Policy, 33*(1), 127-145.

Bandura, A. (1982). Self-efficacy mechanism in human agency. *American psychologist, 37*(2), 122-147.

Bandura, A. (1997). *Self-efficacy: The exercise of control*: Worth Publishers.

Batt, P. J. (2008). Building social capital in networks. *Industrial Marketing Management*.

Bercovitz, J., & Feldman, M. (2008). Academic Entrepreneurs: Organizational Change at the Individual Level. *Organization Science, 19*(1), 69-89.

Binney, W., Hall, J., & Shaw, M. (2003). A further development in social marketing: Application of the MOA framework and behavioral implications. *Marketing Theory, 3*(3), 387.

Borgatti, S. P., Jones, C., & Everett, M. G. (1998). Network measures of social capital'. *Semantic Pajek Networks Software, 21*(2), 27-36.

Bourdieu, P. (1985). The forms of capital. *J.G. Richardson (Ed.) Handbook of theory and research for the sociology of education*, 241-258.

Bowey, J. L., & Easton, G. (2007). Entrepreneurial Social Capital Unplugged: An Activity-based Analysis. *International Small Business Journal, 25*(3), 273.

Brown, T. A. (2006). *Confirmatory factor analysis for applied research*: The Guilford Press.

Burnett, C. (2006). Building Social Capital through an 'Active Community Club'. *International Review for the Sociology of Sport, 41*(3-4), 283-294.

Burt, R. S. (1992). Structural holes. *Cambridge, MA*.

Burt, R. S. (1997). The Contingent Value of Social Capital. *Administrative science quarterly, 42*(2).

Burt, R. S. (2000). The network structure of social capital. *Research in organizational behavior, 22*(2), 345-423.

Byrne, B. M. (2001). Structural Equation Modeling With AMOS: Basic Concepts. *Applications, and Programming, Mahwah, New Jersey*.

Cukierman, P. D. E., Fontana, R., Sarfatti, V., & Nuova, C. S. (2007). What drives the emergence of entrepreneurial academics? A study on collaborative research partnerships in the UK. *Research Evaluation, 16*(4), 257-270.

D'Este, P., & Patel, P. (2007). University–industry linkages in the UK: What are the factors underlying the variety of interactions with industry? *Research Policy, 36*(9), 1295-1313.

Foley, M. W., & Edwards, B. (1999). Is it time to disinvest in social capital? *Journal of Public Policy, 19*(02), 141-173.

Francis, J. J., Eccles, M. P., Johnston, M., Walker, A. E., Grimshaw, J. M., Foy, R., et al. (2004). Constructing questionnaires based on the theory of planned behaviour. *A manual for health services researchers*.

Fukuyama, F. (1995). Trust: The social values and the creation of prosperity. *New York*.

Gabbay, S. M., & Zuckerman, E. W. (1998). Social capital and opportunity in corporate R&D: The contingent effect of contact density on mobility expectations. *Social Science Research, 27*(2), 189-217.

Glaeser, E. L. (2001). The formation of social capital. *Canadian Journal of Policy Research, 2*(1), 34-40.

Goktepe-Hultan, D. (2008). Why and how do scientists commercialize their research? Towards a typology of inventors. *Jena Economic Research Papers*, 071.

Goldman, A. I. (1970). *A theory of human action*: Prentice Hall.

Granovetter, M. (1985). Economic action and social structure: the problem of embeddedness. *American journal of sociology, 91*(3), 481.

Gulbrandsen, M. (2005). But Peter's in it for the money"-the liminality of entrepreneurial scientists. *VEST Journal for Science and Technology Studies, 18*(1-2), 49-75.

Gustin, B. H. (1973). Charisma, recognition, and the motivation of scientists. *American Journal of Sociology*, 1119-1134.

Hagstrom, W. O. (1965). *The scientific community*: New York, Basic.

Hallahan, K. (2000). Inactive publics: the forgotten publics in public relations*. *Public relations review, 26*(4), 499-515.
Hebert, Y., Lee, J., Sun, S. X., & Berti, C. (2003). Relational citizenship as social networks: Immigrant youths maps of their friendhips. *Encounters on education, 4*.
Kenney, M., & Richard Goe, W. (2004). The role of social embeddedness in professorial entrepreneurship: a comparison of electrical engineering and computer science at UC Berkeley and Stanford. *Research Policy, 33*(5), 691-707.
Kline, R. B. (2004). *Principles and practice of structural equation modeling*: The Guilford Press.
Krueger, N. F., & Carsrud, A. L. (1993). Entrepreneurial intentions: applying the theory of planned behaviour. *Entrepreneurship & Regional Development, 5*(4), 315-330.
Krueger, N. F., Reilly, M. D., & Carsrud, A. L. (2000). Competing models of entrepreneurial intentions. *Journal of business venturing, 15*(5-6), 411-432.
Landry, R., Amara, N., & Ouimet, M. (2005). *A resource-based approach to knowledge transfer: Evidence from Canadian university researchers in natural sciences and engineering*.
Lazega, E., Mounier, L., Jourda, M. T., & Stofer, R. (2006). Organizational vs. personal social capital in scientists' performance: A multi-level network study of elite French cancer researchers (1996-1998). *Scientometrics, 67*(1), 27-44.
Lin, N. (2001). Building a network theory of social capital. *Social capital: Theory and research*, 3-29.
Louis, K. S., Blumenthal, D., Gluck, M. E., & Soto, M. A. (1989). Entrepreneurs in Academe: An Exploration of Behaviors among Life Scientists. *Administrative Science Quarterly, 34*(1).
Magnusson, M., McKelvey, M., & Versiglioni, M. (2008). The Forgotten Individuals: Attitudes and skills in Academic Commercialization in Sweden. *Working Paper*.
Merton, R. K. (1957). *Social theory and social structure*: Free Press of Glencoe New York.
Meyer-Krahmer, F., & Schmoch, U. (1998). Science-based technologies: university–industry interactions in four fields. *Research Policy, 27*(8), 835-851.
Meyer, M. (2003). Academic entrepreneurs or entrepreneurial academics? Research based ventures and public support mechanisms. *R&D Management, 33*, 107-115.
Mulkay, M. J., & Turner, B. S. (1971). Over-production of personnel and innovation in three social settings. *Sociology, 5*(1), 47.
Perkmann, M., Walsh, K., & Campus, S. K. (2007). University Industry Relationships and Open Innovation: Towards a Research Agenda. *International Journal of Management Reviews, 9*(4), 259-280.
Pinar, W., Reynolds, W., Slattery, P., & Taubman, P. (2000). *Understanding curriculum: An introduction to the study of historical and contemporary curriculum discourses.* New York: Peter Lang.
Portes, A. (1998). Social capital: its origins and applications in modern sociology. *Annual review of sociology, 24*(1), 1-24.
Putnam, R. D. (1995). Tuning in, tuning out: the strange disappearance of social capital in America. *PS: Political Science and Politics*, 664-683.
Shapero, A. (1982). Social Dimensions of Entrepreneurship. In D. S. In C Kent, & K Vesper (Ed.), *The Encyclopedia of Entrepreneurship* (pp. pp 72-90): Englewood Cliffs, NY: Prentice Hall.
Siegel, D. S., Waldman, D. A., Atwater, L. E., & Link, A. N. (2004). Toward a model of the effective transfer of scientific knowledge from academicians to practitioners: qualitative evidence from the commercialization of university technologies. *Journal of Engineering and Technology Management, 21*(1-2), 115-142.
Smedslund, J. (1997). *The structure of psychological common sense*: Erlbaum Mahwah, NJ.
Smith, S. S. (2005). Don't put my name on it": Social Capital Activation and Job-Finding Assistance among the Black Urban Poor 1. *American Journal of Sociology, 111*(1), 1-57.
Stuart, T. E., & Ding, W. W. (2006). When Do Scientists Become Entrepreneurs? The Social Structural Antecedents of Commercial Activity in the Academic Life Sciences 1. *American Journal of Sociology, 112*(1), 97-144.
Sutton, R. S., & Barto, A. G. (1998). *Reinforcement learning*: MIT Press.
Turner, J. H. (1988). *A theory of social interaction*: Stanford Univ Pr.
Turner, J. H. (2000). The formation of social capital. *Social Capital a Multifaceted Perspective*, 6-11.
Weick, K. E. (1999). Conclusion: Theory construction as disciplined reflexivity: Tradeoffs in the 90s. *Academy of Management Review*, 797-806.
Zucker, L. G., & Darby, M. R. (1996). Star scientists and institutional transformation: Patterns of invention and innovation in the formation of the biotechnology industry (Vol. 93, pp. 12709-12716): National Acad Sciences.

TOWARD A DYNAMIC PERSPECTIVE ON EXPLORATIVE AND EXPLOITATIVE INNOVATION ACTIVITIES: A LONGITUDINAL STUDY OF INNOVATION IN THE WIND BLADE INDUSTRY

Matthias de Visser

University of Twente, Capitool 15, 7521 PL Enschede, The Netherlands

m.devisser@utwente.nl

Innovation requires a combination of explorative and exploitative innovation activities. Previous studies have provided valuable insights in the antecedents of investing in explorative and exploitative activities, the structural governance of exploration and exploitation and the performance implications of engaging in exploration and exploitation. These studies are dominated by cross-sectional research, largely ignoring the evolution of exploration and exploitation over time. Several scholars, however, provide first indications that the allocation of time and resources across exploration and exploitation might change over time. In order to examine the dynamics of explorative and exploitative innovation activities, we conducted an in-depth case study in one particular company in the wind blade industry, applying a novel approach to measure the evolution of the amount of R&D resources allocated to explorative and exploitative activities over a 5 year time period. Our results show that the relative amount of resources and time invested in exploration versus exploitation is not static, but changes over time. The pattern of the evolution of exploration and exploitation at our case company shows phases in which exploration and exploitation activities are well balanced, and phases where one type of innovation dominates innovation activities. Based on additional qualitative data we found first indications of antecedents of the dynamics of exploration and exploitation. Together, our findings provide an interesting starting point for future research on the antecedents, structural governance and performance implications of the evolution of exploration and exploitation over time.

INTRODUCTION

Innovation is seen as crucial for the long-term survival of firms (Schumpeter, 1939; Baumol, 2002). It is increasingly recognized that the innovation process is a multidimensional phenomenon, encompassing processes that focus on the generation of new products and processes (radical innovation) as well as processes that focus on the improvement of existing products and processes (incremental innovation). Innovation therefore requires a combination of explorative and exploitative innovation activities. Explorative activities can be characterized by terms such as search, variation, risk-taking, experimentation, play, flexibility and discovery (March, 1991). Exploitative activities are associated with aspects such as refinement, choice, production, efficiency, selection, implementation and execution (March, 1991).

Previous studies have provided valuable insights in 1) the antecedents of investing in explorative and exploitative activities (Levinthal and March, 1993; Katila and Ahuja, 2001; Gupta et al., 2006). 2) the structural governance of exploration and exploitation (e.g. Gibson and Berkinshaw, 2004; Tushman and O'Reilly, 1996; Jansen et al., 2008), and 3) the performance implications of engaging in exploration and exploitation (Volberda and Lewin, 2003; Jansen et al. 2006). At the same time, these studies are dominated by cross-sectional research, largely ignoring the evolution of exploration and exploitation over time.

Although in-depth studies on dynamics of explorative and exploitative innovation activities are lacking, several scholars provide first indications that, within companies, the allocation of time and resources across exploration and exploitation might change over time. Van de Ven et al. (2000), for instance, emphasize that companies engage in innovation journeys where emphasis might shift over time between different kinds of innovation activities. In a similar vein, modern contingency theory shows that organizations continuously reconfigure their innovation activities to meet changing demands in their internal and external environments (Webb and Pettigrew, 1999; Siggelkow, 2002). Recently, several scholars (i.e. Andriopoulos and Lewis, 2009; Groysberg and Lee, 2009; Raisch et al., 2009) therefore emphasized the need for longitudinal research on exploration and exploitation, which is the main focus of this paper.

In order to examine the dynamics of explorative and exploitative innovation activities, we conducted an in-depth case study in a particular company in the wind blade industry. Whereas existing research (e.g. Lubatkin et al., 2006; Mom et al., 2009) has mainly relied on surveys to measure exploration and exploitation, we apply an alternative approach to measure the evolution of the amount of R&D resources allocated to explorative and exploitative activities over a period of time. In line with Uotila et al. (2003), we applied a word-count method on a database, containing detailed project descriptions of all innovation projects in which the company had engaged during 5 years. Moreover, we were able to link this database to the firm's time-accounting system, allowing to match the hours of each individual employee to specific innovation projects. In this way, we were able to get an exceptionally rich and detailed understanding on how the allocation of time and resources across explorative and exploitative activities evolved over time within this particular company.

Our results show that, within the focal company, gradual shifts from exploration to exploitation and vice versa can be identified. We also found first indications that the tenure of the employees and the turnover of the mother company had a substantial impact on the relative amount of explorative versus exploitative activities over time.

On a theoretical level, this study contributes to the exploration and exploitation literature by showing the inherent dynamic nature of the allocation process across these two kinds of activities. On a methodological level, this study provides an alternative approach to get a more fine-grained understanding of explorative and exploitative innovation activities within firms.

The reminder of this paper is structured in three sections. First, we discuss the innovative methodology that we applied to measure the evolution of exploration and exploitation. Subsequently, we discuss our main results. Finally, we present the main implication of this study and suggest interesting avenues for future research.

METHODOLOGY

This study tracks the evolution of explorative and exploitative innovation activities within a Dutch wind blade technology company from 2003 to 2007. This company was found in 1999 and has been owned by a mother wind energy company since 2001. The wind energy industry is a very volatile and rapidly changing industry, providing the optimal setting to study the dynamics of exploration and exploitation.

Research design

Our research is based on a two-stage case study. According to Yin (1994), a case study strategy has a distinct advantage to other research strategies such as experiments, surveys, archival analysis, and history when "a how or why question is being asked about a contemporary set of events over which the investigator has little or no control." The purpose of this study is to look at how different types of innovation activities evolve over time. The nature of our research objective therefore provides a first ground to decide for a case study research approach.

Addressing the research objective also requires examining the dynamics of different processes such as control and coordination. Several scholars (e.g. Yin, 1994; Eisenhardt, 1989b; Pettigrew, 1990; Poole et al., 2000;) argued that a case study approach is especially useful for studying such processes.

Data collection

Data on the evolution of exploration and exploitation were collected in a retrospective way. Retrospective data collection allowed for a more focused process because it reduced the danger of data overload and collecting much unusable data (Leonard-Barton, 1990; Poole, Van de Ven, Dooley, and Holmes, 2000). However, documenting cases in a retrospective way also has its disadvantages. For instance, respondents have the tendency to filter out events that do not fit or that render their story less coherent (Poole et al., 2000). To improve the validity of these retrospective reports and prevent accepting respondent bias, we applied two strategies. First, we triangulated our data, applying two data sources: an interview and documents (Eisenhardt, 1989b; Yin, 1994). Second, we asked the respondent to reflect on concrete events rather than abstract concepts to reduce the risk of cognitive biases and impression management (Miller et al., 1997).

Our study consists of two stages. In the first stage, archival data were gathered and analyzed. Subsequently, results were triangulated with interview data gathered in the second stage.

Archival data, such as project descriptions and time accounting data, were obtained from our case company. These archival data made it possible to construct a quantitative picture of the evolution of exploration and exploitation related innovation activities. The archival data could be juxtaposed to interview data obtained in the

second stage in order to check for systematic biases in retrospective accounts of past innovation strategy in terms of exploration and exploitation (Golden, 1992).

The co-founder of the company was formally interviewed in the second stage. The conversation lasted two hours and was recorded on mp3, yielding 40 pages of interview transcription. The semi-structured interview clarified key events identified from the archival data and provided a more detailed account of how explorative and exploitative innovation activities within the case company evolved over time, and also provided indications of antecedents of key events identified in this evolution.

Analysis

In the first stage the allocation of R&D resources over explorative and exploitative within the company from 2003 to 2007 was reconstructed. We obtained a project description database from the case company, providing project descriptions of all projects that were realized between 2003 and 2007. Projects that were not focused on development of technology and products (e.g. help desk related activities) were removed from the database. In order to measure the amount of resources this firm allocated to exploitative and explorative activities over time, we first labeled the projects either as "explorative activities" or "exploitative activities". This was done in a manner similar to the method conducted by Uotila et al. (2003), which is based on word-counts of key words. The classification of the projects into explorative and exploitative activities was based on the definition provided by March (1991): "Explorative activities can be characterized by terms such as search, variation, risk-taking, experimentation, play, flexibility and discovery. Exploitative activities can be characterized by aspects such as refinement, choice, production, efficiency, selection, implementation and execution." We searched for synonyms of the nouns and verbs in thesaurus that is part of current version of Apple's operating system. Next, we extended the obtained list of words with all possible conjugations of the verbs and adding singular and plural forms. We then searched for these words in the project description database and calculated the scores for "exploration" and "exploitation" for each individual project. Finally we classified each project "explorative" or "exploitative" based on these scores.

In order to measure the allocation of resources over exploration and exploitation over time, we then matched this database with a time accounting system in which every week of the year all employees entered the hours they spent on each project they were involved in. Finally we were able to calculate the amount of time that was spent on exploitative and explorative projects in every week of the years 2003-2007. By making graphs of the relative amount of resources that were invested in exploration versus exploitation over the period of five years, we identified several key events representing remarkable changes of the balance between both types of innovation activities.

In the second stage we conducted a semi-structured interview with one of the founders of the case company who also was an employee from 2003 till 2007. In the interview we first asked the respondent to describe the history of the company from to present according to his own experience, without instructions about focus on specific events. Subsequently, the key events we selected in our reconstruction of the evolution of exploration and exploitation were discussed and triangulated with the experiences of the respondent in that particular period of time. The respondent related some of the key events of change to factors he referred to earlier in the interview when we were discussing the history of the company. As a result, we are also able to

provide some first indications of antecedents for the key events of change in our reconstruction.

RESULTS

The results of our analysis of project descriptions and time accounting data can be viewed in figure 1. Figure 1 depicts the relative amount of R&D resources spent on explorative innovation activities versus the amount of R&D resources spent on exploitative innovation activities between 2003 and 2007 starting with week 1 in 2003. R&D resources are measured in working hours.

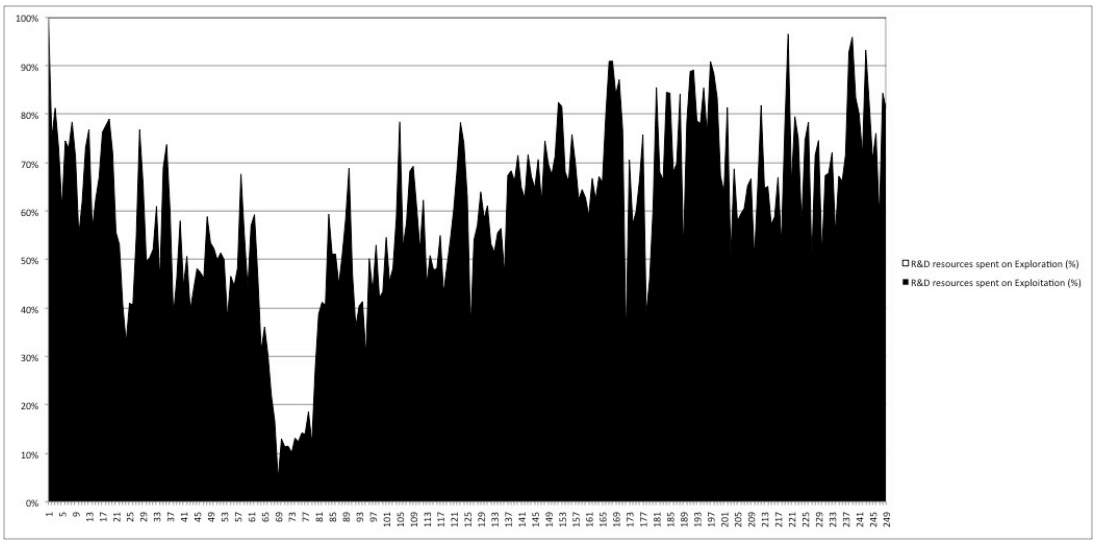


Figure 1: Relative amount of R&D resources spent on exploitative innovation activities versus explorative innovation activities in working hours per week from 2003 to 2007

The results of our analysis show that the amount of resources spent on both types of innovation activities clearly changes over time. Three phases with specific exploration versus exploitation characteristics can be identified.

The first phase begins in week 1 in 2003. In the beginning of that year, innovation is mainly exploitative, representing about 65% of the activities. In the second half of 2003, the amount of working hours invested in explorative innovation activities gradually increases and the investments in both types become almost equal.

In the second phase, starting in week 60 in the second quarter of 2004, exploration radically increases and dominates innovation activities until the fourth quarter of 2004. Only 15% of innovation activities focus on exploitation.

In the third phase, starting week 85, exploitative innovation activities gradually increase. There are many weeks where exploitation peaks at around 90% of efforts made in R&D at the wind blade technology company. Exploitative innovation activities have gradually become the core of innovation.

In order to understand the evolution of the amount of explorative and exploitative activities at the case company, we will now illustrate each phase based on quotes of one of the founders of the case company we interviewed.

Gradual increase of exploration

At the beginning of the first phase we identified, it was two years ago that the company was taken over by its mother company. Research and development was mainly focused on incremental changes of the products that the company delivered before the take-over: "We had to implement our existing technologies in the manufacturing facilities of our mother company in India." At that time manpower was also available to discover new technologies: "There was a healthy balance between attention paid to support what was going on in the field, and to innovation." "We could afford to play around and discover new technologies. We were not too busy with support related activities at that time."

Domination of exploration

In the second phase, completely new blades had to be designed for a new wind turbine with higher MW capacity, including new technologies and production methods. These designs were highly different from the products the company developed before: "We had to design a whole new generation of wind blades and tackle some important issues or previous models suffered from." Engineering personnel mainly consisted of ambitious engineers who were involved in the company from the start.

Gradual increase of exploitation

After explorative activities peaked, exploitative activities gradually increased.
Revenues of the mother company radically raised and there was high pressure for fast scale-up and small modifications of existing blade designs: "Turnover of the mother company radically increased and the pressure to deliver blades that fitted turbines with higher capacity fast, was severe." Because many redesigns were done in a rush, the amount of time that had to be invested in support activities dramatically increased: "The company has been put in a hold by day-to-day activities and support."

In these years, more and more of the original engineers left the company, most of them because there was few room for real innovations: "At a certain moment one is drowned in the volume of day-to-day support related activities. The talented people then leave as a result, they don't buy that." The company consequently experienced difficulty with improving quality procedures and support: "In the early years few attention was paid to documentation and because our people who had most experience left, it got more and more difficult to recover."

In the current situation the company has nearly to no resources left to invest in exploration: "We are mainly busy with product support and trouble shooting." "People who visit us all react the same: the club is numb, everyone sits behind their desks. Where's the spirit, the real debate; what is really going on here? Everyone is just writing procedures."

DISCUSSION AND CONCLUSION

Toward a dynamic perspective on exploration and exploitation

With this longitudinal study we contribute to theory by providing a dynamic perspective on the evolution of explorative and exploitative activities. We reconstructed how the allocation of time and resources across explorative and exploitative activities of a wind blade technology company evolved over a period of

five years. Our results show that the relative amount of exploration versus exploitation is not static, but changes over time. The pattern of the evolution of exploration and exploitation at our case company shows phases in which exploration and exploitation activities are well balanced, and phases where one type of innovation dominates innovation activities. At the same time, within these phases, many ups and downs of exploration occur; the relative amount of exploration versus exploitation is dynamic and continuously changes.

Furthermore, based on an interview we found indications of antecedents of the dynamics of exploration and exploitation. Over the years, mean tenure has decreased and turnover of the mother company has increased. The success of the mother company led the wind blade company to scale-up existing products so fast, that engineers had to spend almost all of their time to updating procedures and repairing problems in the field. As a result the most experienced and talented engineers left the company, leaving young inexperienced engineers alone with day-to-day support and repair tasks without the ability to dive into new technologies for future products. These factors, increase of turnover and decrease of mean tenure of personnel, might explain that over the years, exploitation has become more dominant.

Further research

Because of this indication that innovation strategy can evolve over time, we will continue this research and investigate the drivers and performance implications of the shifts between exploration and exploitation. What causes these changes and how are they managed in terms of structural and control mechanisms? What are the performance implications of changes of the relative amount of exploration versus exploitation, within and between the phases we identified? Based on the indications we found for antecedents of the evolution of exploration and exploitation, we want to link our reconstruction to data about company turnover and mean tenure of personnel. In order to investigate performance implications of exploration and exploitation dynamics, we want to link financial data to our reconstruction of the amounts of time and resources spent on exploration and exploitation. Furthermore we will continue to do similar analyses in other companies to investigate other evolutions of exploration and exploitation, their antecedents and performance implications over time.

Our managerial contribution lies in the application of insight into innovation balance over time as a monitoring tool. Our particular case company plans to invest more resources into explorative activities. By monitoring the relative amount of exploration versus exploitation with the method we applied, the company can check whether plans are met.

REFERENCES

Andriopoulos, C., M. Lewis., 2009. Exploitation-exploration tensions and organizational ambidexterity: Managing paradoxes of innovation. Organization Science 20(4) 696–717.

Baumol, W.J., 2002. In: The Free-Market Innovation Machine. Princeton University Press, Princeton.

Eisenhardt, K.M., 1989b. Building theories from case study research. Academy of Management Review 14, 532-550.

Gibson, C. B., & Birkinshaw, J., 2004. The antecedents, consequences and mediating role of organizational ambidexterity. Academy of Management Journal 47, 209-226.

Golden, B.R., 1992. The Past Is the Past - Or Is It? The Use of Retrospective Accounts as Indicators of past Strategy. The Academy of Management Journal 35(4) 848-860.

Groysberg, B., Lee, L.E., 2009. Hiring stars and their colleagues: Exploration and exploitation in professional service firms. Organization Science 20(4) 740-758.

Gupta,A.K., Smith,K.G., Shalley,C.E., 2006. The interplay between exploration and exploitation. Academy of Management Journal 4, 693-706.

Jansen, J.J.P., George, G., van den Bosch, F.A.J., Volberda, H.W., 2008. Senior team attributes and organizational ambidexterity: The moderating role of transformational leadership. Journal of Management Studies 45(5) 982-1007.

Katila, R., Ahuja, G., 2002. Something old, something new: A longitudinal study of search behavior and new product introduction. Academy of Management Journal, 45 1183-1194.

Leonard-Barton, D., 1990. A dual methodology for case studies: synergistic use of a longitudinal single site with replicated multiple studies. Organization Science, 1 248-266.

Levinthal, D.A., March, J.G., 1993. The myopia of learning. Strategic Management Journal 14, 95-112.

Lubatkin, M.H., Simsek, Z., Ling, Y., Veiga, J.F., 2006. Ambidexterity and performance in small- to medium-sized firms: The pivotal role of top management team behavioral integration. Journal of Management 32(5) 646–672.

March, J.G., 1991. Exploration and exploitation in organizational learning. Organization Science 2, 71-88.

Miller, C.C., Cardinal, L.B., Glick, W.H., 1997. Retrospective Reports in Organizational Research: A Reexamination of Recent Evidence. The Academy of Management Journal, 40(1) 189-204

Mom, T.J.M., van den Bosch, F.A.J. , Volberda, H.W., 2009. Understanding variation in managers' ambidexterity: Investigating direct and interaction effects of formal structural and personal coordination mechanisms. Organization Science 20(4) 812-828.

Pettigrew, A.M., 1990. Longitudinal field research on change: theory and practice, Organization Science 1, 267-292.

Poole, M.S., Van De Ven, A.H., Dooley, K., Holmes, M.E., 2000. Organizational change and innovation processes: theory and methods for research. Oxford: Oxford

University Press.

Raisch, S., Birkinshaw, J., Probst, G., Tushman, M.L., 2009. Organizational Ambidexterity: Balancing Exploitation and Exploration for Sustained Performance, Organization Science 20(4) 685-695.

Schumpeter, J.A., 1939. In: Business Cycles: A Theoretical, Historical, and Statistical Analysis of the Capitalist Process. McGraw-Hill, New York.

Siggelkow, N., 2002. Evolution toward fit. Admin. Sci. Quart. 47(1) 125–159.

Tushman, M.L., O'Reilly, C.A., 1996. Ambidextrous organizations: Managing evolutionary and revolutionary change. California Management Review 38, 8-30.

Uotila, J., Maula, M., Keil, T., Zahra, S.A., 2003. Exploration, Exploition and Financial Performance: Analysis of S&P 500 Corporations. Strategic Management Journal 30, 221-231

Volberda, H., Lewin, A., 2003. Co-evolutionary dynamics within and between firms: From evolution to coevolution. Journal of Management Studies 40, 2111-2136.

Van de Ven, A., Angle, H. Poole, M., 2000. Research on the Management of Innovation: The Minnesota Studies. Oxford University Press.

Webb, D., Pettigrew, A., 1999. The temporal development of strategy: Patterns in the U.K. insurance industry. Organization Science 10, 601-621.

Yin, R.K., 1994. Case study research: designs and methods. London: Sage.

The impact of market orientation on the performance of the Vietnamese software firms

Utz Dornberger
(Contact Author)
International Small Enterprise Promotion and Training (SEPT) Program
University of Leipzig
Beethovenstrasse 15, D-04107 Leipzig
Email: dornberg@uni-leipzig.de
Phone: +49-341-9737039
Fax: +49-341-9737048

Md. Noor Un Nabi
International SEPT Program
University of Leipzig
Beethovenstrasse 15, D-04107 Leipzig
Email: noor@uni-leipzig.de

Ly Diep Linh
International SEPT Program
University of Leipzig
Beethovenstrasse 15, D-04107 Leipzig
Email: lydieplinh@yahoo.com

Abstract

This paper focuses on the exploration of the relationship between the market orientation of the managers/entrepreneurs of the Vietnamese software firms and their business performances. However, research on market orientation is a mature area of research in the Western nations' perspectives, there are little knowledge about how the entrepreneurs and managers in the transition perspectives get along with the market and how this process effect on the performances of their ventures. Results of this research show that there is a positive relationship between the market orientation of the Vietnamese software firms and their business performances. This research also reveals that firm size has an influencing role on the performance setting effect of the market orientation in the firms. Furthermore this research shows that in the case of the Vietnamese software firms, 'organization wide dissemination of market intelligence' and 'organizational responsiveness to the disseminated intelligence' has more influence on business performance. Results of this research contributes to the knowledge for understanding about how the managers and entrepreneurs in new markets are adjusting their focuses to the market and how such adjustments are contributing o the performances of their ventures.

1. Introduction

Entrepreneur is the entity who actively seeks the opportunities, identifies a suitable opportunity from the set of the alternatives and exploits such opportunity by developing the suitable combinations of the resources available at a certain point of time. The opportunities exist in the markets (Zahra and Dess, 2001). Narver and Slater (1990) perceived market orientation as "the organizational culture that most effectively and efficiently creates the necessary behaviors for the development of superior value for buyers and, thus, superior performance for the business". The essence of market orientation is centered round the inclination and practice of continuously collecting the information about the customer needs and competitor's capabilities and using this knowledge for creating superior customer value continuously (Slater and Nerver, 1995). Day (1990) opined that market orientation represents the firms' (*vis a vis* entrepreneur's/manager's) superior skills of understanding and satisfying the customers and using the acquired understanding for producing the superior values for the customers. Kohli and Jaworski (1990) forwarded a process-driven model of market orientation by delineating the distinct phases regarding how to bring the 'market orientation' from the meta level to the operational level in the firm. Kohli and Jaworski (ibid.) explained market orientation by the act of collecting the market intelligence by all the relevant departments of the firm in a targeted and systematic way (information generation), disseminating the market intelligence within the firm in a way that all the organs of the firms as a whole become aware and understand the importance of the intelligence (dissemination) and finally adjusting the firms actions in response to the issues and opportunities revealed in the market intelligence and its common understanding in the firm (responsiveness). Although Narver and Slater (1990) and Kohli and Jaworski (1990) explained the concept of market orientation from their own point of perspectives, they share the common views that market orientation contributes to the creation of greater value and satisfaction of the customers (Kohli and Jaworski, 1993). Kohli and Jaworski (1990) and Narver and Slater (1990) have been taken as the complementary views to the theoretical and conceptual explanation of the concept of market orientation and have been applied in the researches there after (*see for example* Greenley, 1995; Pelham, 1997; Chan and Ellis, 1998; Baker and Sinkula, 1999; Farrell, 2000; Shoham and Rose, 2001; Hult et al., 2005; Ellis, 2005).

Researches on the relationship between market orientation and business performance have produced mixed results. They have revealed that market orientation has positive effect on business performance in the way of contributing to new product success (Slater and Narver, 1994; Frishammar and Horte, 2007), sales growth (Pelham and Wilson, 1996), profitability (Kohli and Jaworski, 1990; Raju et al., 1995; Slater and Narver, 2000) and return on investments (ROI) (Appiah-Adu, 1998). These researches exploited and strengthen the analogy that market orientation provides the firm with better understanding of its environment and customers which lead to more satisfaction of the customers. In

contrast to this group of works, other researches did not support a direct positive relationship between market orientation and business performance (*see for example* Kohli and Jaworski, 1993; Greenley, 1995; Perry and Shao, 2002). Han et al. (1998) did not find any relationship between market orientation and any of the performance measures. Langerak (2001), using the self-reports, customer reports and supplier reports for testing the relationship between the firm's market orientation and its business performance, found that being in the similar level of market orientation firms may produce different business performances which could be both positively and negatively related to the level of market orientation. Langerak (2003) commented that positive effect of market orientation sets gradually over time in the firms and the exploitation of such effect needs investments in management and other resources by the firm. In context of these contrasting results about the relationship between market orientation and business performances, Pelham (1997) comments that the possible reason behind this lack of the availability of the clear relationship may be that the relationship should be envisioned in more complex way than in a 'yes or no' way as done in the previous works. Pelham (ibid.)'s comments provokes more empirical research in this issue in different contexts and methodologies.

Until the arrival of the economic liberalization and reforms in Vietnam (known as Doi Moi) in 1986, the concept of and consideration for market was an unknown issue in the business organizations, since everything was centrally planned. Vietnamese firms had to seriously think about their market in terms of how to get into, stay in and grow in their target markets, once they were exposed to competition in the post 1986 time. For the Vietnamese entrepreneurs and managers, development of market orientation was an issue of learning through trials and errors. This learning process has been quite matured in the two decades since Doi Moi. New generations of entrepreneurs have joined the Vietnamese market and new industries are emerging there. A mostly locally owned and managed software industry is in the development in Vietnam in the recent past, which grew 40% in term of its market size in the 2002-2007 period (Vietnamese Software Association - VINASA, 2009). It is estimated that currently 800 software development firms are in operation in Vietnam with 45000 employments (ibid.). Supportive business climate and availability of the necessary resources for the development and growth of the software industry have contributed to the position of Vietnam within the top 30 growing destination of global off-shoring of the software business (ibid.).

In this context, this paper is focused on the exploration of the relationship between the market orientation of the entrepreneurs/managers and the business performances of Vietnamese software firms. This paper is expected to generate the understanding about whether there is any differential effect of market orientation on the firms' performance in the newly developed market context (*as per example* Vietnam) and the matured market context (*as per example* the Western countries).

2. Methodology

2.1 Constructs and measures

Narver and Slater (1990) measured market orientation with an ordinal measurement of 21 items, known as MKTOR. Narver and Slater (ibid.) operationalized market orientation including three behavioral dimensions (customer orientation, competitor orientation and interfunctional coordination). Kohli and Jaworski (1993) argued Narver and Slater (1990)'s conceptualization of market orientation was too broad and the measures that do not tap the specific behaviors that represent a market orientation. Furthermore, Kohli et al. (1993) pointed that Narver and Slater (1990) measurement gives great emphasis on the role of the customers and the competitors, while skimps the additional factors that drive customer needs and expectations, doesn't tap the speed with which market intelligence is generated and disseminated within an organization, and includes a number of items that do not tap specific activities and behaviors that represents market orientation.

Kohli et al. (1993), based on Kohli and Jaworski (1990) and Jaworski and Kohli (1993), suggested a ordinal measurement of 20 items to analyze market orientation, known as MARKOR scale (market orientation scale). MARKOR assesses the degree to which a firm (1) engages in multi-department market intelligence generation activities (2) disseminates this intelligence vertically and horizontally through both formal and informal channels and (3) develops and implements marketing programs on the basis of the intelligence generated. Key attributes of this measure include (1) focus on the customers of the firm and the forces that drive their needs and preferences (2) activities on the ground, not the business philosophy overwhelmingly and (3) consideration for market orientation factors and associated component factors.

This paper has measured the degree of market-orientation of the Vietnamese software firms adapting the MARKOR scale (Kohli et al., 1993) which focuses on assessment of the firm level practices with the ordinal measures relating to market intelligence generation (6 indicators), intelligence dissemination in the organization (6 indicators) and the responsiveness of the organization to the intelligence (7 indicators).The items were measured on a 5-point Likert scale.

Business performances have been viewed in the researches from different perspectives and have been measured through different measures e.g. long term vs. short term and accounting vs. strategic perspectives and subjective vs. objective measures. The subjective measures are primarily concerned with the performance of firms relative to their own expectations or assessments (Pelham and Wilson, 1996) or relative to the competitors (Verhage and Waarts, 1988; Golden, 1992). Objective measures are based on the absolute measures of the performance (Chakravarthy, 1986; Cronin and Page, 1988), which include mainly the measurement of the financial performance indicators generated through

accounting process of the firm e.g. return on assets (ROA), return on equity (ROE), return on investments (ROI), growth in sales, and growth in profit. This research uses the subjective measures of the accounting and financial indicators of business performance, considering the unavailability of objective data from the publicly available documented sources and the reservations of the managers to reveal the real financial and accounting information outside their firms. Dess and Robinson (1984), Venkataraman and Ramanujam (1986) and Jaworski and Kohli (1993) has tested such mixed approach of measuring the business performance. In this paper, business performance has been measured as the ordinal assessment of the firm's sales target accomplishment, profit target accomplishment and achievement of the target relating to return on investment (ROI).

2.2 Sample

This research has considered only the software firms located in the city of Hanoi in Vietnam. There are about 350 software developer firm in Hanoi. This research has only taken into consideration the firms which are the member of VINASA - the most prestigious national association of software firms in Vietnam. In 2009, the number of VINASA's member in Hanoi was 100. These 100 firms were approached to take part in this research by sending them a web-based questionnaire in the period of June – August 2009. 66 firms filled in the questionnaire completely. Among the respondents, 33.3% were operating in the industry $\leq$ 3 years, while 38.3% were operating >10 years. Among the respondents, 31.6% had the employment size <50, 15% had >50 $\leq$ 100 and 43.3% had > 100.

2.3 Data analysis

Reliability of the collected data was assessed by the analysis of the Cronabch's Alpha both item wise and construct wise way. Cronabch's Alpha for each of the individual items and constructs was >.70, which indicates the acceptable level of internal consistency of the data that has been used for inferential analysis in the later phase.

Partial least square (PLS) regressions using the SmartPLS 2.0 M software (Ringle et al., 2005) were performed to explore the relationship between market orientation, its constructs and the business performance of the Vietnamese software firms. PLS has been chosen as the principle technique of inferential analysis as it is applicable for the small sample size, its free of the assumption of any particular distributional pattern and it can accommodate both nominal, ordinal and ratio data (Pirouz, 2006). The 'rule of thumb' for the minimum sample size requirements is 10 cases per indicator (Chin, 1998; Chin and Newstaed, 1999). With the sample size of 60 and maximum 3 predictors, PLS analysis is fitting to the context of this research. A 200 resampling based bootstrapping process was run to test the external validity (predictive validity) of the regression models and results.

The explanatory power of the PLS model has been estimated in terms of its extent of the variance explained (R^2) in the dependent construct. Chin (1998) suggests that $R^2 \leq 0.19$ to be non-relevant, though in some cases 0.12 has been accepted too as the valid R^2 in organizational performance research (*see* Birkinshaw et al., 1995). Path-coefficient in the PLS model resembles the standardized coefficient in the normal regression model (Götz and Liehr-Gobbers, 2004). Sellin and Keeves (1994) suggest that a qualified path-coefficient should be ≥ .10. This research adopts this standard.

3. Results and discussions

Model I (see table 1) shows that in this research market orientation (MO) has produced a moderate positive relation with the business performance of the Vietnamese software firms.

Table 1: PLS Regression results

	Model I		Model II		Model III	
	t	**t**	**β**	**T**	**β**	**t**
MO -> Performance	0.43	4.99**				
MO * Firm Size -> Performance			0,21	1,98**		
Intelligence generation -> Performance					0.04	0,34
Intelligence dissemination -> Performance					0.20	2,25**
Responsiveness -> Performance					0.44	5.11**
R^2	0.19		0.26		0.34	
F	13.60		6.65		9.61	
P	(.00)		(.00)		(.00)	

** significant at <0.05 level

This moderate effect as well confirms Atuahene-Gima and Ko (2001)'s comments that market-orientation is not a self-sufficient construct; other elements e.g. entrepreneurial orientation and organizational culture are dynamically related to the performance impact of market-orientation (Atuahene-Gima and Ko, 2001). Nevertheless, in context of Vietnam, which is rapidly transforming form a close economy to an open one, this result is an important revelation of the ways the entrepreneurs and managers looks at the market, as the competitive advantage of the firm largely depends on how uniquely the entrepreneur can explore the opportunity and exploit it thereafter, while the level of market orientation of the entrepreneur moderates the relationship between entrepreneurial moves and the firm performance (Bhuian et al., 2005; Menguc and Auh, 2008). Though market-orientation has impact on the performance of the both large and small firms, the smaller firms have more opportunity to instill their respective market-orientation in their market servicing operations due to their inherent flexibility and simplicity (Appiah-Adu, 1998). Results presented in Model II (see table 1) show that firm size has a statistically valid and positive effect on the relationship between market orientation and business performance of the Vietnamese software firms. This result tells that firm size matters in setting the effect of the market orientation on the firms' performances. Market-

orientation could constitute a unique capability of the firm, which can offset some of the classical capability deficiencies of the smaller firms (ibid.). Smaller firms can overcome their limitation of size by developing right market orientation as part of their core capabilities.

Model III in the Table 1, shows the performance effect of the individual components of the market orientation in the Vietnamese software firm. In this case, 'organization wide dissemination of the collected market intelligence' and 'responsiveness of the firm in respect of the market knowledge' have shown positive and significant relationship with the performance of the firms, while 'market intelligence generation' has no relationship with the performances of the firms in this case. This finding complies with the operational and competition norm of the knowledge intensive industry i.e. 'it does matter, what you give to your customers than what you know and how you do it'. Knowledge intensive entrepreneurial activities are heavily subjected to hyper-competition, due to rapidity of the shifting of the technological and institutional boundaries. Innovation and competitiveness are the survival kits for the firms in such dynamic environment. Innovation and competitiveness in such firms largely depend on how uniquely, effectively and timely the firms have scanned their market landscapes and have integrated the learning into its operations i.e. market-orientation.

5. Conclusion

This research has offered the primary understanding about the state of the market focused mental states and actions of the managers and entrepreneurs of the Vietnamese software firms toward their transformation to the market-driven philosophies. These revelations could be put further into research by incorporating the moderating and mediating effects of the other issues e.g. entrepreneurial orientation, learning orientation, organizational culture and the state of the institutions.

Reference

Appiah-Adu, K. (1998), Market orientation and performance: empirical tests in a transition economy, *Journal of Strategic Marketing*, 6(1), 25-45.

Atuahene-Gima, K., and Ko, A. (2001), An Empirical Investigation of the Effect of Market Orientation and Entrepreneurship Orientation Alignment on Product Innovation, *Organization Science*, 12(1), 54-74.

Baker, W.E., and Sinkula, J.M. (1999), The synergistic effect of market orientation and learning orientation on organizational performance, *Journal of the Academy of Marketing Science*, 27 (4), .411-27.

Bhuian, S. N., Bulent, M., and Bell, S. (2005), Just Entrepreneurial Enough: The Moderating Effect of Entrepreneurship on the Relationship between Market Orientation and Performance, *Journal of Business*, 58, 9-17.

Birkinshaw, J., Morrison, A., and Hulland, J. (1995), Structural and competitive determinants of a global integration strategy, *Strategic Management Journal*, 16(8), 637–655.

Chakravarthy, B. (1986), Measuring strategic performance, *Strategic Management Journal*, 17, 437–58.

Chan, H.N., and Ellis, P.D. (1998), Market orientation and business performance: Some evidence from Hong Kong, *International Marketing Review*, 15 (2), 119–139.

Chin, W. W. (1998), The Partial Least Squares Approach to Structural Equation Modeling, in Marcoulides, G. A. (ed.), *Modern Methods for Business Research*, Lawrence Erlbaum Associates, 295-336.

Chin, W. W., and Newsted, P. R. (1999), Structural Equation Modeling Analysis with Small Samples using Partial Least Squares, in Hoyle, R.H. (ed.), *Statistical Strategies for Small Sample Research*, Thousand Oaks CA: Sage Publications, 307-341.

Cronin, J., and Page, T. (1988), An examination of the relative impact of growth strategies on profit performance, *European Journal of Marketing*, *22*, 57–68.

Day, G. S. (1990), *Market-Driven Strategy*, New York: The Free Press.

Ellis, P.D. (2005), Market orientation and marketing practice in a developing economy, *European Journal of Marketing*, 39 (5/6), 629–645

Farrell, M. A. (2000), Developing a market-oriented learning organization. *Australian Journal of Management, 25*(2), 210-222

Frishammar, J., and Hörte, S-Å. (2007), The Role of Market Orientation and Entrepreneurial Oriantation for New Product Development Performance in Manufacturing Firms, *Technology Analysis & Strategic Management*, 19(6), 765-788.

Greenley, G. (1995), Market Orientation and Company Performance: Empirical Evidence from UK Companies, *British Journal of Management*, 6, 1-13.

Golden, B. (1992), SBU strategy and performance: the moderating effects of the corporate–SBU relationship, *Strategic Management Journal*, 13, 145–58.

Götz, O., and Liehr-Gobbers, K. (2004), Analyse von Strukturgleichungsmodellen mit Hilfe der Partial-Least-Squares (PLS)-Methode, *Die Betriebswirtschaft*, 64(6), 714-738.

Han, J., Kim, N., and Srivastava (1998), Market orientation and organizational performance: is innovation a missing link, *Journal of Marketing*, 62(October), 30-45.

Hult, G.T., Ketchen, D. J Jr., and Slater, S.F. (2005), Market orientation and performance: an integration of disparate approaches, *Strategic Management Journal*, 26(12), 1173–1181.

Jaworski, B. J., and Kohli, A. K. (1993), Market orientation: Antecedents and consequences, *Journal of Marketing*, 57(3), 53.

Kohli, A. K., and Jaworski, B. J. (1990), Market Orientation: The Construct, Research Propositions, and Managerial Implications, *Journal of Marketing, 54*(2), 1-18.

Kohli, A., Jaworski, B., and Kumar, A. (1993), MARKOR: a measure of market orientation, *Journal of Marketing Research*, 30, 467-77.

Langerak, F. (2001), The effect of market orientation on the behaviour of salespersons and purchasers, channel relationships, and performance of manufacturers, *International Journal of Research in Marketing*, 18(3), 221-234.

Langerak, F. (2003), The effect of market orientation on positional advantage and organizational performance, *Journal of Strategic Marketing*, 11(2), 93.

Menguc, B., and Auh, S. (2008), The asymmetric role of market orientation on the ambidexterity firm performance relationship for prospectors and defenders, *Industrial Marketing Management*, 37 (4), 455-470.

Narver, J. D., and Slater, S. F. (1990), The Effect of a Market Orientation on Business Profitability, *Journal of Marketing*, 5 (October), 20- 35.

Pelham, A. M., and Wilson, D. T. (1996), A Longitudinal Study of the Impact of Market Structure, Firm Structure, Strategy, and Market Orientation Culture on Dimensions of Small-Firm Performance, *Journal of the Academy of Marketing Science*, 24(1), 27.

Pelham, A. (1997), Mediating Influences on the Relationship between Market Orientation and Profitability in Small Industrial Firms, *Journal of Marketing Theory and Practice*, 5(2), 1 - 23.

Perry, M.L., and Shao, A.T. (2002), Market orientation and incumbent performance in dynamic market", *European Journal of Marketing*, 36(9/10), 1140.

Pirouz, D. M. (2006), An Overview of Partial Least Squares, *http://www.dantepirouz.com/research/pls/PLS.pdf* (Accessed 03.03.2009)

Ringle, C.M., Wende, S., and Will, A. (2005), *SmartPLS 2.0 M (beta)*, www.smartpls.de.

Ruekert, R.W. (1992), Developing a market orientation: an organizational strategy perspective, *International Journal of Research in Marketing*, 9(3), 225-45.

Shoham, A., and Rose, G.M. (2001), Market orientation: a replication, cross-national comparison, and extension, *Journal of Global Marketing*, 14(4), 5-25

Slater, S.F., and Narver, J.C. (1994), Market Orientation, Customer Value, and Superior Performance, *Business Horizons*, 37, 22-28.

Slater, S.F., and Narver, J.C. (2000), The Positive Effect of a Market Orientation on Business Profitability: A Balanced Replication, Journal of Business Research, 48(1), 69–73.

Slater, S. F., and Narver, J. C. (1995), Market orientation and the learning organization, *Journal of Marketing*, 59, 63-74.

Sellin, N., and Keeves, J. P. (1994), Path analysis with latent variables, pp. 4352-4359 in Husen, T., and Postlethwaite, T.N. (eds.), *International encyclopaedia of education*, 2nd edition, London: Elsevier Publishers.

Venkatraman, N., and Ramanujam, V. (1986), Measurement of business performance in strategy research: a comparison approach, *Academy of Management Review*, 11, 801–14.

Verhage, B., and Waarts, E. (1988), Marketing planning for improved performance: a comparative analysis, *International Marketing Review*, 15, 20–30.

Zahra, S., and Dess, G. (2001), Entrepreneurship as a field of research: Encouraging dialogue and debate, *Academy of Management Review*, 26(1), 8–10.

Contractual Alliance Governance:
Impact of Different Contract Functions on Alliance Performance

Dries Faems
d.l.m.faems@utwente.nl

Rutger Alberink
r.alberink@student.utwente.nl

Aard Groen
a.j.groen@utwente.nl

Rosalinde Klein Woolthuis
r.kleinwoolthuis@feweb.vu.nl

Contractual Alliance Governance:
Impact of Different Contract Functions on Alliance Performance

ABSTRACT

Recent research on alliance governance has emphasized that contracts can have both a control and coordination function. In this paper, we test the impact of these different contract functions on alliance performance. Conducting structural equation analyses on a sample of 270 Dutch technology alliances, we disentangle the relationship between different contract functions, partner cooperation and alliance success. Our data show that different contract roles have a different impact on partner cooperation within the alliance. In addition, we find strong indications that the presence/absence of prior trustful collaboration and the number of alliance partners moderate the relationship between contract functions and partner cooperation. Finally, our data provide evidence that contract functions indirectly influence alliance success via partner cooperation.

Contractual Alliance Governance:
Impact of Different Contract Functions on Alliance Performance

Alliances have become an increasingly popular strategy for organizations to complement and supplement their internal activities (Doz & Hamel, 1998; Kale & Singh, 2009; Hagedoorn, 2002). Although popular, their failure rates are high (Bleeke & Ernst, 1991), instigating numerous scholars to study the governance of alliances (Faems, Janssens, Madhok & Van Looy, 2008). In this research stream, contracts or 'agreements in writing between two or more parties, which are perceived as legally binding (Lyons & Mehta, 1997: 241)' have been identified as an important mechanism to effectively govern alliances.

Whereas alliance contract research has traditionally focused on the complexity of the contract (i.e. the amount of clauses in the contract), some scholars (e.g. Faems et al., 2008, Hagedoorn & Hesen, 2007; Mayer & Teece, 2008; Klein Woolthuis, Hillebrand & Nooteboom, 2005) have recently started to also consider the content of the contract. In this way, these scholars managed to identify that contracts can both (i) allow for formal control of the partner's behavior; and (ii) facilitate coordinated action However, research on the impact of such different contract roles on the performance of the alliance has remained absent (de Jong & Klein Woolthuis, 2008).

In this paper, we therefore explore the impact of different contract functions on alliance performance. In order to do so, we rely on a sample of 270 Dutch technology alliances. Conducting structural equation analyses, we explore the relationships between contract functions, partner cooperation and alliance success. Our data provide strong indications that different contract functions can significantly influence partner cooperation during the alliance. For instance, we find that the more important the contractual control function, the lower the partner cooperation within

the alliance. In addition, we find that the presence/absence of trustful prior collaboration and the number of alliance partners moderate the relationship between contract roles and partner cooperation. In particular, we find that the negative impact of the contractual control function on partner cooperation disappears when partners share a history of trustful collaboration. In addition, we observe that, in the setting of dyadic alliance, the contractual coordination function has a significant negative impact on partner cooperation. Finally, our data provide consistent evidence that contract roles indirectly influence alliance success via partner cooperation.

The reminder of this paper is structured in four sections. First, we position our study in the existing alliance governance literature. Subsequently, we discuss the methodology that we applied to examine the impact of contract functions on alliance performance. Next, we present the main findings of our study. Finally, we discuss the main theoretical and managerial implication of our findings, discuss the main limitations of this study and identify several avenues for future research.

THEORETICAL BACKGROUND AND HYPOTHESES

Contractual alliance governance: complexity versus content of the contract

Whereas alliance governance research has long been dominated by a concern for the choice between equity or non-equity structures, scholars have also started focusing on the role of specific structural and relational governance mechanisms (Arino & Reuer, 2005). In this literature stream, contracts have been recognized as an important structural governance mechanism. Alliance contract studies (e.g. Anderson & Dekker, 2005; Luo, 2002; Parkhe, 1993; Poppo & Zenger, 2002; Reuer, Arino & Wellewigt, 2006; Ryall & Sampson, 2006) have mainly focused on the complexity of the contract or the amount of clauses that are present in the contract. In particular these studies examined 1) the impact of several transactional and relational conditions on the

amount of clauses that are present in the contract; 2) the impact of contract complexity on alliance performance, and 3) the relationship between contract complexity and trust or 'a psychological state comprising the intention to accept vulnerability based on positive expectations of the intentions or behavior of another' (Rousseau, Sitkin, Burt & Camerer, 1998: 395).. However, these studies often provided inconsistent results. For instance, whereas some scholars (e.g. Luo, 2002; Poppo & Zenger, 2002) provided evidence for a complementary relationship between contract complexity and trust others (e.g. Lyons & Mehta, 1997; Malhorta & Murnighan, 2002) pointed to the existence of a substitutive relationship between these structural and relational governance mechanisms.

Several scholars (e.g. Faems et al., 2008, Hagedoorn & Hesen, 2007; Mayer & Teece, 2008; Klein Woolthuis, Hillebrand & Nooteboom, 2005) have therefore started exploring not only the complexity of the contract, but also the actual content of the clauses that are defined in alliance contract. Based on this content-based assessment, these scholars came to the conclusion that contracts might play different roles in the governance of alliances. Mellewigt, Madhok and Weibel (2008) identify two different contract roles. First, in line with insights from transaction cost theory (e.g. Williamson, 1985), they emphasize that alliance contracts might have a control role, reducing the risk that one of the partners will abuse the alliance for opportunistic reasons. Second, in line with organizational theory (e.g. Galbraith, 1977; Thompson, 1967), they stress that the contract might also contain clauses that facilitate coordinated action between the partners. Other scholars have come to similar conclusions. Klein Woolthuis et al. (2005) argue that contracts might have a

safeguarding or coordination function in alliances[1]. Examining the 88 strategic alliances, Reuer and Arino (2007) empirically demonstrate that contractual clauses in alliance contracts can have both enforcement and coordination functions.

Impact of contract roles on alliance performance: A conceptual framework

Whereas scholars have provided valuable insights into the different functions that contracts may have in governing alliances, they remain silent on how these contract roles influence alliance performance. Below, we develop a conceptual framework in which we (i) link the different contract functions to partner cooperation and alliance success and (ii) hypothesize on the potential moderating effects of history of trustful collaboration and number of alliance partners (see Figure 1).

----- Insert Figure 1 about here -----

Impact of contractual control function on partner cooperation. One key difference between single-firm strategies and interfirm alliances is the uncertainty attending the cooperation among partners. When independent firms collaborate together, there is the risk of the partner not cooperating in good faith in addition to the usual risk of unsatisfactory business performance (Das & Teng, 2001: 253). Applying a transaction cost framework, scholars have referred to this kind of behavioral uncertainty in terms of opportunistic behavior or 'seeking self interest with guile' (Williamson, 1985). Opportunistic behavior in alliances is exemplified by 'cheating, shirking, distorting information, misleading partners, providing substandard products/services, and appropriating partners' critical resources' (Das & Teng, 1998: 492).

In line with transaction cost theory, numerous alliance governance scholars have argued that alliance partners can negotiate safeguarding clauses, inflicting

[1] Klein Woolthuis et al. (2005) identify a third contract role. They stress that contracts may also serve as a tangible expression of partners' trust in each other and their intention to be loyal partners. In other words, the contract might also function as a signal of commitment.

penalties for the omission of cooperative behaviors or commission of violative behaviors (Parkhe, 1993). As a result, the cost of self-interest activities subsequently increases, curbing partners' willingness to act opportunistically (Dyer & Singh, 1998). In other words, safeguarding clauses allow for formal control or the utilization of formal rules, procedures, and policies to monitor and punish undesirable behavior and/or outcomes (Anderson & Dekker, 2005; Das & Teng, 2001), reducing the likelihood of opportunistic behavior. First indications are also present that, when the contract has a strong control function, knowledge transfer between the partners will be more open and transparent. Examining three R&D alliances, Faems, Janssens & Van Looy (2007), for instance, observed that, in cases were explicit contractual clauses were present that controlled the exchange of knowledge, partners were much more willing to disclose sensitive knowledge to the other partner.

In sum, we expect that, the more alliance partners rely on contracts as a mechanism to control for opportunistic behavior, the lower the probability that opportunistic behavior will occur and the higher the willingness to transfer knowledge between the partners. We therefore formulate the following hypothesis:

> *Hypothesis 1: The more important the control function of alliance contracts, the higher the partner cooperation within the alliance.*

Several scholars have argued that the relevance of the contractual control function might be dependent on alliance partners' history of prior collaboration. When partners share a history of successful prior collaboration, they are likely to have build up 'resilient trust' or a psychological state between collaborating partners, characterized by shared norms, values and beliefs that emphasize faith in the moral integrity or goodwill of others (Ring, 1997). Looking from a social exchange perspective (e.g. Blau, 1964), several scholars (e.g. Inkpen & Currall, 2004; Das & Teng, 1998, 2001; Dyer & Singh, 1998; Jones and George, 1998; Ring & Van de Ven,

1994) argued that the presence of resilient trust influences how partners work together in alliances. First, under conditions of resilient trust, 'shared valued underlying trust provide individuals with the assurance that knowledge and information will be used for the greater good and that one need not exercise power to protect one's own interests' (Jones & George, 1998: 542). In other words, when resilient trust is present, the perception of opportunistic hazards is likely to be reduced. In the alliance literature, these dynamics have been referred to in terms of 'social control' (Inkpen & Currall, 2004; Das & Teng, 2001). Opposite to formal control, emphasizing rules, procedures and policies, social control tries to minimize divergence of preferences among participants by relying on the development of shared values, beliefs, and goals among members (Eisenhardt, 1985; Ouchi, 1979). In such circumstances, partners' incentives to behave opportunistically are reduced (Das & Teng, 2001; Dyer & Singh, 1998).

In sum, in case of prior trustful collaboration, alliance partners do not need formal control because they can rely on social control to mitigate opportunistic behavior and stimulate open knowledge exchange. We therefore expect that the contractual control function is especially relevant for stimulating partner cooperation in settings where a history of trustful prior collaboration is absent:

> *Hypothesis 2: The positive impact of the contractual control function on partner cooperation is stronger when alliance partners do not share a history of trustful collaboration.*

In the alliance literature, a distinction is made between dyadic alliances, in which only two organizations collaborate, and multilateral alliances, in which the collaboration involves more than two partners. Moreover, some scholars (e.g. Garcia-Canal et al., 2003; Gong, Shenkar, Lou & Nyaw, 2007) provide first indications that the impact of the contractual control function on the quality of interaction might differ

in dyadic and multilateral alliances. Both Garcia-Canal et al. and Gong et al. (2007) provide empirical evidence that, in multilateral alliances, contract complexity has a significant positive impact on alliance performance, whereas such a relationship is not present in the setting of dyadic alliances. To explain these findings, these scholars argue that, the more partners are present in an alliance, the more difficult it becomes to monitor the actions of all different parties and to align the partners' goals. In such a setting, partners' incentives to engage in opportunistic behavior are likely to increase (Das & Teng, 2002), which increases the relevance of using the contract as a formal control mechanism. We therefore hypothesize:

> *Hypothesis 3: The positive impact of the contractual control function on partner cooperation is stronger in multilateral alliances.*

Impact of contractual coordination function on partner cooperation. Whereas transaction scholars focus on the behavioral uncertainty of alliances, other scholars, applying insights from organization theory (e.g. Lawrence & Lorsch, 1967; Thompson, 1967), emphasize the difficulty of achieving coordinated action in alliances. Two main reasons have been mentioned to explain the difficulties of coordination in alliance. First, alliances can not make an appeal to all hierarchical structures and systems that are available within organizations to achieve coordinated action (Gulati & Singh, 1998). Second, differences in national context as well as differences in corporate cultures further complicate the coordination between collaborating partners (Parkhe, 1991).

At the same time, the alliance contract has been identified as a viable mechanism to improve coordination. In particular, through extensively defining performance control systems, action planning systems, and standard operating procedures in the formal contract, the division of labor and the interactions between partners become more predictable and joint decisions can be made more by rules than

by exception (Klein Woolthuis et al., 2005; Mellewigt et al., 2008; Reuer & Arino, 2007). In other words, a contract allows for standardized coordination (Mintzberg, 1979), facilitating cooperation between the involved partners:

> *Hypothesis 4: The more important the coordination function of alliance contracts, the higher the partner cooperation within the alliance.*

Based on a longitudinal study of contracting in the personal computer industry, Mayer and Argyeres (2004: 394) concluded that contracts may also function as 'repositories for knowledge about how to govern collaborations.' In particular, they argue that when collaborative partners share a history of previous collaboration, they are likely to adjust the content of the contract based on their mutual learning experiences in their previous collaborative transactions. In addition, Faems et al. (2008) empirically illustrate that this contract learning effect is particularly important for coordination clauses in the contract. Based on these observations, we expect that, when partners share a history of trustful collaboration, they will be able to define in the contract more fine-grained coordination clauses, which will reinforce the positive impact of contractual coordination function on partner cooperation:

> *Hypothesis 5: The positive impact of the contractual coordination function on partner cooperation is stronger when alliance partners share a history of trustful collaboration.*

Focusing on the distinction between dyadic and multilateral alliances, several scholars (Das & Teng, 2002; Garcia-Canal et al., 2003; Gong et al., 2007) argue that multilateral alliances do not only imply a higher risk of opportunistic behavior, but also entail a higher risk of problematic coordination. After all, the more alliance partners, the more likely substantial differences will be present in terms of organizational culture, structure and strategic vision, which complicate achieving coordinated action. At the same time, it is argued that, in dyadic alliances, partners do not need standardized coordination, but can rather rely on coordination by mutual

adjustment (Mintzberg, 1977). In sum, the relevance of the contractual coordination function seems to be higher in multilateral alliances compared to dyadic alliances. We therefore hypothesize:

Hypothesis 6: The positive impact of the contractual coordination function on partner cooperation is stronger in multilateral alliances.

Impact of partner cooperation on alliance success. According to existing alliance research (e.g. Dyer & Singh, 1998; Madhok & Tallman, 1998; Zajac & Olsen, 1993), the extent of partner cooperation has a strong impact on alliance success or the degree to which partners manage to realize or even exceed the initial expectations. In particular, it is argued that the more cooperative behaviors (e.g. open exchange of knowledge between partners, joint sensemaking, joint problem solving) are present and the more non-cooperative behaviors (e.g. shirking, stealing knowledge, hiding information) are absent, the higher the ability of partners to come to synergistic value creation within the alliance. We therefore expect that:

Hypothesis 7: Higher partner cooperation increases alliance success.

METHODOLOGY

Research design and sample

To test our hypotheses, we use a sample of Dutch firms that participated in technology alliances. The sample was constructed with the help of Senter Novem, an agency of the Dutch ministry of Economic affairs. The main goal of Senter Novem is to support the development and innovation activities of Dutch firms on both domestic and international markets. Among other things, Senter Novem manages a funding scheme (i.e. WBSO) that allows firms, knowledge institutes, and individuals to receive tax compensation for technological innovation projects. The research sample for this studies consists of firms that (i) made use of this particular funding scheme for technological innovation project, (ii) indicated that they formally collaborated with

other partners for this particular innovation project, and (iii) indicated that this particular innovation project was recently finished or was in the final stage of being finished. The initial sample consisted of 648 firms that had filed for tax compensation for a particular technological innovation project in 1999. 391 organizations eventually responded to the survey. Because of missing values on the variables that we constructed, the size of our sample was further restricted. In total, the sample of this study consists of 270 collaborative innovation projects. Table 1 gives some additional information about the survey response rate.

----- Insert Table 1 about here -----

An external research organization was made responsible for the data collection phase. This research organization made use of telephone surveys to collect the needed information. The responding firms were active in the areas of: biotechnology, new materials, information technology, maritime technologies, chemicals, and environmental technologies.

Measures

Contract roles. Whereas previous alliance contract research has focused on measuring the complexity of the contract through counting the number of contractual clauses or evaluating the presence/absence of a set of predefined contractual clauses, we wanted to measure to which extent respondents used the contract as a control and/or coordination mechanism. In order to do so, we asked respondents to indicate on a five point Likert scale (i.e. 1 = strongly disagree; 5 = strongly agree) (i) whether the contract functioned as a guarantee against opportunistic behavior of the other partner(s), and (ii) whether the contract functioned as a plan of action in order to streamline the collaboration. The scores on these items were used to measure the

importance of the contractual control function and the contractual coordination function.

Partner cooperation. In line with Luo (2002) and Gong et al. (2007), we measured partner cooperation through evaluating the absence or presence of specific cooperative situations. In particular, we asked respondents to rate on a 5 point Liker scale (1 = strongly disagree, 5 = strongly agree) the degree to which three cooperative situations and two non-cooperative situations characterized the relationship among partners (see Table 2). Subsequently, we conducted an explorative factor analysis, indicating that all items loaded on one single factor (see Table 2). In line with our expectations, the cooperative situations loaded positively on this factor, whereas the non-cooperative situations loaded negatively on this factor. Next, we relied on the standardized factor score for each case to construct the variable 'partner cooperation.'

----- Insert Table 2 about here -----

Alliance success. Alliance scholars (e.g. Geringer & Hebert, 1991; Arino, 2003) have provided evidence that subjective measures of alliance success highly correlate with objective measures of success. Following previous alliance research (e.g. Geringer & Hebert, 1991; Gong et al., 2007) we adopt a multidimensional approach to measure alliance success. We asked respondents to rate on a 5 point Likert scale (1 = totally disagree, 5 = totally agree) the following three aspects: (i) the project has become a technological success; (ii) the project has lead to lower development costs than if we would have done the project alone or if we would have done the project with another partner; (iii) the result of the collaboration has exceeded my expectations. Subsequently, we conducted an explorative factor analysis, indicating that all items loaded on one single factor (see Table 3). Next, we relied on the standardized factor score for each case to construct the variable 'alliance success.'

----- Insert Table 3 about here -----

History of trustful collaboration. Previous alliance research (e.g. Garcia-Canal et al., 2003; Gulati, 1995; Mellewigt et al., 2008) has relied on the presence of prior collaboration as an indicator of resilient trust. However, these studies ignore that prior collaboration might have been unsuccessful, which might even trigger negative trust dynamics (Faems et al., 2008). In this study, we therefore rely on a more fine-grained measure of prior collaboration. In particular, we asked respondents whether a friendly connection already existed before the project. Based on this question, we constructed a dummy variable, representing the absence (value = 0) or presence (value =1) of 'prior trustful collaboration.' In our sample 176 (65.2%) of the observed alliances had a history of trustful collaboration.

Number of alliance partners. In the survey, respondents had to indicate the amount of partners that were involved in the alliance. Based on this information, we constructed a dummy variable 'number of alliance partners', representing the difference between dyadic alliances (value = 0) and multilateral alliances (value = 1). In our sample 96 (35.6%) alliances were of a dyadic nature whereas 174 (64.4%) were of a multilateral nature.

Contract complexity. Although we focus in this study on the different functions of the contract, we also wanted to control for contract complexity. In line with previous alliance contract research (e.g. Parkhe, 1993; Poppo & Zenger, 2002; Reuer & Arino, 2007), we therefore provided respondents with a list of 13 specific contractual clauses and asked them to indicate whether or these contractual clauses were present in the contract. Based on this information, we constructed the variable contract complexity, representing the sum of these 13 items.

Alliance objectives. Firms can rely on collaboration with external partners for both explorative and exploitative innovation projects (Faems et al., 2005; Lavie & Rosenkopf, 2006; Rothaermel & Deeds, 2004). Explorative innovation projects refer to projects in which the focus is on fundamental research in order to generate new technological capabilities. Exploitative innovation projects are defined as projects in which the focus is on applied research in order to leverage existing technological capabilities. In the alliance literature (e.g. Bijlsma-Frankema & Costa, 2003; Koza & Lewin, 1998; Faems et al., 2006) first indications have been provided that explorative and exploitative collaborations are characterized by different interaction patterns and have different success rates. We therefore wanted to control for the objective of the collaboration in our analyses. In the survey, we asked respondents to indicate whether the collaborative innovation project was (i) very fundamental; (ii) rather fundamental; (iii) in the middle between fundamental and applied research; (iv) rather applied; (v) very applied. Based on this information, we constructed the variable 'Exploitative orientation.'

RESULTS

Descriptive statistics and analyses

Table 4 gives an overview of the most important descriptive statistics. This table shows the presence of a significant positive correlation between the contractual control function and the contractual coordination function. This indicates that alliance partners can simultaneously apply the contract as a mechanism to safeguard against opportunistic behavior and, at the same time, rely on it as a tool to facilitate coordinated action.

----- Insert Table 4 about here ----

To test the hypotheses, we used structural equation modeling (SEM) with manifest variables. Compared to ordinary linear regression models, this technique has two advantages (Sels et al., 2006). First, the method enables to define and test hypothesized relationships between variables. The output indicates whether the model is supported by the data as a whole and gives a significance test for the various individual relationships. Second, a variable in a SEM model can either be dependent or independent. This allows testing the indirect influence, if any, of certain variables.

We relied on the Calis procedure in the SAS software package to conduct our SEM analyses. First, we analyzed the relationship between contract functions, partner cooperation and alliance success on the full sample. In this model, we did not take into account the potential moderating impact of history of trustful collaboration and number of alliance partners. Instead, we integrated these latter variables as control variables in addition to contract complexity and exploitative orientation. Subsequently, we did split the full sample based on the variable 'history of trustful collaboration' in order to test the moderating impact of it. After splitting the sample we ran one SEM analysis for the cases that lacked a history of trustful collaboration and one analysis for the cases that were characterized by the presence of prior trustful collaboration. A similar procedure was conducted to test the moderating impact of the number of alliance partners. In all models, we programmed the existence of a significant correlation between the contractual control function and the contractual coordination function. The goodness-of-fit overview (see Table 5) indicates that the different analyzed models were adequately supported by the data.

----- Insert Table 5 about here -----

Below we interpret and explain the effects. First, we look at the effect of the contractual control function on partner cooperation. Second, we assess the impact of

the contractual coordination function on partner cooperation. Third, we evaluate the indirect effect of these contract functions on alliance success via partner cooperation. Fourth, we discuss the impact of our control variables. For the different models, the standardized path coefficients are listed in Table 6, Table 7, Table 8, Table 9, and Table 10. The results are also represented in Figure 2 and Figure 3. The control variables have been omitted in this graphical representations in order not to overload the figures.

----- Insert Table 6, Table 7, Table 8, Table 9, and Table 10 about here -----

----- Insert Figure 2 and Figure 3 about here -----

Impact of contractual control function on partner cooperation

In our first hypothesis, we expected a positive impact of the importance of the control function of the contract on partner cooperation. Our findings in model 1 (see Table 6 and Figure 2), however, suggest the existence of a significant negative effect of the contractual control function on partner cooperation. This means that, the more the contract was used as a mechanisms to control the behavior of the partners, the less (more) likely (non)-cooperative behaviors were to emerge within the alliance.

In hypothesis 2, we also expected a moderation effect of the presence of prior trustful collaboration. Model 2 and Model 3 (see Table 7, Table 8 and Figure 3) provide strong indications that prior trustful collaboration indeed moderates the relationship between the contractual control function and partner cooperation. In particular, we observe that the significant negative impact of the contractual control function on partner cooperation disappears when a history of prior collaboration is present.

Finally, we also find that the number of alliance partners has a moderating impact on the relationship between contractual control function and partner

cooperation. However, whereas we expected in hypothesis 3 that the contractual control function has a more positive impact on partner cooperation in the setting of a multilateral alliance, Model 5 (see Table 10 and Figure 3) points to a significant negative impact of the contractual control function on partner cooperation in this particular setting, At the same time, Model 4 (see Table 9 and Figure 3) indicates that the contractual control function has no impact on partner cooperation in dyadic alliances.

Impact of contractual coordination function on partner cooperation

In contrast to our hypothesis 4, we do not find a significant impact of the contractual coordination function on partner cooperation for the full sample (see Table 6 and Figure 2). In addition, we do not find that the relationship between the contractual coordination function and partner cooperation is moderated by the presence or absence of prior trustful collaboration (see Table 7, Table 8 and Figure 3). At the same time, we find strong indications that the number of alliance partners moderates the relationship between contractual coordination function and partner cooperation (see Table 9, Table 10 and Figure 3). Whereas Model 5 indicates that the contractual coordination function has no significant impact on partner cooperation in multilateral alliances, Model 4 points to a significant negative impact of the contractual coordination function on partner cooperation in dyadic alliances.

Impact of partner cooperation on alliance success

In line with hypothesis 7, we find in all different models a significant positive impact of partner cooperation on alliance success. This significant effect also implies the existence of some indirect effects between the contractual control/coordination function and alliance success in different models. An overview of these indirect effects can be found in Table 11. This overview of the indirect effects shows that the

actual impact of the contractual control/coordination functions on alliance success is close to zero or negative.

----- Insert Table 11 about here -----

Impact of control variables

In the different models, we controlled for contract complexity, exploitation orientation, presence of prior trustful collaboration and number of alliance partners. For the full sample, we observe that multilateral alliance have a significant higher alliance success rate than dyadic alliances (see Table 6). If we only consider the alliances in which a history of trustful collaboration is lacking, this positive effect of multilateral alliances on alliance success becomes even more pronounced (see Table 7). At the same time, we do not find a significant effect of the number of alliance partners on alliance success for alliance that are characterized by a history of trustful collaboration (see Table 8).

In the full sample, we do not find an effect of exploitation orientation on alliance success (see Table 6). However, we also observe that exploitation orientation has a positive impact on alliances success for 1) alliances that are characterized by a history of trustful collaboration (see Table 8) and 2) dyadic alliances (Table 9). In other words, we find that the impact of the exploitation orientation on alliance success depends on the presence/absence of prior trustful collaboration and the number of alliance partners.

Previous studies (e.g Luo, 2002; Poppo & Zenger, 2002) have examined the impact of contract complexity on alliance success. However, our study indicates that, when we also consider the actual functions of the contract, the explanatory value of contract complexity becomes rather low. We only find a significant negative effect of contract complexity of partner cooperation for alliances in which partners lack a

history of trustful collaboration. In the other models, no significant impact of contract complexity on partner cooperation or alliance success was observed.

DISCUSSION AND CONCLUSION

In this section, we first discuss our main findings. Subsequently, we present their main managerial implications. Finally, we point to the main limitations of this study and suggest interesting avenues for future research.

Contractual control function and partner cooperation

Previous research has provided evidence that, in settings were the risk of opportunistic behavior is high (e.g. high asset specificity, high uncertainty), alliance partners are likely to negotiate more complex contracts (Parkhe, 1993) and are likely to pay more attention to control clauses in such contracts (Reuer & Arino, 2007). Based on these findings and in line with transaction cost theory, these scholars pointed to contracts as an important control mechanism in alliance settings.

In this study, we actually tested the impact of this contractual control function on partner cooperation. In contrast to our expectations, we found that the more important the contractual control function, the less (more) likely (non)-cooperative behaviors are to emerge in alliances. This unexpected result can be explained in different ways. A first explanation might be that when partners pay a lot of attention to negotiating control clauses, they actually signal to each other that they expect the manifestation of opportunistic or non-cooperative behavior. Subsequently, it might be that partners will act in line with these initial expectations, engaging in opportunistic actions. In other words, negotiation of control clauses might function as a self-fulfilling prophecy were the announcement of the risk of opportunistic behavior will indeed become true.

A second potential explanation is that, when partners emphasize the control function of the contract, they actually create a foundation of distrust. In such a setting, it might be that alliance partners are more likely to link the emergence setbacks during the alliance to the endogenous behavior of the other partner (i.e. opportunistic action) instead of attributing such negative events to exogenous conditions. Our observation that the negative impact of the contractual control function on alliance contracts disappears when partners share a history of prior trustful collaboration seems to support this latter reasoning.

Contractual coordination function and partner cooperation

Adopting insights from organization theory, several scholars (e.g. Mellewigt et al., 2008; Reuer & Arino, 2007) have stressed that contracts can not only used as a formal control mechanisms, but can also be used as a mechanism to facilitate coordinated action. Our analyses, however, suggest that the actual impact of the contractual coordination function on partner cooperation is quite limited. This result might suggest that contractual coordination clauses mainly have an informational purpose (i.e. they inform partners about how they will perform the tasks), but do not really have a facilitating impact (i.e. they do not really stimulate more cooperative behavior).

In addition, we observe a significant negative effect of the contractual coordination function on partner cooperation in the particular setting of dyadic alliances. This latter finding might be explained by the fact that the standardized coordination, which is imposed on the alliance via contractual coordination clauses, might actually obstruct the emergence of coordination by mutual adjustment that is easily established in dyadic alliances.

Managerial implications

In the alliance governance literature, numerous scholars have argued that, when managers are able to adjust the complexity of the contract to the transactional and relational conditions in which the alliance is embedded, the contract can have a positive impact on the success of the alliance. Based on our findings, we rather caution managers for the potential negative impact of contracts on the success of alliances. In particular, we emphasize that negotiating a strong contractual control function is likely to have a negative impact on alliance performance especially when no history of trustful collaboration is present. In addition, we warn for the use of contracts as mechanisms for achieving standardized coordination in the setting of dyadic alliances.

Limitations and future research

Although the goodness-of-fit of the tested models turns out to be very satisfactory, there is a lot of potential to improve the explanatory power of the models. For instance, we only could find significant effects of the contractual functions on partner cooperation, whereas all the control variables did not have a significant impact on this variable. These results suggest that there are other transactional and/or relational characteristics that determine the level of (non)-cooperative behaviors during the alliance. A more fine-grained assessment of the determinants of partner cooperation in alliances therefore seems to be necessary.

Our research was situated in a very particular setting. More specifically, we focused on subsidized technological innovation projects in which different firms were involved. This particular setting might limit the generalizability of our findings. Additional survey research on the impact of contractual functions on performance in other interfirm settings therefore seems to be necessary.

A final limitation of our study was that we could only survey one partner of the alliance. However, it might be that different partners have different opinions about the function of the contract, the nature of partner cooperation and the success of the alliance. We therefore encourage future research on alliance governance that incorporates the opinions of all involved partners.

Despite these limitations, this study has triggered first insights in how different contractual functions influence alliance performance. We hope that our findings might help alliance managers in optimizing their contractual governance strategies. In addition, we hope that our insights might motivate other scholars to further examine the governance of interfirm relationship in a wide variety of organizational settings.

REFERENCES

Anderson, S. W. & Dekker, H. C. 2005. Management control for market transactions: The relation between transaction characteristics, incomplete contract design, and subsequent performance. ***Management Science***, 51: 1734-1752.

Ariño, A. & Reuer, J.J. 2005. Alliance contractual design. In O. Shenkar, & J.J. Reuer (Eds.) ***Handbook of Strategic Alliances,*** 149-167. Sage.

Ariño, A. 2003. Measures of strategic alliance performance: An analysis of construct validity. ***Journal of International Business Studies,*** 34: 66-79.

Bijlsma-Frankema, K. & Costa, A. C. 2005. Understanding the trust-control nexus. ***International Sociology***, 30:259-282.

Blau, P. 1964. ***Exchange and power in social life.*** John Wiley & Sons, New York

Bleeke, J. & Ernst, D. 1991. The way to win in cross-border alliances. ***Harvard Business Review,*** November-December: 127-135.

Das, T. K. & Teng, B-S. 1998. Between trust and control: Developing confidence in partner cooperation in alliances. ***Academy of Management Review,*** 23: 491-512.

Das, T. K. & Teng, B.S. 2001. Trust, control, and risk in strategic alliances: an integrated framework. ***Organization Studies,*** 22: 251-283.

Das, T. K. & Teng, B-S. 2002. Alliance constellations: a social exchange perspective, ***Academy of Management Review,*** 27: 445-456.

De Jong, G. & Klein Woolthuis, R.J.A. 2008. Contract research and high-tech alliances: Vistas for future studies. ***Scandinavian Journal of Management,*** 24: 284-289.

Doz, Y. & Hamel, G. 1998. ***Alliance advantage: The art of creating value through partnering.*** Boston: Harvard Business School Press.

Dyer, J. H. & Singh, H. 1998. The relational view: cooperative strategy and sources of interorganizational competitive advantage. ***Academy of Management Review,*** 23: 660-679.

Eisenhardt, K. M. 1985. Control: organizational and economic approaches. ***Management Science,*** 31: 134-149.

Faems, D., Janssens, M., Bouwen, R. & Van Looy, B. 2006. Governing explorative R&D alliances: Searching for effective strategies. ***Management Revue,*** 17: 9-29.

Faems, D., Janssens, M., Madhok, A. & Van Looy, B. 2008. Towards an integrative perspective on alliance governance: Connecting contract design, contract application and trust dynamics. ***Academy of Management Journal,*** 51: 1053-1078.

Faems, D., Janssens, M. & Van Looy, B. 2007. The initiation and evolution of interfirm knowledge transfer in R&D relationships. ***Organization Studies***, 28: 1699-1728.

Faems, D., Van Looy, B. & Debackere, K. 2005. Interorganizational collaboration and innovation: toward a portfolio approach. ***Journal of Product Innovation Management,*** 22: 238-250.

Galbraith, J.R. 1977. ***Organization design.*** Reading: Addison-Wesley.

Garcia-Canal, E., Valdés-Llaneza, A. & Arino, A. 2003. Effectiveness of dyadic and multi-party joint ventures. ***Organization Studies,*** 24: 743-770.

Geringer, J.M. & Herbert, L. 1991. Measuring performance of international joint ventures. ***Journal of International Business Studies,*** 22: 249-264.

Gong, Y., Shenkar, O., Luo, Y., & Nyaw, M-K. 2007. Do multiple parents help or hinder international joint venture performance? The mediating roles of contract completeness and partner cooperation. ***Strategic Management Journal***, 28: 1021-1034.

Gulati, R. 1995. Does familiarity breed trust? The implications of repeated ties for contracutal choice in alliances. ***Academy of Management Review,*** 38: 85-112.

Gulati, R. & Singh, H. 1998. The architecture of cooperation: managing coordination costs and appropriation concerns in strategic alliances. ***Administrative Science Quarterly,*** 43: 781-814.

Hagedoorn, J. 2002. Inter-firm R&D partnerships: an overview of major trends and patterns since 1960. ***Research Policy,*** 31: 477-492.

Hagedoorn, J. & Hesen, G. 2007. Contract law and the governance of inter-firm technology partnerships: An analysis of different modes of partnering and their contractual implications. ***Journal of Management Studies,*** 44: 342-366.

Inkpen, A. C. & Currall, S.C. 2004. The coevolution of trust, control, and learning in joint ventures. ***Organization Science,*** 15: 586-599.

Jones, G. R. & George, J.M. 1998. The experience and evolution of trust: implications for cooperation and teamwork. ***Academy of Management Review,*** 23: 531-546.

Kale, P. & Singh, H. 2009. Managing strategic alliances: What do we know now, and where do we go from here. ***Academy of Management Perspectives:*** 45-62.

Klein Woolthuis, R., Hillebrand, B. & Nooteboom, B. 2005. Trust, contract and relationship development. ***Organization Studies,*** 26: 813-840.

Koza, M. P. & Lewin, A.Y. 1998. The co-evolution of strategic alliances. ***Organization Science,*** 9: 255-264.

Lavie, D. & Rosenkopf, L. 2006. Balancing exploration and exploitation in alliance formation. ***Academy of Management Journal***, 49: 797-819.

Lawrence, P.R. & Lorsch, J.W. 1967. ***Organization and environment.*** Boston: Harvard Business School Press.

Luo, Y. 2002. Contract, cooperation, and performance in international joint ventures, ***Strategic Management Journal,*** 23: 903-919.

Lyons, B. & Mehta, J. 1997. Contracts, opportunism and trust: Self-interest and social orientation. ***Cambridge Journal of Economics,*** 21: 239-257.

Madhok, A. & Tallman, S.B. 1998. Resources, transactions and rents: managing value through interfirm collaborative relationships. ***Organization Science,*** 9: 326-339.

Malhorta, D. & Murnighan, J.K. 2002. The effects of contracts on interpersonal trust. ***Administrative Science Quarterly,*** 47: 534-559.

Mayer, K. J. & Argyres, N.S. 2004. Learning to contract: evidence from the personal computer industry. ***Organization Science,*** 15: 394-410.

Mayer, K.J. & Teece, D.J. 2008. Unpacking strategic alliances: The structure and purpose of alliance versus supplier relationships. ***Journal of Economic Behavior & Organization***, 66: 106-127.

Mellewigt, T., Madhok, A. & Weibel, A. 2007. Trust and formal contracts in interorganizational relationships – substitutes and complements. ***Managerial and Decision Economics.***

Mintzberg, H. 1979. ***The structuring of organizations: a synthesis of the research.*** N.J.: Prentice-Hall Englewood Cliffs.

Ouchi, W.G. 1979. A conceptual framework for the design of organizational control mechanisms. ***Management Science,*** 25: 833-848.

Parkhe, A. 1991. Interfirm diversity, organizational learning, and longevity in global strategic alliances. ***Journal of International Business Studies,*** 22: 579-601.

Parkhe, A. 1993. Strategic alliances structuring: a game theoretic and transaction cost examination of interfirm cooperation. ***Academy of Management Journal,*** 36: 794-829.

Poppo, L. & Zenger, T. 2002. Do formal contracts and relational governance function as substitutes or complements? ***Strategic Management Journal,*** 23, 707-725.

Reuer, J.J. & Ariño, A. 2007. Strategic alliance contracts: Dimensions and determinants of contractual complexity. ***Strategic Management Journal,*** 28: 313-330.

Reuer, J. J., Arino, A. & Mellewigt, T. 2006. Entrepreneurial alliances as contractual forms. Journal of Business Venturing, 21: 306-325.

Ring, P.S. 1997. Processes facilitating reliance on trust in inter-organizational networks. In M. Ebers (Ed.) ***The formation of inter-organizational networks.*** Oxford: Oxford University Press.

Ring, P. S. & Van De Ven, A.H. 1994. Developmental processes of cooperative interorganizational relationships. ***Academy of Management Review,*** 19: 90-118.

Rothaermel, F. T. & Deeds, D.L. 2004. Exploration and exploitation alliances in biotechnology: a system of new product development. ***Strategic Management Journal,*** 25, 201-221.

Rousseau, D. M., Sitkin, S.B., Burt, R.S. & Camerer, C. 1998. Not so different after all: a cross-discipline view of trust. ***Academy of Management Review,*** 23: 393-404.

Ryall, M. D. & Sampson, R. C. 2006. Do prior alliances influence alliance contract structure? In: Arino, A. & Reuer, J.J. (eds.) ***Strategic alliances: Governance and contracts.*** IESE Business School.

Sels, L., De Winne, S., Maes, J., Delmotte, J., Faems, D. & Forrier, A. 2006. Unraveling the HRM-Performance link: value-creating and cost-increasing effects of small business HRM. ***Journal of Management Studies,*** 43: 319-342.

Thompson, J. D. 1967. ***Organizations in action.*** New York: Mc Graw-Hill.

Williamson, O.E. 1985. ***The economic institutions of capitalism.*** New York: The Free Press.

Zajac, E. J. & Olsen, C.P. 1993. From transaction cost to transactional value analysis: implications for the study of interorganizational strategies. ***Journal of Management Studies,*** 30: 131-145.

Table 1: Overview Sampling Procedure

Initial Sample	**648 firms**
Unable to come in contact with project leader	24 firms
Double address in database	18 firms
Project leader has quitted the company	6 firms
Not a cooperative project	28 firms
Total base for response	**572 firms**
Unable to locate project leader during data collection phase	115 firms
Respondent only wants to answer in written form	6 firms
Respondent does not want to cooperate for various reasons	60 firms
Total response rate	**391 firms (68.5%)**
Missing values on constructs	121 firms
Final sample	270 firms

Table 2: Exploratory Factor Analysis on Partner Cooperation

	Factor loadings
We and our partner always talked openly and informally about our ideas, feelings, and wishes	**0.522**
We and our partner always gave each other all information that is relevant for the project	**0.874**
We and our partner could openly criticize each other when this contributes to the execution of the project	**0.601**
Our partner tried to get more advantages from the project than could be justified based on her efforts	**-0.684**
Our partner kept important information hidden for us	**-0.788**

Table 3: Exploratory Factor Analysis on Alliance Success

	Factor loadings
the project has become a technological success	**0.715**
the project has lead to lower development costs than if we would have done the project alone or if we would have done the project with another partner	**0.640**
the result of the collaboration has exceeded my expectations	**0.748**

Table 4: Descriptive statistics and correlations
(* Correlation is significant at the 0.05 level; ** Correlation is significant at the 0.01 level)

Variable	Mean	S	Partner cooperation	Alliance success	Contractual coordination function	Contractual control function	Exploitation orientation
Partner cooperation	0.00	1.00	1				
Alliance success	0.00	1.00	0.217***	1			
Contractual coordination function	3.34	1.66	-0.027	0.033	1		
Contractual control function	2.03	1.46	-0.150*	-0.077	0.145*	1	
Exploitation orientation	3.56	1.23	-0.057	0.075	-0.022	-0.118	1
Contract complexity	9.17	2.81	-0.034	0.065	0.048	0.213**	-0.290

Table 5: Goodness-of-fit measures

	Model 1: Full sample (n =270)	Model 2: No history of trustful collaboration (n = 94)	Model 3: History of trustful collaboration (n = 186)	Model 4: Dyadic alliances (n = 96)	Model 5: Multilateral alliances (n = 184)
Bentler's Comparative Fit index	1.00	1.00	1.00	1.00	1.00
Bentler and Bonett's Non-normed index	1.26	1.00	0.99	1.09	1.27
Bentler and Bonett's Normed Fit index	0.99	0.98	0.97	0.98	0.98
Chi-Square test (p-value)	0.68	0.37	0.36	0.48	0.60

Table 6: Standardized path coefficients Model 1: Full sample (†p<0.10; *p < 0.05; **p<0.01; ***p<0.001)

Path from / to	(3)	(4)
(1) Contractual control function	-0.14*	
(2) Contractual coordination function	-0.01	
(3) Partner cooperation		0.22***
(4) Alliance success		
Control variables		
(6) Exploitation orientation	-0.08	0.10
(7) Contract complexity	-0.03	0.10
(8) History of trustful collaboration	0.05	0.02
(9) Multilateral collaboration	0.04	0.14*

Table 7: Standardized path coefficients Model 2: No history of trustful collaboration (†p<0.10; *p < 0.05; **p<0.01; ***p<0.001)

Path from / to	(3)	(4)
(1) Contractual control function	-0.20**	
(2) Contractual coordination function	-0.01	
(3) Partner cooperation		0.20**
(4) Alliance success		
Control variables		
(6) Exploitation orientation	-0.11	0.01
(7) Contract complexity	-0.16*	0.07
(8) History of trustful collaboration		
(9) Multilateral collaboration	-0.02	0.22**

Table 8: Standardized path coefficients Model 3: History of trustful collaboration (†p<0.10; *p < 0.05; **p<0.01; ***p<0.001)

Path from / to	(3)	(4)
(1) Contractual control function	-0.09	
(2) Contractual coordination function	-0.03	
(3) Partner cooperation		0.23***
(4) Alliance success		
Control variables		
(6) Exploitation orientation	-0.05	0.16*
(7) Contract complexity	0.07	0.10
(8) History of trustful collaboration		
(9) Multilateral collaboration	0.08	0.10

Table 9: Standardized path coefficients Model 4: Dyadic alliances (†p<0.10; *p < 0.05; **p<0.01; ***p<0.001)

Path from / to	(3)	(4)
(1) Contractual control function	-0.11	
(2) Contractual coordination function	-0.19**	
(3) Partner cooperation		0.26***
(4) Alliance success		
Control variables		
(6) Exploitation orientation	-0.03	0.21**
(7) Contract complexity	0.04	0.06
(8) History of trustful collaboration	0.00	0.08
(9) Multilateral collaboration		

Table 10: Standardized path coefficients Model 5: Multilateral alliances (†p<0.10; *p < 0.05; **p<0.01; ***p<0.001)

Path from / to	(3)	(4)
(1) Contractual control function	-0.17*	
(2) Contractual coordination function	0.09	
(3) Partner cooperation		0.20**
(4) Alliance success		
Control variables		
(6) Exploitation orientation	-0.10	0.03
(7) Contract complexity	-0.04	0.11
(8) History of trustful collaboration	0.09	-0.02
(9) Multilateral collaboration		

Table 11: Indirect of contractual functions on alliance success

	Model 1: Full sample (n =270)	Model 2: No history of trustful collaboration (n = 94)	Model 3: History of trustful collaboration (n = 186)	Model 4: Dyadic alliances (n = 96)	Model 5: Multilateral alliances (n = 184)
Contractual control function	**-0.03**	**-0.04**	-0.02	-0.03	**-0.03**
Contractual coordination function	0.00	0.00	-0.01	**-0.05**	0.02

Figure 1: Conceptual framework

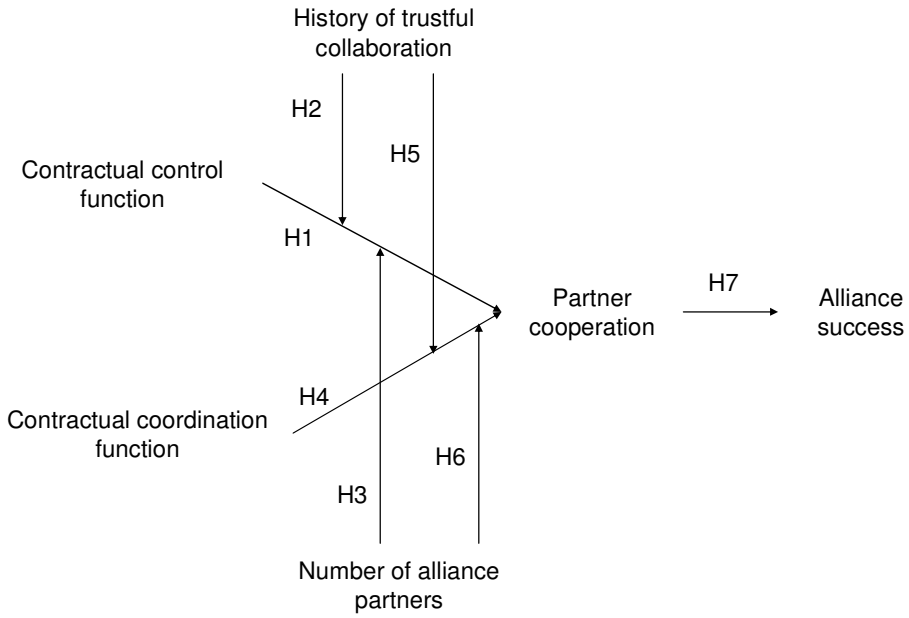


Figure 2: Result for Full sample (†p<0.10; *p < 0.05; **p<0.01; ***p<0.001)

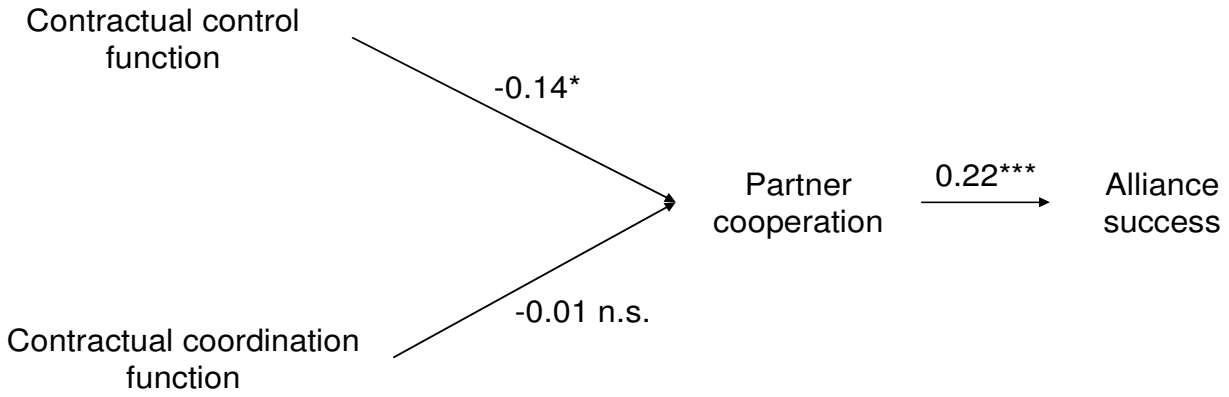
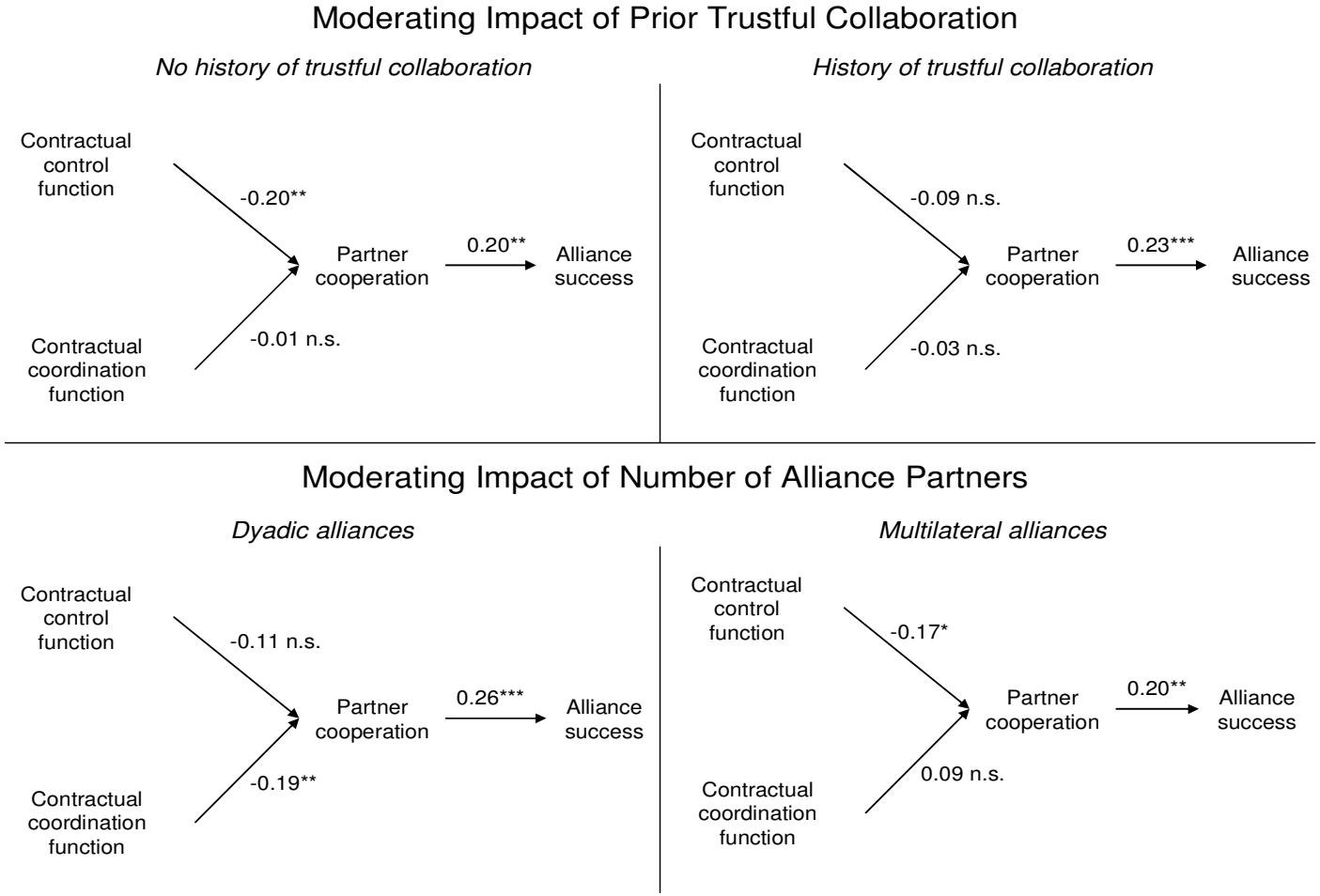


Figure 3: Results for Split samples (†p<0.10; *p < 0.05; **p<0.01; ***p<0.001)



From Firm Network to a Sector-System of Production and Innovation: A Case Study of Innovation Policy Initiative

Carl-Otto Frykfors[1,2)] & Magnus Klofsten[2)]

1) The national agency for research for sustainable growth and innovation (Vinnova), Sweden
2) IEI/PIE, Helix Centre of Excellence, Linköping University, Sweden

Abstract

This paper examines innovation policy making during the transition of innovative ideas into mature industries within building/construction and mineral extraction/mining industries. The main focus is how interaction occurs between major stakeholders and intermediating actors and how industrial change processes are orchestrated. A case study approach examines the rather complex processes occurring within industrial sector development. Two main success criteria were observed: (1) continuity in initial vision and leadership and (2) a clear intention to achieve strategic interplay and knowledge fusion between heterogonous industrial sectors. Currently, this has been achieved in a classic way using R&D and technology development approaches combined with explorative market development to co-ordinate and allow knowledge fusion between the sectors. The transition process is illustrated in four phases: (1) idea and start-up, (2) formation of a technical R&D programme and networking, (3) consolidation of actor networks and formation of an embryological innovation system, and (4) development of a more sector-based production and innovation system.

Keywords: Mature industries, sector innovation system, transition and change management

1. Introduction

Baldwin (2006) refers to globalisation as the "great unbundling" – as not just the slicing up of value chains and the relocation of various stages of production processes to more comparatively advantageous regions, but also as the elevation of innovation and intrinsic knowledge to a dominant position. Public policies and scientific prospects in the face of the gleaming development and prosperity produced by a footloose flow of knowledge and global competition between regions and networks of firms and individuals have for some time been collected under the heading knowledge society. The assumption that future social development and prosperity is largely in the hands of high-tech innovation, technology, and production of new scientific knowledge has, as in other countries, a decisive impact on Swedish government R&D policies (OECD, 2005; SOU, 2008).

This outlook – with its seemingly narrow perspective on knowledge and innovation – may be overlooking the industrial and technological development potential of traditional non-high-tech, non-research-intensive industries (Hirsch-Kreisner et al, 2005). A broader view of varying modes of innovation and knowledge production could well require policies and policy measures to be revisited, especially concerning innovation modes typical for low-tech – but often knowledge-intensive – firms and industries. Since the 1970s, policy-making insights have mainly occurred through intervention in (i) the scientific-based R&D and knowledge transfer from universities to firms and (ii) early-phase projects in various sectors and industrial branches that are in varying stages of their life cycle to maturity. Like elsewhere, policy making and policy measures in Sweden – the channelling of knowledge, communication, and net-

works between universities and single firms or networks of firms – have been characterized by their one-way mode (SOU, 2008).

In recent decades, a wider concept of networks and the power of networking has received much attention in policy making, particularly concerning entrepreneurship, innovation, and business organization (Håkansson, 1993; Laestadius & Berggren, 2000; Etzkowitz & Klofsten, 2005). Köhler's recent paper (2008) states that innovation must be embedded in coherent business strategies to be effective; compared with in R&D-intensive industries, economic performance and the capacity to innovate in low-tech or in mature and less research-intensive industries are much more a result of smooth interplay – networking – between the stake-holders of competitive firms in value-chain sectors and clusters. Innovation in mature, non-high-tech industry tends to be incremental, and this type of industry seems to attract process innovators rather than product innovators (Edquist, 1997). Companies that mainly embrace process innovation seem to base their innovations largely on contributions from others (Bender, 2006). Up-grading existing production processes and products is the primary tool for satisfying consumer demand. For example, in mineral extraction and mining industries, separating process from product development can be difficult and determining a distinct divide may be impossible. In summary, the innovativeness of non-high-tech – but quite often knowledge-intensive – industry seems to be largely based on its capability to absorb knowledge generated elsewhere and transform it internally according to their needs and situation (Robertson et al, 2003).

2. Frame of reference

Since the mid-1980s, innovation and innovation processes in industry have been considered crucial for sustainable development and economic growth. Economic research inspired by Freeman's (1987) and Lundvall (1992) initial work related to the OECD Technology and Innovation Policy (TIP) studies, proceeds by the seminal works of Nelson & Winters (1982), have concurred in this standpoint. And many studies have discussed the strong connections between (i) investments in innovation and R&D and (ii) economic growth of companies, branches, and community sectors. North (1990) and DiMaggio & Powell (1991) feel that it is the differences in the underlying institutional structures and their surrounding economic, cognitive, and political environment that explain the causality and elasticity of these connections. Malerba (2002) made the point that the degree of elasticity in this connection between innovation and R&D investment and economic gain and productivity efficiency varies between the different industrial sectors and R&D areas. Such variations are coupled to differences in factors such as technical or economical maturity (Lundvall, 2004) and differences in competence and learning.

Differences in development stage, socio-economic structures, and communicative closeness have recently become more important (Malerba, 2003). These factors lead to the conclusion that effects of different innovation and research initiatives will differ depending on sector, development area, and development stage. And these effects will differ because of underlying variations in communication and time-related interaction patterns. Dorsi (1982) introduced the concept of technological paradigms as a plausible explanation and overarching determinant of traits of path dependencies and transitions in technological socio-economic systems. Other influential scholars, like Malerba (2002), consider sector approaches to make up the core unit of analysis for economists, policymakers, and scholars – not least in the examination of innovative and production activities. Sector-system innovation visualizes innovation as an interactive process between various asymmetric firm and non-firm actors (e.g. research institutes and policy organizations). These actors have bounded rationalities, and their actions are shaped by collective institutions and accepted beliefs and practises (Edquist, 1997; Carlsson & Stankkiewicz, 1991). Sector-system production is a set of firms and non-firms that produce a set of products and other artefacts for a particular market (Bergek, et al, forthcoming). More pre-

cisely, Malerba (2006) views the concept of sector-system innovation and production as a way of providing a multidimensional, dynamic view of the sectors. Systems of innovation and production can thus be defined as a set of agents (e.g. firms and non-firms) that carry out market and non-market interaction to create, produce and sell new products and other artefacts (including commoditization knowledge) for market niches.

The sector-system perspective has many advantages. First, a sector-system innovation and production strategy results in a more precisely targeted innovation policy. Second, because sectors may differ in the nature of change and because sector participants may differ in experience and technology and skill capacity, an upsurge of new knowledge and techniques may result in outcomes that vary widely at the sector level. Third, adaptation of a sector-system approach allows better insight into the system and better assessment of the forces underlying innovation and competitiveness. Innovative behaviour and innovation output merely co-evolve with institutional settings and structural properties of sector (Nelson & Nelson, 2002). Using an economic perspective, Malerba (2006) studied how innovation firms relate to their environment during sector-system innovation and production and defined three key factors as crucial to the analysis in mature sector-systems:

- Market demand in terms of competent users and innovative procurements.
- The knowledge base within the sector and the adsorptive capacity and competence at the firm level.
- The dynamics of collaboration in innovation and R&D network.

To explain the emergence of innovation in sector-systems, Breschi & Malerba (1997) focused on four attributes in these systems:

- Opportunity in relationship to revenue expectations. Level of market scale, variety in technological solutions, market permeability, and input sources affect this relationship.
- Innovation conditions. The capability of adsorbing innovative knowledge or invention and how well specific findings on innovation can be enclosed and obtain protection determine whether or not these conditions are favourable.
- Reservoir of technological knowledge. The ability to accumulate, pool, and exploit technological knowledge affects the development of innovations.
- Complementarily of the knowledge base. How well the accumulated components in the knowledge base relate to and supplement each other affects the emergence of innovation.

To sum up, economic and evolutionary literature define the technical paradigm and regimes of innovation and production systems in slightly different ways: innovation is studied using the sector-system approach described above or an evolutionary viewpoint. The economics perspective emphasizes understanding the economic relationship between the innovating firms and their environment; the evolutionary approach, focuses on the technology itself and its environment (c.f. Carlson & Stankkiewicz, 1991; Jacobson, 1997). Similar to Dorsi's (1982) concept of technological paradigm, Rip and Kemp's studies (1998) of transition and technology shifts, for example, define the technological regime broadly and inclusive as: ".. the ruleset or grammar embedded in a complex of heuristic practices, characteristics of product & production technologies as well way and procedures of handling relevant artefacts and division of innovative labour, as way of defining problems; all of them embedded in institutions and infrastructures" (p. 340).

3. Aim and scope

As discussed by Godö (2009), although both approaches to sector-systems of innovations and production are fertile for explaining innovation dynamics within a technological regime, neither is capable of explaining how a new sector emerges and a new technological regime is established. From the perspective of policy design, intentionality and institutional embeddings at the actor level are an open question with these approaches. The sector-systems approach and the evolutionary approach are well capable of describing a particular technological regime – but not of explaining why it changes or why and how new technological regimes emerge. The research focus of this paper is thus: How does interaction between major stakeholders occur? and How do intermediating actors orchestrate the industrial change processes within these three industries?

Transition literature recognizes and often discusses (Geels 2004; Geels & Schot 2008) how a radical technological innovation becomes the seed for the establishment of a new technological regime and a new innovation system This occurred with GSM in the case of the mobile communications sector. In the encounter with incremental innovation, however, transition literature appears to explore transition management preconditions in traditional industrial branches to a lesser extent. This paper discusses lessons learned in the ongoing case of MinBaS. The focus is the process of incremental regime changes in mature branches that are subjected to increasing environmental pressure. These insights, we believe, will add to our theoretical and practical understanding of transition management. Transition processes concern not only structural, cultural, and institutional transformation but also the ways these changes are organized in matured industries.

4. Method and case background

Eisenhardt (1989) considers the case study approach to be a practicable way of examining rather complex processes, such as the emergence of a new industrial sector. The technique allows processes and causes of complex social phenomena to be assessed and understood. In Yin's view (1999) a 'critical' case that is representative of a focal phenomenon can provide detailed insights. And the outcomes of such a study can have implications that reach beyond the scope of the case. MinBaS was selected as a focal organization because it had made an important commitment to the pursuit of sustainability and environmental conservation in a sector-system perspective. Case information was collected via periodic participative observations between 1995 and 2009. Two more sets of standard case evaluation procedures were done in 2005 and 2009. Three rounds of semi-structured interviews with firm actors and project management occurred in 2002–2009, together with two one-day workshops of hearings.

5. The MinBaS case

MinBaS as an acronym for a joint Research, Technology and Innovation (RTI) programme between three traditional and relatively small industrial branches: industrial minerals, crushed rock aggregates, and dimension stone producers. Resting on historical causes, their own regimes of R&D, and business tradition, a more than 15–20-year period of transition is today targeting a plausible fusion of the three branches. The initiative behind MinBaS and the ongoing change process can traced to the mid-1990s and an informal discussion on co-operative interaction between a small group of major stake-holders and representatives in the three industries. Quite soon into the discussion, this informal group became aware of the need to involve the government. in order to undertake a governmental authorized foresight dealing with the issues of future development of a joint development aiming to create a new branch structure. Discussions with the Geological Survey of Sweden (SGU) and the Ministry of Enterprise, En-

ergy, and Communications (formerly the Ministry of Trade and Industry) resulted in SGU carrying out a foresight study with the participation of the concerned sectors.

From a policy perspective, timing is crucial. A few years later, the Ministry of Enterprise, Energy, and Communications commissioned SGU to conduct another study to investigate the prerequisites for enhancing innovation performance and production in the Swedish minerals and rocks industry. The study resulted in suggestions concerning the production chain from geology and prospecting via product and process development to market use (e.g. application technique in users' products and processes). The frame program – with over 200 experts and scholars from industry and academia involved in the program design of RTI activities – proposed joint financing of EUR 35 million during five years between government, industry, and academia. But due to governmental reorganization, difficulties in financing the proposed MinBaS programme arose. In 2002, the problem was partially solved and the project continued for the next three years, creating a substantially smaller technical programme – the MinBas I – and involving a core network of key actors from the three branches.

The next step in core activities addressed networking and system aspects. The same the key actors in the first stage – producers in the industrial minerals, crushed rock aggregates, and dimension stone industries – were financed by the Ministry of Enterprise, Energy, and Communications from 2007 to end 2010. Currently, planning activities are ongoing to extend the program for another five years by the potential subjects and challenger of "green job" and environmental issues.

5.1 MinBaS as an organisational metaphor for branches in transformation

As a metaphor for a transition process, MinBaS covers a time from when the first conceptual ideas were formulated in the mid-1990s until today, when changes are beginning to culminate in an embryological fusion of the three industrial branches involved in the RTI program. The results of the change process have been achieved using traditional research and technological development techniques as well as explorative market development strategies to co-ordinate and fuse knowledge. For a long time, a contributing success factor in the current MinBaS process has been the well-established interaction on a conceptual basis between a visionary team and an executive project organisation through the Swedish Mineral Processing Research Association (MinFo, established in 1976). The change process has spanned nearly 20 years, and group members have naturally shifted during this time:

- The pre-incubation period – from the early 1990s, when the MinBaS idea first emerged and then manifested in the MTU project in 1997.
- The incubation period – from 1997 to the present.

The stepwise advancement of this process has several analogies with the processes that Vinnova, the Swedish government agency for innovation systems, identified for spurring sector and regional innovation and R&D renewal. Vinnova currently uses its processes in its regional Vinn Growth initiatives. The concept design of Vinn Growth is based on the idea of combining (i) the approach of sector systems of innovation and (ii) triple helix modes of collaboration. In potential regional growth areas with reasonably strong knowledge bases, the triple helix collaboration modes promote innovation and R&D capacity between regional localized parts of (i) a particular industrial sector, (ii) a university, and (iii) regional authorities.

An activity flow of production and innovative development, MinBaS can be described at the micro level as a manifold of activities. At this level, viewed horizontally and vertically, the

companies and the sub-sectors are heterogeneous, concerning issues of business concepts, firm size, experiences of R&D, collective co-operation, and knowledge-driven ventures. Analysis problems of the fuzzy interfaces between branches also occur, for example, how to determine how far along the refinement/processing chain each sub-sector must go before another branch sector takes over. Many of the companies in MinBaS's domain of stake are due to supply agreements part of larger production structures and net of supplies connected to users in other branches, for example, the building and construction industry, the pulp and paper industry, the chemical industry, the steel and base metal industry as main constituents (c.f. Dahmén, 1958, and his concept of development blocks). MinBaS – as an overarching branch structure – can schematically be described as a mixture of large and small companies working with development and production in three main product and market segments.

Industrial minerals applications with its central stake in traditional chemical, pulp and paper, and pyro-metallurgical industries, aggregates for physical transport infrastructure and construction industry and dimension stone products mainly for application in buildings and in the outdoor infrastructure. Production value in the MinBaS sector – for the three sub-sectors combined – is approximately SEK 10–15 billion.

5.2 Pre-history of MinBaS

Retrospectively, the main incentive to MinBaS can be traced back to the Swedish government and its white paper on Mineral Politics (1980), which gives R&D priority and legitimacy to industrial mineral production in its own right as a public research and development area. But in line with this, two other R&D initiatives in the 1980s seem to have had a pronounced impact on further endowments. The Atik project: Industrial Mineral, the mining industry's and Department of Trade & Industry's flagship project to develop high quality products and advanced industrial production based on tailings from the Atik copper mine in northern Sweden. The project was initiated in 1976 and terminated 1983. The project showed after six years of development work that the basic philosophy of development about production of industrial mineral products from tailings of mines failed due to facts that was not possible to met user demand of robust and eve production of high quality products.

This caused the Swedish National Board for Technical Development (STU), one of the financers of the Atik project, to reconsider the basic development philosophy and initiate Focus Area Industrial Minerals, a mission programme that was conducted between 1985 and 1989, along with a number of associated projects, under the auspices of MinFo's Industrial Minerals Section. The Focus Area created this section to manage business-oriented tasks and market issues, which at that time were unaccounted for in STU's organisational structure and policy framework. The programme borrowed some positive features from the Atik project concerning identification of promising niche markets but shifted focus to exploring process and product technologies to enable exploitation of natural mineral resources "in a green state" and formation of an appropriate research base at a university and research institute. This mission programme, which for the times, contained several new policy measures on a micro level, later evolved into MinFo. Its purpose was to stabilize and consolidate previous investments in network building and established customer and supplier relations, together with its achievements, in a knowledge base and interconnected research network.

5.3 Key actors and critical events

In the early and mid-1980s, the prevailing policy at the former Department of Industry and its subordinate agency, STU, had its locus in basic industry. Unease over basic industry's vulner-

able situation as an export sector due to the oil crisis in 1974–1976, not least concerning the pulp and mining industries in northern Sweden and how these could be strengthened in the otherwise low employment environment of the northern regions of Sweden was a central issue for executive management at the Department and at STU.

At the same time, new policy ideas – outgrowths of Dahméns (1950, 1958) conceptual theory building and studies on industrial development blocks – began to circulate within STU. The ideas involved the dynamics of complementarity and how tension between these blocks could be used to stimulate renewed development and break lockups in mature sectors and sector-systems. These new policy ideas evolved into the design framework for STU's mission programme Focus Area Industry Mineral and became implementation guidelines during 1985–1989. The emergence of the Focus Area created a unique arena for executive managements of mineral producers and key Swedish customers in strategic market niches to meet. Twelve persons from these managements were invited to become active members of the Focus Area's board. On the initiative of SCA's board members on Focus Area's board, a special industry section for industrial mineral questions was formed in MinFo in the last half of 1985. Members on the producer side of the Focus Area's board comprised the board of the new industrial section's operations.

The discussions between the industry members of the Focus Area's board during its 5-year lifetime (1985–1989) and the bilateral dialogues with and between the companies within and outside of the Focus Area's immediate action framework during this time created a cognitive platform of common interest. This became the intellectual foundation of the processes that occurred during the rather long incubation and lead time that resulted in the formation of Mineralteknisk Utveckling AB (MTU) in 1994 and was the intellectual starting point for MinBaS. This more than 5-year cooperation in the Focus Area for industry minerals and its extension through MinFo's programme and project activities made it possible for companies and branch and research organisations in the industrial mineral sector, together with nearby user branches, to develop joint routines and development projects to strengthen preconditions for competitive Swedish industrial mineral production. The cooperative efforts were based on a mutually growing insight that several things would be needed to succeed: (i) extensive cooperation between mineral producers and various categories of customers, (ii) development alliances with suppliers of services and equipment on both sides, and (iii) assistance from government permitting agencies and other standard-setting organisations in the development processes. For example, a fruitful partnership and development cooperation between STU's Focus Area and the Board for Government Mining Properties [Statens Nämnd för Gruvegendomar] was developed to exploit industrial minerals. This realisation, of the necessity of partnership, laid the group for MinFo's actions in the MinBaS programme and its predecessor, MTU.

5.4 The long incubation time and the creation of MinBaS' predecessor, MTU

In the rather long incubation time, and during period 1990 to 1997, which culminated in MinBaS's idea and start-up phase, MinFo played a key role as an intermediary in development, both as idea carrier and as administrative actor with the ability to orchestrate and maintain ongoing processes. In the early 1990s, Sweden underwent a deep economic crisis. Substantial structural changes and elimination of production capacity in Swedish industry created an anxiety concerning previous industrial trade policies.

This unease (anxiety) caused policymakers to seek new ways of addressing the issue and to speak increasingly of knowledge and competence development as the decisive factor in economic growth. This view is exemplified in political statements during 1992-1993, that "knowl-

edge is becoming the most important production factor in industrial life". For the first time, the term knowledge society makes its way onto the Swedish political map. As a concept and an ideal, knowledge society, which had entered Swedish research circles at the beginning of the 1980s, now became the focus of industry and research politics.

This shift had great consequences for the Swedish Agency for Economic and Regional Growth (Nutek), STU's successor. The new focus was on generic technologies and knowledge generation in academic environments. The academic world's third task – to disseminate knowledge – was being formulated. In the face of the threat of drastic budget cuts and fund transfers to the academic-controlled research councils, which occurred in the constant struggle between the Ministries of industry and education, a competence centre programme was introduced for interdisciplinary cooperation between academic research and industry. As a consequence, this programme deviated from earlier forms of cooperation between industrial companies and mature industrial branches that were considered low technology.

At the same time, a historic sector-thinking was more or less cemented, with an inherent loyalty to attempt to fulfil previous commitments. Simplified, expressions such as knowledge diffusion and knowledge transfer became basic elements in the emerging policy. Knowledge was considered an object that could be manipulated, that could be "commodified", and which should be transferred and spread as effectively as possible from higher learning institutions to small and medium-sized firms in vulnerable regions. Large companies' historical importance for technological advancement also had a clear role in this policy. Universities and large companies were more or less considered providers of knowledge to smaller and medium-sized companies in this modified policy.

5.5 Stakeholders in firms and non-governmental organisations

At the same time, MinFo and the group of idea generating stakeholders in MinFo's network began to get signals from Nutek that an extension of the ongoing funding for branch-specific programmes and framework appropriations would be reviewed in light of Nutek's new programme focus. For MinFo, this was cause to announce a reorganisation and to see over its core of member firms and operational structure.

MinFo's management had long felt a need to expand operations and took Nutek's signals to heart. This resulted in efforts to (i) interest junior prototype firms and entrepreneurs in the exploitation of industrial mineral finds and (ii) to develop the small-scale traditional dimension stone companies. Likewise, these two categories see in MinFo and the proposal to MTU an opportunity to (i) obtain administrative support for and help with public co-financing for R&D work and (ii) get access to beneficial research and business contacts in MinFo's network. Thus, these parties actively committed themselves in the preplanning stage of MTU. MinFo, which has worked up substantial competence in creating and running R&D programmes and experience in negotiating with the government, starts up in advance a corporation – MTU – and sells shares to potential participating firms.

Nutek encouraged MinFo to apply for funding for MTU within the framework for a temporary regional pilot programme, which Nutek administered on behalf of the government. The programme targeted technology diffusion and knowledge transfer to local networks of small and medium-sized firms (< 200 employees) in regions with high unemployment.

In its first formulation, MTU's programme proposal was too controversial for Nutek to approve it. The proposal did not fulfil the stated criteria. The difficulty was that the proposal comprised

a mixed constellation of (i) large companies belonging to corporations (ii) small prototype firms run by entrepreneurs and which aimed to exploit potential mineral deposits, and (iii) traditional, established micro firms in the dimension stone sector. For various reasons, Nutek was anxious to find an acceptable legal and structural solution. After several drafts, such a solution was reached and the MTU proposal was approved.

MinFo, which has worked up substantial competence in creating and running R&D programmes and experience in negotiating with the government, starts up in advance a corporation – MTU AB – and sells shares to potential participating firms. The aims behind formation of MTU AB were to (i) engage participants in a common concern and (ii) create a neutral business structure. The newly created board of directors for MTU envisioned long-term development opportunities arising from a broader collaboration between several branches. One goal, then, was for each member to have at least one project important to the member accepted in the programme.

This way of structuring the programme became the standard for MinFo's future programmes. When it assumed programme administration in MTU, MinFo wanted to show with this new programme structure that it could expand operations beyond its circle of member company and specialty of competence networks. So MinFo focused on the project groups with little experience in collective research to expedite work, which mean creating a structure where programme management and the board actively assisted the project groups when needed without taking over leadership. The type of knowledge management and communication pattern that emerged consisted of (i) a functional board that representing all sub-sectors (ii) a communicative chairman of the board – an entrepreneur , self-made businessperson, anchored and well known in the regions, (iii) a small office for daily project guidance and coordination consisted by MinFo's research director, and a consultant with good knowledge of the firms and sector needs. In short, MTU created the organisational form for MinBaS, and the industrial mineral focus area contributed the intellectual cognitive model and strategy.

5.6 The kick-off of MinBaS

The question of closer cooperation between the industrial mineral firms represented by MinFo and the other two sub-sectors – dimension stone and crushed rock aggregates – arose early 1994 during MTU’s founding, and it’s project start up of cooperation in between a group of small new industrial mineral and established dimension stone firms and the MinFo’s group of larger industrial mineral companies and that was conducted in 1995–1998. But it was first in 1997, during this MTU project, that an informal cooperation group comprising the visionary idea bearing team of board members in MinFo and the executive management from the Swedish Aggregates Producers Association (SBMI) and the Swedish Foundation for Strategic Research (SSF), sector associations, to discuss questions of common interest. In these discussions, it emerged that the companies had a great desire for an official investigation into the conditions for a mutual development of the sub-sectors. After many formal and informal contacts with the Ministry of Enterprise, Energy and Communications, the Ministry asked SGU in 1998 to carry out, in close cooperation with sector representatives, a forward-thinking inquiry into Swedish industry's future in the production of industrial minerals and rock.

The inquiry found a need for development work in not only geology but also in production and process technique, and market and user applications The inquiry suggested that a common R&D programme with a focus on technique and marketing development be formed in cooperation with the industry.

5.7 A prospective frame for a large research, technology, and innovation programme

Plans for an R&D programme on business development per the inquiry's proposal were begun in November 1999. SGU provided project management and coordinated the work as intended state organiser. Nutek, who perceived growing difficulties in maintaining government responsibility for R&D in the mining and mineral extraction sector, financed the inquiry. Nutek had inherited this responsibility from STU, but the government was cutting research appropriations to the sector and shifting focus by doubling funding to the IT industry and for IT use, so Nutek pushed for a new state organiser for the sector, so it would develop well. Approximately 200 experts and researchers from firms, research organisations, and public authorities were involved in working out the details of a programme proposal that spanned geology and prospecting, product adaption, and market development. The proposal, which totalled SEK 300 million over five years, was presented in November 2000 to the Ministry of Enterprise, Energy and Communications.

5.8 A reversed smaller programme as a possible solution – MinBaS 1

For various interdepartmental reasons, the Ministry of Enterprise, Energy and Communications cited difficulties in obtaining necessary in-house acceptance by the Swedish Government Offices for the proposal. Apparently, MinBaS had gotten caught in the middle of an interdepartmental policy tug-of-war during a reorganisation in the Offices. As the initiator of the MinBaS proposal, MinFo began to experience a credibility and funding gap. In such a critical situation, it became vital to keep industry's interest alive and retain organisational credibility as a professional intermediary. Some support was had by pointing out two short projects: the newly formed Vinnova (2001) and a negotiated project package from the Swedish Energy Agency (STEM) that was lifted out from the proposed MinBaS programme (2002–2004).

After repeated proposals from SGU's new management and key stakeholders concerning the MinBaS sector need for a development programme, the government commissioned SGU in spring 2002 to write a programme proposal for what the Ministry named as a cluster net covering the three mineral extraction sectors. The commission was contingent upon SGU consulting with Nutek and Vinnova on the focus and formulation of the proposal. In June 2002, SGU submitted a proposal on the purpose and funding of the programme to the Ministry of Enterprise, Energy and Communications. In September of the same year, the government decided to assign SGU a frame of SEK 15 million from resources intended for regional balancing. The money was to fund a 3-year programme to develop the industrial metal, crushed rock aggregate, and dimension stone sectors. The work to adapt the initial proposal to the new volume, MinBaS I, was thereby begun.

So how did the political landscape look at the time of the MinBaS proposal, which led to a considerably smaller project that was 1/6 the volume of the original that had been presented to the Ministry of Enterprise, Energy and Communications in November 2000? In short, the playing field could be summarised thus:

- The Ministry of Enterprise, Energy and Communications find it difficult to obtain acceptance in the Swedish Government Offices for the MinBaS programme due to varying views on internal policy.
- Nutek is in the process of involuntarily spinning off its third leg – the R&D department – according to a directive to the new Vinnova that was starting up. Having financed the inquiry together with SGU, Nutek authorizes a Tran regional cluster venture.

- Vinnova is newly started up from R&D sections of three government bodies and needs to create an image for itself distinct from, for instance, Nutek. Vinnova shows little interest for mature sectors such as the minerals industry and, due to budget cuts, divests frame support to mature sectors that are considered non-research-intensive. Vinnova adopts a wait-and-see view.
- SGU conducted inquiries into the development of the MinBaS sectors in 1998 and 2000. It now attempts to actively lobby for MinBaS, among other reasons, because of SGU's stated environmental goal of radically reducing use of pit run gravel in the industry.
- STEM is interested in those sections of the proposal concerning large carbon dioxide generating and energy consuming industries.

The picture that is emerging is that it was in the late 1990s that cluster policy issues were beginning to be more seriously discussed at the ministerial level. Not least, cluster policy was being seen as a more realistic alternative for industrial development in lower regional politics. Porter's (1990) business economic–oriented cluster concept appealed not only to Nutek – with two of its three legs in (i) business development and SME-support and (ii) regional balancing and business support – but also to wide circles of researchers and policy makers, where it won acceptance in surprisingly short time. In a neo-economic perspective, teaching and learning institutions had previously drawn attention to the micro-plane at the firm level; this was what Porter now, in an attractive way, bound together into a broader development perspective in his cluster concept.

Networks and clusters were two dominant concepts that became fixed tenets in Nutek's programme policy. Concepts such as the teaching economy and innovation in a comprehensive system perspective had been discussed in research circles since the mid 1990s, but such concepts had rarely reached the policy level. This was especially true for the process- and system-oriented concept of innovation system in the international discourse that first later, during the formation of Vinnova in 2001, became an operative policy concept in Sweden. Further, it can be noted that environmental and energy aspects, which have always been vital determinants for the mining and mineral extraction industries, became increasingly so for development and research in the MinBaS sectors.

The result of the authorities' positioning and actions was an offer in early spring 2002 for a very small MinBaS programme – SEK 30 million with SEK 15 million in government financing – from the Ministry of Enterprise, Energy and Communications, which considered the full MinBaS proposal difficult to finance. The government commissioned SGU in spring 2002 to draft a programme proposal for a cluster network spanning the three mineral extraction sectors. The formal decision meant that SGU would draft the proposal together with the three sectors after consulting with Nutek and Vinnova.

SGU submitted a proposal in June 2002 for the aims and financing of the programme. In September 2002, with funds earmarked for regional balancing, the Swedish parliament decided to assign SGU a frame of SEK 15 million for a 3-year programme to develop the industrial mineral, crushed aggregate, and dimension stone sectors. Thus, the work to adapt the previous proposal to the new volume began.

The MinFo groups of industrial mineral and dimension stone firms – which had already developed links through the MTU project and had positive administrative experience in the later stages of MTU – decided to continue and try to effect a new, larger R&D programme with gov-

ernment co-financing. The crushed aggregate sector and the Swedish Aggregates Producers Association (SBMI), on the other hand, were indecisive. Sole proprietorships in the aggregate sector on the west coast were driving forces for collaboration, due to the need to produce increasingly larger shares of crushed rock and to find new techniques. In their eyes, SBMI and the Stockholm firms were not concerned enough about these issues. MinFo had already begun some R&D that was highly relevant to the aggregates industry, for example, concerning crushed aggregates in cement, because the industrial mineral companies in MinFo were interested in whether they could deliver filler quality that would solve some of the issues with using crushed aggregate instead of sand in cement.

The dimension stone industry, which after MTU had had its own government co-financed research project with Nutek, wanted to start a new, larger programme. So the industry decided to work collectively for the start of MinBaS I to (i) satisfy its sector's development needs and (ii) get assistance in rigging and administrating larger programmes. The aggregate industry, which had no previous experience in the premises and requirements of collective research with government funds and had only conducted projects under the auspices of the sector organisation, wanted to tone down R&D activities. Internally, the industry was split. The pit run gravel issue and the changeover to crushed rock began to interest more firms, even though the official sector policy was to effect a change in the environmental national target of reducing the industrial use and extraction of natural sand and gravel . So SBMI was initially hesitant, unsure of how everything would turn out, but the larger firms soon pressured it to initiate a more long-term research project. SBMI eventually participates in SGU's sector inquiry and in the development of the larger RTI programme for the MinBaS sectors.

MinFo's board, of which the dimension stone industry is a member, and the executive managements that were firmly committed to bringing about the first common sector programme for the MinBaS sectors, assisted SGU in the start-up of the greatly reduced government proposal for MinBaS I. These two groups worked with SGU in spring 2002 to clear up cooperation issues and refinements of aims and organisation. A solution similar to previous ones for project companies was chosen. Equal amounts of share packages in MTU AB were offered the sector organisations in the stone and the aggregate industries. In this way, a neutral legal unit for forming the MinBaS project organisation and a node for coordinating project activities in MinBaS I was created. This was done when the government passed its resolution in fall 2002.

MinFo is anxious for this first common sector programme to succeed and make a positive impression at higher levels. MinFo, who is responsible for the company's reorganisation, drafts the budget and organisation plan for the MinBaS I application – to be submitted in December 2002. MinFo also (i) conducts negotiations and contacts with SGU, (ii) drafts routines for follow-up and reporting in collaboration with SGU, (iii) assumes administrative responsibility for MinBaS AB, and (iv) ensures that there is a contract with SGU in spring 2003.

5.9 MinBaS II – a prolongation toward a sector system

In 2004, political unease for Sweden's industrial base again appears, and a renewed political policy with roots from long back begins to emerge. The government at that time makes a direct proposal to industry and suggests bilateral sector discussions and follow-up sector inquiries to create growth and innovation in sectors what, for Swedish standards, are important for employment and the economy. MinBaS I has begun plans for a new MinBaS programme and notifies the Ministry of Enterprise, Energy and Communications of its wish to participate in discussions.

MinBaS' participation in sector discussions on issues and development needs relevant to MinBaS faces an important challenge: in policy matters, sub-sectors are traditionally referred to the construction and the metallurgy and mining industries. During the sector inquiry for metallurgy, which begins in 2005, MinBaS is invited to participate via NCC/aggregate, Sweden's second largest construction company. At the same time, a slight policy shift occurred in 2005. The previously clear-cut thinking on clusters was being broadened at the policy level – under pressure of the discourse on learning economies and innovation systems that had taken place since the 1990s. Much of this was owing to the establishment of Vinnova, which raised the questions politically through its efforts to operationalise the concepts.

In short, the political policy landscape, its authorities' raison d'être, and its actions related to MinBaS can be summarised as follows:

- The Ministry of Enterprise, Energy and Communications, which is finding it difficult to get the necessary acceptance in the Swedish Government Offices for the programme proposal, initially shows no interest in 2004–2005 for MinBaS II. During the metallurgy sector inquiry, which began in fall 2005, the MinBaS II proposal is accepted. But no notification of government co-financing is given during the 2006 election year. Those behind the proposal bide their time during instalment of a new government, but word at the civil servant level is that a somewhat slimmed version of MinBaS II may be in the future. The co-financing agreement is announced in April 2007. SGU is again chosen as state organiser.
- SGU, which early on was interested in a continuation from the executive office and civil servant side and which as state organiser wished to carry out a MinBaS II, follows the sector inquiry closely. SGU puts in a good word for the programme with the government and finally is awarded the MinBaS II commission in April 2007. SGU pushes through MinBaS's work by revising programme plan II per the new directive. SGU announces that it will administrate and follow up the programme per earlier decisions and routines worked out for MinBaS I. It will, however, be more directly involved in programme work and more active as future R&D executor in the project.
- Nutek/Vinnova, who are involved in the governments sector inquiries, shows no special interest for MinBaS. The mining industry, which perceives MinBaS as competition, prefers Vinnova as a government co-financier and organiser, with the expectation of potentially greater economic muscles and a more wide-reaching competence network.
- STEM again shows interest in supporting a project package in the mineral industry – this time for the quicklime product CO2.

The knowledge and communication pattern that crystallises from this process is that the contacts that were established during MinBaS I between persons at the Ministry, in SGU, and in MinBaS management continue and become an important part of MinBaS II's birth. The good reputation that MinBaS I built up through its commitment to industry and favourable evaluation had a positive effect on relations between authorities and the industry and MinBaS.

All sector organizations and firms that participated in MinBaS I clearly stated that they were willing to continue with a MinBaS II programme. MinFo and the two sector organizations, SSF and SBMI, have strong inducements to create a larger, common programme: to improve chances for co-financing and effectives programme work. Many associated questions on envi-

ronment and legislation, EU standardisation, and harmonising of regional decisions on mining concessions act to consolidate sector collaboration.

MinBaS AB's management worked out a preliminary programme proposal for MinBaS II in autumn 2004 and submitted it to SGU and the Ministry. In subsequent sector discussions in 2005, MinBaS AB's chairman MinFo's director of research, and SBMI's head of research had the possibly to participate in the subsequent the sector inquiry for metallurgy industry with delivery of various inputs of texts and arguments a MinBaS-program , When a government decision for an extension of MinBaS was received, MinBaS management, together with the firms, drafted a modified programme that was adapted to the government directives and the budget. Groundwork for a MinBaS III is included in the programme planning. The new programme was initiated based on previously worked-up routines and networks. Like in I, work in MinBaS II was organised in five work packages and so was quickly underway on various hierarchical levels in the project network.

A mid-term evaluation in October 2009 noted that MinBaS II had accomplished much in a surprisingly short time and with limited public funds. The management network between, for example, MinBaS management and the sub-sectors, as with SGU and to some extent the Ministry, were well established, as were the operational activity network in the work package and on the project level. Also in this latter network, which was formed after MinBaS I, were regional actors and private research financers such as the Development Fund of the Swedish Construction Industry and Workers Association (SBUF), the Hesselman foundation who were now even more committed.

The critical point at this stage for MinBaS management and MinFo's role as facilitator was the necessity to get access to discussions and legitimacy as active discussion partners in the government's sector discussions with the industry. This was a strategic issue for MinBaS's continued existence and status, not least in a political perspective. The crucial points for MinBaS were (i) access to governments documents for the sector inquiry into the metallurgy and mining industries and (ii) the opportunity as propounded to continually submit documents and influence aims. In the inquiry's final document, a new MinBaS programme was identified as key to achieving growth-oriented innovation and development in the metallurgical and mining sector products.

In a larger view, the policy argument to support development projects like MinBaS, which represents fairly low-tech sectors, seems to include an ecological perspective. The by-products of MinBaS firms are fairly neutral and harmless or chemically inert raw materials that are used in other industrial sector production processes. The upsurge of new knowledge and techniques to upgrade product and production technology within the MinBaS sectors will have an economic impact in other domestic sectors (c.f. the EU PILOT project, 2005). The various MinBaS outcomes will also push development toward efficient utilisation of domestic resources in a range of economic sectors such as transportation infrastructure, the construction and housing sector, and major traditional Swedish net exporting industries like the pulp and paper, and the steel and pyrometallurgy sectors. These arguments obviously appealed to government authorities, and a MinBaS II project was in script in the final report.

6. Analysis and discussion

Broadly, MinBaS typifies a process of transition. It spans a period of more than 20 years – from a protracted period of pre-planning, incubation, and formulation of the first conceptual ideas to today's plans for a potential fusion of the three sectors involved: industrial minerals, crushed rock aggregates, and dimension stone.

Table. Phases, actors, and activities in the MinBaS transition process

Actor/Phase	**Incubation** (1985–1996)	**Idea & start up** (1997–2001)	**Technical R&D programme & networking** (2002–2006)	**Consolidation of actor networks and emergence of an innovation system** (2007–2010)
Government and agencies	The MinFo mineral programme is funded. STU/Nutek is responsible for administration and follow-up.	The MTU consortia is organised and funded as MTU AB. Nutek is responsible for administration and follow-up. SGU starts a foresight activity and develops a proposal for a 'large' MinBaS.	Re-negotiation of MinBaSand funding of a smaller MinBaS I programme. SGU is responsible for financing, administration, and follow-up.	Re-negotiation of MinBaS. Financing the MinBaS II programme. SGU responsible for administration and follow-up.
Non-governmental organisations	Initial university and institute networking activities establish a research base for industrial mineral research and user applications.	New research network through MTU AB focuses on smaller entrepreneurial businesses for exploring industrial minerals and mature dimension stone firms.	MinBaS activities start up. A joint networking programme between universities and the industrial minerals, dimension stone, and crushed rock aggregate industries is formed.	MinBaS continues with the same network of R&D actors.
Private stakeholders (firms)	MinFo coordinates industrial mineral and user firms.	Co-operation as a cluster between established mineral industries and established and new small businesses.	Co-operation expands to include firms in the crushed aggregate industry but not small firms in the industrial mineral sector.	Co-operation continues and is strengthened between firms.
Project management and organisation	MinFo is the managing organisation.	MinFo and SSF own MTU AB. MinFo supports MTU as the managing organisation.	MinFo, SSF and SBMI own MinBaS AB. MinFo administrates MinBaS.	Past ownership and administration continues.

This transition can be illustrated in four phases: (1) incubation, (2) idea and start-up, (3) technical R&D programme and networking, and (4) consolidation of actor networks and emergence of an innovation system. The table illustrates this transition process as phases, actors, and important activities.

What can be said about leadership and interaction between the key stakeholders in the MinBaS transition process? In the eyes of management scholars like Ven de Van et al (1999), Garud & Karnoe (2001), and Garud et al (2009), an intentional transition management must (i) be aware of various factors of change and contingency and (ii) in a reflective way, navigate a changing environment with agility to create actual space for its own route in a flow of internal and external events (Garud et al 2009). The first observation is that leadership processes and central actors occur on four (triple-helix like) levels (c.f. Etzkowitz & Leydesdorff, 2000), from the highest level – the government and various agencies – to lower decision instances such as non-governmental organisations (NGOs: the academic system, research institute, and sector organisations), private actors, and actors at the project management level.

Phase 1. During the incubation phase, the government dominated through its agencies, which finance competence and network formation in the industrial minerals area via STU's mission programme "Focus Area Industrial Minerals". This resulted from the close interaction between STU and the industry, in particular the Swedish pulp and paper industry (c.f. Frykfors & Klofsten, 2010, "development pairs"). The outcome of this interaction was the formation of MinFo industrial minerals – the successor of STU's Focus Area Industrial Minerals. MinFo became the driving organisation behind the emerging sector programme, MTU, which later transitioned into MinBaS.

Phase 2. In the next phase (idea and start up), thoughts on a common development of the MinBaS sectors are realised in a first step by the formation of MTU AB as coordinator of the first programme. This phase is characterised by a transition from government dominance to development that is clearly driven by industry. The MTU programme exemplifies this through its focus on product and process development in the stone and industrial mineral sectors.

As in phase 1, the central organisational actor in this process was MinFo. During the MTU programme, a dialogue is initiated between branch representatives (industrial minerals, dimension stone, and crushed rock aggregates); the Ministry of Enterprise, Communication and Energy; and SGU. The purpose was to start a foresight process into the common development of the three sectors. The outcome was a joint programme study between industry and SGU on the first proposal for a MinBaS programme, which was presented to the Ministry in 2000. Via Nutek (STU's successor), the government was still important for a large part of development funding during start up. In the next phase, SGU assumed this role.

Phase 3. With time, the Ministry developed problems funding the MinBaS programme in the proposed size, primarily due to changes in directives concerning R&D funding of the base industries and traditional industries overall. This led to greater industrial involvement in the third phase, namely, to form an R&D programme and R&D networks because of the government's change of focus. The focus was more and more on high technology, such as IT and biotech, and an increasing emphasis on industrial cooperation. This third phase was characterized by strong, increasing intensity in research and innovation, primarily through cooperation between industry and academia. As a result, industry, represented by MinBaS AB and MinFo, initiated renegotiations with the Ministry and SGU concerning a substantially smaller programme – MinBaS I.

Only a few selected companies in the three branches and the innermost network of NGOs (research institutes and certain universities) could be included. The government was still responsible for the project and, via the Ministry of Enterprise, delegated funds to SGU for financing and implementation of MinBaS I. SGU was thereby given a new role as research financier.

Phase 4. In the fourth phase, a consolidation of existing actor networks occurred and was strengthened in the form of a new innovation system that began to emerge. This was the main outcome of the technical development programme in MinBaS I and II and the community of practice and project networks that were conducted by MinBaS AB. SGU is now the sole source of government support and becomes increasingly interested and committed to the technical development of MinBaS II. Development is characterised by an expansion of the MinBaS I cluster network to an embryonic innovation system through various policy issues (e.g. environmental issues) and more concentrated cooperation with an emphasis on innovation and business development between companies.

The development of MinBaS has features similar to those described by Wenger (1998) for communities: (i) the sense of joint enterprise, (ii) a mutual engagement, and (iii) a shared repertoire of means and resources. These three features are hallmarks of the management approach in MinBaS and MinFo's role in the development process. A closer look at MinFo's approach to uncovering intentions through network activities reveals thirdly an other basic mechanism in the frequent use of open participative approaches and firm commitment to the concepts of community of practice throughout all levels of the MinBaS programme. According to Wenger (1998), the heuristics of meaning within a community of practice is negotiated through a process of participation and reification by producing abstractions, concepts, and stories as well as terms, means, and tools.

7. Conclusions and lessons learned

The research questions addressed in this paper deal with transition processes between mature industries, and particular interest is devoted to interaction with key stakeholders and the role of leadership (transition management). The MinBaS case illustrates this process by showing how persistent management and stakeholder interaction occur in the transition process within three industries and how a supportive intermediate such as MinFo successfully orchestrates this transition in a landscape characterized by contingent and shifting politico-administrative policies. fundamental mechanisms can be seen in the transition process from incubation to embryonic innovation system: first, a continuity throughout the development process of a vision-oriented, idea-generating team, forming a proactive leadership with intentions to achieve a strategic collaboration between three industrial branches; and second, the assistance of an executive project organisation in the unfolding of these intentions through an orchestration of activities.

In a discussion of socio-political system transition, Marsh and Rhodes (1992) defined four categories of change processes: economic, institutional, ideological, and knowledge dimensions. Marsh and Rhodes (1992) defined four categories of processes of changes labelled as economic, institutional, ideological and knowledge dimensions that must be met by an intentional transition management to be successful. In this study, long-term, collective leadership that was able to adapt to changing political policy without deviating from predetermined development policy (Braudel, "la lounge durée") proved to be important. This ability to adapt to changing surroundings while holding to a consistent internal policy was made possible by the

visions and the strong personal commitment of the individual dominant actors (Etzkowitz & Klofsten, 2005).

What is an exogenous and what is an endogenous impact in this perspective is not always defined. The type of impact is contingent upon how the actors (e.g. in innovation systems) define their stake boundaries. What an outside observer might consider an impact by an exogenous event or change process may actually be the outcome of an activity that had been actively cultivated by the involved actors for a long time that according to Garud and Karnoe (2001) may create new paths in transitions. However it is unclear to what extent the authors include new paradigms and institutional settings. We believe that this is similar to the case of MinBaS.

Defences

Baldwin, R, (2006), Globalisation: The great Unbundling(s), Report for the Prime Minster's Office, Economic Council of Finland

Bender, G, (2006), Peculiarities and Relevance on Non-Research Intensive Industries in the Knowledge Economy, Final Report of the PILOT project, University of Dortmund (www.pilot-project.org)

Bergek, A., Jacobsson, S., Hekkert, M., Smith, K, Functionality of Innovation Systems as a Rtionale and Guide in Innovation Policy, in Smits, R., Kuhlmann, S., Shapira, P, (eds.), Innovation Policy, Theory and Practice: An International Handbook, Cheltenham, Elgar Publishers, (forthcoming)

Braschi, F., Malerba, F, (1997), Sectoral innovation system: Technological Regimes, Schumpeterian Dynamics and Spatial Boundary, in Edquist, C, (ed.), System of Innovation, Technologies, Institutions and Organizations, 130-152, London: Pinter Publishers

Braudel, F, (1985/1988), Kapitalismens dynamik, Hedemora: Gidlunds Förlag

Carlsson, B, (1991), (ed.), Development Blocks and Industrial Transformation- the Dahmenian Approach to Economic Development, Stockholm; IUI, Almkvist & Wiksell

Carsson, B. Stankiewicz, R, (1991), On the Nature, Function and Composition of Technology system, Journal of Revolutionary Economics, 1(2) 93-118

Carlsson, B, (1997), Technology Systems and Industrial Dynamics, Boston: Kluwer

Dahmén, E, (1950), Svensk Industriell Företagsverksamhet, Kausalanalys av den Industriella Utvecklingen 1919-1939, Stockholm: IUI

Dahmén, E, (1998), Development Blocks in Industrial Economics, Scandinavian Economic History Review, XXXVI (1), 3-14

Dorsi, G, (1982), Technological Paradigm and Technological Trajectories, Research policy, 11(!), 147-162

Dorsi, G., Grazzi, H, (2010), On the Nature of Technology: Knowledge Procedure, Artefacts and Production Inputs, Cambridge journal of Economics, 34(1), 173-184

DiMaggio, P.J., Powell, W.W, (1991), Introduction in Powell, W.W., DiMaggio,P. J, (eds.), The New Intuitionalism in Organizational Analysis, 1-34, Chicago: University Press

Edquist, C, (1997), ed., Systems of Innovation- Technologies, Institutions and Organizations, London: Pinter publisher

Eisenhardt, K. M. (1989), Building theories from case study research. Academy of Management Review, 14(4), 532-50

Etzkowitz,H., Klofsten, M, (2005), The innovative region: Toward a theory of knowledge-based regional development, R&D Management, 35(3), 243-255

Etzkowitz, H., Leydesdorff, L, (2000), The dynamics of Innovation : from national systems and "Mode 2" to a Tripel helix of university- industry-government relations, Research Policy, 20(1) 109-123

Freeman, C, (1987), Technology Policy and Economic Performance: Lesson learned from Japan, London: Pinter Publisher

Fridlund, C.F, (1993), The Development Pair as a Link Between System Growth and Industrial Innovation, paper presented at the 35:th Annual Meeting of the Society of History of Technology, Washington DC

Frykfors, C-O., Klofsten, M, (2010), Emergence of the Swedish Innovation System and the Support for Regional Entrepreneurship, in Mian, S.A. (ed.) A Socio-Economic Perspective, in Science and Technology Based Regional Entrepreneurship: Global Experience in Policy and Program Development, Northampton, London: Edward Elgar (forthcoming)

Garud,R., Karnoe P, (2001), Path Creation as a Process of Mindful Deviations, in Garud, R, Karnoe, P. (eds.), Path Dependence and Creation, 1-38, Hillsdale: Lawrence Earlbaum Associate

Garud, R., Karnoe, P, (2003), Bricolarge versus Breakthrough: Distributed and embedded agency in technology entrepreneurship, Research Policy, 32(2), 277-300

Garud, R., Kumaraswamy, A., Karnoe P, (2009), Path Dependence or Path Creation, Journal of Management Studies, 47(4), 760-74

Geels, F. W, (2004), From Sectoral Systems of Innovation to Socio-Technical System: Insights About Dynamics and Change from Sociology and Institutional Theory, Research Policy, 33(6-7), 897-92

Geels, F , Schot, J, (2008), Strategic Niche Management and Sustainable Innovation Journeys: Theory, Findings, Research Agenda, and Policy, Technology Analysis & Strategic Management 20(5), 537–554

Godo, H, (2009), The Research Agenda in Firms. Rapport 11/ 2009 NIFO-STEEP

Håkansson, H, (1993), (ed.), Teknikutveckling i Företag: Ett Nätverksperspektiv, Lund: Studentlitteratur

Håkansson, H., Eriksson, A.K, (1993), Getting Innovations Out Of the Supplier Networks, Journal of Business to Business Marketing, 1(3) 3-34

Håkansson, H, (1998), Corporate Technological Behaviour and Networks, London: Routledge

Hirsch-Kreisner, H, (2005), Low–Tech Industries Knowledge Base and Organisation Structures, in Hirsch-Kreisner, H., Jacobson, D., Leastadius, S, (eds.), Low-Tech Innovation in Knowledge–based Economy, 147-255, Peter Lang GmbH

Köhler, H-D. (2008), Profit and Innovation Strategies in Low Tech Firms. Estudios de Economia Aplicada, 26(3), 1-17

Laestadius, S., Berggren, C, (2000), The Embeddedness of Industrial Clusters: The Development of Telecommunication Technologies and Industry in Scandinavi**a,** paper presented at the 8th International Schumpeter Conference

Lundvall, B-Å, (1992), National Innovation System: Towards a Theory of Innovation and Interactive Learning, London: Pinter Publisher

Malerba, F, (2002), Sectoral Systems of Innovation and Production, Research Policy, 31(2), 247-64

Malerba, F, (2004), Sectoral Systems of Innovation: Basic Concepts, in Malerba, F, (ed.), Sectoral Systems of Innovation, 9-35, Cambridge: Cambridge University Press

Malerba, F. (2006), Innovation and the Evolution of Industries, Journal of Evolutionary Economics, 16(1), 3-23

Marsh, D., Rhodes R.A, (1992), Policy Networks in British Government, New York, Claredon Press

Nelson, R., Winter, S, (1982), An Evolutionary Theory of Economic Change, Cambridge: Harvard University Press

Nelson, R., Nelson, K, (2002), Technology, institutions & innovation system. Research policy, 31(2) 267-272

North, D, (1991), Institutions, Institutional and Economic performance, Cambridge: Cambridge University, Press

Porter, M.E, (1990), The Competitive Advantage of Nations, New York: The Free Press

Rip, A., Kemp, R, (1998), Technological Change, in Rayner, S., Malone, E.L. (eds.), Human Choice and Climate Change, vol. 2, 327-399, Columbus: Batelle Press

Robertson, P., Pol, E., Carrol, P, (2003), Receptive Capacity of Established Industries as a Limiting Factor in the Economy's Rate of Innovation, Industry and Innovation, 10(4), 457-474
Van de Ven, A., Polley, D.E., Garud, R., Venkataraman, S, (1999), The Innovation Journey, New York: Oxford University Press

Wenger, E, (1998), Communities of Practice, Learning, Meaning and Identity, Cambridge University Press

Wenger, E, (2000), Communities of Practice and Social Learning Systems, Organization, 7(2) 225-46

Yin, R. K, (200), Case Study Research Design and Methods. Fourth Edition. Applied Social Research Methods Series, vol. 5, Newbury Park, Sage

The Eighteenth Annual High Technology Small Firms Conference, University of Twente, Enschede, the Netherlands, May 27-28 2010

Valorisation of knowledge: preliminary results on valorisation paths and obstacles in bringing university knowledge to market

Marina van Geenhuizen
Professor of Innovation and Innovation Policy of Urban Economies
Delft University of Technology, Delft, The Netherlands
Contact: m.s.vangeenhuizen@tudelft.nl

Abstract

The current paper is concerned with exploring the outcomes of valorisation of technology focused research projects in the Netherlands. Drawing on an evaluation of 240 projects at universities in three cities and on in-depth knowledge of almost 50 projects, the paper explores to what extent technology inventions are brought to market and which factors hamper such development. An evaluation after 10 years indicates that a quarter of the projects could be brought to market and that in almost 30% of the projects research is still continuing. Looking back to factors hampering knowledge valorisation, it appears that shortage in the organizational situation at the university at that time is the most important factor. Problems in interaction with the business world are in second place The most important regional factor appears a shortage of financial incentives including easy access to (regional) venture capital. The implications of the results for policymaking and further research are discussed.

1. Setting the scene

Universities have a longstanding tradition as a knowledge creator, but not as a wealth creator. However, nowadays as wealth creators universities are often involved in contract-research commissioned by the business sector, in collaborative research projects (consortia) with business partners, and in the creation of spin-off firms aiming to use new knowledge owned by the university in a commercial setting. The rather new phenomenon of wealth creation started to grow in Europe in the early 1980s (Charles & Howells, 1992) and has now fully entered the research policy of modern universities as the 'third mission' often denoted as 'knowledge valorisation'. Consequently, university policy is nowadays full of tasks concerning invention disclosures, venturing, collaboration, patenting and licensing, etc. (Shane, 2004).

Knowledge valorisation is a process in which value is added to new knowledge in order to transform it into a new (improved) product, process or service in the market (PriceWaterhouseCooper, 2007). Conceived in this way, knowledge valorisation is a broader concept than innovation because the latter only refers to a successful introduction into the market. By contrast, knowledge valorisation also includes the often long lasting chain of processes that starts with first thoughts about market introduction and about the research/development steps needed to reach this goal. In this respect, knowledge valorisation refers to specific research projects and clearly defined products and/or processes. There is also a broader conceptualization of knowledge valorisation, namely as a complex and interactive process in which knowledge is made ready and available, and in which interaction between

knowledge institutes and firms is crucial in all stages (Valorisation agenda, 2008). In this sense, valorisation is seen on a somewhat higher level of aggregation than individual projects.

Despite its current popularity in university policy and local/regional economic policy, much is still unknown about knowledge valorisation, e.g. to what extent knowledge is actually brought to market, how long this process takes, and which factors exert a hampering or stimulating influence on the speed of the process. It seems that the lack of insight and understanding is mainly caused by the comprehensiveness of the phenomenon of knowledge, and consequently of its valorisation. The many forms knowledge may take make it difficult to picture the flows of knowledge. Knowledge may be tacit, it may be codified in journals, patent descriptions, etc., it may be embodied in instruments, machinery and advanced equipment, and it may be embodied in academics and graduates starting a business. At the same time, knowledge valorisation may take many modes, like licensing of a patent to a firm, university-business collaboration to elaborate an invention to bring it to market, graduates working in research departments in the business sector, and spin-off firms engaged in developing an invention towards a marketable product or service.

Innovation studies in general tell us that market introduction depends on the nature of the invention (radical/incremental) including its cost level, the market (regulation, subsidies, market demand), as well as the strategies of the firms that are involved (Utterback, 1996; Christenson, 2003; Tidd et al., 2009). In terms of radical/incremental character, it seems that radical inventions requiring structural changes in infrastructures or even transitions (like the fuelling infrastructure in the case of electric cars and road equipment in the case of automated guided vehicles) face more obstructions than inventions that are incremental and fit into existing structures (Geels, 2004). Of course, the cost level plays a rule and the trade-off between newness/additional benefits of the invention and additional costs compared with existing products or processes. In addition, the way to market introduction may be full of obstacles in the case of heavy regulation, like in designing new drugs due to intensive testing and approval procedures. Conversely, inventions without such regulation and at the same time a strong subsidization by public money, may face an acceleration of their way to market. Such inventions may be dealing with cleaning the environment (like treatment of solid waste, polluted air and water). Of course, in connection with the previous factors, the strategies of the involved firms play an important role in bringing inventions to market. For example, firms may follow the path of first movers or follower (Lieberman and Montgomery, 1998). In addition, shifts in strategy may have an impact on attention for an invention. Firms may, for example, loose initial attention if they gain easy access to a competing innovation, following the strategy of merging or acquisition. Similarly, spin-off firms may become less focused on an invention if they move attention to consultancy, e.g. as a strategy of internal investment or merely of survival.

Also, spatial innovation studies have developed ideas on factors that hamper or stimulate market introduction of inventions. Among these are studies emphasizing agglomeration economies of large cities (Feldman, 1999; Capello, 2008), particularly knowledge spillovers, pools of specialized workers and other creative people (e.g. Florida 2002), and access to global traffic nodes (and global knowledge interaction); studies emphasizing a common regional culture, trust and social networks facilitating knowledge exchange (Keeble et al., 1999; Malmberg and Maskell, 1999), as well as more practical studies emphasizing the role of specific support infrastructure, including the supply of incubators, business accelerators and support packages for spin-off firms (Hannon and Chaplin, 2003; Hackett and Dilts, 2004; Soetanto and van Geenhuizen, 2007), and the establishment of science parks (van Geenhuizen and Soetanto, 2008).

So far, studies have analysed patents and patent citations (e.g. Jaffe et al., 2002) as well as spin-off firms (Pirnay and Surlemont, 2003; Lockett et al., 2003; Soetanto, 2009) as modes of knowledge valorisation, but other modes of valorisation that most probably are more significant (or at least more comprehensive) (d'Este and Patel, 2007) have remained outside the focus of analysis. The current paper deals with such a mode of knowledge valorisation, namely dedicated research projects at universities that are financed by public money to bring knowledge to market with involvement of potential users of the knowledge. The questions are as follows:

1. To what extent are research projects aimed at valorisation successful in bringing knowledge to market (or use in society)?
2. Which factors hamper a quick valorisation? To what extent are these factors related to the invention, the organizational context at universities, and to what extent are these related to regional conditions?
3. What could be new roles for local or regional authorities to enhance knowledge valorisation and to benefit more from it?

The paper has the following structure. Section 2 presents a conceptual model of knowledge valorization in a regional setting. This is followed by a discussion of the methodological characteristics of the study (section 3) and of the results in terms of market introduction and failure of research projects (section 4) and factors underlying failure (section 5). The type of factors identified forms the basis for a brief exploration of new roles of local/regional policy to enhance conditions for valorization and to improve benefits for the city/region (section 6). The paper closes with a reflection on the implications of the results, among others for policymaking and for further research. The study draws on data of 240 technology-focused research projects financed by Technology Foundation STW in the Netherlands, covering the cities of Amsterdam, Delft and Eindhoven, and on in-depth data from a selected sample of almost 50 of these research projects.

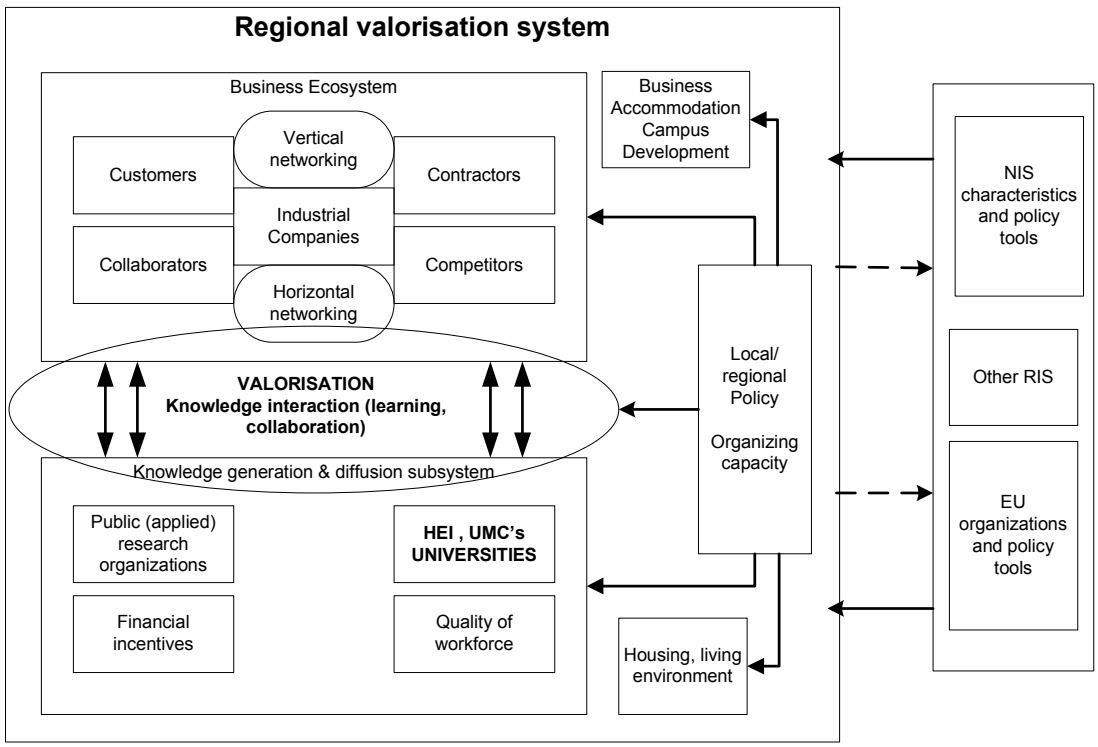
2. Regional valorisation system

A main condition for knowledge valorisation is *interaction* between university and the business sector (Figure 1). The term interaction is used in this context, not transfer, because increasingly university research is triggered by questions from the business sector, making the development process of an invention increasingly a two-way process instead of a one-directional linear process. In the interaction between researchers and firms, learning in bringing an invention to market may follow different models dependent on the types of technology involved. A distinction can be made between science-based learning including laws of nature (know-why), like in life sciences and nanotechnology, and problem-based learning with new applications (combinations) of existing knowledge (know how), like in medical instruments and automotive (Asheim et al., 2007).

From a regional perspective, Figure 1 pictures the ecosystem of firms in the region, including customers, contractors, competitors, and collaborators. If well-developed, this ecosystem provides supportive services, potentials for subcontracting, knowledge collaboration and collective learning, aside from access to knowledge sources in the country and abroad. These kinds of benefits have been indicated as cluster advantages in the literature (Porter, 1996; Bathelt et al., 2004). The size of this business ecosystem and the large players herein seems important, not only for developing economies of scale and scope but also for having a critical mass above which growth starts to develop as a self-propelling mechanism, and quite

differently, also for reasons of image towards the outside world and attractiveness as a place of location. The figure also indicates importance of organisations of applied research (TNO in the Netherlands), of financial incentives and of the regional labour market. The latter not only refers to specialised academic knowledge workers but also skilled practical workers, like technicians and laboratory analysts. In an indirect way, the quality of living (housing) in the region is important. This holds for attracting and keeping knowledge workers in the region, in particular international top scientists from abroad. Partially this is a matter of improving the housing stock and spatial planning. Local spatial planning is also involved in supply of the business accommodation, land on industrial parks and development (restructuring) of university campuses and large firms' campuses.

What has increasingly attracted attention as an overall factor is what is named 'the organising capacity' of the municipality and regional authority (van den Berg et al., 2003). This quality characteristic of governing refers to the capacity of local/regional political actors to gain consensus and a sense of urgency on the direction of knowledge-based development in the city/region in the near future, and to gain sufficient commitment for policies that support this. More specific it refers to the capacity to connect university, public policy actors and the business sector, to gain benefits from their collaboration and activities in each other realms (Triple Helix) (e.g. Etzkowitz, 2008). The national innovation system needs also to be mentioned, as it influences for example how science and technology policy, particular public R&D spending, is organized, and how entrepreneurship and knowledge valorisation are valued in society (e.g. Edquist, 1997). Knowledge valorisation is also influenced by regulation of R&D and market access (testing rules, quality control, ISO standards, etc.) but this nowadays also partly originates from European Union regulation (Rathenau Instituut, 2009).



UMC's : university medical centres.

Figure 1 A simplified model of a regional valorisation system

3. Methodological aspects

The analysis of valorisation involves two steps. First, there is a broad scan of the outcome of 240 research projects financed by Technology Foundation STW (STW, various years) in terms of market introduction, continuation and failure, and secondly, there is an in-depth study of almost 50 projects representing market introduction and failure (or continuation with delay).

Technology Foundation STW (note 1) in its annual Utilization Reports provides for each project a short description and an evaluation of results at 5 or (if appropriate) 10 years after the start. This information, in some cases together with web-based information, enables to identify different outcomes of the projects. The label 'introduced to market' in the current paper indicates that the projects have led to a product, process or method that was brought to market through firms or to use in society, like in health care and environmental fields. This is a quite strict definition, adopted on purpose in order to identify the unambiguous 'success stories'. However, it does not mean that projects *not* labeled 'introduced to market' have been useless. On the contrary, they often have led to contracts with users, patent applications, have gained investment money and have led to a clear-cut product, process or method. The knowledge may still be used in other ways like sideways of the project and embodied in PhD graduates working in firms, but the projects have simply not reached the stage of market introduction or application in society. In line with this, failure is defined as 'not having reached this stage'. In a few cases this happens quite early with ceasing the project before the official end date or directly after the end, if no continuation can be foreseen, but in most cases it takes a longer time. Aside from these two results, there is a category of 'stagnation or development unknown' (only older projects) and a category 'continuation' of research.

In view of the long-lasting nature of knowledge valorisation, two different periods of project starts are selected in the current study, i.e. the years 1995 to 1997 and the years 2000 to 2002. A reason for taking two periods is the change in economic climate in the early 2000s which makes aggregating all years dangerous. It is plausible that in the early 2000s firms have been reluctant in engaging themselves with valorization. In addition, there is a different awareness of valorisation and requirements for success in the two periods: relatively low at the end of the 1990s but it has increased since then. Further, 2002 is selected as the most recent year of project starts because this is the year of the most up-to-date evaluation information available when the current study took off. (2008).

For the first period, STW provides evaluation information after 10 years, for the last period it provides evaluation information after 5 years. In addition, the number of projects in each period covers a sufficient amount for the three cities in this research as a first scan: Amsterdam, Delft and Eindhoven, i.e. a minimum of about 30 projects. This selection of cities means that both technical universities (Delft and Eindhoven) and general universities (University of Amsterdam and Free University) are included in the study.

The first step of the study is followed by an in-depth analysis of hampering factors in valorization processes, based on a selected sample of 48 projects representing market introduction and failure (delay), and covering the two periods and the two technical universities (Delft and Eindhoven) and two general universities (Amsterdam). To avoid manifold influences of different technologies and markets involved in valorization, the in-depth analysis covers a limited number of selected technology segments, i.e. biotechnology (medical and industrial), medical instruments (hardware/software), new materials

(nanotechnology) and systems for sustainable energy, and automotive. The respondents in the in-depth interviews are the project leaders of the research. The in-depth interview is semi-structured with a mix of fixed and open answers. The subjects addressed are the timeline of the valorization, including major events, like application of a patent and start of collaboration with a firm, personal evaluation of the valorization so far, and major factors causing failure or delay. The current paper has a focus on the last part.

4. Valorisation results

This section deals with the outcomes of research projects started in the two periods. Overall, failure is faced by a minority of the projects, around 30%, but it tends to be somewhat stronger among the younger projects (34% versus 27%) (Table 1 and Table 2). On the other side, market introduction is also faced by a minority of the projects, i.e. 24% among the older projects and 12% (or 19%, if taken somewhat broader) among the younger ones. Aside from the downturn in the economy, the latter meagre results may also be caused by the short time-period of evaluation. Knowledge valorisation in technology areas takes more than five years before application can be reached, as evidenced by a high share of continued research (54%) for younger projects.

With regard to the different universities, TU Eindhoven is facing a relatively low failure rate for older projects, but also a relatively high share of stagnation or unknown development. It seems that Philips (with main research facilities in Eindhoven) and TNO (applied research facilities here) are major users in many projects. It is plausible that after some clear-cut development results, researchers (PhD) move from the university to these organisations for a job to elaborate the work, meaning that no next steps are visible in the context of the research projects and the share of introduction to market is relatively low (7%). However, the knowledge is certainly not lost in this situation. Among the younger projects, TU Eindhoven is facing a relatively high share of introduction to market, particularly if defined slightly broader, i.e. 16% and 25% respectively.

By contrast, TU Delft is facing a high share of introduction to market (33%) for older projects. This situation mainly rests on societal applications, and these fall back to a relatively low share among younger projects, i.e. 8% and (broader defined) 15%. The two general universities in Amsterdam are facing a somewhat high failure rate in both periods (34 and 43%) but perform on the average concerning introduction to market. It is plausible that researchers at these universities take more risks in adopting higher levels of newness in selected projects, a situation that would match with ideas in urban innovation theory. However, the two universities, in particular the bèta-complex, may also be less strongly oriented towards practical application compared with technical universities.

In conclusion, almost a quarter of the older projects (24%) could be brought to market according to the evaluation after 10 years and a slightly larger segment (28%) is facing a continuation of the research. This development suggests that valorisation of technical knowledge through dedicated projects is a long-lasting and vulnerable process, stumbled by many blocks. However, there is also some differentiation between the universities involved. TU Delft tends to be relatively successful in older projects; whereas TU Eindhoven tends to be relatively successful in younger projects.

Table 1 A scan of outcomes of projects taken off in 1995-1997 a)

	Amsterdam b)		Delft		Eindhoven		Totals	
Outcome	Abs.	%	Abs.	%	Abs.	%	Abs.	%
Failure after 5 or 10 years	13	34%	21	29%	4	15%	38	27%
Stagnation or development unknown after 10 years	7	18%	10	14%	12	43%	29	21%
Continuation after 10 years	11	28%	18	25%	10	36%	39	28%
Introduction to market/societal use	8	21%	24	33%	2	7%	34	24%
Totals	39	100%	73	100%	28	100%	140	100%

a) a few projects dealing with equipment are excluded.
b) University of Amsterdam and Free University aggregated.
Source: calculation by the author based on information from STW and website information.

Table 2 A scan of outcomes of projects taken off in 2000 - 2002

	Amsterdam a)		Delft		Eindhoven		Totals	
Outcome	Abs.	%	Abs.	%	Abs.	%	Abs.	%
Failure after 5 years	13	43%	12	30%	10	31%	35	34%
Continuation	13	43%	25	63%	17	53%	55	54%
Introduction to market/societal use	4	13%	3	8%	5	16%	12	12%
(according to a broader definition) b)	*5*	*17%*	*6*	*15%*	*8*	*25%*	*19*	*19%*
Totals	30	100	40	100	32	100	1	

a) University of Amsterdam and Free University aggregated.
b) Including introduction to firms for last test/checks.
Source: calculation by the author based on information from STW and website information.

5. Obstacles in valorisation

The results in this section are derived from in-depth interviews with researchers involved in valorisation, both in introduction to market and failure. Again a distinction is made between older projects and younger projects (Table 3). The results for older projects are as follows:

- Broadly speaking, almost 60% of all factors affect the 'inner oval' of the projects directly (Figure 1), including the profile of the invention, the organizational context (university) and interaction with firms. By contrast, regional factors amount to 30% and national factors to around 10%.

- Shortages in the organisational situation at the university is the single most important hampering factor (31% of all factors). This concerns not only a lack of affinity of some researchers with valorisation, but also reorganisation of faculties leading to closing down or regrouping of specialized research groups, dealing with valorisation.

- Next is failure in interaction with firms (17%). This is concerned with a decreasing interest from firms over time, due to upcoming risks in market demand and high costs

of taking the new product/process into production, aside from emerging competing technologies (solutions). Organisational change plays also a role, like bankruptcy of firms and merger and acquisition coming with new strategies. These developments tend to happen relatively often in medical life sciences and medical technology (instruments).

- A factor that also needs to be mentioned is the profile of the invention (10%). Inventions that have no outlook on mass production, seem too expensive for the extra's they bring (no breakthrough), or bear strong technology risks in next steps of the research suffer from lack of interest from firms and investors from the beginning.

- Among regional factors, it is a lack of particular financial incentives that hampers valorisation most (12% of all factors). This deals with both subsidies to attract firms from outside the region (abroad) and keeping spin-offs from the local university in the region (holds mainly for the region of Delft) and it deals with easy access to regional venture capital for spin-off firms provided by consortia of regional actors, like banks, universities, research institutes, and the province. The need for larger amounts of such venture capital is also a key issue (holds for all regions).

- Second are shortages in the labour market and business accommodation (7% each). Labour market shortages (specialists) occur in the regions of Delft and Maastricht, and deal with inventions that do not match with the current industrial structure of the region. Shortage in business accommodation holds for Delft and Amsterdam; the latter (shortage in room in incubators) is particularly true for spin-offs from Amsterdam Medical Centre.

Table 3 Factors hampering valorisation a)

Type of factors	**Projects 1995-97**		**Projects 2000-02**	
	Abs.	**%**	**Abs.**	**%**
Profile of invention	6	10%	0	
Organizational context (university)	18	31%	8	24%
Interaction with business world	10	17%	5	15%
Business ecosystem	2	3%	3	9%
Financial incentives	7	12%	4	12%
Labour market	4	7%	2	6%
Business accommodation	4	7%	3	9%
Remaining region	1	2%	2	6%
Regulation (e.g. prohibition of certain tests)	3	5%	1	3%
Culture/attitude (entrepreneurship, valorisation)	3	5%	4	12%
Remaining national system	1	2%	2	6%
Totals (number of factors)	59	100%	34	100%

a) Number of projects: 33 and 13 respectively.
Source: in-depth interviews by the author.

Comparing with the younger projects the following differences can be observed:

- Factors directly affecting the 'inner oval' have lost some importance (fallen back to almost 40%), particularly due to absence of inventions facing an unfavourable profile and less frequent problems in the organisational context at the university. It is plausible that these changes rest on an increased learning experience and awareness among researchers and university managers. At the same time, based on new awareness, new factors are forwarded, like lack of fertile ground for valorisation at academic hospitals (short-sighted planning, fragmentation of research), low urgency of valorisation at the university and lack of professional approach to valorisation at technology transfer offices (holds for all regions).

- With regard to regional factors, lack of financial incentives has remained as important as for older projects, but shortage in the business ecosystem has now increased in importance (9%). Also this phenomenon seems to relate to a new awareness, particularly the idea that the regional economy (and university) should exceed a certain size limit before growth starts to propel itself and the region becomes attractive for large firms from abroad (Eindhoven and Maastricht). In a similar vein, a lack of entrepreneurial spirit and drive for valorisation (12%) is now forwarded as a hampering factor in the broader context of the Dutch culture and value system.

The attention now briefly shifts to hampering factors affecting *spin-off firms* as a particular mode of valorisation. The in-depth study indicates that on average older projects produce almost one spin-off per project (0.9) whereas younger projects so far produce one spin-off out of three projects (0.3). However, averages are somewhat misleading in this context, due to a considerable differentiation between the projects. Thus, projects concerning a new process with multiple applications tend to yield larger numbers of spin-off firms compared to single product projects.

Problematic situations can be identified specifically for spin-off firms not cooperating with larger firms. The results of a study of 60 spin-off firms from TU Delft (van Geenhuizen and Soetanto, 2009) supplemented with insights from the in-depth interviews (medical life sciences and new materials) point clearly to two major bottlenecks in bringing university inventions to market by technology spin-offs:

- A shortage in knowledge and capabilities among researchers/entrepreneurs in marketing, concerning: 1) finding access (channels) to market, 2) negotiation with potential customers, and 3) assessment of market value of the invention.

- A shortage of financial capital in somewhat later stages, i.e. in which prototypes need to be tested and larger numbers of new products need to be manufactured for next steps of testing.

6. Local/regional authorities: new roles

There are no direct answers to the above set of hampering factors. Of course, universities themselves have an important task in improving the organizational situation inside the 'oval' (Figure 1). This mainly deals with increasing the affinity of researchers with valorisation, or compensating a shortage of affinity by appointment of additional (part-time) staff members with stong relations in the business world. In some universities (mainly technical) this is

already common practice, at others not. One of the main solutions is that the *award structure* is changed: valorisation needs to be awarded in a manner similar to scientific publications; but this is a matter of the Ministry of Education, Culture and Science. Another point is that valorisation needs to focus on those areas that are in the centre of university research programs in flourishing research groups, not in small groups vulnerable to impacts from reorganisation.

This section deals with what municipalities/regional authorities could do to enhance valorisation and at the same time increase the benefits of valorisation for the city/region. The focus will be on relatively new roles, in addition to the more traditional roles in spatial planning, like providing room in incubators and business parks (science parks) and campus reconstruction. Two rather uncommon but necessary roles will be briefly examined, i.e. acting as a 'connector' and acting as an 'initiator'. Acting according to these roles is clearly related to what has been addressed in the conceptual part of the paper, i.e. the organising capacity of local/regional authorities and Triple Helix building.

The valorisation 'oval' (Figure 1) is concerned with management of research in valorisation (eventually in spin-off firms) and with management of relationships with the business sector. Local/regional authorities have no role to play in this management. However, there is also the design of *strategies* for short/medium term research and valorisation programs, particularly focusing on promising themes. Local/regional authorities have no direct influence here but may – in a cooperative effort – connect their interests with university interests in selecting relevant themes in a broader context of cluster formation and business development. The municipality/regional authority could act as a *connector* here. This role also involves bringing together other main players in selected valorisation processes in the region in order to enhance a stronger collaboration. A few municipalities/regional authorities are already quite experienced and successful in this role (like the region of Eindhoven); for most municipalities/regional authorities however, it is new and often a highly complicated task due to the involvement of more than one large city, a number of (different) universities and higher educational institutes, and a variety of regional valorisation themes.

The advantage of a better connection and alignment between municipality, university and regional businesses is a more efficient use of local/regional knowledge, including an improved chance to participate in national and EU regional funding of research. However, a warning is in place here. A too strong focus on the local/regional in collaborative learning policy contradicts the growing experience indicating that spatial proximity is just a facilitating condition for learning, not a necessary one (Boschma, 2005; Torré and Rallet, 2005). Thus, a local/regional policy in valorisation needs to balance the 'local/regional' with the 'national/global'.

Municipalities/regional authorities could also act more actively as an *initiator* of new financial incentives, particularly in responding to the need for easy access to venture capital in later stages of technology-based spin-offs. Note that experience is currently gained in the metropolitan area of Amsterdam with a consortium active in providing investment capital in the life sciences (the Life Science Fund Amsterdam). The actors involved are the large financial banks, the two universities and academic hospitals, related research institutes and the local and regional authority (Province). The benefits for the university will be that valorisation already quite far on the road to commercialisation gets an extra impulse with positive feed-back to research, and the benefits for the city/region will be that value-added

and employment growth can take place in the metropolitan region, avoiding that the knowledge is sold abroad and benefits leave the region.

7. Conclusions, implications and future research

This paper has explored the outcomes of valorisation of technology projects at universities in the Netherlands. Drawing on an evaluation of 240 projects in three cities and on in-depth knowledge of almost 50 projects, the paper explored to what extent technology inventions are brought to market and which factors hamper such development. Projects were examined in two periods. It appeared that a quarter of the older projects could be brought to market within 10 years and a somewhat larger segment of the projects was facing a continuation of research. This situation suggests that valorisation of technical knowledge through dedicated projects is a long-lasting and vulnerable process, stumbled with many blocks. The share of younger projects brought to market is understandably smaller than among older projects, due to a shorter time available for valorisation. However, there is some differentiation between the universities involved, with the best results for TU Eindhoven. Note that with regard to projects in which market introduction could not be reached, valorisation efforts nevertheless have often led to clear-cut new products, processes or methods, patent applications and contracts with business actors.

With regard to hampering factors, the study revealed a dominance of problems in the organizational context of the universities involved, dealing with a lack of affinity of some researchers with valorisation, reorganisation of research sections and faculties, and in particular for younger projects, lack of urgency of valorisation and a lack of a professional approach to valorisation. Problems in interaction with the business world are in second place, mainly dealing with strategic shifts of firms and a reconsideration of risks taken with the invention. The most important regional factor appears to be a shortage of financial incentives including easy access to (regional) venture capital. The last factor holds in particular for technology-based spin-off firms, potentially affecting their chance of survival. A second danger for these firms is a shortage of market-related knowledge and capabilities.

The work in this paper on exploring the path to market introduction and related problems contains various limitations due to the use of information from one particular source of financing technology research. It could be that other programs in the Netherlands in which the business sector is stronger involved or involved in other ways, may produce a somewhat different picture. However, the in-depth interviews in the current study were structured in such a way that a broader picture could be reached than merely in relation to the particular financing source. This suggests that the most important obstacles to valorisation and particularly to spin-off firms have larger implications. However, this research had to narrow with regard to technologies and applications; i.e. medical and industrial life sciences and medical technology, material sciences (nanotechnology) and systems for renewable energy, and automotive. This means that fields like micro-electronics and information and communication technology, including multimedia and software design, have remained beyond the study. In addition, the study covered the Netherlands. However, given some similarities in the national value system and perceptions on entrepreneurship and risk-taking, the results may have implications for a larger area than only the Netherlands, like for Norway and Sweden, and partially also for Switzerland and Austria (GEM, 2007).

With regard to policy implications concerning the organisational context at universities, it can be safely stated that many conditions are currently being improved, because valorisation is

facing a strong and more explicit attention at universities nowadays. For local/regional authorities, dealing with spatial conditions is not new, many are involved in incubation centres, science parks and campus development. What is new is the role of 'connector' of major actors in valorisation in the region and outside and of 'initiator' of supportive financial measures. The study so far has been descriptive and based upon a rather small number of in-depth studies of research projects. Next step of the research will include the elaboration of a causal model of knowledge valorisation and extension of the number of research projects, allowing for statistical testing of this model.

Notes

1. STW has been funding scientific research at Dutch universities and institutes since 1981. Its methods in organization of research bring together, immediately after start of the research projects, researchers and potential users of the results of these projects. The 'users' provide input and also financial or other contributions to the project. The consultations during the projects ensure that the research groups and users get as much as possible out of these contacts.

References

Asheim, B., Coenen, L. and Vang, J. (2007) Face-to-face, buzz and knowledge bases: sociospatial implications for learning, innovation and innovation policy, *Environment and Planning C: Government and Policy* 25: 655-670.

Bathelt, H., Malmberg, A. and Maskell, P. (2004) Clusters and Knowledge: Local Buzz, Global Pipelines and the Process of Knowledge Creation, *Progress in Human Geography* 28, 31-56.

Berg, L. van den, van der Meer, J., and P. Pol (2003) Organising capacity and social policies in European cities, *Urban Studies* 40 (10): 1959-1978.

Boschma. R., (2005) Proximity and innovation: a critical assessment, *Regional Studies* 39: 61-74.

Capello, R. (2006) *Regional Economics*. London: Routledge.

Christenson, C. (2003) *The Innovators Dilemma*, Cambridge (US): Harvard University Press.

Clarysse, B., Wright, M., Lockett, A., Van de Velde, E, and Vohora, A (2005) 'Spinning out new ventures: a typology of incubation strategies from European research institutions', *Journal of Business Venturing* 20, 183-216.

Charles, D. and Howells, J. (1992) *Technology Transfer in Europe. Public and Private Networks*. London: Belhaven Press.

Edquist, C., and B. Johnson (1997) 'Institutions and organizations in systems of innovation', in: C. Edquist (ed.) *Systems of Innovation. Technology, institutions and organizations*. London: Pinter, pp. 41-63.

D'Este, P. and Patel, P. (2007) University-industry linkages in the UK: What are the factors underlying the variety of interactions with industry? *Research Policy*, 36: 1295-1313.

Etzkowitz, H. (2008) *The Triple Helix: University-Industry-Government Innovation in Action*. London: Routledge.

Feldman, M. (1999) The New Economics of Innovation, Spillovers and Agglomeration, *Economics of Innovation and New Technology*, 8**,** 1999, 5-25

Florida R. (2002) 'The economic geography of talent', *Annals of the Association of American Geographers* 92, 743-755.

Geels, F.W. (2004) From sectoral systems of innovation to socio-technical systems insights about dynamics and change from sociology and institutional theory, *Research Policy*, 33: 897-920.

Geenhuizen, M. van (2003) How can we reap the fruits of academic research in biotechnology? In search of critical success factors in policies for new-firm formation. *Environment and Planning C*, 21, 139-155.

Geenhuizen, M. van (2009) Life Sciences in the Netherlands: Weakness in a Strong National Policy, *European Planning Studies*, 17 (1), 1-17.

Geenhuizen, M. van, and D. P. Soetanto (2008) Science Parks: What they are and how they need to be evaluated. *Int. Journal of Foresight and Innovation Policy*, Vol. 4 (1/2): 90-111.

Geenhuizen, M. van, and D. P. Soetanto (2009) Academic spin-offs at different ages: A case study in search of obstacles to growth, *Technovation*, 29 (10), 671-681.

GEM Monitor (2007) *Global Entrepreneurship Monitor 2007*. Executive Report, London Business School, London and Babson College, Babson Park, MA.

Hackett, S.M and Dilts, D.M. (2004)'A Systematic Review of Business Incubation Research', *Journal of Technology Transfer* 29, 55-82.

Hannon, P.D. and Chaplin, P. (2003) 'Are incubators good for business? Understanding incubation practice – the challenges for policy', *Environment and Planning C*: *Government and Policy* 21, 861-881.

Jaffe, A.B., Trajtenberg, M. and P. M. Romer (2002) *Patents, citations, and innovativeness: a window on the knowledge economy*. Cambridge: MIT Press.

Keeble. D., Lawson. C., Moore, B., Wilkinson, F. (1999) 'Collective Learning Processes, Networking and 'institutional thickness' in the Cambridge Region', *Regional Studies* 33, 319-332.

Lieberman, M.B. and Montgomery, D.B. (1998) First mover (dis)advantages: retrospective and link with the resource-based view, *Strategic Management Journal* 19-12: 1111-1125.

Lockett, A., Wright, M., and S. Franklin (2003) 'Technology Transfer and Universities' Spin-Out Strategies', *Small Business Economics*, 20, 185-200.

Maskell, P. and Malmberg, A. (1999) Localised learning and industrial competitiveness, *Cambridge Journal of Economics*, 25: 167-185.

Phillips, R.G. (2002) 'Technology Business Incubators: How Effective as Technology Transfer Mechanisms?' *Technology in Society* 24, 299-316.

PriceWaterhouseCooper (2007) *Staying in control while unlocking the knowledge* (in opdracht van TechnoPartner).

Rathenau Instituut (2009) *Science systems compared: A first description of governance innovations in six science systems.* Den Haag: Rathenau Instituut.

Shane, S. (2004) *Academic Entrepreneurship. University Spin-offs and Wealth Creation*. Northhampton (MA): Edward Elgar.

Soetanto, D. and Geenhuizen, M. van (2007) Technology Incubators and Knowledge Networks: A Rough Set Approach in Comparative Project Analysis, *Environment and Planning B* (Planning and Design), Vol. 34, 1011-1029.

Steen, M. v.d., and Verspagen, B. (2008) Cashing from university knowledge (in Dutch) *ESB* 93 (4537).

Technology Foundation STW (various years) *Reports on Utilisation, 2006-2007-2008* (in Dutch). Utrecht: STW.

Tidd, J., Bessant, J. and K. Pavitt (2009) *Managing Innovations. Integrating Technological, Market and Organizational Change*, 4th edition, John Wiley.

Torré, A. and Rallet, A. (2005) Proximity and localization, *Regional Studies*, 39: 47-59.

Utterback, J. (1996) *Mastering the Dynamics of Innovation*. Harvard Business School Press.

Valorisatieagenda (2008) *Valorisatieagenda: kennis moet circuleren*. Den Haag: Innovatieplatform.

Professor Edward Stawasz
University of Lodz
Paweł Glodek, PhD
University of Lodz

SMEs innovation and job creation potential in the shadow economy context

1. Innovativeness and SME growth

One of the most important functions small and medium-sized enterprises (SMEs) perform in economy is their ability to create new jobs. Conditions of SME growth became one of the focal interests of both researchers and the government's policy aimed to support this sector. Innovativeness is at the forefront of SME-oriented issues. According to Schumpeter, an entrepreneur is an innovator who owing to innovations generates revenues and creates new jobs. He acknowledged that such a role belongs to large firms due to resources and possibilities they possess. The role of SMEs in the process of Schumpeterian "creative destruction" was presented by Kirchhoff [1994]. From his perspective entrepreneurship and innovation do not necessarily have to go hand in hand as Schumpeter argued. This is because there is plenty of innovations that are not used successfully by entrepreneurs, and at the same time there are many entrepreneurial activities carried out without constant exploitation of innovation. "Creative destruction" can also be made by SMEs as evidenced by a growing share of SMEs in creation of new jobs and inventions as well in generation of production, revenues and exports [Schreyer , 2000; Technology, Productivity and Job Creation, 1998; Calom, 1994]. Kirchhoff distinguishes two dimensions in his analysis: SME innovativeness and the rate of their growth (employment) and argues that both dimensions are independent of each other which means firms characterized by varied rates of employment growth (from a low to a high rate) and by degrees of innovativeness (from low to high innovative) can exist independently. This independence does not mean that innovativeness of firms guarantee a growth in employment, neither does it mean poorly innovative firms can be fast growing firms that contribute to a considerable growth of employment. Storey [1994] stated that on closer examination, there is considerable variation in the employment generating activities of small innovative firms and, as has been noted for the small firm sector generally. And the large share of new jobs are likely to have been created by only a small sub-set of the total population.

An independence of SME innovativeness and the rate of employment growth can result from the fact that they are under influence of various factors. The rate of employment growth can be determined by such factors as personal aims of firms' owners, resources in possession (competences, financial means etc.) and a market acceptance for innovation. The innovativeness of firms is determined by same factors. However, to a certain extent they are controlled more by entrepreneurs who can specify aims (e.g. proinnovative ones) and make inventions and ideas that lay the foundations for innovation independently.

Given the market and resource restrictions, entrepreneurs may be incapable to attain an intended degree of innovativeness. However, an entrepreneur who keeps producing new inventions and attempts to be innovative presents himself as a different entrepreneur as the one who starts an economic activity with one innovation and makes little effort to enhance innovations possessed by the firm [Sheikh, Oberholzner, 2001]. The SME sector is not at all homogenous, on the contrary – it constitutes a set of varied units, with respect to both their economic dynamics and their degree of innovativeness, and the role they play in economy. Depending on the innovative dynamics and the rate of growth very different types of firms

can be distinguished (see Table 1). The following types were differentiated: (1) economic core, (2) ambitious, (3) constrained growth and (4) glamorous.

Table 1: Typology of SMEs from the viewpoint of innovativeness and the firm's growth rate

Innovativeness of firms	Low	High
High	Type III CONSTRAINED GROWTH	Type IV GLAMOROUS
Low	ECONOMIC CORE Type I	AMBITIOUS Type II

Firm's growth rate

Source: B. A. Kirchoff, 1994.

Whereas the views expressed in the topical literature basically agree as to the positive correlation between innovativeness of firms and an increase in turnover, the results of studies carried out in relation to an employment growth bring a mixed outcome. Tether and Massini [1998], Sheikh and Oberholzner [2001] point to a considerable positive impact of innovations (especially product innovations) on the growth of employment in the firm. On the other hand, Kalantaridis and Heby [1999] argue that on the micro level there is no justification to link innovative activity and the growth of employment. Although it is difficult to identify the reasons for differences in the results of individual studies, the most significant are variations in used definitions, and in particular in the operationalisation of the notion of innovativeness.
Analyses also refer to selected groups of an SME sector. Holzl [2009] analyzed the problem among fast-growing SMEs. He used a numerous sample of enterprises from 16 EU countries between 1998 and 2000. He finds that innovation in the form of R&D and turnover share coming from products new to the market is more important for the growth (measured on the basis of an employment level) of fast-growing SMEs. In this case innovation can be seen as a high-risk and high-gain strategy: if successful, innovation might provide a growth premium, but it is also very likely that the innovation turns out to be a failure and even a drag on the growth rate of most firms. Freel [2000] points to the fact that in the sample of firms that he analyzed innovative firms showed a growth in employment with the same frequency as non-innovative firms did. At the same time the size of their growth rate was considerably higher than it was the case for non-innovative firms.
Stam and Wennberg [2009] analyzed firms in the initial phase of their operations. They argue that the innovativeness of start-ups measured by an R&D intensity, despite a positive influence on such factors as increasing interfirm alliances or new product development activity, does not show a significant correlation with an increase in employment.

2. The shadow economy and SMEs

The shadow economy is defined in an economic context as running an activity that is not prohibited by its nature, however it is carried out in an undisclosed manner [Schneider, Enste, 2000]. It may include a number of activities related to the failure to declare part of legitimate business income to the tax authorities, employing workers with no appropriate contracts or the use/provision of informal sources of financing. Thus, it is markedly different from criminal activity or other prohibited activities [Glodek, 2008]. The reasons for non-

disclosure vary, however the existence of the shadow economy as described above has both positive and negative consequences for the entities involved [Williams, 2007].

The share of the shadow economy in Polish economy is significant and it stabilized in recent years. According to estimates, its level amounts to 15-17% of GDP. The biggest impact on the size of the shadow economy has an economic activity run mainly in the domain of trade, construction as well as real estate services and services to the firms [Central Statistical Office, 2007].

For entities running their operations in the shadow economy, mainly from the SME sector, the main benefit is a possibility to avoid taxes and other obligations imposed by the state through the existing law regulations [Beloled, 2005; Djankow, Liberman, Mukherjee, Nenova, 2002]. These benefits can be expressed in the directly visible cash form as lower taxes and payments, but also as time savings in handling all business formalities. Under certain circumstances the existence of the shadow economy makes it possible to gain market experience and use entrepreneurial opportunities in an effective way [Williams et al, 2009; Stawasz, 2008].

It can be assumed that the use of some elements of the shadow economy may exert its influence on the firm's innovativeness and the growth potential in many different ways. Potentially favourable factors include an increased profitability of the firm which facilitates an accumulation of own capital that finances investment outlays. However, declaring lower profits will negatively influence the possibilities to acquire external financing and to use accumulated capital to run investment activity (a problem of disclosure of the sources of financing). In addition, an increase in the scale of activity may influence in different ways the possibility to use the shadow economy instruments through the firm's greater visibility on the market and a higher number of employees who have knowledge of shadow-economy operations (the risk of disclosure). On the other hand, a withdrawal from the use of shadow-economy instruments will mean an actually higher level of taxation and lower profits for the firm.

As the financial surplus from the shadow-economy operations may go towards both consumption of the household and investment processes of the entrepreneur, there is a clear motivation to use the first option and allocate the profits gained from the shadow-economy activities for household consumption while retaining the present level of profitability. It can be also assumed that shadow-economy activity affects negatively the openness of the firm to contacts with new external partners, confidence and other social elements essential from the viewpoint of processes of innovation generation (e.g. a failure to respect copyright law).

3. The sample

The authors used a database consisting of 81 SMEs from the Lodz region being the average size in Poland and typical for the Polish economy. The survey was carried out by means of direct questionnaire interviews. The arithmetic mean of surveyed firms was 13 years in 2007. Almost 80% of firms can be labelled as mature (more than 5 years in operation). Considering the age of the firms and their experience the above data allow to treat the responses as representative for the SME sector and mature firms. More than 90% of them were established after the period of deep political and economic transition in Poland, sometimes labelled as the period of an "entrepreneurship boom" or "market self-regulation of entrepreneurship". Almost 15% of the firms were established in the years 1999-2003, that is in the period when economy was overcoming the crisis and implementing the solid foundations for political and economic transition, just before Poland's accession to the European Union. These firms can be described as relatively unstable and „immature". Every tenth firm that was established prior to 1989 before economic reforms were introduced. These characteristics are similar to the age structure of the SME sector in Poland. In the group of the

oldest firms established before 1989 the average number of employees was 36, whereas in the group of firms established between 1990 and 2001 it reached more than 48. In the group of the youngest firms (established between 2002 and 2006) the average number of employees amounted to 46. This shows a weak correlation between the age of the firms and the size of employment in the group of the surveyed firms.

Micro firms with up to 9 employees prevailed in the sample and amounted to 59.3% of the total number of firms. Small enterprises employing between 10 and 49 persons constituted 25.9% of the total number whereas the share of medium-sized firms with an employment level between 50 and 249 was 14.8%. The average size of employment was 23 employees and the median (a typical firm) was 7 employees. The surveyed firms vary significantly with respect to the size of activity – they belong to 38 sections of the Polish Classification of Economic Activities. The highest number of firms run manufacturing and trading activities (32.1% each). More than half of the manufacturing firms are located in big agglomerations. Then, 60% of trading firms come from small towns. All IT firms are located in big agglomerations. The surveyed firms sell most of their products on local or regional markets – 81.5% of firms generate 66% of total turnover. 54.3% of firms operate on the domestic market producing 28.6% of their turnover there. Although 19.1% of enterprises operate on foreign markets, the share of exports in the total volume of sales is small and it does not exceed 6%. In the latter case this mainly concerns manufacturing firms and medium-sized firms (with more than 50 employees).

4. The results of the survey

4.1. The innovativeness of the firms

The firms that introduced at least one product or process modification within the period of the last three years were considered as innovative. The surveyed firms are characterized by high innovative activity. Almost 90% of the firm introduced some changes in their products, technologies or methods between 2004 and 2006. The sample is diversified in terms of innovativeness measured by a degree of novelty of innovative changes that were introduced. Generally, most changes is new only to the firm (74.7% of the firms). 21.5% of the firms introduced changes new to the domestic market, whereas a small 3.8% of the firms introduced changes new to the world, which is about 7 times less than in the case of the domestic market. The highest number of innovative changes took place in the area of the firm's product assortment - 60% of the firms. Quite high was also an index of changes of the marketing nature (40% of the firms) and changes in the domain of technology (35.8% of the firms). Modifications in the field of management and organization were indicated by 22.2% of the firms. Thus, changes of "hard" nature, i.e. taking place in products and technologies, predominate. A separate case is an implementation of new patents, licenses or *know-how*. These changes constitute a real novelty. However, such changes were quite few and only from 5.1% to 10.1% of the firms reported on them. However, it seems that this reflects better a real picture of the innovativeness of the surveyed enterprises than a merely declared degree of changes in innovation.

As a measure of the firm's innovativeness, a share of turnover generated from the sales of new or modified products or services that were introduced within the previous three years in the total turnover of the firm in 2007 was used in this article. The average value of this index for the analyzed group amounted to 30%, whereas the median was 20.0%. However, the range of the index presenting the share of sales in new or modified products or services that were introduced in the years 2004-2006 in the total turnover in 2006 was very high and varied between 0% to 100%. This reflects a wide diversity of the surveyed sample of the firms.

The analysed index does not show considerable variations with regard to the firms' size and age. However, differences concerning the type of activity are noticeable. The highest value of the share of turnover generated from novelties was achieved by IT firms (100%). Trading, service and manufacturing firms achieved values close to the average for the whole sample, whereas the value of the index for construction firms was less than half of its value for the whole sample (15%).

The surveyed firms were divided into two categories: (1) the firms with the lower innovativeness level i.e. those characterized by "a lower share of turnover generated from novelties", where the share of turnover generated from novelties in 2006 was less than 30% of the total turnover (58% of the total number of firms) and (2) the firms with the higher innovativeness level i.e. those characterized by "a higher share of turnover generated from novelties", where the share of turnover generated from novelties exceeded 30% of the total turnover (24.7% of the sample). Both groups differ significantly with regard to the value of the index that took the value of 14.6% for the firms with a lower innovativeness level and a high 67% for the firms with a higher innovativeness level (see Table 2).

Table 2: The distribution of firms with respect to innovativeness (in %)

Specification	% of total firms	Index of innovativeness
Firms with a lower innovativeness level	58.0	14.6
Firms with a higher innovativeness level	24.7	67.0

The external conditions of the innovativeness of the surveyed firms were displayed in spatial and market variations. Relatively the most advantageous conditions for the development of innovativeness took place in large agglomerations (the index of innovativeness amounted to 37.6%). On the other hand, the lowest level of the innovativeness index was reported for the firms located in smaller towns (23.3%). As the type of the market where firms operate is concerned, the broader the market the higher the level of the innovativeness index. The highest level of the index was recorded by the firms active on international markets (48%), and the lowest by the firms active on local markets (27.2%).

4.2. The dynamics of employment

The surveyed firms employed 1,851 persons in total. Between 2004 and 2006 they managed to increase an employment level by a small 2% (see Table 3). The span in the growth rate was high. One third of the firms reported an increase in employment, and the next 22.5% of the firms its decrease. The remaining 43.8% of the firms did not show any changes in the level of employment. In the group of growing firms an average increase (an arithmetic mean) of jobs was high and amounted to 37.9%, whereas the median was 21%.

The analyzed index does not present considerable variations with respect to the firm's age, however the differences with regard to the firm's size are noticeable. The larger the firm, the higher index of the employment growth. Between 2004-2006, a decrease in employment by 0.1% was recorded in micro firms, whereas in small firms there was a growth of employment by 3.8% and in medium-sized firms by 7.5%.

Table 3: The change in employment of surveyed firms in the years 2004 - 2006

Specification	2006/2004
Average of employment growth (in %)	2.0

Median of employment (in %)	0.0
Firms with employment growth (in %)	32.1

For further analysis, the firms were split into the two groups: non-growing firms, i.e. those who showed no growth or reduced their employment in the surveyed period (67.5% of the total number of the firms) and growing firms, i.e. those who increased their employment in the surveyed period (32.5% of the total number of the firms). Both groups differ significantly as regards the value of the index of the employment change. For the non-growing firms the index value amounted to -14.7% in the surveyed period, whereas for the growing firms it reached a negative value of -36.9% (see Table 4).

Table 4: The distribution of firms with regard to the dynamics of employment (in %)

Specification	As % of total	Index of change in employment (in %)
Non-growing firms	67.5	-14.7%
Growing firms	32.5	36.9

The external conditions of the employment growth of the firms were displayed in sectoral and spatial variations. Relatively the most advantageous conditions for the growth took place in IT and manufacturing sectors (an average growth of employment for the years 2004-2006 was 94% and 32.7% respectively). The highest drop was reported by trading firms (a decrease by 47%). The most convenient conditions for the growth occurred in large agglomerations (an average rise of employment between 2004 and 2006 amounted to 47.8%). On the other hand, the most profound fall was recorded by the firms located in smaller towns (a drop by 60%%). Also an intensity of the contacts with the external environment has a noticeable influence on the growth of employment of the surveyed firms. The most beneficial conditions in that respect took place in the case of a well developed collaboration with the environment (an average employment growth for the years 2004-2006 was 94%), whereas the deepest decrease occurred in the case of the firms characterized by the moderately developed collaboration with the environment (a fall by 41%).

4.3. The typology of the firms

The combination of the two dimensions, i.e. the innovativeness and the change of employment enables to make a typology of four different types of the surveyed firms. Table 5 presents their distribution by means of the innovativeness index measured by the share of turnover generated in 2006 from novelties introduced between 2004 and 2006 and the change in the employment level. The most numerous group that embraces 50% of the firms (type I) is formed by the firms characterized by a lower innovativeness level and making no changes in employment. This means that half of the surveyed firms do not contribute to a job generation and they are passive with respect to innovation. Also the group of the firms who increase their employment and are characterized by a lower innovativeness level is quite big in numbers and encompasses 21.2% of the firms (type II). The firms that belong to the remaining groups represent a smaller population. These are either the firms where an employment growth is followed by a low innovativeness level (type III – 15.2%) or the firms where a growth of employment is accompanied by a high innovativeness level (type IV – 13.6%).

Table 5: The distribution of the firms with respect to the innovativeness and the dynamics of employment*

Innovativeness			
High level of turnover from innovation	Type III 15.2%	Type IV 13.6%	
Low level of turnover from innovation	Type I 50.0%	Type II 21.2%	
	No growth of employment	Growth of employment	**Dynamics of employment**

** data for 66 firms*

The data presented above indicate a certain extent of independence of both analysed factors, that is the innovativeness and the capacity to generate new jobs. Less than 2/3 of the firms support this relationship (the group I and IV).

The growth of innovativeness of the surveyed firms is accompanied only to a limited extent by a greater capacity to generate new jobs. Only 47.4% of the highly innovative firms did realize their potential for the growth of employment. The remaining 52.6% of the highly innovative firms did not record any growth or just the opposite – their employment level fell (35.7% of the firms) due to personal limitations, resource limitations or the lack of the market acceptance for the introduced innovations.

Basically, a growth of employment takes place without an increase in the innovativeness level of the surveyed firms. 60.9% of the total number of the firms reported a rise in employment at the low innovativeness level, while the remaining 39.1% of the firms at the higher level of innovativeness. This means that a general increase in employment was achieved by the less innovative firms.

Table 6: The selected characteristics by the type of the firm

Type of the firm	Average index of innovativeness (%)	Average rate of employment growth (%)
I	13.6	-10.4
II	17.2	36.4
III	66.5	-14.4
IV	65.0	30.8

The innovativeness and the capacity of the different groups to achieve an employment growth is illustrated in Table 6. The analysis of the data confirms the variations between the groups. The group IV ("glamorous") is characterized by the high levels of innovativeness and the capacity to job generation (65% and 30.8% respectively), whereas the group I („economic core") is marked by the lowest innovativeness level and a low capacity to generate jobs (13.6% and -10.4% respectively).

Table 7: The selected characteristics by the type of the firm (cont.)

Type of the firm	Average employment (in persons)	Rate of exporting firms	Share of firms with innovations new to the world
I	11.6	9.1	6.1
II	50.4	28.6	21.4
III	30.2	40.0	10.0
IV	37.2	33.3	22.2

The separated types of the firms also show significant differences with regard to other economic indices (see Table 7). The group of the firms with a weak dynamics of the employment growth and a low innovativeness level is marked by the highest average employment in the sample. On the other hand, the group of the firms characterized by a higher innovativeness level and simultaneously a higher dynamics of the growth is composed of smallest entities. A bigger size is typical for the firms with a lower dynamics of employment which points to the larger potential of growth of smaller firms. The index of the share of the exporting firms is much lower in the group of the firms with a lower dynamics of the employment growth and a lower innovativeness level as well as the share of innovations new to the world.

5. The assessment of the firms' capacity to grow in the shadow economy conditions

Shadow-economy activities exert their influence on the firms' capacity to grow (see Table 9). However, in the opinion of the enterprises, their influence is rather harmful to their capacity to achieve growth. Nevertheless, it should be stressed that as many as more than one third of the enterprises believe that these activities have a positive influence. This means that a considerable proportion of SMEs have a positive view on the shadow-economy activities as far as the capacity to achieve growth is concerned. Almost one in ten respondents believe that shadow-economy operations may even create very advantageous conditions to build the firms' capacity to grow.

Table 9: The influence of shadow-economy activity on the firm's capacity to grow (% of the firms)

Specification	Firms by employment growth		Firms by innovativeness level	
	Growing	Non-growing	Highly innovative	Little innovative
Definitely favourable	13.0	9.4	10.5	11.1
Rather favourable	34.8	20.8	10.5	31.1
Neutral	8.7	30.2	15.8	24.4
Rather harmful	34.8	32.1	47.4	31.1
Definitely harmful	8.7	7.5	15.8	2.2

The assessment of activities run in the shadow economy conditions as regards their influence on the firms' capacity to grow shows considerable variations for the different categories of the enterprises (Table 9). The enterprises that achieve an employment growth underline more strongly a positive impact of the shadow economy on building growth capacities than non-growing firms (48% and 30% respectively). This may suggest that the shadow economy contributed to the success of the expansion of a considerable portion of

SMEs, or it is considered by the enterprises planning an expansion as a key success factor for this process.
In the opinion of nearly two thirds of the highly innovative firms, shadow-economy activities produce a harmful effect on the firms' capacity to grow. Only one in five enterprises believe the influence is favourable. A different view on the influence of shadow-economy activities on the firms' capacity to grow is presented by low innovative enterprises – 42.1% of them find an influence of the shadow economy on the firms' capacity to grow as favourable, while one third of them share an opposite opinion. These data indicate that shadow economy activities rather do not favour an economic activity. This concerns undertaking investments necessary to launch highly effective technologies due to a high risk and too small a scale of operations, as well as respecting contracts or property rights protection being practically beyond the reach of shadow-economy enterprises.

Table 10: The influence of shadow-economy activity on the firm's capacity to grow by type of firm (% of the firms)

Specification	Type of firm			
	I	II	III	IV
Definitely favourable	9.4	15.4	10.0	12.5
Rather favourable	28.1	38.5	0.0	25.0
Neutral	34.4	38.5	20.0	12.5
Rather harmful	28.1	7.7	50.0	37.5
Definitely harmful	0.0	0.0	20.0	12.5

An influence of the shadow-economy activity on the firms' capacity to grow distinguished by the type of the firm is illustrated in Table 10. The data analysis provides the evidence of the firms' variations. The group II of the firms who increase their employment and have a low innovativeness level is quite distinct as compared with the remaining groups with regard to their very positive assessment of the shadow economy (54% of the firms). Contrary to that, the group III of highly innovative firms with no growth of employment achieved assess the shadow economy in a very negative manner as regards its influence on the growth capacity (70% of the firms). The group of the highly innovative and growing firms have rather a negative view on the influence of the shadow economy on their growth capacities. These data support the previous statements that shadow-economy activities favour rather growth-oriented than innovative activities. However, the shadow economy is not favourable to the most desired activities of firms, that is innovation and expansion that generates new jobs taking place parallelly. A passive role of the shadow economy in building growth capacities was expressed in the opinions of the group I firms that is the firms passive in achieving growth and innovation. The most numerous group of the firms, if already use the shadow economy do it rather for consumption purposes of the entrepreneur's household than for investment and innovation.

6. Conclusions

The analysis of the survey results supports a hypothesis according to which the innovativeness and the capacity to generate employment among Polish SMEs that operate in the conditions of profound market transition are independent to a considerable extent. Less than two thirds of the firms support this relationship: the higher the innovativeness level the higher the capacity to generate new jobs. In the remaining cases (1/3 of the firms) no such

correlation was identified. This indicates a high independence of both dimensions of firms' operations.

It is worth noting that only ca. 14% of the surveyed firms are highly innovative that reported a considerable increase in employment. On the other hand, there were more than 15% of the firms with a higher innovativeness level and moderate (or none) employment growth, i.e. the firms that failed to use their growth potential.

Undertaking shadow-economy activities affects the firms' capacity to grow, however in the opinion of enterprises this influence is rather harmful than favourable. Nevertheless, a proportion of SMEs that have a positive view on the shadow-economy activities – as far as the capacity to achieve growth is concerned - is quite substantial. The assessment of activities run in the shadow economy conditions as regards their influence on the firms' capacity to grow shows considerable variations for the different categories of the enterprises. The enterprises that achieve an employment growth underline more strongly a positive impact of the shadow economy on building growth capacities than non-growing firms. This may suggest that the shadow economy contributed to the success of the expansion of a considerable portion of SMEs, or it is considered by the enterprises planning an expansion as a key success factor for this process.

Highly innovative enterprises assess much stronger than less innovative ones that shadow-economy activities are harmful to their capacity to achieve growth. It can be assumed that the shadow-economy activities do not favour innovative activities that require undertaking investments necessary to launch highly effective technologies due to a high risk and too small a scale of operations, as well as respecting contracts or property rights protection being practically beyond the reach of shadow-economy enterprises.

Shadow-economy activities favour rather growth-oriented than innovative activities. However, the shadow economy is not beneficial to the most desired activities of firms, that is innovation and expansion that generates new jobs taking place parallelly. The most numerous group of the firms, if already use the shadow economy do it rather for consumption purposes of the entrepreneur's household than for investment and innovation.

References (selected):

R. E. Baldwin, *The Effect of Trade and Foreign Direct Investment and Relative Wages*, OECD Economic Studies, vol. 23/1995.

O. Beloled, *Shadow Economy of Ukraine: A Case of Financial Constraints*, National University, "Kyiv-Mohyla Academy", Kijów 2005.

J. Calof, *The Relationship Between Firm Size and Export Behavior Revisited*, Journal of International Business Studies, 2/1994.

Central Statistical Office, *Rachunki narodowe według sektorów i podsektorów instytucjonalnych 2000-2005*, Central Statistical Office, Warszawa 2007

S. Djankow, I. liberman , J. Mukherjee, T. Nenova, *Going Informal: Benefis and Costs*, Word Bank, Working Paper, 2002.

M. S. Feel, *Do Small Innovating Firms Outperform Non-Innovators?*, Small Business Economics, 14, 2000, p. 195-210.

P. Glodek, *Szara strefa – zakres pojęcia i podstawowe obszary badań*, in; E. Stawasz (ed.) Zarządzanie wzrostem małych i średnich przedsiębiorstw zarządzanie wzrostem małych i średnich przedsiębiorstw w kontekście szarej strefy", Lodz University Press, Lodz 2008.

W. Hőlzl, *Is the R&D behaviour of fast-growing SMEs different?* Small Business Economics 33, 2009, p. 59-75.

C. Kalantaridis, J. Pheby, *Processes of Innovation Among Manufacturing SMEs: The Experience of Bedfordshire*, Entrepreneurship and Regional Development 11(1), 1999, 57–78.

B. A. Kirchoff, op.cit., S. Sheikh, T. Oberholzner, *Innovative Small and Medium Sized and the Creation of Employment, Final Report*, Inno-Studies 99 -Lot 9, Vienna, October 2001.

B. A. Kirchoff, *Entrepreneurship and Dynamic Capitalism. The Economics of Business Firm Formation and Growth*, PRAGER, Wesport, London 1994.

P. Schreyer, *High-Growth firms and employment*, STI Working Paper 2000/3; *Technology, Productivity and Job Creation, Vol. 2, Analitycal Report*, The OECD JOBS STRATEGY, Paris 1998.

S. Sheikh, T. Oberholzner, Innovative Small and Medium Sized Entreprises and the Creation of Employment, Inno-Studies 99-Lot 9, IfGH, Vienna, October 2001.
F. Schneider, D. Enste, *Shadow Economies: Size, Causes and Consequences*, Journal of Economic Literature vol. 38/ 2000.
E. Stam, K. Wennberg, The roles of R&D in the new firm growth, Small Business Economics 33, 2009, p. 77-89.
E. Stawasz (ed.) *Zarządzanie wzrostem małych i średnich przedsiębiorstw zarządzanie wzrostem małych i średnich przedsiębiorstw w kontekście szarej strefy",* Lodz University Press, Lodz 2008.
D. Storey, *Understanding the Small Business Sector,* Routledge, London, 1994.
B. Tether,S. Massini, *Employment Creation in Small Technological and Design Innovators in the UK During the 1980s*, Small Business Economics 11(4), 1998, 353–370.
C. C. Williams *Small business and the informal economy: evidence from the UK*, International Journal of Entrepreneurship Behaviour&Research, Vol. 13, No. 6, 2007.
C. C. Williams, J. Round, P. Rodgers, Evaluating the motives of informal entrepreneurs: some lessons from Ukraine, Journal of Developmental Entrepreneurship, Vol. 14, No. 1, 2009.

Summary

Professor Edward Stawasz
University of Lodz
Dr Paweł Glodek
University of Lodz

SMEs innovation and job creation ability in the shadow economy context

Abstract: The presented paper treats about the ability of creating new jobs by innovative SMEs in Poland in the age of a deep transformation of the Polish economy. The authors try to verify the concept of B. A. Kirchoff about the relationship between innovation and enterprise growth. Some sector and market conditions of functioning of innovative SMEs are also analyzed in the paper. A study among 81 Polish SMEs from Lodz region confirms that there is an independence between enterprise innovation and its ability to create jobs. On one side, among analyzed enterprises about 14% was highly innovative fast growing. On the other side, low innovative and slowly growing made a high percentage. The research pointed an important factor of the ability of job creation – sector and market conditions, management problems (lack of experience, problems with gathering the initial capital) and poor public support. The shadow economy has a positive impact on growth rather than on innovation. However, it does not have a positive influence on expansion, innovation and new jobs creation undertaken simultaneously, which is the most desirable activities of the enterprise.

Business Incubators: Creation of a Fit in Armenia

A. Grigorian, T. Ratinho, R. Harms
Nikos, School of Management and Governance, University of Twente.

In this paper, we evaluate the extent to which business incubation services meet tenant's needs. Additionally, we pose the question of whether the current business incubators actually cover the needs of a particular industry. Our empirical setting is a developing country in the Caucasian Region (Armenia) and we chose to research solely the IT industry. We employed a two stage procedure: first, we conducted interviews with pivotal people familiar with business incubation in Armenia; second, an electronic questionnaire survey was sent to the entire Armenian IT population. The results suggest a moderate need of IT companies for the typical business incubation services. Further, we show that incubated companies are generally satisfied with the services they enjoy albeit this satisfaction level decreases as the needs increase. Non-incubated companies, on the other hand, perceive incubation services to be valuable for their development and this value increases when their needs increase. Our study implies that a more extensive service provision is necessary to fully cover the needs of the Armenian IT industry for business incubation services.

1. Introduction

Business incubators (BI) are often seen as an important component of a local economic development strategy. Their intervention is based mostly on addressing market failures by enabling entrepreneurship where it previously was too costly or too risky (Hackett and Dilts 2004b). In the particular context of new high technology based firms, literature has shown that such market failures reduce the access of these companies to essential inputs such as finance (Storey and Tether 1998; Carpenter and Petersen 2002) or appropriate professional networks (Smilor 1987; von. Zedtwitz 2003; Peters. et al 2004).

BIs are perceived to be helpful in achieving these objectives. However, a flexible oversight with dynamic readjustment of incubation programs as dictated by local needs is important for maintaining the vitality and effectiveness of BIs in a cost-effective manner (Hackett and Dilts 2004b). This argument is often emphasized in theorizing about BIs highlighting the importance of a "fit" between what is offered by BIs and what is needed by their tenants. Consequently, in order to be effective BIs do not just have to offer services, they also must offer the adequate services. Mismatches between BI's offer and the tenant's needs might lead to a failure of the incubators. An example is seen when BIs focus their offer entirely on infrastructure while entrepreneurs need high expertise and capital (Carayannis and von Zedtwitz 2005).

Our study set out to research the extent to which Business Incubation Services (BIS) meet tenant's needs. Additionally, we pose the question of whether the current BIs actually cover the needs of a particular industry. Our empirical setting is a developing country in the Caucasian Region (Armenia) and we chose to research solely the IT industry. More extensive insight in the ability of the business incubation system to meet the demand of companies will enable policy makers and other stakeholders in the process of fine-tuning of their business incubation efforts. This is important as a better developed business incubation system can contribute to the economic development of a country as a whole.

2. Literature Review

Previous work on BIS recognizes that incubation is most effective when a fit

exist between the offered services, the service provision approach of the BI and the needs of incubatees. We show that that three important elements need to be considered for evaluating such a fit: *"What"*, *"How"* and *"How Much"*.

2.1. What do BIs offer?

This element refers to the services that BIs offer and the support services needed by incubatees. To understand *"What"* better, it is important to consider the different dimensions along which BIs create value for their incubatees. Bergk and Norrman (2008) categorize the benefits of BIs for their incubatees along five dimensions and discern the main business incubation dimensions as: *Selection*, *Infrastructure*, *Business support*, *Mediation* and *Graduation*.

Selection refers to decisions of BIs concerning which ventures to accept for entry and which to reject. *Infrastructure* concerns localities such as office facilities and administrative services. Through this dimension, BIs generally offer a comparable set of administrative services, including office space and equipment as well as facility-related services and also office services such as reception and clerical services (Mian 1996a; Colombo and Delmastro 2002; Rice 2002; Lalkalka 2003; Lyons and Li 2003; Bollingtoft and Ulhoi 2005; Chan and Lau 2005). *Business Support* is associated with training and coaching activities that are undertaken by BIs to help incubatees develop. Business Support services typically include entrepreneurial training and business development advice, consultancy and other services concerned with general business and legal matters, marketing issues such as advertising and financial assistance (Mian 1996a; Lalkalka 2003; Lyons and Li 2003; Bollingtoft and Ulhoi 2005; Chan and Lau 2005). *Mediation* is concerned with the connection of incubatees to each other and to the outside world. A BI has a bridging function; consequently an important incubator role is to act as an intermediary or mediator between incubatees and relevant external resources. The BI therefore is a network of individuals and organizations including the BI manager and staff, BI advisory board, incubatee companies and employees, local universities and university community members, industry contacts, and professional services providers such as lawyers, accountants, consultants, marketing specialists, venture capitalists, angel investors, and volunteers (Hackett and Dilts 2004b). Finally *Graduation* is related to the policies of BI's regarding exit of incubatees from the incubator.

BIs however not always comprehend all these dimensions in their support provision. For understanding *"What"* it is therefore also important to consider that the actual service mix offered by BIs is affected by the BI taxonomies. Hackett and Dilts (2004b) identify different taxonomies employed in the literature for categorization of differences between BIs. These taxonomies classify BIs on the basis of several elements of differentiation such as the BI's primary financial sponsorship, the nature of incubatees when founded, the business focus of the incubatees and the business focus of the BI. Publicly-sponsored BIs benefit from national and state-government funding sources, while nonprofit BIs benefit from local or community level funding. University-sponsored BIs are funded and operated directly or indirectly by a university. The main objective of universities when promoting a BI is the commercialization of university research and scientific knowledge. Privately-sponsored BIs on the other hand are typically self-funded and are operated in a fashion that resembles hands-on venture capitalists' involvement in venture investments. They can be run by private investor groups, or by the new venture development units of corporations (Hackett and Dilts 2004b). The second element of differentiation is concerned with the nature of the incubatees when funded. More specifically, it refers to whether incubatees are spin-offs and have

been formed through a split from a larger (mother) company or are completely new companies with no such relation. The remaining elements of differentiation are concerned with the focus of both BIs and incubatees.

Carayannis and von Zedtwitz (2005) also strived to explain how BIs differentiate themselves from other startup facilitators (such as venture capitalists, business angels or consulting companies). They suggest that BIs can be classified based on their particular competitive scope, strategic objective and service package (Carayannis and von Zedtwitz 2005). Based on the work of Porter (Porter 1986), they discern four different elements of competitive scope namely; Vertical scope, Segment scope, Geographical scope and Industry focus.

Vertical scope is concerned with how BIs differentiate themselves from other startup facilitators in the business of providing financial and business support to companies in their initial development stages. They differentiate themselves along factors such as the development stage of the clients in their focus (pre-venture, existence or infancy, early growth) and the institutionalization of the coaching and other services they offer. The *Segment scope* is concerned with the actual source of the client companies in terms of any preferences regarding the actual entrepreneurs. University Incubators for instance typically prefer faculty students and staff entrepreneurs from their host university. The *Geographical scope* is concerned with the geographical focus of a Regional Incubator as a natural competitive factor. Network access as a crucial element of successful business incubations is usually bound to a certain region; this motivates BIs to establish a strong local presence. Exceptions do exist as for example Virtual Incubators which base their business models on a variety of startups rather than a certain geographical region. Finally the *Industry focus* is concerned with the focus of BIs on a particular industry such as the IT industry. BIs can have different motivations for choosing such a specific focus such as the preferences of the BI manager or simply for the purpose of creating synergies.

Building on Porter's four elements of competitive scope (Porter 1986) and the distinctive strategic objective (for-profit or non-profit), Carayannis and von Zedtwitz (2005) proposed a classification of five different BI archetypes as the most frequently used BI taxonomies; *Regional Business Incubators*, *University Incubators*, *Independent Commercial Incubators*, *Company-Internal Incubators and Virtual Incubators*. Different authors (Hackett and Dilts 2004b; Bergek and Norrman 2008) recognize a shared office space as a necessary component of BIs. Von Zedtwitz however does not consider co-location as a necessary feature of BIs (von Zedtwitz 2003). This is also one of the underlying factors behind the recognition of Virtual Incubators by some authors (Nowak and Grantham 2000; Durão, Sarmento et al. 2005) and the rejection of these institutions as incubators by others (Bearse 1998; Hackett and Dilts 2004b; Bergek and Norrman 2008).

Influenced by their competitive scope and strategic objectives, BIs provide their incubatees with certain services. They however can incorporate elements of different archetypes. In other words, *"What"* or the actual service mix depends on the focus of the BI as well as the needs and preferences of the incubatees (Nash-Hoff 1998). Regarding the latter, Carayannis and von Zedtwitz (2005) point that the actual mix of services should be developed through an agreement between the incubator and the incubatees.

2.2. How (Much) do BIs offer?

BI's service provision can also be differentiated based on their assistance approaches (Rice 2002; Hackett and Dilts 2004a). Bhabra-Remedios and Cornelious (2003) recognize the effectiveness of the services in relation to the success of the tenants is not only effected by the nature of

the services offered, but also by how services are provided. In line with this, Bergek and Norrman (2008) refer to two different categorizations of how services are provided. These categories describe the dimensions within the different approaches that a BI may have with regard to provision of assistance to incubatees. The first and more specific categorization is that of Hackett and Dilts (2004a). The authors recognize that the provision of services by BIs differ along three dimensions: Time intensity (percentage of working hours devoted to monitoring and assisting incubatees), comprehensiveness (the degree to which assistance includes strategic and operational assistance as well as administrative-related services) and degree of quality (the relative value of the assistance) (Hackett and Dilts 2004b).

The second more general categorization of service provision approaches is the one developed by Rice (2002). He distinguishes three different approaches to service provision: Reactive and episodic counseling takes place when the entrepreneur requests help for dealing with a crisis or problem and the assistance is focused on that specific problem and is generally of limited duration. Proactive and episodic counseling is mostly BI initiated; the BI manager engages entrepreneurs in informal, ad hoc counseling. Continual and proactive counseling is also BI initiated and is present when the venture is subjected to an ongoing review and intense-aggressive intervention by BI managers (Bergek and Norrman 2008).

Our study will attempt to evaluate the fit between BIS provision and the needs of the IT companies regarding BIS in the identified framework of *"What"*, *"How"* and *"How Much"*. In line with this, it is important to create a more extensive understanding of the specific needs of already incubated companies in comparison to non-incubated companies which never received such services.

3. Methods

3.1. Research Procedure

A two stage research procedure was employed for answering the research question. The first stage of the research comprehended interviews with pivotal people involved or related with the business incubation system in Armenia and the second stage was a self-administered questionnaire survey. Such a two stage approach enabled us to use the qualitative data gathered from the in-depth interviews for improving the quantitative data gathering through the survey of IT companies.

Interviews were aimed to help us develop a better understanding of the major issues concerning Armenian IT firms. These in-depth interviews were conducted with entrepreneurs, managers, consultants and other professionals operating within the IT industry. The acquired insight enabled us develop expectations regarding the needs of IT companies for BIS and also enabled us to create a questionnaire that better addressed key issues of concern to these companies.

During the second research stage, the survey questionnaires were administered to the complete population of IT companies in Armenia. The Enterprise Incubator Foundation (EIF) which is a non-profit publically sponsored BI is also the single main BI in Armenia. The study therefore involved companies which did or did not receive any services of EIF. Surveying both on and off-incubator companies allowed us to evaluate how the business incubation system covers the needs of different companies for BIS and make a comparison between these two groups. Such a comparison of non-incubated and incubated companies could provide us with valuable information on the needs of non-incubated companies for BIS and needs of incubated companies after receiving such services. Further, studying incubated firms would help us to analyze the match between the received services and the needs of incubated companies for

BIS. The existence of any gaps in demanded and offered BIS in the framework of the tree elements *"What" "How"* and *"How Much"* was set as a condition for negatively answering the research question.

3.2. Variables

What. To evaluate this element of fit, we categorized the most common BIS under the three main business incubation dimensions as; Infrastructure, Business Support and Network Mediation. The two remaining dimensions namely; Selection and Graduation were less relevant to the Armenian context as very limited selection procedures existed for receiving BIS by companies in Armenia.

The choice for including the selected lines of BIS was based on the most emphasized BIS in the literature, nevertheless, before inclusion; they were also evaluated by the expert panel. The panel evaluated the presented lines of support and provided us with their expert opinion on their relevancy and made suggestion for inclusion or exclusion of different lines of BIS.

Infrastructure was operationalized through three lines of support services namely; office space, R&D facilities and clerical services. Office space and clerical services are often mentioned as common Infrastructural services. In addition, we also studies R&D facilities as relevant Infrastructural services for IT companies as such facilities are assumed to help companies become/stay innovative. Business Support was operationalized through nine different lines of Business Support services namely; training and coaching regarding leadership, business plan development, innovative problem solving techniques, legal matters, project management, financial management, marketing management, HR management and strategic management. With regard to Mediation, BI's mediation regarding seven different relevant external parties namely partners, customers, suppliers, employees, university researchers and financiers was measured. Following the guidance of the expert panel, venture capital was added to the list of Mediation services as this type of investment is found to have specific importance for IT companies in general and more particularly for nascent companies.

Furthermore, variables which indirectly were expected to influence *"What"*, such as the entrepreneurial and managerial education level and experience and the quality of the available infrastructure were used as control variables for evaluating the need for BI services. Through education and work experience individuals develop key skills and enhanced knowledge which positively contributes to the survival of firms (Roberts 1991). The reason for using these variables as control variables was consequently based on the assumption that managers without lower educational levels and work experience would relatively have a higher need for BI support than managers with higher educational attainments.

How. The preferred BI's approach to support provision was operationalized through the two divergent approaches a BI can have to services provision namely; an BI initiated (proactive) service provision approach and an incubatee initiated (reactive) approach. The preferences of companies in this regard were evaluated for service provision in general and the preferred support provision approach with regard to the different lines of Mediation services.

How Much. For measuring the usage of BIS we used "Man Hours per Month" (M.h.p.m) as a unit of measurement. M.h.p.m stands for the total hours that all employees together are using or in case of non-incubated companies expect to use services if offered. Further, square meters were used as a unit of measurement of the need for office space.

3.3. Data analysis

The Mann-Whitney U test was used for analyzing the statistical differences between the need for BIS of incubated and

non-incubated companies. The choice for this particular test was based on the fact that the computations concerned two independent groups and the collected data were ordinal. The Spearman's correlation coefficient was used for analyzing the interrelation between the need and perceived value of BIS. Here, the Spearman's coefficient was chosen as it is based on ranking of two variables and ordinal data.

Further, the needs of both incubated and non-incubated companies regarding different lines of BIS were evaluated on a five point Likert scale. The match between the offered BIS and the needs of the incubated companies was evaluated through a three point scale ranging from *Does not Match*, *Matches* and *Surpasses*. The gathered data was recoded for evaluating the interrelation between the five and three point scales used during data collection.

4. Results

4.1. First research stage

In addition to commenting on the validity and relevance of the questions in the questionnaire, the panel also evaluated *"What"* or the needs of the IT industry for the measured BIS. The panel was requested to rank the needs for BIS through the same scaling used in the survey questionnaire. The evaluations of the needs regarding the different BIS by the panel including the average ranks are illustrated in Annex Table 1.

Generally, the results of first research stage made us expect a large need for BIS by IT companies. Regarding Infrastructure, the results pointed towards a high need for services regarding R&D facilities and secretarial services as these were found to be the most needed lines of support services by the expert panel. The expert panel evaluated office space and bookkeeping services to be the de least needed support services in this regard. Based on the comments of the panel, our initial measurement approach regarding bookkeeping and secretarial services was revised and these two lines of BIS were combined into clerical services as one variable. Such a change was also in line with the literature since the literature considers these services as parts of clerical services.

With regard to Business Support services, the panel found marketing management and project management the most needed lines of Business Support services followed by strategic management and consulting services. The panel also pointed towards certain lines of support services relevant to IT companies which initially were not operationalized. These were training and coaching regarding leadership, innovative problem solving techniques and legal matters. Consulting services and operational management were excluded as they to some degree already were covered by the other lines of BIS operationalized.

Furthermore, the panel found Mediation regarding suppliers and university researchers to be the highest needed line of Mediation by IT companies. Mediation regarding partners was the second most needed line of Mediation. In the questionnaire, direct supply of financing was replaced by mediation regarding venture capital which was considered to be vital and very relevant to IT companies.

4.2. Second research stage

4.2.1. Enterprise Characteristics

11 respondents (20 percent of all respondents) had received BIS of EIF. The remaining 44 respondents (80 percent) indicated not to have received any such services before (See Annex Table 2). Of the incubated companies 45.5 percent were branches of foreign companies when this was only 20.9 present for non-incubated companies.

4.2.2. Entrepreneur Characteristics

Statistically significant differences were only found regarding IT related educational attainments of managers (P=0.05 percent), pointing towards higher

levels of technical IT related knowledge of the managers of incubated companies (See Annex Table 3). In contrary to IT related education, managers of non-incubated companies on average had slightly higher educational attainments regarding business management education.

With regard to working experience, as illustrated in Annex Table 4, 96 percent of all companies had managers with prior IT related work experience who on average also had 13 years of experience in this field. At the same time, 70 percent of companies had manager(s) with prior business management experience.

4.2.3. Need for Business Incubation Services

Regarding *"What"* the first element of fit, the need of IT companies for BIS was smaller than expected, considering the results of the first research stage which respectively pointed towards a large need (See Annex Table 5). Nevertheless, a considerable group of the non-incubated companies needed BIS. Statistically significant differences in the needs of incubated and non-incubated companies were only found regarding business plan development, marketing management support services and Mediation services regarding partners, costumers and financiers. These significant differences of the needs between incubated and non-incubated companies illustrated an interesting pattern of smaller needs by incubated companies. Regarding Infrastructure, 63.6 percent of the non-incubated companies had a need for office space. Further, the need for R&D facilities and clerical services were considerably low as 63.6 and 67.3 percent of all companies indicated not to need such services at all. Such a low need contrasted the expectations of the expert panel.

Furthermore, leadership training and coaching and marketing management were the most needed Business Support services followed by project management and strategic management. The need for these services was in line with the expert evaluations. Regarding Mediation services however, again the expert panel evaluations varied from the actual need indicated by the companies. Here, mediation with regard to costumers was the most needed line of Mediation support followed by mediation regarding employees and financiers.

Concerning *"How Much"*, non-incubated companies clearly perceived a larger usage of Business Support services than incubated companies were receiving. With an average expected use of 22.5 M.h.p.m, non-incubated companies found innovative problem solving techniques to require the highest volume of assistance. Innovative problem solving techniques were followed by marketing management and financial management which on average were expected to require 20 M.h.p.m of support services. The lowest support volumes of Business Support services were needed for project management training and coaching regarding legal matters and strategic management.

4.2.4. Value of Business Incubation Services

During the data analysis we saw that in some cases when there was no need for a service, respondents omitted to indicate the value of such a service if provided. These (missing) responses were corrected with (no value at all) answers. The following correlation analysis showed a significant interrelation between respondents need for infrastructure, business support services and the expected value of these services for the future development of companies. Regarding Mediation services, there only was a significant positive relationship between the need for mediation regarding partners, costumers and financier and the respective value of these services. The positive significant interrelationship between the need for and the expected value of different services pointed towards a higher value perception for these services in case the need for such services increased. In other words, the larger the need for business support services became

the value of these services for the businesses also increased. Table 1 illustrates this interrelation by the correlation coefficient (rs) and the probability of an interrelation through the significance value.

Table 1 Percentage of Companies Categorized by their Perceived Value of Business incubation Services and the Interrelation of the Need for and the Expected Value of BIS.

Lines of support services	*No value at all*	*little value*	*Average value*	*Large value*	*Very large value*	*(r_s)*	*Sig (2-tailed)*
INFRASTRUCTURE							
Office space	31.8%	20.5%	2.3%	.0%	9.1%	0.806	0.000
R&D Facilities	59.5%	2.4%	9.5%	14.3%	14.3%	0.743	0.000
Clerical Services	60.5%	4.7%	18.6%	7.0%	9.3%	0.708	0.000
BUSINESS SUPPORT SERVICES							
Leadership Training and Coaching	37.2	20.9%	9.3%	18.6%	14.0%	0.884	0.000
Business-plan development	51.2%	11.6%	9.3%	16.3%	11.6%	0.979	0.000
Innovative problem solving techniques	48.%	14.0%	4.7%	16.3%	16.3%	0.994	0.000
Project Management	46.5%	9.3%	11.6%	11.6%	20.9%	0.897	0.000
Financial Management	55.8%	7.0%	9.3%	11.6%	16.3%	0.857	0.000
Legal matters	46.5%	11.6%	11.6%	11.6%	18.6%	0.974	0.000
Marketing Management	31.8%	6.8%	9.1%	20.5%	29.5%	0.823	0.000
HR Management	46.5%	4.7%	23.3%	11.6%	14.0%	0.947	0.000
Strategic Management	48.9%	8.9%	8.9%	13.3%	20.0%	0.870	0.000
MEDIATION SERVICES							
Partners	30.2%	9.3%	18.6%	23.3%	18.6%	0.400	0.003
Costumers	21.4%	14.3%	19.0%	21.4%	23.8%	0.316	0.021
Suppliers	63.6%	27.3%	4.5%	4.5%	.0%	0.505	0.000
Employees	52.4%	9.5%	4.8%	19.0%	14.3%	0.620	0.000
University Researchers	66.7%	2.4%	11.9%	14.3%	4.8%	0.467	0.000
Financiers	37.2%	9.3%	11.6%	14.0%	27.9%	0.363	0.007
Equity investors	66.7%	11.9%	9.5%	4.8%	7.1%	0.401	0.003

The correlation coefficient is illustrated as the (rs).

4.2.5. Match of the Needs and Received Services

In order to compute the interrelation between the need for BIS and the satisfaction level of incubated companies an equal number of ranks were required. We therefore, changed the ranking of the needs form a five point to a three point scale. This was done by recoding the ranks 1 and 2 into 1, rank 3 into 2 and the ranks 4 and 5 into 3. Furthermore, during the correlation analysis we disregarded responses indicating no need for support services as dissatisfaction in such cases would be of no avail. Such an analysis allowed us to evaluate whether the high satisfaction level of incubated companies regarding the services they received was only based on a low need for such services or on the actual fit between the needs of these companies and the offered services. The results showed that the offered BIS were highly matching the needs of incubated companies. In case office space and R&D facilities, even all incubated companies found the offered services to be matching their needs. However, despite the high satisfaction level, there was a strong negative correlation between the need for services and the match of the offered

services. Significant negative interrelation was found between the need and satisfaction level of BIS concerning innovative problem solving techniques, financial management, legal matters, marketing management and strategic management, pointing towards a decrease in the satisfaction level regarding the received services as the need for these services increased. The satisfaction level of incubated companies regarding the incubation services received is illustrated in Table 2.

Table 2 Match of the Offered Services with the needs

Matching the needs	*Is less*	*Matches*	*Surpasses*	*(r_s)*	*Sig (2-tailed)*
INFRASTRUCTURE					
Office space	0%	100%	0%	.	.
R&D Facilities	0%	100%	0%	.	.
Clerical Services	0%	81.8%	9.1%	-.143	0.736
BUSINESS SUPPORT SERVICES					
Leadership Training and Coaching	9.1%	72.7%	.0%	0.125	0.749
Business-plan development	9.1%	90.9%	.0%	0.100	0.770
Innovative Problem Solving Techniques	27.3%	72.7%	.0%	-0.908	0.000
Project Management	18.2%	81.8%	.0%	-.241	0.476
Financial Management	20.0%	80.0%	.0%	-1	.
Legal matters	18.2%	81.8%	.0%	-0.809	0.003
Marketing Management	18.2%	81.8%	.0%	-1	.
HR Management	18.2%	81.8%	.0%	-.333	0.317
Strategic Management	27.3%	72.7%	.0%	-.989	0.000
MEDIATION SERVICES					
Mediation regarding Partners	10%	90%	.0%	-.430	0.214
Mediation regarding Costumers	11.1%	88.9%	.0%	-.612	.0.080
Mediation regarding Suppliers	20%	80%	.0%	.	.
Mediation regarding Employees	36.4%	63.6%	.0%	-.357	.345

4.2.6. Service Provision Approach

Regarding *"How"*, the third element of fit; the preferences of companies were quite diverse regardless whether they were incubated or non-incubated. Both reactive and proactive service provision approaches were favored regarding services provision in general. The differences between incubated and non-incubated companies were very small and there were no statistical significant differences in the preferences of these two groups of companies (See Annex Table 6).

With regard to the preferred BI approach to support provision for Mediation services, again the preferences varied very much among companies. As illustrated in Annex Table 7, for mediation regarding partners, costumers and financiers a proactive or BI initiated service provision were more often favored. An incubatee initiated service provision approach was often favored for mediation regarding suppliers, employees, university researchers and equity investors.

4.2.7. Quality of the Available the Infrastructure

The results demonstrated no statistically significant differences between the quality of the available infrastructure for incubated and non-incubated companies (See Annex Table 8). The over majority of companies evaluated the quality of the currently available infrastructure as good and some even excellent. The relative high quality of the currently available infrastructure was therefore in line with the moderate identified need for infrastructural support services.

Moreover, incubated companies found the quality of the available infrastructure to be higher that than non-incubated companies. Additionally, of the incubator tenant companies, 60 percent evaluated the overall quality of the infrastructure as excellent. This percentage was only 16 percent for companies residing outside the incubator premises, indicating a higher satisfaction of tenant companies on the quality of the available infrastructure compared to non-tenant companies.

5. Discussion

Regarding *"What"*, the needs of IT companies for BIS were weaker than initially thought, especially if we consider the moderate level of business management education and experience of managers and also the moderate developed national innovation system in Armenia. Managers with advanced education and business management experience are expected to perform better than those without such skills and consequently are assumed to need less support in this regard (Peña 2004). The moderate need also contradicts suggestions made in the literature regarding high-technology laggard countries where the presence of bridging institutions such as BIs may relatively be more beneficial than in countries where the national innovation system is more advanced (Colombo and Delmastro 2002).

Furher, there was a moderate need for BIS regarding infrastructure. Companies found the quality of the currently available infrastructure to be quite high, which is an important factor influencing the need for BIS regarding infrastructure. Further, a large share of the non-incubated companies had a moderate need for office space; reasonably, this need was smaller for incubated companies as some of these companies were also tenants of EIF. The moderate need for Infrastructural BIS to some degree justifies the primary focus of the current BI system on the other dimensions of BIS as service mix the should depend on both the focus of the BI as well as the needs and preferences of the incubatees (Nash-Hoff 1998). This also suggests that (future) BIs should also have a relative low focus on the provision of Infrastructural services than other BIS. Moreover, the need for R&D facilities was even smaller than the need for office space. We assume that the low need for such facilities is related to the main activities of the Armenian IT companies which do not need extensive R&D facilities as labs to function. The need for such facilities is therefore only likely to increase in case the industry will become more engaged in activities that require higher levels of innovational attainments. Once this is the case it may be better if BIs would base their business models on companies with high needs for such facilities in a certain geographical region which is typical for Regional Business Incubators (Carayannis and Zedtwitz 2005). As an exception, the need of incubated companies regarding clerical services was slightly larger than the indicated need by the non-incubated companies. The need for such services by the incubated companies may have been a reason for some of these companies to be located at the EIF premises.

Business Support was the highest needed dimension of Business Incubation dimensions identified by Bergk and Norrman (2008). Regarding Business Support and Mediation, non-incubated companies perceived marketing management training and coaching and mediation with regard to costumers as very valuable to the future development of their company. This can signify issues regarding the market and costumer orientation of these companies. The small Armenian domestic IT market can be an underlying factor for such a high need for marketing training and coaching and mediation with regard to costumers (EIF 2008). As costumers must be found on the international market this increases the geographic and businesswise distance

between producer and costumer. Therefore, the provision of these services by the Armenian business incubation system may have a crucial effect on the development of the Armenian IT industry.

Financial management involves three major types of decisions: (1) long-term investment decisions, (2) long-term financing decisions and (3) working capital management decisions. These decisions concern the acquisition and allocation of resources among the firms various activities (H K Baker and Powell 2005). The low revealed need for BIS regarding financial management can therefore point towards a low necessity of making financial decisions as for example investments are limited and no sales need to be funded on credit. The extreme low need for mediation regarding equity investments was also interesting in this regard. Logically, such a low need can be caused by two factors, one is that companies already have sufficient access to equity investors, or that companies are not ready to receive financing in exchange of company shares. If the second is causing such a low need, this might also tell us more about the willingness of businesses to invest. Consequently, for the development of the industry it may be interesting to explore what barriers businesses see for investing and developing their business before offering services such mediation regarding equity investors.

Bearing in mind that incubated companies had a significant lower need for BIS than non-incubated companies; it is probable that the currently offered BIS are effective in addressing the needs of the incubated companies. This would also imply that BI is an effective tool assisting the development of the Armenian IT industry. Nevertheless, needs of incubated companies might also have been affected by the nature of these companies as 45 percent of the incubated companies are subsidiaries of foreign companies compared to 20 percent of the non-incubated ones. Being a subsidiary of a foreign company can affect the need for BIS as such a company usually is established for a very specific purpose such as R&D and has a very limited list of responsibilities next to this specific purpose. This is line with the assumption that the role of such a subsidiary is "assigned" to it by the parent company according to such factors as the perceived capabilities of the subsidiary and the strategic importance of the local market (Bartlett and Ghoshal 1986). Companies that for example are solely occupied with performing in-sourcing tasks for their (foreign) mother company are assumed to have limited interest in assistance with regard to marketing management as all marketing activities are carried out by the mother company. This also could be an underlying reason for the large difference between the need for BIS among incubated and non incubated companies.

The results of the study also illustrated that the offering of BIS is perceived to be valuable by non-incubated companies. In other words, non-incubated companies believe that BIS in case offered will be valuable for their development. This implies that the non-incubated companies are likely to become part of the incubation system if the chance occurs. The value perception of this companies and their willingness to participate will have consequences for future incubation initiatives and should consequently be taken into account.

6. Conclusions and Recommendations for Further Research

Regarding *"What"*, the study results suggest that there is a moderate need for BIS by the Armenian IT industry. Nevertheless the high value perception of non-incubated companies and the positive correlation of the perceived value with higher needs suggest that the non-incubated companies find the availability of BIS valuable for their development. There is consequently a considerable

group of non-incubated companies in need of BIS which currently is not served. Furthermore, despite the high satisfaction level of incubated companies, the negative correlation between the need for BIS and the match of the offered services points that the high satisfaction level of incubated companies' currently is a result of the moderate need of these companies for such services. Consequently, BIs fall short to cover the needs of companies if their needs increase. The study results therefore reveal a gap between the need for BIS and the BIS actually offered by the Armenian BIs.

Regarding *"How"*, the second element of fit, the results suggest that both reactive and proactive service provision approaches were favored regarding service provision in general. Currently EIF often tailors it support services to the needs of individual companies. The incubator is therefore able to adjust its approach to the preferences of the incubatees in this regard and utilize this element for increasing the effectiveness of its support provision which is positive (Carayannis and Zedtwitz 2005). There however is a large group of companies which are in need of BIS. Consequently, if the Armenian business incubation system is to cover the complete IT industry such an individual approach may be impossible to maintain by the currently operating BI(s).

With regard to the third element *"How Much"*, there was a large difference between the use of BIS by incubated companies and the expected usage by non-incubated companies. Non-incubated companies need many M.h.p.m of different Infrastructural and Business Support services; however, only limited support exists regarding these business incubation dimensions. Regarding Business Support services, the most M.h.p.m were needed for innovative problems solving techniques, followed by financial management and marketing management. Different components such as R&D facilities and services regarding innovative problem solving techniques are however not offered at all, again pointing towards a gap between the demand for BIS and the offering of these services.

To this end, the findings suggest that the current business incubation efforts in Armenia do not cover the need for BIS of the Armenian IT industry as a considerable need exists which currently is not addressed. Tailored support provision is positive but may be hard to do if not impossible as EIF tries to cover the entire IT population with BIS. The current efforts with regard to business incubation in Armenia are therefore on the right track; however there is much to be done to cover the demand of the IT industry for BIS.

Contribution and Further Research

This work extends prior research on business incubation by targeting the specific needs of IT companies and shedding more light on the needs of such companies in a moderately developed industry with a relative low level of innovativeness. Such a study in this geographical context is an interesting addition to the literature that usually is focused on northern European and American countries where the national Business Incubation and innovation system is more advanced. Moreover, a study of an entire population is quite unique and is to our notice not done before.

In addition, despite the less advanced national business incubation system and the existence of considerable market failures in Armenia, the need for essential inputs and BIS appeared to be moderate. The results of the study, consequently contradict suggestions made in the literature regarding high-technology laggard countries where the presence of bridging institutions such as BIs may relatively be more beneficial than in countries where the national innovation system is more advanced (Colombo and Delmastro 2002).

As, the target group of this study was companies in a moderately developed industry. The extent to which the new

insights gained from this research are generalizable to other geographical contexts and industry development must be tested through follow-up studies. Comparative studies on the influence of industry development and innovativeness level on the need for BIS will also be a valuable addition to the existing literature. It would also be desirable to develop a clearer understanding on the needs of companies with different orientation than the ones studied here. The underlying factors influencing the preference of companies regarding the BI's involvement in support provision are also an interesting point for further research. Such an understanding will contribute to the fit between BIs offering and the needs of their (potential) target companies. BIs could therefore be able to adjust their involvement approach to their target companies before the start of the incubation process. In line with this, further research is also required to assess the necessary measures that must be taken in order to meet the needs of these companies. Respective feasibility studies are needed to assess the most efficient and effective ways of providing the needed support services.

As discussed before, despite being declared a priority sector, the development of the Armenian IT sector has been less intensive as in some other developing countries. Similar research in such countries can shed more light on the needs of IT companies in other context. Hence, it would also be interesting to analyze the needs of the Armenian IT companies in later points in time when the business incubation system in the country has developed further. Such longitudinal studies will allow researchers to further develop the theory on business incubation.

Annexes

Annex Table 3 Evaluation of the Industry Needs by the Expert Panel

Business Incubation Services	*Mr. Kirakosyan*	*Mr. Vardanyan*	*Mr. Yengibaryan*	*Average Ranks*
INFRASTRUCTURE				
Office space	3	4	3	3.3
R&D Facilities	4	5	3	4.0
Secretarial Services	4	5	2	3.7
Bookkeeping Services	4	3	2	3.0
BUSINESS SUPPORT SERVICES				0.0
Consulting Services	5	4	4	4.3
Business Plan Development	2	4	5	3.7
Project Management	5	4	5	4.7
Financial Management	4	4	4	4.0
Marketing Management	5	4	5	4.7
HR Management	4	4	3	3.7
Strategic Management	5	4	4	4.3
Operations Management	2	4	4	3.3
MEDIATION SERVICES				0.0
Partners	5	4	4	4.3
Customers	2	4	5	3.7
Suppliers	5	4	5	4.7
Employees	4	4	4	4.0
University Researchers	5	4	5	4.7
Financiers	4	4	3	3.7
Direct supply of financing by incubator	5	4	4	4.3

Notes: 1 = no need at all, 2 = little need, 3 average need, 4 = Large need, 5 = Very large need

Annex Table 4 Company Origin of Responding Companies

Company Groups	*Foreign Branch*	*Local Company*
Percentage of Incubated	45.5%	54.5%
Percentage of Non-incubated	20.9%	79.1%

Annex Table 5 Percentage of Companies Categorized by Manager's Educational Attainments

Lines of education	*Non-of the managers (1)*	*At least one of the managers (2)*	*All of the managers (3)*	*Average Ranks*	*P-value*
IT related Education					0.050
% of incubated companies	10.0%	20.0%	70.0%	2.60	
% of non-incubated companies	18.2%	50.0%	31.8%	2.14	
Business Management Education					0.284
% of incubated companies	40.0%	60.0%	.0%	1.60	
% of non incubated companies	25.0%	70.5%	4.5%	1.80	

Annex Table 6 Prior Work Experience of Managers

Field of Experience				*Yes*	*No*
% of companies had managers with prior IT related work experience				96.0%	4.0%
% of companies had managers with prior Business Management experience				70.0 %	30.0%
Years of working experience (average 13 years)	**0-5**	**6-10**	**11-20**	**21-30**	**31+**
Years of experience	34.8%	21.7%	21.7%	13.0%	8.7%

Annex Table 7 Percentage of Companies Categorized by their Need for Incubation Services

Lines of support services	*No need at all*	*little need*	*Average need*	*Large need*	*Very large need*	*M.h. p.m*	*Average Ranks*	*P-value*
INFRASTRUCTURE								
Office space								0.148
Incubated	63.6%	9.1%	18.2%	9.1%	.0%	N.A	1.73	
Non-incubated	36.4%	22.7%	22.7%	6.8%	11.4%	N.A	2.34	
R&D Facilities								0.365
Incubated	72.7%	9.1%	9.1%	9.1%	.0%	N.A	1.55	
Non-incubated	61.4%	6.8%	9.1%	11.4%	11.4%	131	2.05	
Clerical Services								0.631
Incubated	63.6%	.0%	18.2%	.0%	18.2%	N.A	2.09	
Non-incubated	68.2%	11.4%	2.3%	11.4%	6.8%	40	1.77	
BUSINESS SUPPORT SERVICES								
Leadership Training and Coaching								0.244
Incubated	54.5%	27.3%	9.1%	9.1%	.0%	2.3	1.73	
Non-incubated	39.5%	25.6%	11.6%	14.0%	9.3%	16.5	2.28	
Business-plan development								0.035
Incubated	81.8%	9.1%	9.1%	.0%	.0%	1	1.27	
Non-incubated	48.8%	14.0%	9.3%	20.9%	7.0%	17	2.23	
Innovative problem solving techniques								0.457
Incubated	48.8%	14.0%	9.3%	14.0%	14.0%	1	2.00	
Non-incubated	63.6%	.0%	9.1%	27.3%	.0%	22.5	2.30	
Project Management								0.185
Incubated	63.6%	9.1%	27.3%	.0%	.0%	1.5	1.64	
Non-incubated	46.5%	16.3%	7.0%	16.3%	14.0%	15	2.35	
Financial Management								0.593
Incubated	72.7%	.0%	.0%	27.3%	.0%	0	1.82	
Non-incubated	60.5%	9.3%	9.3%	14.0%	7.0%	20	1.98	

Annex Table 8 Percentage of Companies Categorized by their Need for Incubation Services (continued)

Lines of support services	*No need at all*	*little need*	*Average need*	*Large need*	*Very large need*	*M.h. p.m*	*Average Ranks*	*P-value*
Legal matters								0.159
Incubated	72.7%	.0%	18.2%	9.1%	.0%	0.5	1.64	
Non-incubated	47.7%	11.4%	18.2%	11.4%	11.4%	15	2.27	
Marketing Management								0.043
Incubated	72.7%	9.1%	.0%	9.1%	9.1%	0	1.73	
Non-incubated	36.4%	6.8%	9.1%	29.5%	18.2%	20	2.86	
HR Management								0.352
Incubated	63.6%	9.1%	18.2%	9.1%	.0%	1	1.73	
Non-incubated	48.8%	14.0%	18.6%	9.3%	9.3%	17	2.16	
Strategic Management								0.070
Incubated	72.7%	.0%	18.2%	9.1%	.0%	0	1.64	
Non-incubated	43.2%	13.6%	6.8%	20.5%	15.9%	15	2.52	
MEDIATION SERVICES								
Mediation regarding Partners								0.040
Incubated	63.6%	9.1%	18.2%		.0%	N.A	1.73	
Non-incubated	34.9%	7.0%	20.9%		18.6%	N.A	2.79	
Mediation regarding Costumers								0.030
Incubated	54.5%	9.1%	27.3%		.0%	N.A	1.91	
Non-incubated	23.8%	14.3%	21.4%		16.7%	N.A	2.95	
Mediation regarding Suppliers								0.142
Incubated	90.9%	.0%	.0%		9.1%	N.A	1.36	
Non-incubated	64.3%	26.2%	4.8%		.0%	N.A	1.50	
Mediation regarding Employees								0.795
Incubated	45.5%	18.2%	18.2%		18.2%	N.A	2.27	
Non-incubated	52.4%	11.9%	9.5%		9.5%	N.A	2.19	
Mediation University Researchers								0.340
Incubated	81.8%	.0%	18.2%		.0%	N.A	1.79	
Non-incubated	69.0%	2.4%	14.3%		4.8%	N.A	1.36	
Mediation regarding Financiers								0.011
Incubated	72.7%	9.1%	18.2%		.0%	N.A	1.45	
Non-incubated	37.2%	7.0%	11.6%		20.9%	N.A	2.84	
Mediation Equity investments								0.161
Incubated	90.9%	.0%	9.1%		.0%	N.A	1.18	
Non-incubated	69.0%	11.9%	11.9%		2.4%	N.A	1.60	

Notes: the average need is based on the following ranks, no need at all =1, little need=2, average need =3, Large need= 4, Very large need =5. M.h.p.m stands for the total hours that all employees together are using or incase of non incubated companies expect to use such services if offered. The correlation coefficient is illustrated as the (r_s).

Annex Table 6 Companies Categorized by the Preferred Service Provision Approach in General and the Statistical Differences between the Preferences of Incubated and Non-Incubated Companies.

P-value = 0.871	*Very Much Reactive*	*Somewhat reactive*	*Neither*	*Somewhat proactive*	*Very much proactive*	*Average Ranks*
Incubated	36.4%	9.0%	.0%	27.3%	27.3%	3.00
Non-incubated	25%	16%	14%	18%	27%	3.07

Annex Table 7 Percentage of Companies Categorized by the Preferred Services Provision Approach for Mediation Services

	Partners	*Costumers*	*Suppliers*	*Employees*	*University Researchers*	*Financiers*	*Equity Investments*
On-demand	48.1%	43.8%	84.6%	56.0%	57.1%	34.6%	58.3%
Pro-active	51.9%	56.2%	15.4%	44.0%	42.9%	65.4%	41.7%

Annex Table 8 Percentage of Companies Categorized by the Quality of the Available Infrastructure and the Statistical Differences between the between Incubated and Non-Incubated Companies.

P-value = 0.094	*Excellent (1)*	*Good (2)*	*Moderate (3)*	*Poor (4)*	*Not-useful (5)*	*Average Ranks*
Incubated	36.4%	36.4%	27.3%	.0%	.0%	**1.91**
tenant companies	60.0%	20.0%	20.0%	.0%	.0%	3.60
non-tenant companies	16.7%	50.0%	33.3%	.0%	.0%	2.17
Non-incubated	11.4%	45.5%	34.1%	9.1%	.0%	**2.05**

References

Bartlett, C. A. and S. Ghoshal (1986). "Tap your subsidiaries for global reach." Harvard Business Review 64(6): 87-94.

Bearse, P. (1998). "A Question of Evaluation: NBIA's Impact Assessment of Business Incubators." Economic Development Quarterly 12(4): 322-333.

Bergek, A. and C. Norrman (2008). "Incubator best practice: A framework." Technovation 28(1-2): 20-28.

Bhabra-Remidos, R. K. and B. Cornelius (2003). Cracks in the egg: improving performance measures in business incubator research. Small Enterprise Association of Australia and New Zealand 16th Annual Conference. Ballarat.

Bollingtoft, A. and J. P. Ulhoi (2005). "The networked business incubator leveraging entrepreneurial agency? ." Journal of Business Venturing 20(2): 265–290.

Carayannis, E. G. and M. von Zedtwitz (2005). "Architecting gloCal (global-local), real-virtual incubator networks (G-RVINs) as catalysts and accelerators of entrepreneurship in transitioning and developing economies: lessons learned and best practices from current development and business incubation practices." Technovation 25(2): 95-110.

Carayannis, E. G. and M. v. Zedtwitz (2005). "Architecting gloCal (global-local), real-virtual incubator networks (G-RVINs) as catalysts and accelerators of entrepreneurship in transitioning and developing economies: lessons learned and best practices from current development and business incubation practices." Technovation 25(2): 95-110.

Carpenter, R. E. and B. C. Petersen (2002). "Capital market imperfections, high-tech investment, and new equity financing." Economic Journal of Business Venturing 112: F54–F72.

Chan, K. F. and T. Lau (2005). "Assessing technology incubator programs in the science park: the good, the bad and the ugly. ." Technovation 25(10): 1215–1228.

Colombo, M. G. and M. Delmastro (2002). "How effective are technology incubators?: Evidence from Italy." Research Policy 31(7): 1103-1122.

Durão, D., M. Sarmento, et al. (2005). "Virtual and real-estate science and technology parks: a case study of Taguspark." Technovation 25(3): 237-244.

EIF (2008). Armenian Information Technology Sector State of Industry Report. Yerevan, Enterprise Incubator Foundation: 20.

H K Baker and G. E. Powell (2005). Understanding financial management: A practical guide Door Oxford, Blackwell Publishing Ltd.

Hackett, S. M. and D. M. Dilts (2004a). "A real options-driven theory of business incubation. ." Journal of Technology Transfer 29 (1),(55–82).

Hackett, S. M. and D. M. Dilts (2004b). "A Systematic Review of Business Incubation Research." The Journal of Technology Transfer 29(1): 55-82.

Hackett, S. M. and D. M. Dilts (2004b). "A Systematic Review of Business Incubation Research." Journal of Technology Transfer 29(1): 55-82.

Lalkalka, D. (2003). Current trends in business incubation. The Africa Regional

Conference on Business Incubation. Bagamayo, Tanzania,.

Lyons, T. S. and S. Li (2003). The state of the Wisconsin incubation industry in 2002: an analysis of the results of the survey of membership, Report prepared for The Wisconsin Business Incubator Association.

Mian, S. A. (1996a). "Assessing value-added contributions of university technology business incubators to tenant firms." Research Policy 25(3): 325–335.

Nash-Hoff, M. (1998). For-profit incubators—An industry survey report. N. Publications. Ohio.

Nowak, M. J. and C. E. Grantham (2000). "The virtual incubator: managing human capital in the software industry." Research Policy 29(2): 125-134.

Peña, I. (2004). "Business Incubation Centers and New Firm Growth in the Basque Country." Small Business Economics(22): 223–236.

Peters. et al (2004). "The Role of Incubators in the Entrepreneurial Process." Journal of Technology Transfer 29: 83-91.

Porter, M. (1986). Competition in Global Industries: A Conceptual Framework. Boston, Harvard Business School Press: pp. 15–60

Rice, M. P. (2002). "Co-production of Business Assistance in Business Incubators: An Exploratory Study." Journal of Business Venturing 17: 163–187.

Rice, M. P. (2002). "Co-production of Business Assistance in Business Incubators: An Exploratory Study." Journal of Business Venturing 17: 163–187.

Rice, M. P. (2002). "Co-production of business assistance in business incubators: an exploratory study." Journal of Business Venturing 17(2): 163-187.

Roberts, E. B. (1991). Entrepreneurs in High Technology. Oxford, Oxford University Press.

Smilor, R. W. (1987). "Managing the Incubator System: Critical Success Factors to Accelerate New Company Development." IEEE Transactions on Engineering Management EM 34(4): 146–156.

Storey, D. J. and B. S. Tether (1998). "Public policy measures to support new technology-based firms in the European Union. ." Research Policy 26(1037–1057).

von Zedtwitz, M. (2003). "Classification and management of incubators: aligning strategic objectives and competitive scope for new business facilitation." International Journal of Entrepreneurship and Innovation Management 3(1/2): 176 –196.

Government's Role as Public Venture Capitalist in High-Technology Small and Medium Sized Enterprises

Jan Petrus Grundling, Lizl Steynberg & Anrui Wang
Centre for Entrepreneurship, Tshwane University of Technology, South Africa
Private Bag X680, Pretoria South Africa 0001
Tel: +27 12 3825583 E-mail: grundlingjp@tut.ac.za

Productivity growth is dependent on technological advancement. However, capital constrains commercialization of technology, which venture capital could solve. Still, a capital supply gap exists between venture capital and technology commercialization, especially in the start-up stages of high-technology enterprises. The outcome of this research will provide guidelines for participation in the public venture capital industry. This research introduce the government as public venture capitalist for filling the gap between technology opportunities and technology commercialization and found that the government plays an important role in high-technology enterprises in developing countries. Further, the venture capital industry adopts various operational models, especially in developing countries that lacks legal and accounting infrastructure. In the infancy stage, government plays a catalyst, but indispensable role.

Introduction

Prevailing economic thought argues that technology is a key production factor along with capital and labour (Solow, 1956; Solow, 1957; Romer, 1986; Romer, 1987; Romer, 1990). Thus, the government including industrial and developing countries give more priority to the development of science and technology (S&T), and they formulate various policies and public programmes to directly and indirectly boost S&T innovation and development. These programmes emphasize the crucial role of innovation, higher education and Research and Development (R&D), in which innovation is an expression of the productive use of knowledge, and technology-based enterprises are recognized as active innovators and important contributors to technological progress and economic growth.

Given these motivations, the formidable link between innovation and entrepreneurial activity in the world has become increasingly important. People are now aware of this link and have begun to emphasize the ways entrepreneurship leads to greater national and global prosperity (Timmons & Spinelli, 2003). In these linkages, one form of government assistance is public or government venture capital programmes that are suppose to bridge the significant funding gap between innovation and commercialization.

Venture capital is alternately described as the engine fuelling innovation in the economy and as the instrument that fuelled the boom and bust of high-technology enterprises. Research on venture capital in developing countries has not emerged until very recently (Lerner & Schoar, 2002; Cummings, Fleming & Schwienbacher, 2005). In reality, governments as public venture capitalists, especially in developing countries, are playing an important role and have

set up public venture capital programmes. Although public venture capital programmes have become increasingly popular, it is not without controversy.

Positive arguments

Market failure has been a main economic justification of government programmes. Stiglitz (2000) summarizes six types of market failures namely incomplete markets, public goods, externalities, information failures, imperfect competition, and unemployment and other macroeconomic disturbances. Proponents of public venture capital programmes use the first four market failures as argument to support their position and assert that capital market failure leads to a funding gap and underinvestment in technology SMEs.

Negative arguments

The opponents' biggest concern is the set of various distortions created by government programmes. One distortion is the rent-seeking behaviour of interest groups or politicians that take advantage of government programmes and their own benefits from possible beneficiaries (Buchanan & Tollison, 1984); another distortion is that bureaucrats may select enterprises based on their likelihood to succeed instead of the actual funding need in order to claim credit for the enterprises' ultimate success (Cohen & Noll, 1991; Wallsten, 2000).

The debate about public venture capital programmes is a classical argument centered on market and government failures in the context of investment in Technology Small and Medium Enterprises (TSMEs). It is disputed whether government should become a venture capitalist and directly finance TSMEs. More proponents stress market failure as a defensible reason for providing sufficient seed funds to start-up TSMEs. Another concern is that government action could distort market mechanisms in the VCI. In either case, it is agreed that a significant funding gap exists in start-up TSMEs (Moore, 1994; Murray & Lott, 1995; Sohl, 1999; Hall, 2002). The above debate is briefly summarized and synthesized in Figure 1.

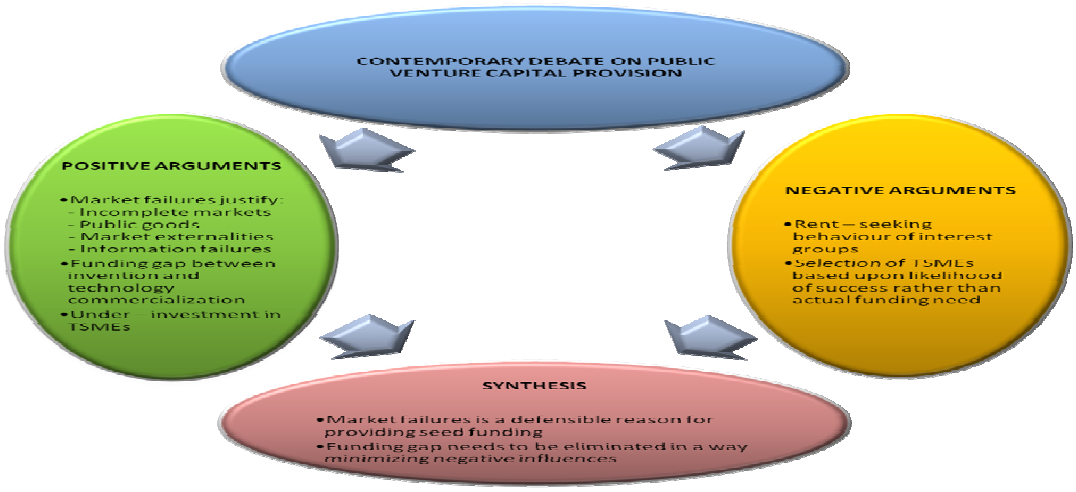


FIGURE 1: Summary and synthesis on public venture capital motivation

Problem description and statement

The literature review indicated that the most of private venture capital are invested into the expansion stage of new TSMEs rather than into the seed or start-up stages, to avoid the higher risk in these early stages of technology commercialization. This financial gap is experienced by certain types of TSMEs, due to their investment demand range (it is more difficult to attract minor investments than major investments), life-cycle stage (start-up enterprises face more problems than established ones), the technology concerned (high TSMEs are at a disadvantage compared to those applying less advanced technology), or geographical location (TSMEs in the periphery will find it more difficult to access capital than those in the centre) (Harrison & Mason, 2000). In many Organization for Economic Cooperation and Development (OECD) countries, the share of start-up and other early stage investment are insignificant, and thus leave many TSMEs to battle with cash constraints, particularly those in the seed and start-up phases (OECD, 2003). It can be speculated that this constraint is even more serious in developing countries where the shortage of mature financial marketing mechanisms exist.

Thus, the question could be asked: ***"How could high technology small and medium enterprises (TSMEs) access financial support in their early stages?"*** A second question of equal importance, which needs to be addressed, is: ***"What is the basic function of government in the fostering of high technology small and medium enterprises (TSMEs) in the early stages?"*** The domain of the above question is restricted to the following secondary questions:

- Why is public capital support more important in developing countries than developed countries?;
- What are the approaches that government could utilize in developing TSMEs?; and
- How can government, as a public venture capitalist, perform more efficiently in a venture capital investment programme?

The research problem is therefore presented as a government challenge in filling the technology commercialization funding gap as depicted in Figure 2.

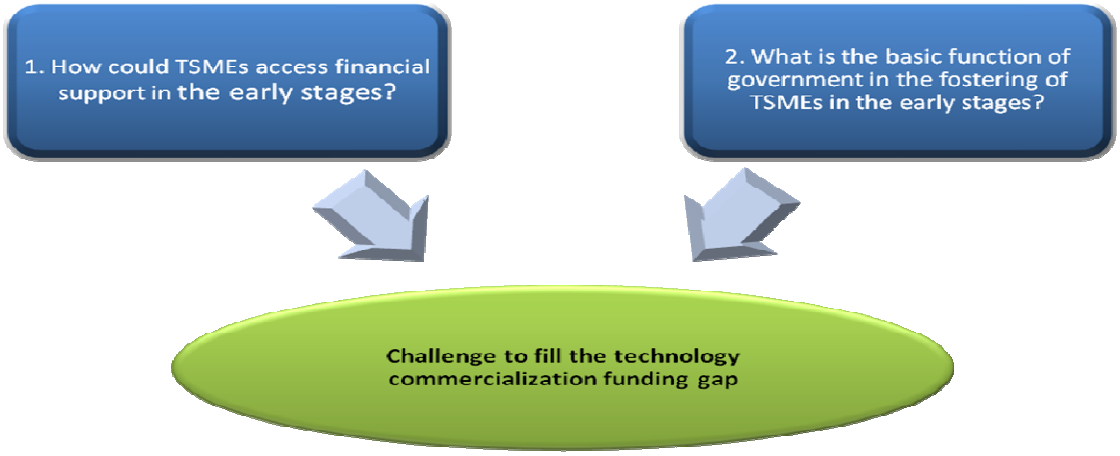


FIGURE 2: The government TSME challenge in technology commercialization

Study design and method

The study design is based upon a system theory case study approach. In this research the

particular phenomena is to understand the public venture capital provision by governments in developing countries taking China as example, and the United States of America, Europe, Japan and Singapore as developed countries. In China, three TSMEs cases were studied, namely:

(i) Suntech Power Holding Co. Ltd.; interested in TSMEs technology commercialization that received public venture capital and government support;

(ii) China New Technology Venture Investment Corporation (CNTVI); a central government owned company, trying to provide funding channels to technology-based enterprises as compared to the government's traditional Science and Technology (S&T) system which failed to transform Research and Development (R&D) output into commercial technologies. It was closed by the People's Bank of China on June 22, 1998; and

(iii) Innovation Fund for Small and Medium Technology-based Enterprises (Innofund); it was set up in 1999 after the CNTVI went bankrupt in 1998. It represents a milestone in China's public venture capital practice, and has become a model for the Chinese public venture capital programmes.

The questionnaire and interview survey

To deeper probe the practical experiences in the real industrial environment, the researcher designed 30 questionnaires and 10 interview surveys which were administrated in China.

Hypotheses and narrative impressions

Two hypotheses will be tested using the data obtained from the structured questionnaire, namely:

The first hypothesis:
H_0: The technology small and medium enterprise entrepreneurs are dispassionate in attitude towards public venture programmes.
H_a: The technology small and medium enterprise entrepreneurs have a positive attitude towards public venture capital programmes.

The second hypothesis:
H_0: The technology small and medium enterprise entrepreneurs are indecisive in their expectations of the barriers that exist in the industrial environment.
H_a: The technology small and medium enterprise entrepreneurs are decisive in their expectations of the barriers that exist in the industrial environment.

The open-ended interviews were intended to obtain a general impression from the 10 interviews on their:

- Experiences of the major problems experienced by high technology firms to access venture capital;
- Identification of the single most helping factor in the public venture capital system that will enable high technology enterprises to finance their activities;
- Learning experiences in the venture capital industry in developed countries that could be transferred to developing countries.

- Main considerations when high technology enterprises apply for government financial support?
- Opinions regarding the Chinese Government's programme to provide public venture capital to support the growth of high technology enterprises;
- Opinions whether public venture capital will eventually push out private venture capital investment activities;
- Preferences if they could chose freely between public venture capital and private professional venture capital investment;
- Understanding of the principal difference between public venture capital and other forms of private equity venture capital; and
- Views about the principal obstacles or problems experienced by entrepreneurs in the Chinese venture capital market;

It is important to indicate that the analysis was done according to the "Triple Helix" model (Etzkowitz & Loet, 1997) and according to the "Agency Theory" (Jensen & Meckling, 1976). These two analyses methods were used to justify the necessity for government venture capital support and intervention in developing countries, and address the first research question. To answer the second research question, the researchers developed an "Arrow Pattern" that outlines a possible policy to guide government programmes and actions in the venture capital industry. The development of an "Arrow Pattern" was done in conjunction with a comprehensive secondary literature data analysis (Figure 3).

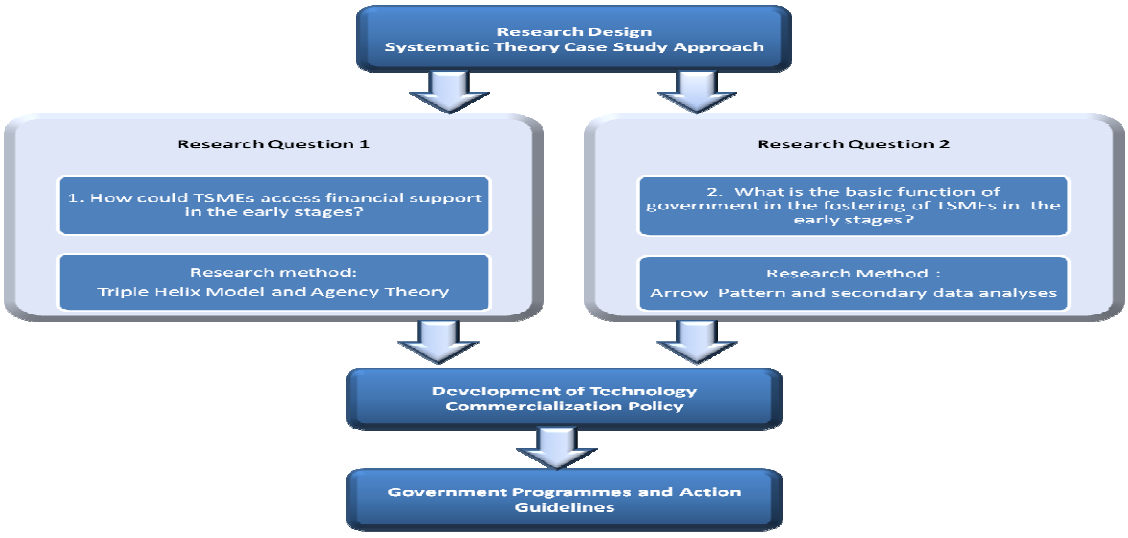


FIGURE 3: Research design and method

Opinions held by surveyed technology small and medium enterprise entrepreneurs

Sample description

Of the 30 subjects selected to participate in the study, only 25 entrepreneurs demonstrated a willingness to participate in the questionnaire survey research. The remaining 5 selected subjects were excluded from the research after numerous participating requests by e-mail and telephone. It was assumed that these subjects were not willing or motivated to participate in

the research. Further to the questionnaires, a total of 10 telephonic interviews were conducted. Figure 4 gives an indication of the composition of the questionnaire surveyed respondents participating in the research, whilst Figure 5 gives an indication of the respondents participating in the interviews.

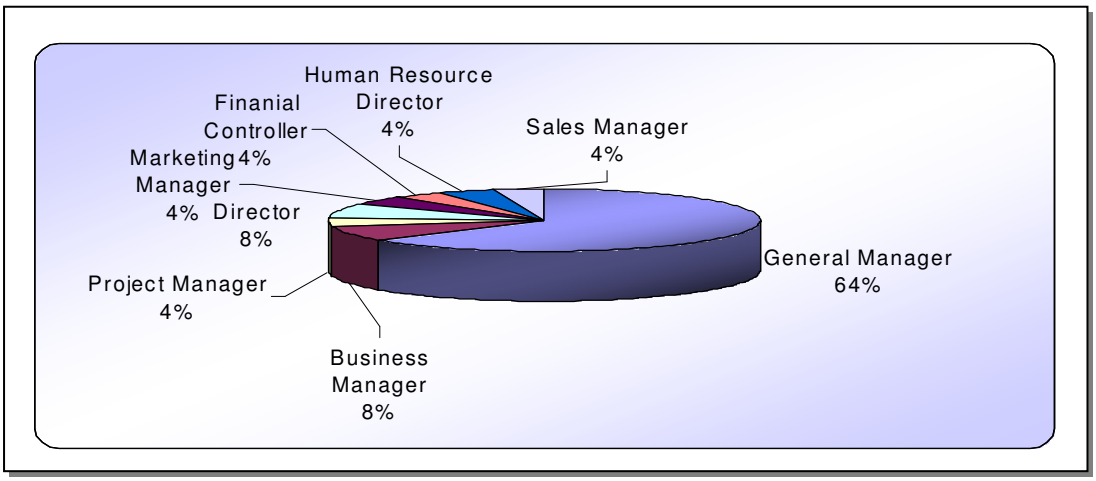


FIGURE 4: Composition of survey respondents in enterprises (n=25)

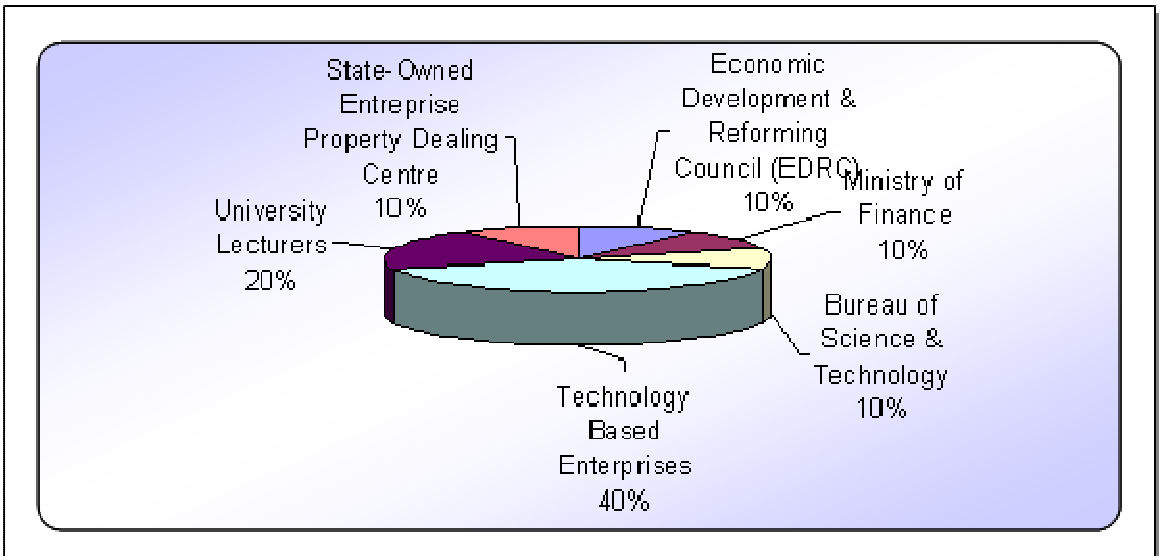


FIGURE 5: Composition of interview respondents in enterprises?

A more detailed profile description of the high technology small and medium enterprises participating in the questionnaire survey is described in Table 1. A total of 25 enterprises participated in the survey research.

TABLE 1: Enterprise profile description of high technology small and medium enterprises

Business Activity	Product Classification	Economic Sector	Business Phase		Employees				Total
					Less than 100	101-300	301-500	501 or more	
Logistics Provider (N=1)	Rail, road & transport equipment (N=1)	Real estate, renting & business activities	Expansion stage				1		1
Manufacturer (To multiply finished products using various processes, machines and energy) (N=7)	Pharmaceuticals (N=1)	Manufacturing	Stock exchange listed			1			1
	Radio, TV & communi-cation equipment (N=1)	Manufacturing	Stock exchange listed					1	1
	Electrical machinery & apparatus (N=1)	Manufacturing	Expansion stage			1			1
	Chemicals excluding pharmaceuticals (N=1)	Manufacturing	Buy-out stage					1	1
	Machinery & equipment (N=3)	Manufacturing	Phase	Buy-out stage				1	1
				Stock exchange listed				2	2
Producer (To create something i.e. converts inputs into outputs) (N=13)	Pharmaceuticals (N=2)	Manufacturing	Stock exchange listed					2	2
	Radio, TV & communi-cation equipment (N=1)	Manufacturing	Early development stage				1		1
	Electrical machinery & apparatus (N=1)	Manufacturing	Expansion stage				1		1
	Chemicals excluding pharmaceuticals (N=4)	Manufacturing	Phase	Early development stage		1	0	0	1
				Expansion stage		0	1	0	1
				Stock exchange listed		0	0	2	2
	Basic metals & fabricated metal products (N=2)	Manufacturing	Phase	Start-up stage		1			1
				Buy-out stage		1			1
	Food products, beverages & tobacco (N=3)	Manufacturing	Early development stage		1				1
		Health & social work	Phase	Buy-out stage				1	1
				Stock exchange listed				1	1
Research & academic (N=1)	Office, accounting & computing machinery (N=1)	Agriculture, hunting & forestry	Early development stage		1				1
Service centre (N=1)	Radio, TV & communi-cation equipment (N=1)	Transport, storage & communications	Early development stage		1				1
Technology provider (N=1)	Office, accounting & computing machinery (N=1)	Transport, storage & communications	Early development stage		1				1
Trader (N=1)	Other non-metallic mineral products (N=1)	Wholesale & retail trade	Early development stage			1			1
Total					4	6	4	11	25

Quantitative data analysis of the survey

The first analysis intended to test the hypothesis on whether technology small and medium enterprise entrepreneurs are dispassionate in attitude towards public venture programmes. A total of five questions were posed to test this hypothesis, one question tested by the bi-nominal test, whilst the remaining four questions will be tested by means of the chi-square (χ^2) test. The findings are presented in Tables 2 and 3.

Tables 2 and 3 provide partial support for rejection of H_0 on two of the five questions posed thus revealing that high technology small and medium enterprise entrepreneurs are indeed passionate in attitude about some aspects of public venture capital. In the first place, the majority was motivated to apply for and to receive some form of public venture capital (Table 2). The respondents also consider the help provided by existing public venture capital as having a helpful effect on their enterprises. However, it seems that the entrepreneurs were dispassionate in attitude about participating in public venture capital programmes for the use of technology and innovation, the kind of venture capital receiving and whether the Chinese Government's promotion on the use of technology will indeed help their enterprises to excel (Table 3).

TABLE 2: Bi-nominal test for making use of public venture capital support

Item Description	Response	N	Observed Prop.	Test Prop.	Exact Sig. (2-tailed)	Point Probability
Q10: Public Venture Capital Support Received	Yes	23	.92	.50	0.0000**	0.0000**
	No	2	.08			
	Total	25	1.00			

TABLE 3: Opinions on public venture capital

	Kind of Support	Interest	Helpfulness	Technology Promotion
Chi-Square	6.286	4.880	13.520	4.750
df	4	2	2	2
Sig.	.120	.160	.000	.200

Possible reasons to explain this phenomenon can be deducted. It seems that these enterprises are willing to take any kind of support from the Chinese government to enhance and empower their enterprises and to demonstrate their credibility in the business environment. Another possible explanation is also that any form of government financial support aligned with the policy framework of the country, serves as a confidence boosting instrument indicating to the enterprise that it is moving in the right direction. It can furthermore be speculated that any kind of support by a government, could be used as a form of security to raise further capital.

This result is not surprising as the reputability of a government evaluation and support in China for an investment, supported by the Chinese government, is a strong motivation to local governments and financial institutions to support such ventures. This type of trust in the transferability of the kind of support can only be attributed to the highly structured nature of the planned economic system that exists in China. Any form of support by a higher hierarchy in the Chinese culture, create a perception of trust in the mind of customers and investors. Despite the fact that no preferred public venture capital support could be identified, Figure 6 provides an indication of the most received public venture capital support programmes by the participating high technology small and medium enterprises.

From these results it appears that that the most popular forms of public venture capital support programmes in descending order is: debt finance, free finance, preferential taxation treatment, guarantees and equity investment. Because of the small sample size, no conclusive conclusion could be deducted. However, one may deduct that the government may prefer to provide support of a kind, like debt finance, that demands some form of responsibility and risk from technology small and medium enterprises instead of providing free handout support that does not create a challenge or obligation to enterprises.

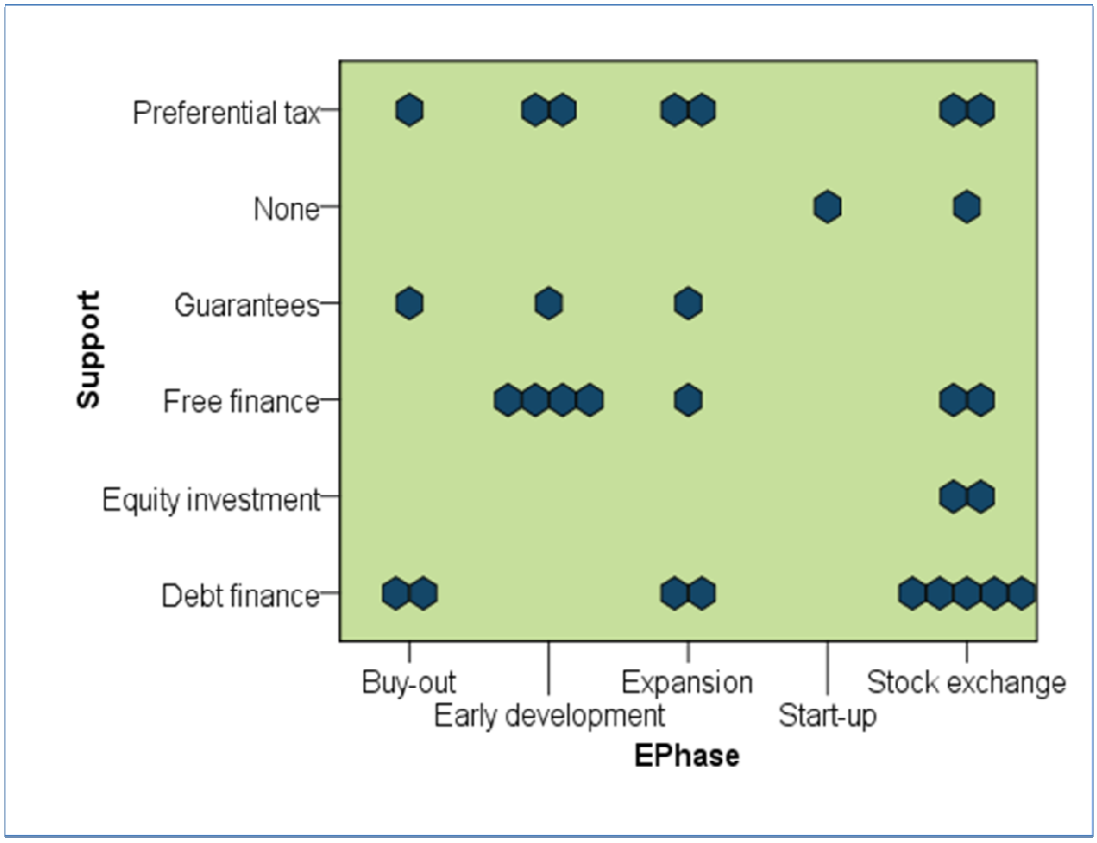


FIGURE 6: Most received public venture capital support programmes

The second analysis intends to test the hypothesis that technology small and medium enterprise entrepreneurs are indecisive in their expectations of the barriers that exist in the industrial environment.

Table 4 reveals that H_0 should be partially accepted to indicate that high technology small and medium enterprise entrepreneurs are indecisive in their expectations of the barriers that exist in the industrial environment. The smaller the χ^2-values, the greater the chance that differences between the reported responses (observed) and the expected responses can be contributed to chance and not because of decisive responses.

A possible reason for the indecisiveness of the above items, may be that the respondents did not have sufficient information on items posed to them as all the above questions relates to barriers in the industrial environment that are not enterprise specific. Whilst, the items in which significant differences occurred leading to the rejection of the H_0 (Table 5) relates directly to enterprise specific issues or were directly experienced by the enterprise, enabling them to express an opinion.

TABLE 4: Items in which the H_0 is accepted

Item	Test Statistic		
	chi-square (χ^2)	df	Exact sig.
The Chinese Government procure insufficient amounts of high technology products	1.0400	2	0.6750
Enterprises has not yet become the backbone of research and development investment in	1.0400	2	0.6750
High technology enterprises need more support to succeed in the external environment	1.5200	2	0.5050
Regulation of intellectual property is not sufficient	2.0000	2	0.4100
registration fees in is too high	3.9200	2	0.1700
Competition from overseas high technology enterprises is high	4.2800	3	0.2460
My enterprise is short of professional employees	4.6000	3	0.2120
There is a legal lack of protecting investment in research and development	5.3330	3	0.1520
My enterprise lacks a management system to protect intellectual property rights	6.2000	3	0.1060

TABLE 5: Items on which the H_0 is rejected

Item	Test Statistic		
	chi-square (χ^2)	df	Exact sig.
I expect that government finance can support my enterprise in future	22.5200	3	0.0000
Government as public venture capitalist plays an important role in fostering high technology enterprises	11.2000	4	0.0240
Great obstacles are experienced in the international marketing of high technology products	11.0000	3	0.0110
The value-added tax (VAT) on technology based enterprises in is heavy	11.0000	3	0.0110
Research and development investment in represents a too low percentage of the GDP	9.9200	2	0.0070
The transparency of public venture capital for high technology enterprises is low	9.3330	3	0.0220
The taxation policy and regulation in is unstable and imperfect	8.7600	3	0.0320
I believe that the Chinese Government can provide stronger protection of high technology intellectual property rights	8.3330	3	0.0450
The accessibility of professional private equity venture capital is difficult to obtain in	8.1200	3	0.0410
The equity market in is not mature	8.1200	3	0.0410
Preferential taxation treatment of high technology enterprises in is not sufficient	7.2800	2	0.0300
Company registration procedures in is too complex	6.3200	2	0.0410

Another reason for the indecisiveness may be that if one assumes that the respondents did have sufficient information to interpret the above questions, then it may imply that insufficient consensus exist amongst respondents on the barriers that exist in the industrial environment and that some respondents consider the barriers in the industrial environment as not too challenging to overcome whilst others may experience some difficulties to overcome these barriers. Nevertheless, it cannot be concluded that the above barriers are conducive for conducting business in high technology small and medium enterprises.

Table 5 provides clear evidence on the decisiveness of entrepreneurs in high technology small and medium enterprises of barriers that exist in the industrial environment that demands intervention.

It can be synthesized that government has a definite role to play to support high technology small and medium enterprises, especially with regards to the promotion of high technology products, filling the financial gap by means of public venture capital programmes, and through good regulatory policies like the taxation policy, protection of intellectual property rights, policy transparency procedures, and simplification of venture capital provision procedures. A strategy is also required to ensure proper investment by the government in research and innovation for high technology small and medium enterprises. The support role of government through public venture capital programmes is therefore sufficiently proven by Table 5, whilst speculative suggestions for support were provided by Table 4.

The major problems experienced by high technology enterprises to access venture capital

The respondents have identified three major problems experienced by high technology enterprises trying to access venture capital namely:

- The financing channel for technology enterprises are limited in terms of numbers as well as too limited information exist to discover and identify venture capitalists in the market;
- Public venture capital is the principal aim of technology enterprises seeking venture capital resulting in an under emphasis of other sources of venture capital and an over demand for public venture capital; and
- Unless high technology enterprises have well-developed management teams they may experience huge problems to convince venture capitalists to provide venture capital to overcome the financial gap.

The role of government according to 'Triple Helix' model

The 'Triple Helix' model (Figure 7) represents a new perspective in modern innovation theory, expressing the interactive relationship between the university- industry-government, it is considered to be the key to improve the conditions for innovation in a knowledge-based society (Etzkowitz & Loet, 1997).

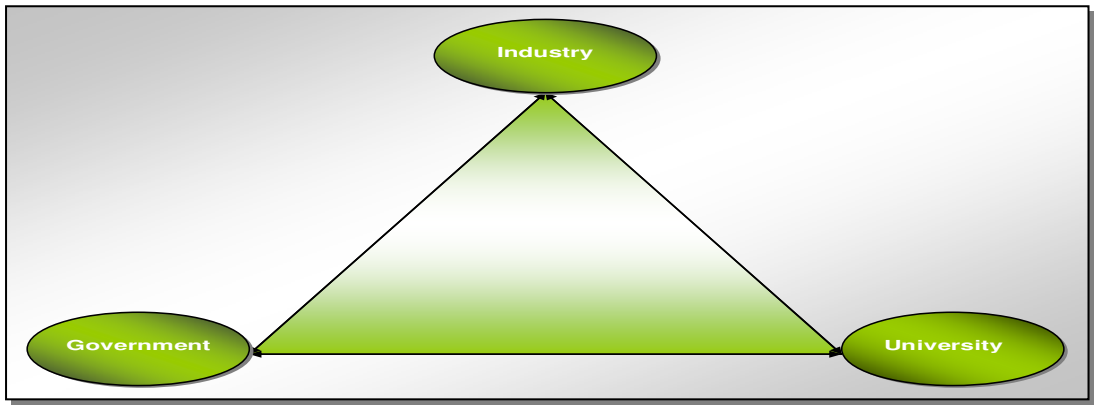


FIGURE 7: The Triple Helix Model (Etzkowitz & Loet, 1997:14-19)

Figure 8 provides a more detailed content on the role of each member belonging to the Triple Helix model in terms of interaction circles.

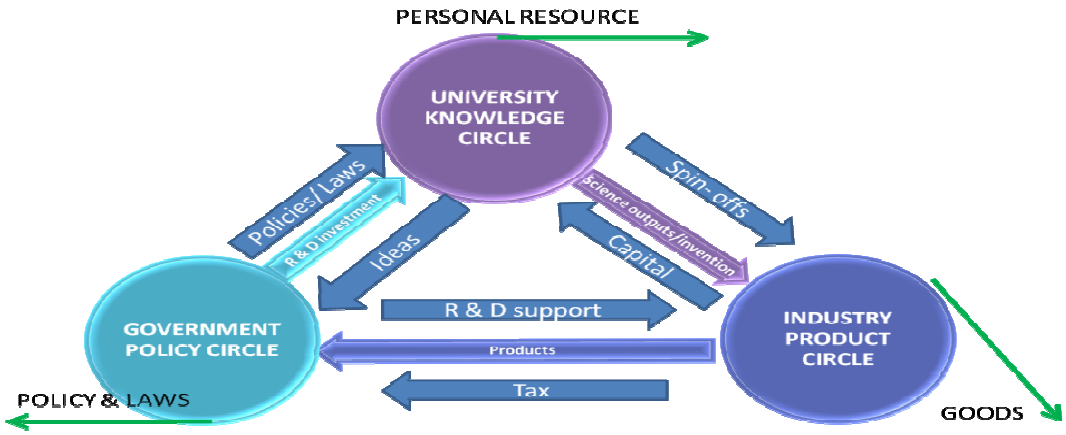


FIGURE 8: Triple Helix-field interaction circles (Etzkowitz & Zhou, 2006)

Figure 8 is showing the innovation process in university and industry, through the formulation of policies, enacting laws, direct investment or indirectly encouraging (venture) investment, government stock, as well as promoting high technology small and medium sized enterprises (TMSEs). Strauss (2001) for example has systematically examined the role of government activity in the economic growth of 64 industrialized and developing countries, considering both the expenditure and financing aspects of government. Strauss's examination concluded that the role of *good* government is important, especially in developing countries, where government action falls into three broad categories. Firstly, the government can have a creative function. Secondly, government policies such as tax policies and regulations of venture investment, directly affect the venture capital industry. Thirdly, laws and regulations governing pension funds, stock markets, labour markets, patents, as well as other areas; affect the venture capital industry indirectly. Hellmann (2000) supported these conclusions and derived five institutional forces that affect the vitality of the venture capital industry of a country (Figure 9).

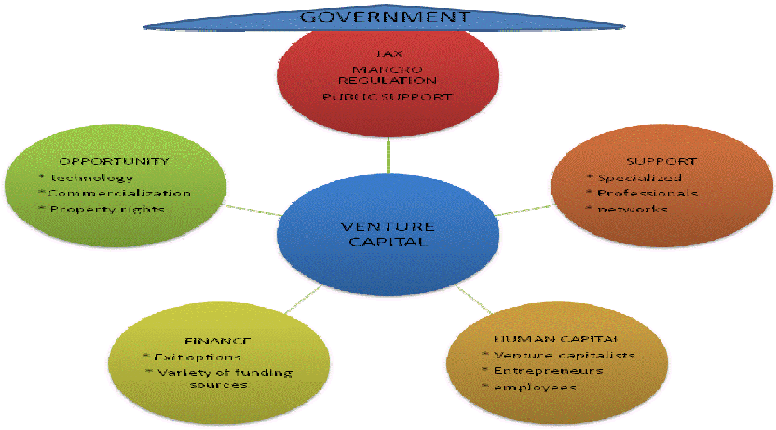


FIGURE 9: The five institutional forces that affect the vitality of the venture capital industry (Source: Hellmann, 2000: 2)

Examples of venture capital models to support high technology enterprises in China

In Suzhou (an eastern coast city in China), 75% of science parks are supported by municipal

public venture capital (Qing & Zhu, 2006). A special institute was established for the purpose of administering the science parks on behalf of Suzhou municipality. This institute is directly and indirectly responsible to the Local Science Committee of the central Chinese government. The government directly recruits and trains the employees for the institute. The operational capital of the institute is derived partly from the rental and service charges accrued from incubated TSMEs and partly from fiscal revenues. In return the science parks in Suzhou city provide lower rent and various free services for enterprises and are therefore non-profit seeking institutes. The Suzhou municipality provides direct subsidies from fiscal revenues (Figure 10).

Model 1: Government's direct involvement in high technology enterprises as applied in Suzhou city

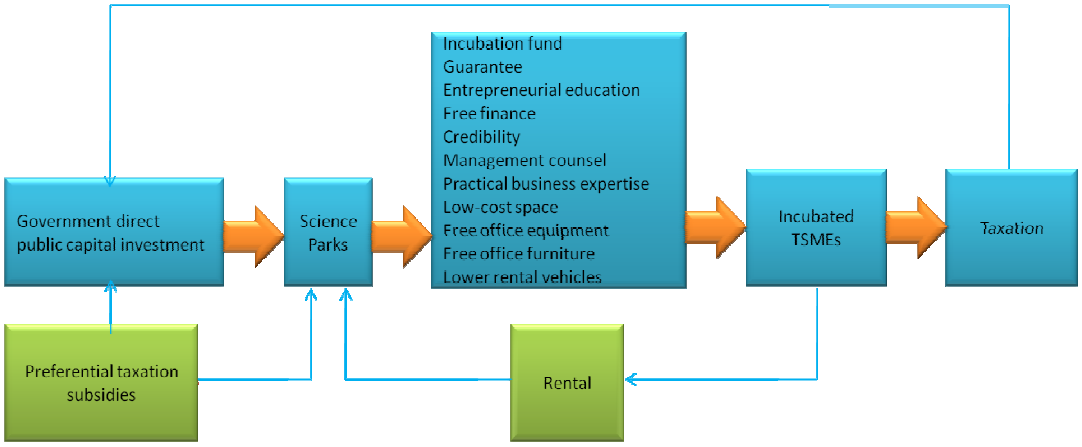


FIGURE 10: Model 1 - Government's direct involvement in high technology enterprises

Model 2: The state-owned enterprise (SOE) participation model

In this model, SOEs form a co-investment with private equity enterprises to invest in particular science and technology projects. In this position, SOEs act as a government agency in the venture capital industry. These SOEs often have preferential access to the social and economic resources of a country. Having a SOE as a venture capital investor can afford an enterprise extra benefits, such as government finance, products ordering by government, managerial skills, reputation enhancement, and improved networks. Figure 11 depicts this model in more detail.

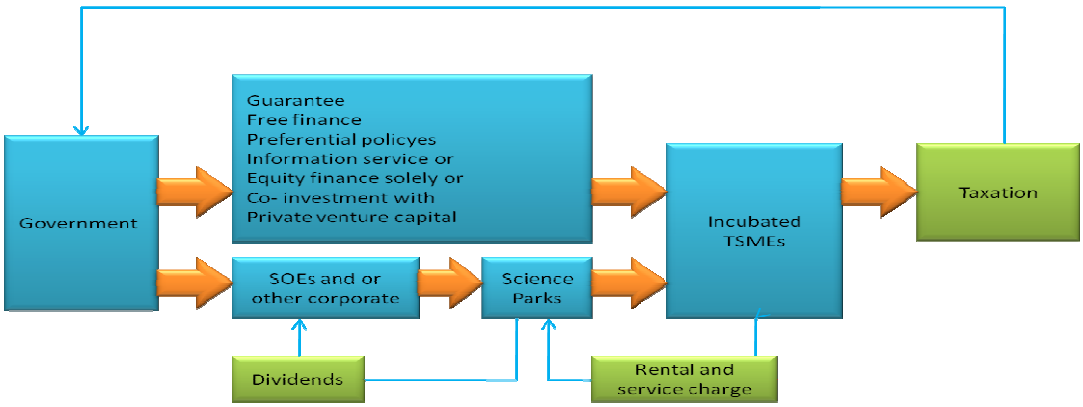


FIGURE 11: Model 2 - State owned enterprise participation model

Model 3: Research institutes as venture capitalists

In China, various public research institutes and universities have established science parks, such as: Fudan University, Tshing Hua University, and the Chinese Academy of Sciences Institute. These research institutes and universities have attracted numerous high technology enterprises and located them in science parks. Their investments rigorously tend to focus on commercializing the scientific research outputs (Figure 12). These entrepreneurs include students, professors, and administration staff. Such science parks operations often seem like an entrepreneurial university. The Triple Helix model describes the university-industry-government relationship and this way of thinking has become a historical legacy in China (Etzkowitz & Zhou, 2006).

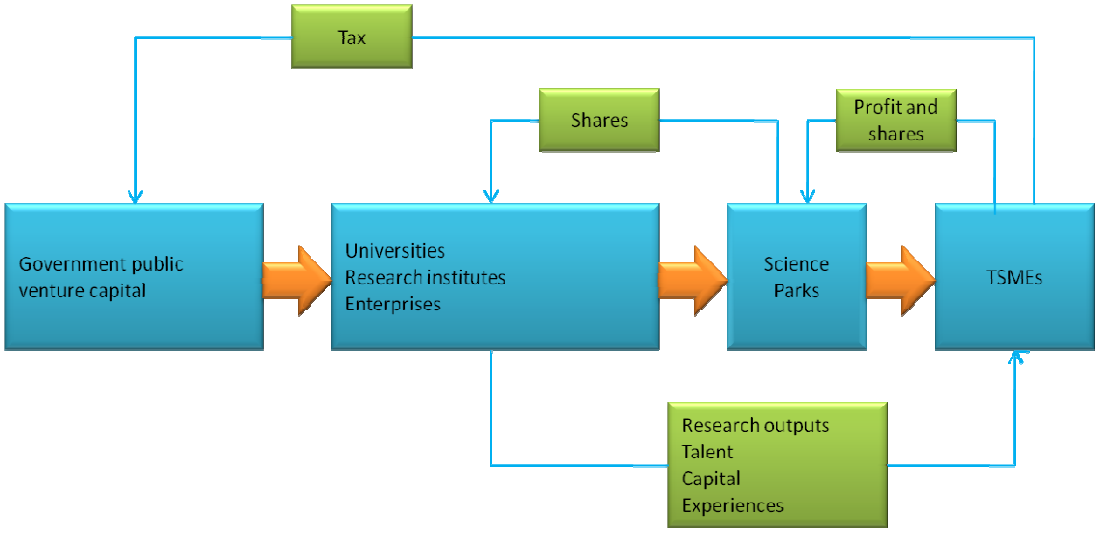


FIGURE 12: Model 3 - Research institutes as venture capitalist

Integration and Interpretation

The examples from both the developed world and from China, representing a developing country, clearly demonstrated the need of government intervention by means of policy regulatory systems, its legal system and financial institutions. The main difference is the degree of involvement and dimension in promoting the venture capital industrial and the manner in which government's become directly or indirectly involved in supporting high technology small and medium sized enterprises. The depth of government involvement is dependent on various factors; amongst the cultural environment, historical background, the national strategy, and the economic development status of a country. Even though this represents a complicated problem to differentiate the effects of these influences, it can in general be concluded that a government's role in the venture capital industry can be described as reflected in the arrow model presented in Figure 13.

This arrow pattern summarizes the common influencing factors in developing and developed countries are summarized. Arrow line "D" divides the fundamental base of the arrow pattern into two components, A and B, as indicated in Figure 13. A and B are showing the different characteristics of developing countries and its counterpart, developed countries. Portion "A" represents the developing countries and portion "B" developed countries. In order to support high technology enterprises, portion "A" countries (developing countries) have to be more directly involved in the venture capital industry. The reason being, that these governments

are faced with a more undeveloped financial market. This further implies that these governments need to develop operational regulations, a proper legal system and a venture equity market in order to overcome the scarcity of venture capital.

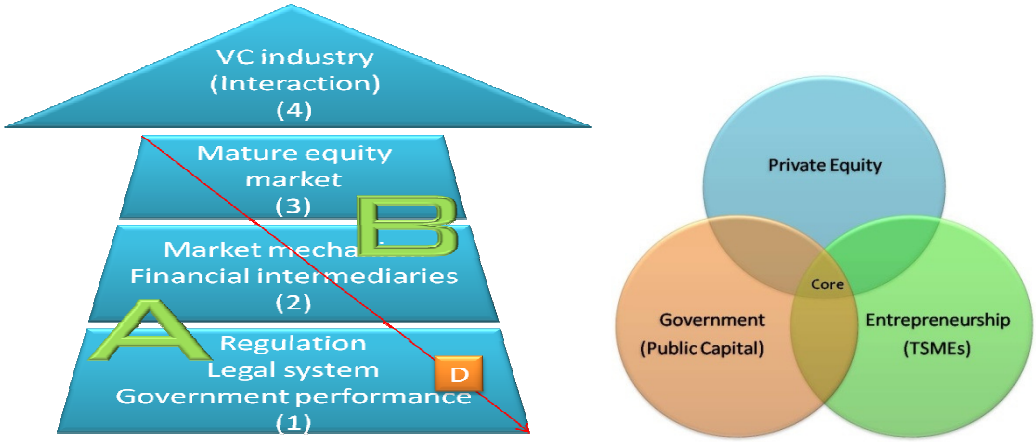


FIGURE 13: The variety of government roles in developing and developed countries, and its interaction in the venture capital industry

The above also provides reason why governments in developing countries choose to directly invest and provide free finance for high technology enterprises, whilst still in the early stages. Due to this situation, agency problems and possible crowding out of private venture capital investors are not seriously considered in the early promotion stage of the venture capital industry. The first task of these governments is to catalyze public sources and other private sources into industrial growth, and to balance the geographical and industrial distribution of venture capital. Figure 13 indicates that governments in developing countries will have to work hard to reinforce the foundation of venture capital in terms of building blocks 1 (policy regulations, legal system and government performance), 2 (market mechanisms and financial intermediaries), and 3 (development of equity market), in this sequence.

In contrast, governments in developed countries operating in Portion "B" of the arrow pattern will spend more time to establish an effective equity market, like some European countries have already done and continue to perfect and expand equity options for high technology small and medium sized enterprises. In the ideal mature equity market complete interaction and good relationships will be established between the government, entrepreneurs and knowledge generation institutions which will also interact in the venture capital industry. In the ideal developed industrial environment, a mature equity market exists, with excellent government performance and active entrepreneurship, and research and development activities to create the ideal conditions for fostering high-technology innovation, and a conductive high-technology enterprises support system in a country.

In conclusion, if an imperfect interaction is derived from the asymmetric intensity of the three relationship spheres, in which one participant is too strong or too weak, an ideal result will never be reached. Based upon this understanding, the researchers are of the opinion that this could be a reason why so many controversies have arisen around government's role in the venture capital industry, even around all market issues in a country's economic growth.

Conclusion

As a developing country moves towards becoming a developed country its role in the public

venture capital system will gradually change from being a direct participant and supporter in the market environment to being a service provider in the market environment. Government's public capital support includes free finance, an interest-free loan, guarantee, preferential taxation, incubator, other indirect support such as policy, regulation support, network service and a free information service are also very important for high-technology enterprises. The implementation of such favourable measures is crucial in developing countries.

The research has probed the government role played in the market environment, and how to maximize the effectiveness of public venture capital, with the minimum possible distortion of the market mechanism. This dilemma concerning government's behaviour is actually an essential debate in the field of economics. This classical controversy debated around the market mechanism and government intervention, exists between Neoclassical economics and Keynesian economics.

Nevertheless, government's participation is always a positive force for high-technology enterprises in a developing country, especially for those technology-based enterprises in infancy, and such participation provides for practical needs according to the actual legal and market environment in developing countries. The significance of this research was intended to answer the question of how government can be good public venture capitalist in assisting high-technology enterprises as well as incubating the innovative business environment in order to promote economic growth.

References

BUCHANAN, R. & TOLLISON, R.D. 1984. *The theory of public choice.* Ann Arbor: University of Michigan Press.

COHEN, L.R. & NOLL, R.G. 1991. *The technology pork barrel.* Washington, DC: The Brookings Institution.

CUMMINGS, D., FLEMING, G. & SCHWIENBACHER, A. 2005. Style drift in private equity. *Journal of Business Finance & Accounting,* 29, Apr.:295-331.

ETZKOWITZ, H, & LOET L. 1997. The triple helix of university-industry-government relations: a laboratory for knowledge-based economic development. *EASST Review*, 14(1):14-19.

ETZKOWITZ, H. & ZHOU, C. 2006. Triple helix twins: innovation and sustainability. *Science and Public Policy,* 33(1):77-83.

HALL, B.H. 2002. *The financing of research and development.* Cambridge, Mass.: National Bureau of Economic Research:34.

HARRISON, R.T. & MASON, C.M. 2000*:* Editorial: the role of the public sector in the development of a regional venture capital industry. *Venture Capital*, 2(4):243–253.

HELLMANN, T. 2000. Developing a venture capital industry. In: Kochendörfer-Lucius, G. & Pleskovic, B. (eds.). *The institutional foundations of a market economy.* Berlin: Germany Foundation for International Development.

JENSEN, M. & MECKLING, W. 1976. Theory of the firm, managerial behavior, agency costs, and ownership structure. *Journal of Financial Economics,* 30, Oct.:305-306.

LERNER, J. & SCHOAR, A. 2002. The illiquidity puzzle: theory and evidence from private equity. *Journal of Financial Economics,* 72:3-40

MOORE, B. 1994. *Financial constraints to the growth and development of small high-technology enterprises.* London: Routledge:112-144.

MURRAY, G.C. & LOTT, J. 1995. Have UK venture capitalists a bias against investment in new technology-based firms? *Research Policy,* 24(2):283-299.
OECD. 2003. *Science technology industry venture capital: trends and policy recommendations.* Paris: Organization for Economic Co-Operation and Development.
QING, L. & ZHU, Z. 2006. The operation model of Suzhou Science Park comparing international operation. *Journal of University of Science and Technology of Suzhou (Social Science),* 23(4):672-695.
ROMER, P.M. 1986. Increasing returns and long-run growth. *The Journal of Political Economy*, 94(5) Oct.:1002-1037.
ROMER, P.M. 1987. Growth based on increasing returns due to specialization. *American Economic Review,* 77(2):56-62.
ROMER, P.M. 1990. Endogenous technological change. *European Journal of Political Economy,* 7(4), Nov.:629-632.
SOHL, J.E. 1999. The early-stage equity market in the USA. *Venture Capital,* 1(2):101-102.
SOLOW, R.M. 1956. A contribution to the theory of economic growth. *Quarterly Journal of Economic,* 70(1), Feb.:65-94.
SOLOW, R.M. 1957. Technical change and the aggregate production function. *Review of Economics and Statistics,* 39(3), Aug.:312-320.
STIGLITZ, J.E. 2000. *Economics of the public sector.* New York: W.W. Norton & Company.
STRAUSS, T. 2001. Growth and government: is there a difference between developed and developing countries? *Economic of Governance,* 2(2), Jul.:135-157.
TIMMONS, J.A. & SPINELLI, S. 2003. *New venture creation: entrepreneurship for the 21st century*. 6th ed. Boston: McGraw-Hill.
WALLSTEN, S.J. 2000. The effects of government-industry R&D programs on private R&D: the case of the small business innovation research program. Rand Journal of Economics, 32(1):82-100.

HOW TO REDUCE ENTREPRENEURIAL FAILURE IN THE POST START-UP PHASE

THE EFFECT OF INTERVENTIONS ON ENTREPRENEURIAL COMPETENCE, ENTREPRENEURIAL MOTIVATION AND THE DEVELOPMENT OF COGNITION TO STARTING ENTREPRENEURS

Ing. Matthijs Hans Maria Hammer M.Sc.
Saxion University of Applied Science
Faculty of Business Engineering and Entrepreneurship
P.O. Box 70.000, 7500 KB, Enschede, the Netherlands
E-mail: m.h.m.hammermsc@saxion.nl

How to reduce Entrepreneurial Failure in the post start-up phase

The effect of interventions on Entrepreneurial Competence, Entrepreneurial Motivation and the Development of Cognition to starting entrepreneurs

1. Abstract

The field of entrepreneurial start-ups is broadly studied by scholars. To increase the amount of successful entrepreneurs, the stimulation for more starting entrepreneurs is a referenced field of research and subject to governmental stimulation. More entrepreneurs lead to a bigger gross national product, which has a positive impact on an economic region. More new entrepreneurs do not mean more successful entrepreneurs. According to prior research, in half of the cases of entrepreneurial exit, the exit was more or less avoidable. Beside the stimulation of more people to become an entrepreneur the reduction of the entrepreneurial failure in the post start-up phase of a venture is worth full to consider in order to get more successful entrepreneurs. This PhD proposal wants to shed light on that phase of the entrepreneurial process and want to identify effective interventions to prevent Entrepreneurial Failure.

2. Why this research?

In my daily work as a trainer, coach, supporter of young entrepreneurs I have met many enthusiastic people who are entrepreneurs or want to be. It strikes me that one has more drive, is more ambitious than the other. In addition I notice that one is more successful than others. Some start very enthusiastic, but stop after a while, despite a very serious start. One question that in my mind is: Why one entrepreneur is successful and the other, after a short time, stops? Is there a relationship with the education they have received previously? Is it the right way guided towards entrepreneurship?

How entrepreneurs start is studied by many scholars. Research on the success or failure after the start, I come across less often. When the success or failure criteria of entrepreneurship in the initial phase are known, it can be investigated if and how it affects that failure and what can be done to counteract. This allows more (young) people to stay entrepreneur and thereby give the economy a positive boost. I suppose a relationship between "what makes someone a venture start" and "what makes a successful venture remains". When someone starts a business, he obviously has good reasons and considerations for it. If someone forced to stop outside to external factors, it is obviously something happened to those reasons / considerations. The corollary question then is: *what* happened? And more importantly, how would it stand out up must be? To find answers to the main question I intend to launch a study with the ultimate result a doctorate.

This proposal describes the first design of that study. Once the importance of entrepreneurship has been expounded, a proposal for the phasing of the entrepreneurial process is stated. Per phase will be focused on some relevant theory and results of previous studies. Sets the materials provided to substantiate the topic of the research and a first version of the model to the research base should lie. The research proposal concludes with an overview of current data sources for the study available or can be made available, and how the research fits into the flow of work within the Saxion research group Knowledge Innovative Entrepreneurship.

3. The importance of entrepreneurship.

In addition to the general importance of entrepreneurship, the importance of Saxion is put out, so that the social and institutional relevance of this research can be assessed.

Early in the last century, Joseph Schumpeter (1934) pronounced a positive relationship between economic growth and entrepreneurship. For nearly a century, scientists working here and come within a certain range, again and again to the conclusion that entrepreneurship provides a positive contribution to the development of the economy (Schumpeter, 1934, Baumol, 1990, Verhoeven et al, 2005, Van Praag, 2006; Laroullet, 2009). The Organization for Economic Cooperation and Development (OECD) believes that entrepreneurship makes a major contribution to economic growth of countries and regions (Ahmad & Seymour, 2008). Hence the OECD in 2008 developed a monitor to identify and compare entrepreneurship in a country, as can be obtained grip on economic growth (Ahmad & Hoffmann, 2008). Research by the OECD (IMHE / OECD, 2007) shows that higher education can be a boost to regional development. This may, according to research, by "the region to support indigenous development by means of skills, entrepreneurship and innovation "(IMHE / OECD, 2007, p1).

The aforementioned study by the OECD, the Twente region participated, directed by Saxion. Together with all institutions of higher education in Twente and regional stakeholders is *entrepreneurship,* as an important basis for the contribution of higher education to regional development, identified (Sijgers , Hammer, ter Horst, Nieuwenhuis, van der Sijde, 2005). In its strategic vision (Saxion, 2008) Saxion has spearheaded excel, including a provision explicitly refers to entrepreneurship, the independent exercise of the profession. This vision is to excel, "Ambition 3: An increasing number of our students (compared to the number measured in 2007) annually elect for entrepreneurship" (Saxion, 2008, p 8).

The above essay appears that entrepreneurship matters because it is a positive impetus to both the global as well as regional economic growth. Given that Saxion itself as a regional knowledge partner, it is obvious that they add relevant knowledge to her region and so stimulating the regional economy.

4. The entrepreneurial process.

This chapter discusses the various theories of the entrepreneurial process and the different phases. Will prove to exist in the literature no clear generally accepted model, and therefore a choice to be made in any model for investigating this will be used. Then explains what is happening at every phase and the factors influencing these phases.

An anchor for fostering entrepreneurship can be found in the person of the entrepreneur (e.g. Stewart & Roth, 2007, Judge & Ilies, 2002 and Kirton, 1976) and in the process of entrepreneurship (e.g. Shane & Venkataraman, 2000, Gartner, 1985 and Shapero, 1982). To be connected with the research centres within Saxion, this proposal chosen for the process approach preferred remaining theoretical flow. The role of the personal characteristics of the entrepreneur is briefly discussed in every phase.

In the entrepreneurial process it is assumed that the starting entrepreneur, sequential runs a number of steps (van der Veen & Wakkee, 2004, van der Sijde, 2004, Shane & Venkataraman, 2000, Low & MacMillen, 1988, Gartner, 1985; Shapero & Sokol, 1982). Although there are differences in detail of the models, the basic concept, start-ups chronological phases, widely accepted. Most scholars come to a three-or four-stage model.

A commonly used three-stage model is that of Shane and Venkataraman's (2000, p. 218). This model has the phases: (1) recognize the opportunity, (2) the planning of the operation to take chances and (3) exploiting that opportunity. The three phases are others also entrepreneurial activities mentioned (Baron, 2008, van der Veen & Wakkee, 2004, Bhave, 1994, Morris, Lewis, & Sexton, 1994).

Other researchers found that this process is preceded by an intention-phase (van Gelder, Thurik, & Bosma, 2006, Krueger et al, 2000, Shapero & Sokol, 1982), leading to a four-stage model: (1) intention to start, (2) recognize the opportunity, (3) preparing a chance and (4) exploit that opportunity. This preliminary phase formats suggest that after the last stage there is nothing and operation lasts indefinitely. Research shows that more than half of start-ups within 5 years again stopped (e.g. Bangma & Quick, 2009, p5, Hayward, Shepherd & Griffin, 2006). Detienne (2008, p1) states "that the entrepreneurial process is not complete when the exit- phase is excluded from the process." Another generalized model is that of Veccio, 2003 (in Samuels, Joshi & Demory, 2008) and consists of the following four stages:

1. the preparatory phase (pre-start)
2. start,
3. the venture being in action (exploration)
4. stopping doing business (exit)

This four-stage model adding that a venture is finite. It is therefore suitable to serve as a model for this research proposal. Below in Figure 1 the schematic representation of the entrepreneurial process to continue use in this proposal appears.

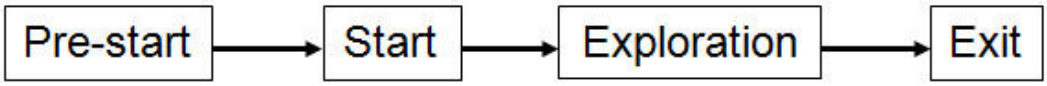


Figure 1, the entrepreneurial process (Veccio, 2003)

Based on the previous paragraphs, a choice is made for a four-stage model of the entrepreneurial process which is accepted in the literature and will be applied in this research proposal. The following paragraphs discuss the theories and results of previous studies of every phase. It also consider the role of personal characteristics.

4.1. The pre-start phase

This section examines existing theories discussed prior to the start of a venture. The recent literature on this phase is divided on the role of personal characteristics. Part of the literature indicates that the correlations between entrepreneurial behaviour and personal characteristics are not there (Ottesen & Grønhaug, 2005, Driessen, 2005, Ziegler, Schmidt-Atzert, Bühner, & Krumm, 2007). Other literature shows partial correlation (Hans Mark, 2003) and others complete correlation (Diaz & Rodri'quez, 2003; Gürol, Yonca, Atsan, & Nuray, 2006, Rauch & Frese, 2007; Wu, Matthews, & Dagher, 2007; Bilsky & Schwartz, 2008).

The flow leaving the largest independent to the person comes from the behavioural sciences. It is known that, according to the comparison of Lewin, behaviour is a function of the individual and his environment (Lewin, 1951). The literature also shows that entrepreneurship is itself a form of planned behaviour (Bird 1988, Katz & Rartner 1988), which makes intention models well suited to predict the behaviour (Krueger, Jr., Reilly, & Carsrud, 2000). Regarding the determinants of the intention to start a venture, the literature comes up with two similar models: the Ajzen's Theory of Planned Behaviour (TPB) (Ajzen, 1991) and the model of Shapiro (1982) of the Entrepreneurial Event (SEE). Comparing these models by Krüger

(Krüger Jr., Reilly, & Carsrud, 2000), indicates that the perceived desirability and perceived feasibility reason for the intention, if a rise occurs (moment of displacement, Shapero, 1982). As a distinctive personal characteristic of the intention is Perceived Self-efficacy (Bandura, 1986) mentioned (Mitchell & Shepherd, 2010). Also Van der Sijde (Groen & Van der Sijde, 2004) posits in his lectorale speech the personal characteristics are important, but that need not automatically lead to the creation of a venture, the interaction between the entrepreneur and his environment should be paramount (Groen & Van der Sijde, 2004).

In summary it can be said that the pre-start phase influenced by (1) personal characteristics (motivation and cognition) and the firm (2) the environment of the entrepreneur.

4.2. The start phase

This section dealt with the theories surrounding the start phase of a venture.
With regard to the actual start of a venture is the focus of research on motives from the start. In the literature different reasons why someone mentioned a company actually starts. Mainly looking for freedom (autonomy), more money, dissatisfaction with present job in payroll and (potential) unemployment are often mentioned. To combine greater challenge and concern for the family is mainly mentioned by older entrepreneurs (Stigter, 2001; Snel & Bruinsma, 2004; Snel & Meijaard, 2006). And the appearance of some of the above situations (eg more money, threat of unemployment, dissatisfaction with the job, no challenge anymore), depends on external factors (Fast & Meijaard, 2006).

In 1938, Murray found that an intrinsic desire for action (need for achievement, nAch), an important driver for an entrepreneur. Stewart (Stewart & Roth, 2007) indicates that entrepreneurs a higher desire for action (achievement motivation) than managers. This result is consistent with the findings of Collins, Hanges, and Locke (2004). These results support the predictive value of the night and the task motivation theory (Stewart & Roth, 2007, p 411) for entrepreneurship. Besides nAch assumes Hans Mark (2003) that the Locus of Control (LoC) (Rotter, 1966) the launch of a company affects motivation. Perceived Self-efficacy is one of the important antecedents of motivation (Bandura, 1986). Baron (2008) in his research found evidence that personal qualities not only preconditions for the start, but also positively correlated to the entrepreneurial process.

The literature covered in this section and theories show that the initial phase is mainly influenced by the motives and personal characteristics that the entrepreneur and the environment in which it is located.

4.3. The exploration phase

This section examines the theories and findings of previous research with respect to the exploration of the venture. After examining the definition of the exploration in what follows is under exploration means exploring how this phase experienced entrepreneurs.

In the literature, the exploration phase is defined as success (Bosma et al, 2000; Driesen, 2005) which in turn has several dimensions. At macro-level success as employment growth, or the extent to which social goals are achieved (Driessen, 2005; Bosma, 2000). Meso-level and longevity, growth in sales, personnel and profits or the extent to which business goals are achieved (Driessen, 2005, Sadler-Smith et al, 2003; Chattopadhyay, 2002; Nandram, 2000; Bosma, 2000). Finally, the micro level, the extent to which the entrepreneur finds himself successful or the extent to which personal goals are achieved (Driessen, 2005).Driessen (2005) defines the minimum level of success as an entrepreneur to the survival of the venture.

The cognitive style of an entrepreneur is seen as moderator on the relationship between competitive environment and growth intention (Duta & Thornhill, 2008; Driessen, 2005). Also give Collins et al (2004) in a meta-analysis, the presence of an elevated achievement motivation as a potential success factor. Heynie (2008) indicates that the cognitive response of meta-cognition plays an important role in the success of a venture. Meta cognitive knowledge and experience influence the cognitive response of the entrepreneur (Heynie, 2008), in common with Baum and Locke (2004), that cognition and competence as a record of economic growth. That argument Driessen (2005) endorsed. In later research adds Baum (2009) as self-efficacy and intelligence to it (Baum & Bird, 2009). There are indications that early present entrepreneurial skills, personality and business interests (motives) are indicators of entrepreneurial success (Schmitt Rodermund, 2004) .Rauch and Frese (2000) have reported the 'Giessen-Amsterdam model' to 'small business' success. Here they explain causal relationships between economic success, strategy, environment, personality and goal setting (Rauch & Frese, 2000).

Above literature shows that exploration is seen as gaining success. As confounding factors include the environment of the entrepreneur and, closer to the entrepreneur, cognition, motivation and competence.

4.4. The exit-phase

In this section, existing theory and findings from previous research on the exits discussed. The literature distinguishes two ways to stop (failure):

(1) quit because of good performance (desired failure or Entrepreneurial Exit (EE) named) (e.g. Detienne, 2008; Wennberg et al, 2009), or
(2) because the performances are not good (unwanted outages or Entrepreneurial Failure (EF) named) (e.g. Samuels et al, 2008; Wennberg et al, 2009).

Research shows that the relationship between EE and EF, after the first seven years, is roughly equal (Wennberg et al, 2008). Cardon, Stevens, & Potter (2009) divide EF further into two categories *tough luck* and *mistakes* by the operator. Wennberg (Wennberg et al (2008) reaches the same format, without quantifying. Among *mistakes* by Cardon (Cardon et al (2009) issues such as business, mismanagement, unrealistic expectations, pride, finance and innovation mentioned. Other literature indicates that EF is related to the strategic resources (Michael & Combs, 2008), planning strategies (van Gelder et al, 2007; pride (Hayward et al, 2006), not able to cope with uncertainty (Mc Grath, 1999) and over-optimism and overconfidence (Muir, 2007). Research Wickham (2003) shows that cognitive aspects of decision-making affects what EF strengthened. Baron (2000) and Simon et al (2000) propose more general that a biased cognition entrepreneurship negatively impacted which can lead to EF. It also appears that the experience of an EF is perceived as a learning experience (Corbett et al, 2007; Cardon, Stevens, & Potter, 2009) which leads to learning (Cardon, 1997; McGrath, 1999) and an increase in self-efficacy (Wood & Bandura, 1989). Apart from personal qualities and experience, by Vaillant (2007) the lack of role models as a cause of EF data.

From this paragraph can be concluded that in about half the cases where a venture stops this was to prevent. The causes of EF are found in the environment of the company and the cognition, motivation and competence of the entrepreneur.

In this chapter, based on existing literature and theories, a model is chosen for the entrepreneurial process. The study of each individual phase of this model showed that besides

the environment, the personal characteristics of entrepreneurs play an important role in the entrepreneurial process.

5. Position of Research

This chapter briefly describes existing theories and relevant literature on the usefulness of further research in the entrepreneurship process and where in the entrepreneurship process, further research is desirable. This chapter ends with a conclusion about the relevance and appropriateness of this investigation, whereupon the *scope* of this proposal is presented.

According to the model of the OECD, the increase of entrepreneurship can be achieved by the increase of ventures and entrepreneurs (Ahmad & Hoffmann, 2008). The question is then how we get more ventures? One possibility is to push more people towards entrepreneurship; the more entrepreneurs starts, the greater the statistical probability that more remain. Many initiatives have been developed for this purpose and much research is done here (Holtz-Eakin, 2000). Another option is to drop the Entrepreneurial Failure, to reduce the major causes to fight. By encouraging entrepreneurship a lot of energy can be put into it to get more (young) people on the "threshold of intent" for entrepreneurship. At the time of launch all entrepreneurs are convinced of their businesses to achieve success (Shane & Venkataraman, 2000; Driessen, 2005, Shane, 2003). To some entrepreneurs something happens on the road, making them to stop unwanted.

Research shows that the majority of the entrepreneurs do not survive the first five years (Parsa et al, 2005, Hayward, Shepherd & Griffin, 2006, Bangma & Snel, 2009, Verhoeven et al, 2005; Meijaard et al, 2007). In America it appears that after 2 years 34%, after 4 years 50% and 60% after 6 years did not survive (Hayward et al, 2006, p.160). Parsa et al (2005) cites a study showing that to American restaurants the percentage is even higher, 60% is not surviving the third year. In the Netherlands approximately 50% of the ventures is not surviving the first five years (Meijaard et al, 2007; Bangma & Snel, 2009). For spin-off companies from universities shows that figure lower. The University of Twente reports in the 25 years that they accompany spin-offs in the TOP program the dropout rate is 25%, while unaccompanied spin-off companies have a drop of 40% (University of Twente, 2005). This is a better result than the average in the Netherlands.

About half the cases of entrepreneurial drop out refers to situations which are not desirable (Wennberg et al, 2008) and where the entrepreneur (e.g., Simon et al, 2000, Ottesen & Grønhaug, 2005, Hayward el al, 2006) and its environment (Vaillant, 2007) has a role in the cause. In the Netherlands, 80 - 90% of stopping entrepreneurs indicate that external circumstances do not play an important role (Meijaard et al, 2007). The numbers show that there is no linear relationship between the number of years that a company exists and the EF rate, the first years after the start rate is the widest and most interesting to focus. McGrath (1999) argues that although failure is painful nor desirable, researchers have to overcome biased this failure to deny, because understanding the failures in the future value can be created, not just for society at large but certainly for entrepreneurs. McGrath (1999, p16) "by the continued denial of the EF are many important lessons lost on the EF and will not anticipate the negative consequences." "Careful analysis of failure, rather than put the focus on success rates researcher's systematic progress towards analytical models for value-based entrepreneurship (McGrath, 1999, p 28).

Actual literature shows that it makes sense to investigate in entrepreneurship promotion, especially in the less studied part of the entrepreneurial process, the (undesired) failure, either the Entrepreneurial Failure in the first years after the start. It also appears that there are

sufficient points that can be investigated in order to reduce the EF, even though there is little research on this subject.

5.1. Scope of research

Based on literature and the conclusions in the previous section, this research proposal focuses on, the first part of the exit phase of the entrepreneurial process. The figure below (Figure 2) is shown schematically. In the figure, 'exit' is to be seen as a point in time.

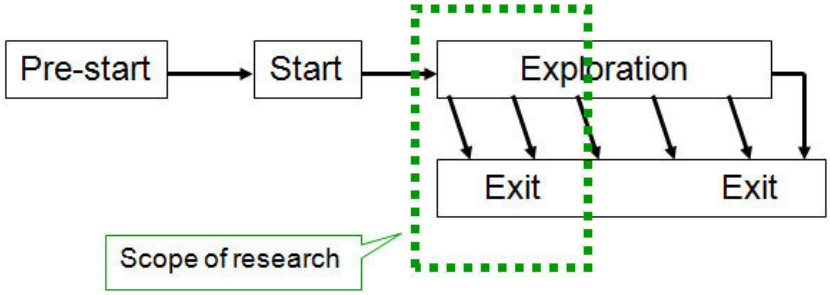


Figure 2, Scope of research

6. What is studied?

This chapter explains what is being examined in this study and in what order. At the end of this chapter the research model is presented.

Based on literature and observation, the following explanatory factors for the reduction of the EF are distinguished:

- Internal factors:
  - Motivation
  - Cognition
  - Competence
- External factors (e.g. lack of a role model)

The figure below (Figure 3), these factors have been related with the entrepreneurial process to form the research model.

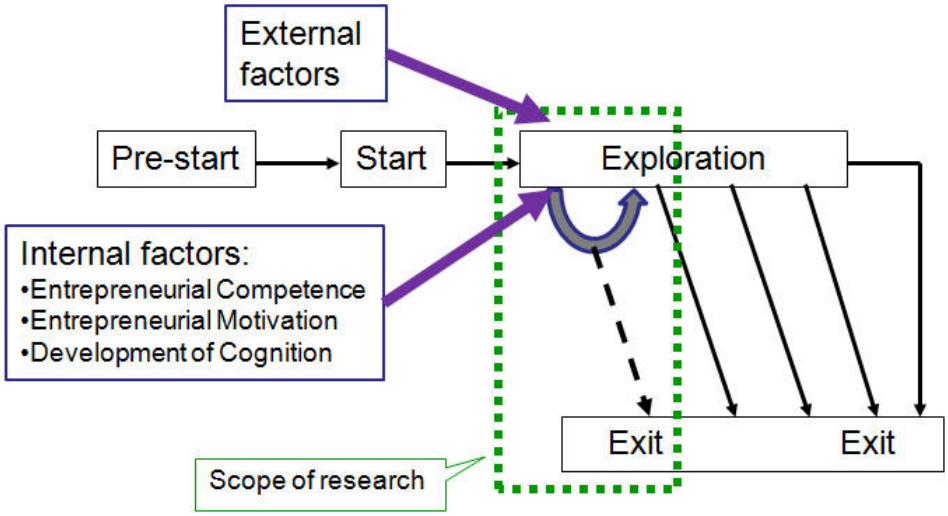


Figure 3, Research model

The first part of the research focuses on identifying the most relevant explanatory factors for EF. Then consider how these factors can be influenced within the context of the entrepreneur. Subsequently the possibilities of interventions are explored, after which there is a check whether they are being applied. The form and content of these interventions will lie down in terms of accompanying programs just after the venture started. After the desk research phase, the quasi experimental studies on the effects of various interventions start. The data from this study should lead to a pronouncement of which is the most effective interventions to combat EF. Finally, we investigate how these interventions within the framework Saxion are doing, so more successfully in operation phase intoxicated, the regional business community to deliver. Schematically the above steps are shown in the steps of the research model, Figure 4. The study design is described in Chapter 7.

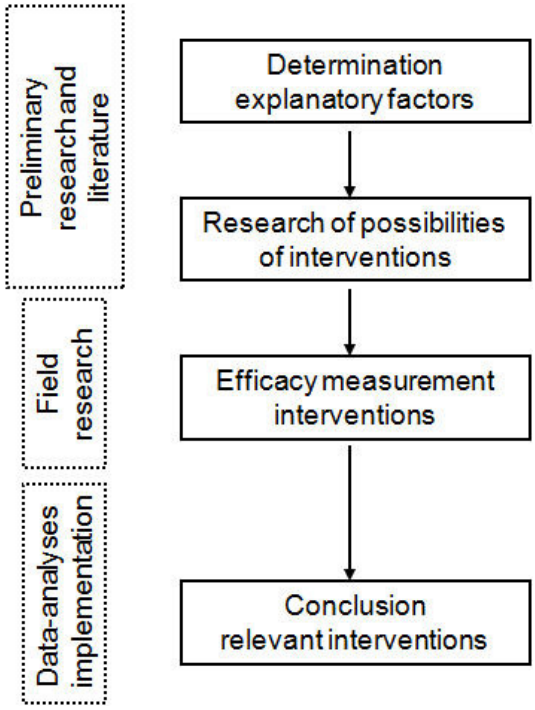


Figure 4, steps of the research

Now it is known what is being investigated and which result is to assume, in the next chapter the research design is explained.

7. Research design

This chapter describes the research design. After the main research topic is stated, the research questions are given. Hereafter the research activities and planning are shown. This chapter ends with a plan for data collection.

As main research topic being chosen for the following:

- *How to reduce Entrepreneurial Failure (EF) in the post start-up phase of entrepreneurship?*

7.1. Research questions and design

From the main research topic, the following research questions extracted. After each research question the research design for that question is indicated.

1. What are the most explanatory failure factors? *Literature Research.*
2. What causes these failure factors? *Literature Research.*
3. When and how often failure factors occurs? *Literature Research.*
4. What interventions are possible? *Outcome literature.*
5. How change the entrepreneurial motivation during the start-up phase? *Quasi-experimental (correlational research)*
6. How change the entrepreneurial cognition during the start-up phase? *Quasi-experimental (correlational research)*
7. How change the entrepreneurial skills during the start-up phase? *Quasi-experimental (correlational research)*
8. What effect has the interventions on the frequency and intensity of Entrepreneurial Failure? *Quasi-experimental (non-equivalent control group design)*

7.2. Planning the research

This section contains the activities necessary for this research, plotted over time. After a description of the different phases close this section with a planning table. The research is divided into 8 phases, which allow a logical and adequate monitoring.

Research A: Phase 1.
This phase will consist of research in the form of literature search, to the most explanatory failure factors and antecedents of those factors. The result of this phase is an overview of the most explanatory failure factors and there antecedents, summarized in a model for Entrepreneurial Failure.

Research B: Phase 2.
This phase will also include research in the form of literature search. Based on the results in phase 1, in this phase, possible instruments to measure the failure factors and its antecedent identified. Furthermore possible interventions are searched. The result of this phase is a long list of instruments for the measurement of failure factors and their antecedents and a long list of possible interventions.

Preparion Data Collection: Phase 3.
In this phase choices made for the applicable measuring instruments and interventions. In addition, potential measurement groups mapped. Because it is difficult to determine who and where a venture starts, the measurements take place as soon as possible after the start. This phase may apply partly parallel with the end of phase 2. The result of this phase is a roadmap for data collection.

Pre -measurement: Phase 4.
In this phase of the pre-measurement is applied to the measurement groups. For the reason not to influence the entrepreneurial process, the time of this measurement varies for each venture, however before the possible intervention took place. The results of this phase, is the raw data set of measurements for all teams.

Intervention: Phase 5.
In this phase an intervention will be applied to the venture (except for the reference group). The result of this phase is that interventions are applied.

Post-measurement: Phase 6.
In this phase, the measurement groups again measured with the instruments selected in phase 3. In addition, the research results from Phase 4 processed. The results of this phase, the raw dataset of the post-measurement and processed data set from the pre-measurement.

Analysis: Phase 7.
In this phase of the acquired data from phase 6 is processed. Together with the processed data of the pre-measurement, the research data will be analyzed and interpreted.

Report: Phase 8.
In this last phase, the research data and research results will be written down in a report.

Summarized and plotted over time are shown in the research study plan, figure 5.

	Year	1		2		3		4	
	Semester	1	2	1	2	1	2	1	2
Phase	Description								
1	Research A								
2	Research B								
3	Preparation Data Collection								
4	Pre -measurement								
5	Intervention								
6	Post-measurement								
7	Analyse								
8	Report								

Figure 5, Research planning

7.3. Data Collection Plan

This section sets out how the data for this research is obtained and processed.

The data for the research will be obtained from the measurement of the individual entrepreneurs. In an attempt to keep as many variables consistent, there is searched for similar groups of entrepreneurs. Within the Saxion Centre for Innovative Entrepreneurship, several studies in the entrepreneurship process executed, as show in Chapter 8. Therefore, there is the possibility of joining other research programs and make use of the nascent entrepreneurs from these studies. Perhaps the available data sets can be used as well. The mentioned group consists of entrepreneurs and spin-offs from regional research institutions. In addition there are discussions with the Municipality of Hengelo and the ROZ Twente, to assist with the organisation of the venture-start price of Hengelo. Herewith annually a group of about 250 new entrepreneurs can be interviewed.

The test group is exposed to one (or combination of) intervention, then again after 2 years the variables are measured. The reference group is also measured, but without some form of intervention took place. The model for data collection is shown in Figure 6.

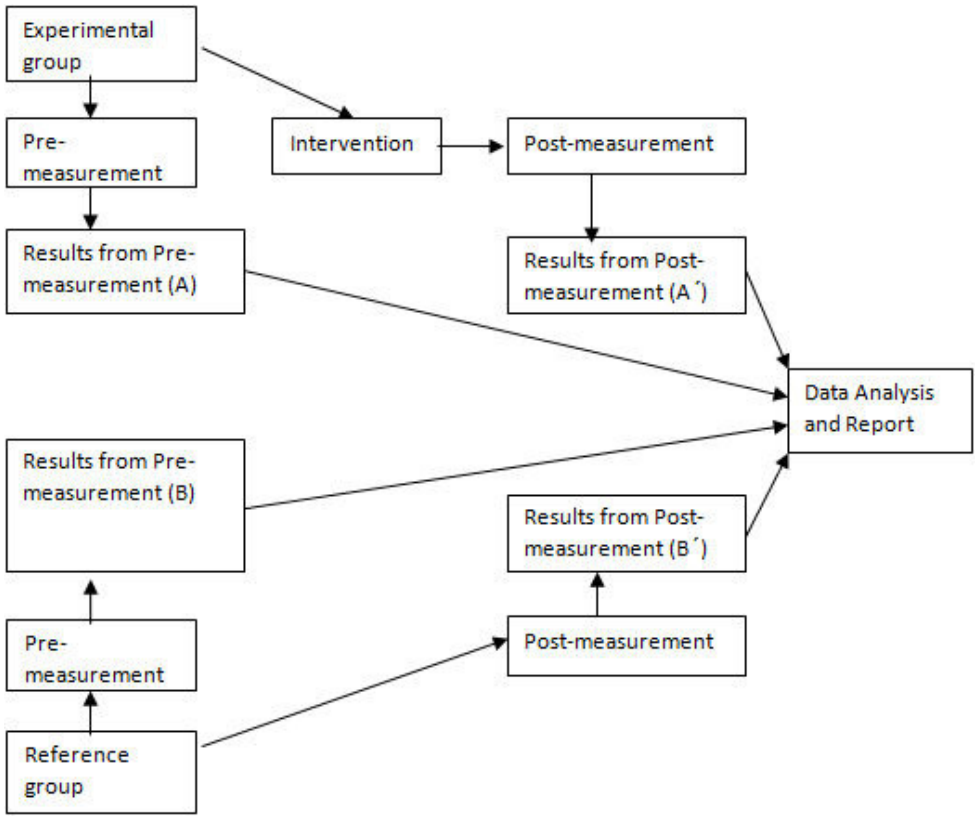


Figure 6, model for data collection

Possible interventions
Without take advance to the results of Phase 2 of this research (Research B), there appear to have been some initiatives which are to consider as an intervention. It should be noted that the initiatives currently not designed for this, but perhaps some might be adjusted. Examples include the Venture Lab Twente, YBP Entrepreneurs Network, Local networks / associations.

8. Embedding in the Saxion Knowledge Centre for Innovative Entrepreneurship

This chapter briefly describes how this research is embedded in the Saxion Knowledge for innovative entrepreneurship. Within this knowledge centre another PhD research is done by Luc de Krosse. The Krosse's research is titled "Learning business through entrepreneurial learning ', a study on the effectiveness of entrepreneurship education in higher vocational education. His research takes place just before and at the beginning of the entrepreneurial process, so this investigation since the time given, logically consistent. As mentioned in Chapter 7 indicated a possible sharing of research data and certainly there will also be examined. In addition, new entrepreneurs of a student entrepreneurial network, Young Business Professionals (YBP), can serve as a potential data source. The results of this study can serve as input for both the design of activities for the YBP, several minor study programs of

Saxion. By facilitating nascent entrepreneurs from the start, Saxion or any of its institutions, remains visible and useful in the region of Twente seeking to deliver more successful entrepreneurs (Sijgers et al, 2005).

9. Literature

Ahmad, N., & Hoffmann, A. N. (2008). *A framework for adressing and measuring entrepreneurship.* OECD. Paris: OECD.
Ahmad, N., & Seymour, R. G. (2008). *Defining Entrepreuneurial Activity:: Definitions Supporting Framwork for Data Collection.* Paris: OECD.
Ajzen, I. (1991). Theory of planned behaviour. *Organizational Behavior and Human Decision Processes* (50), pp. 179-211.
Bandura, A. (1986). *The Social Foundations of Thought and Action.* Englewood Cliffs: Prentice Hall.
Bangma, K. L., & Snel, D. (2009). *Bedrijvendynamiek en werkgelegeneheid, periode 1987-2008.* Zoetermeer: EIM.
Baron, R. A. (2008). The Role of Affect in the Entrepreneurial Process. *The Academy of Management Review* (33, 02), 328 - 340.
Baum, J. R., & Bird, B. J. (2009). *The Succesfull Intelligence of High-Growth Entrepreneurs: Links to New Venture Growth*. Retrieved 04 10, 2010, from Organizational Science online: http://orgsci.highwire.org/cgi/reprint/orsc.1090.0445v1
Baum, R. J., & Locke, E. A. (2004). The relationship of entrepreneurial traits, skill and motivation to subsequent venture growth. *Journal of Applied Psychology* , 587-598.
Baumol, W. J. (1990). Entrepreneurship: Productive, Unproductive and Destructive. *Journal of Political Economy , 98* (5), 893-921.
Beaver, G., & Jennings, P. (2005). Competative advantage and entrepreneurial power: The dark side of entrepreneurship. *Journal of Small Business and Enterprise Development , 12* (1), 9-23.
Bhave, M. P. (1994). A proces model of Entrepreneurial Venture Creation. *Journal of Business Venturing , 9*, 223-342.
Bilsky, W., & Schwartz, S. H. (2008). Measuring motivations: Integrating content and method. *Personality and Individual Differences* (44,8), pp. 1738-1751.
Bosma, N., Praag van, M., & Witte de, G. (2000). *Deermination of succesful entrepreneurship.* Scales.
Cardon, M. S., & Mc Grath, R. G. (1999). When the going gets tough . . . Towards a psychology of entrepreneurial failiur and re-motivation. *not published* , -.
Cardon, M. S., Stevens, C. E., & Potter, D. R. (2009). Misfortune or mistakes? Cultural sensemaking of entrepreneurial failure. *Journal of Business Venturing* .
Collins, C. J., Hanges, P. J., & Locke, E. A. (2004). The relation of Achievement Motivation to Entrepreneurial Behavior: a Meat-Analysis. *Human Performance* , 95-117.
Diaz, F., & Rodri´quez, A. (2003). Locus of Control and Values of Community Entrepreneurs. *Social Beavior and Personality: an international Journal* , pp. 739-747.
Driessen, M. P. (2005). *E-scan ondernemerstest.* Entrepreneur Comsultancy.
Duta, D. K., & Thornhill, S. (2008). The evolution of growth intentions:Toward a cognition-based model. *Journal of Business Venturing , 23*, 307-332.
Eliot, A. J. (2006, June Vol. 30, No. 2). The Hierarchical Model of Approach-Avoidance Motivation. *Motivation and Emotion* , pp. 111-116.
Gartner, W. B. (1985). A conceptual framework for describing the phenomenon of new venture creation. *Academy of Management Review , 10* (4), 696-706.
Groen, A. J., & van der Sijde, P. C. (2004). Lectorale redes. *Inauguratie* (pp. 6 - 30). Enschede: (not published).

Gürol, Yonca, Atsan, & Nuray. (2006). Entrepreneurial characteristics amongst university students: some insight for entrepreneurship education and training in Turkey. *Education + Training* (48, 1), pp. 25-38.
Hansemark, O. C. (2003). Need for Achievement, Locus of Control and the prediction of business start-ups: a longitudinal study. *Journal of Economic Psychology* (23, 3), pp. 301-319.
Haynie, M. J., Shepherd, D., Mosakowski, E., & Earley, C. P. (2008). A situated metacognitive model of the entrepreneurial mindset. *Journal of Business Venturing* .
Hayward, M. L., Shepherd, D. A., & Griffin, D. (2006). A hubris theory of entrepreeurship. *Management Science , 52* (2), 160-172.
IMHE/OECD. (2007, 04 01). *IMHE info April 2007*. Retrieved 04 15, 20110, from OECD: http://www.oecd.org/document/6/0,3343,en_2649_35961291_38248134_1_1_1_1,00.html
Judge, T. A., & Ilies, R. (2002, Vol. 87, No. 4). Relationship of Personality to Performance Motivation. *Journal of Applied Psychology* , pp. 797-807.
Krüger jr., N. F., Reilly, M. D., & Carsrud, A. L. (2000). Competing models of entrepreneurial intentions. *Journal of Business Venturing* (15), pp. 411-432.
Larroulet, C., & Couyoumdjian, J. P. (2009). Entrepreneurship and Growth: A Latin American Paradox? *The independent Review , 14* (1), 81-100.
Lewin, K. (1951). *Field Theory in Social Science: Selected Theoretical Papers* (edited by D. Cartwright ed.). New York: Harper and Row.
Lewis, K. Z. (1936). *Principles of Topological Psychology.*
Low, M. B., & MacMillen, I. C. (1988). Entrepreneurship: past research and future challenge. *Journal of Management , 14* (2), 139-161.
McClelland, D. C. (1965). Need achievement and entrepreneurship. *Journal of Personality and Social Psychology* , pp. 1: 389-392.
McClelland, D. C. (1961). *The Achieving Society.* Princeton, NY: Van Nostrandt.
McGrath, R. G. (1999). Falling Forward: Real Options Reasoning and Entrepreneurial Failure. *Academy of Management Review , 24* (1), 13-30.
Meijaard, J., van Eck van der Sluijs, L., & Stam, E. (2007). *Stoppen binnen vijf jaar.* Zoetermeer: EIM.
Michael, S. C., & Combs, J. G. (2008). Entrepreneurial Failure: the case of franchisees. *Journal of Small Business Management* , 73-90.
Mitchell, J. R., & Shepherd, D. A. (2010). To thine own self treu: Images of self, images of opportunity, and entrepreneurial action. *Journal of Business Venturing* (25), 138-154.
Morris, M. H., Lewis, P., & Sexton, D. L. (1994). Reconceptualizing Entrepreneurship: an Input-Output perspective. *SAM Advanced Management Journal , 59* (1), 21-31.
Murray, H. A. (1938). *Exploriations in Personality.* New York: Oxford University Press.
Ottesen, G. G., & Gronhaug, K. (2005). Positive illusions and new venture creation: Conceptual issues and an empirical illustration. *Creativity and Innovation Management , 14* (4), 405-412.
Parsa, H. G., Self, J. T., Njite, D., & King, T. (2005). Why restaurants fail. *Cornell Hotel and Restaurant Administration Quarterly , 46*, pp. 304-22.
Rauch, A., & Frese, M. (2007, December). Let´s put the person back into entrepreneurship research: a meta-analyses on the relation between business owners´personality traits, business creation and success. *European Journal of Work and Organizational Psychology* (16, 4), pp. 353-385.
Rauch, A., & Frese, M. (2000). Psychological approaches to entrepreneurial succes. A general model and an overview of findings. *International Review of Industrial and Organizational Psyychology* , 101-142.
Sadler-Smith, E., Chaston, I., & Badger, B. (2003). Managerial behavior, entrepreneurial style and small firm performance. *Journal of Small Business Management , 41* ((1)), 46-67.

Samuels, L. B., Maheshkumar, J. P., & Demory, Y. (2008). Entrepreneurial failure and discrimination: lessons for small service firms. *The Service Industries Journal , 28* (7), 883-897.
Saxion. (2008). *Strategische Visie 2008 - 2012.* Enschede: Saxion University of Applied Science.
Schindehutte, M., Morris, M., & Allen, J. (2006). Beyond achievement: Entrepreneurship as Extreme Experience. *Small Business Economics* (27), pp. 349-368.
Schumpeter, J. A. (1934). *The Theory of Economic Development: An inquiry into Profits, Credit, Interest and the Business Cycle* (2d ed. ed.). (R. Opie, Trans.) Cambridge: Harvard University Press.
Shane, S. (2001). Orgamizational incentives and organizational morality. *Organization Science , 12*, 136-160.
Shane, S., Locke, E. A., & Collins, C. J. (2003). Entrepreneurial motivation. *Human Resource Management Review 13* , pp. 257-279.
Shapero, A., & Sokol, L. (1982). Social Dimensions of Entrepreneurship. In C. Kent, D. Sexton, & K. Vesper, *The Encyclopedia of Entrepreneurship* (pp. 72-90). Englewood, Cliffs: Prentice Hall.
Shepherd, D. A. (2003). Learning from business failure: propositions of grief recovery for the self-employed. *Academy of Management Review 282* , 318-329.
Shepherd, D. A., Wiklund, J., & Haynie, M. J. (2009). Moving foreward: balancing the financial and emotional costs of buisiness failure. *Journal of Buisiness Venturing* , 134-148.
Sijgers, I., Hammer, M. H., ter Horst, W., Nieuwenhuis, P. A., & van de Sijde, P. (2005). *Supporting the contribution of Higher Education Institutes to regional development.* OECD.
Simon, M., Houghton, S. M., & Aquino, K. (2000). Cognitive biases, risk perception, and venture information: How individuals decide to start companies. *Journal of Business Venturing , 15* (2), 113-134.
Singh, S., Corner, P., & Pavlovich, K. (2007). Coping with entrepreneurial failure. *Australasian Entrepreneurship , 13* (4), 331-344.
Snel, D., & Bruinsma, A. (2004). *Oudere versus jongere starters.* Zoetermeer: EIM Onderzoek voor bedrijf & Beleid.
Snel, D., & Meijaard, J. (2006). *Met ervaring aan de start: over debutanten, weerondernemers en meerondernemers.* Zoetermeer: EIM Onderzoek voor Bedrijf en Beleid.
Stewart, W. H., & Roth, P. L. (2007). A Meta-Analysis of Achievemnet Motivation Differences between Entrepreneurs and Managers. *Journal of Small Business Management 45(4)* , pp. 401-421.
Stewart, W. H., Watson, W. E., Carland, J. C., & Carland, J. W. (1998). A proclivity for entrepreneurship: a comparison of entrepreneurs, small business owners and corporate managers. *Journal of Business Venturing* , pp. 14:189-214.
Stigter, H. W. (2001). *Het voorbereidingsproces: van start tot finish?: onderzoek naar de overeenkomsten en verschillen in het voobereidingsproces van starters, potentiële starters en stoppers.* Zoetermeer: EIM Onderzoek voor Bedrijf en Beleid.
University of Twente. (2005, 08 17). *Survival rate of the spin-offs of the University of twente.* Retrieved 04 04, 2010, from University of Twente: http://www.utwente.nl/top/general_information/top_in_statistics/Survival_rate_of_the_spin-offs_of_the_University_of_Twente.doc
Vaillant, Y., & Lafuente, E. (2007). Do different institutional frameworks condition the influence of local fear of failure and entrepreneurial examples over entrepreneurial activity? *Entrepreneurship and Regional Development , 19* (4), 313-337.
van der Meer, J. D. (2007). Kennisinnovatief ondernemerschap,; stabilitiet, dwarsverbanden en fijnafstemming. *Lectorale rede.* Enschede.
van der Veen, M., & Wakkee, I. (2004). The entrepreneurial proces, an overview. (o. Watkins, Ed.) *Annual review of progess in entrepreneurial research* .

van Gelder, M., Thurik, R., & Bosma, N. (2006). Succes en Risk Factors in the Pre-Startup Phase. *Small Business Economics* (26), 319-335.
van Praag, M. (2006). *Entrepreneurship and Human Capitel.* Amsterdam Center for Entrepreneurship, University of Amsterdam.
Vecchio, R. P. (2003). Entrepreneurship and leadership: common trends and common threads. *Human Resource Management Review , 13* (2), 303-327.
Verhoeven, W., Gibcus, P., & de Jong- ´t Hart, P. (2005). *Bedrijvendynamiek in Nederland: goed of slecht?* Zoetermeer: EIM.
Vloon, N. J., & Hammer, M. H. (2009). *Het CompetentCV.* Hengelo: V&H Uitgevers.
Wennberg, K., Wiklund, J., DeTienne, D. R., & Cardon, M. S. (2009). Reconceptualizing entrepreneurial exit: Divergent exit routes and their drivers. *Journal of Business Venturing* .
Wickham, P. A. (2003). The representativeness heuristic in judgements involving entrepreneurial success and failure. *Management Decision , 41* (2), 156-167.
Wijbenga, F. H., & van Witteloostuijn, A. (2007). Entrepreneurial locus of control and competitive strategies - The moderating effect of environmental dynamism. *Journal of Economic Psychology* (28), 566-589.
Wu, S., Matthews, & Dagher, G. K. (2007). Need for achievement, Business goals, and Entrepreneurial persistance. *Management Research News* (12), pp. 928-941.
Ziegler, M., Schmidt-Atzert, L., Bühner, M., & Krumm, S. (2007). Fakebility of different measurement mehods for achievement motivations: questionair, semi-projective, and objective. *Psychology Science* (49), pp. 291-307.

SUMMARY

PRIOR BUSINESS EXPERIENCE AND START-UP SUCCESS; THE MODERATING ROLE OF HELPERS EXPLORED

Joris Heuven, University of Twente/Nikos, The Netherlands
Paul Kirwan, California State University San Bernardino, USA

Principal Topic

The prior functional business experience of an entrepreneur is shown to have a positive impact on entrepreneurial outcomes. Multiple arguments have been made that explain this positive relation. For example, entrepreneurs with more functional business experience are believed to be better skilled, to be more reputable and have wider networks in place when starting a business (Campbell, 1992; Kim, Aldrich and Keister, 2006; Reuber and Fischer, 1994; Westhead, Ucbasaran and Wright, 2005). In the current paper we want to create a more precise understanding on the network argument that influences the relation between functional experience and start-up success (Aldrich & Zimmer, 1986; Lockett, Ucbasaran & Butler, 2006). More specifically we focus in depth on the role that key helpers play in the very early stages of the start-up process. We hypothesize that the relation between the functional business experience of a nascent entrepreneur and subsequent start-up success is moderated by the use of helpers during the start-up process. Hereby we study (1) the effectiveness of helpers for nascent entrepreneurs with a variety of experience levels in general and (2) the actual network properties that can explain helper effectiveness for nascent entrepreneurs with a variety of experience levels (when nascent entrepreneurs do use helpers).

Method

The data for this study were obtained from the PSED, a longitudinal database of individuals who were in the process of starting businesses. A detailed description of the background and methodology of the PSED data set can be found in Reynolds (2000).

Results and Implications

Our results show that the functional experience of the nascent entrepreneur has a significant positive impact on start-up success. Added to this we find that this direct impact is strongly moderated by the use of helpers. Entrepreneurs with more experience relatively benefit more from helpers then entrepreneurs with less functional business experience. Next to the effectiveness of helpers we also looked into the actual network properties between helpers and the nascent entrepreneurs (for those nascent entrepreneurs that made use of helpers). Hereby we find that the actual network properties between helpers and nascent entrepreneur do not explain helper effectiveness in the early stage of the entrepreneurial process for entrepreneurs with a variety of experience levels.

CONTACT: Joris Heuven; j.m.j.heuven@utwente.nl; (T): +3153 4895355; (F): +3153 4892159; University of Twente/ Nikos, Capitool 15, PO Box 217, 7500 AE Enschede, The Netherlands

Approaches to Delivering Entrepreneurship Education

Kainu Ari-Pekka, Klaavu Antti, Laine Kari, Lähdeniemi Matti, Stenbäck Camilla

1. Background for the research project

This research project presents as a case study of building strategically co-operation between three universities for new way of teaching and learning entrepreneurship. The research is a part of ERDF funded SaTaVa project. The ERDF programme for western Finland carries out the Western Finland vision for 2015: Western Finland is the leading Finnish region in entrepreneurship and humane growth which is nationally and internationally attractive due to its special expertise and innovation. The aim of the project is to promote innovative preconditions of the participating institutes of higher education and research institutes by creating a common, entrepreneurship-supporting innovation and learning environment. The writers also make some conclusions based on the results and experiences gained already of SaTava project. Project started in autumn 2008 and will continue to end of year 2010. The goal of the project is to investigate the development challenges of teaching entrepreneurship in higher education. The main target for the project is to plan, to build and test a common innovative learning environment for entrepreneurship. The project partners are Satakunta University of Applied Sciences, Tampere University of Applied Sciences and Vaasa University of Applied Sciences. Participating universities fulfilling each other knowledge and are looking for the best practices for student driven entrepreneurship with the commitment of building a real enterprise not only studies for degree.

The traditional entrepreneurship education on the basic level has emphasized obligatoriness earlier. Every student is given the knowledge of the basic level about the entrepreneurship matters. However, this has not led to the increase in the university entrepreneurship. The authors explore three questions: how can a university develop an entrepreneurial environment, how can a university find potential students and teachers for stimulating cultural change and what are general learning points already to be gained from the experience of regional co-operation between universities? The main argument is that entrepreneurship education should be part of a strategic design of University curricula. The authors have several years' experiences of developing 'Entrepreneurial University', including the development of an entrepreneurship curriculum, innovative learning methods, funded projects for higher education entrepreneurship and managing business incubators.

Keywords entrepreneurship education, strategic entrepreneurship, student entrepreneurship

2. SataVa project - guidelines for new strategy - increasing entrepreneurship activity of the students

SaTaVa project is strongly related to the study of new pedagogical models and search for new ways of teaching in the participating institutions. The wide scope of entrepreneurial education sets high expectations for pedagogy in higher education, traditionally focused on the superiority of knowledge. The research is based on the view that the students 'activities and aims outweigh the teachers' knowledge and ideas. The wide concept also integrates institutions and learning processes in the surrounding reality, extending the concept of a learning environment. Their significance may be perceived through the current learning environments and methods on one hand, and through constructions of personality and intelligence on the other. (Kyrö, Ripatti. 2006)

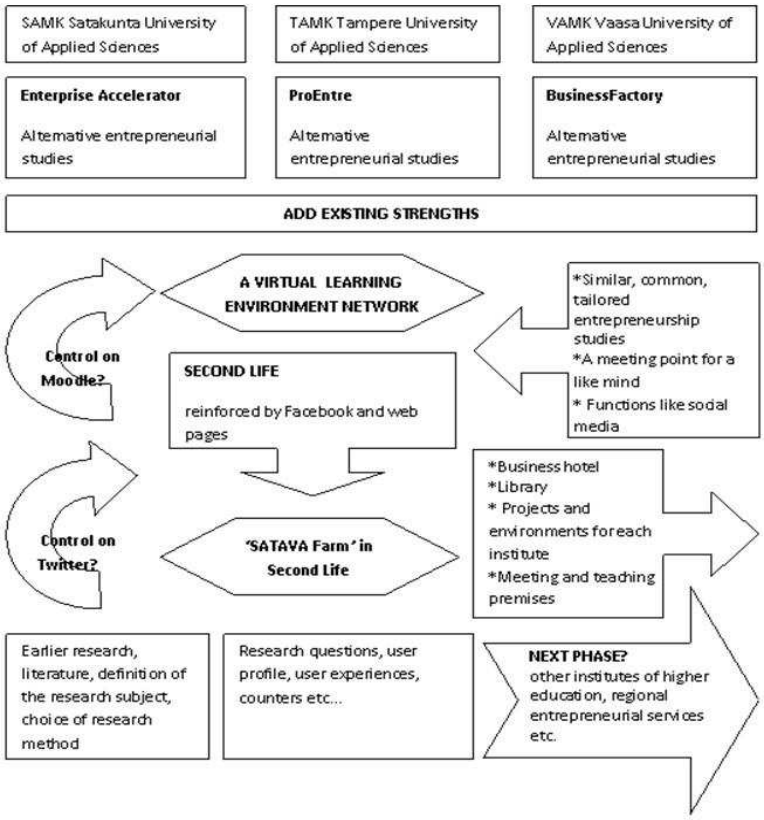


Figure 1. Structure of the project

The principal target groups of the project are the teaching and R & D staff of the participating universities of applied sciences, their present and future students, and the enterprises already running in the incubators. A group of potential student entrepreneurs has been identified through mappings. Among other things the project aims at experimenting with social media in promoting entrepreneurship in higher education, increasing the mobility of

students and the number of new enterprises launched during studies. The participants of the project are three institutes of higher education from three regions: Satakunta, Tampere, and Vaasa Universities of Applied Sciences. The project tests out new entrepreneurship-promoting activities which have not been tried before in the participating institutions. The entrepreneurship-promoting social media chosen for the project's use were Facebook and Second Life environments.

3. The SaTaVa learning environment on Second Life

Higher education entrepreneurship is becoming a widely accepted point of view (Rae, D., Gee, S. & Moon, R. 2009), but there are still questions of how an institute of higher education could be entrepreneurial. Rae et al. present in their study some interesting views from Derby University where a teaching team operated in an entrepreneurial manner for five years in order to stimulate learning of entrepreneurship. In their article the researchers highlighted three themes: the way an institute of higher education can develop entrepreneurial culture, the way teachers working entrepreneurially can act as a catalyst for cultural change, and the learning experiences of this five year period. Using a similar model of thinking, SaTaVa-project built a virtual learning environment where everything would happen in an entrepreneurial manner and all surrounding material would stimulate entrepreneurship. Each of the SaTaVa participant institutes used Virtualia and Moodle, the more traditional virtual environments. The experiences from them were positive especially concerning the ease of uploading material on the environment and the impeccability of giving out tasks. However, they did not offer real-time communication with the entrepreneurship mentor, for instance, nor a meeting place for entrepreneurs. As a result of mapping we found four interesting environments: Twitter, Second Life, LinkedIn and Facebook. Considering the aims of the project and some user interface tests, we chose Second Life as the main development platform for the learning environment and Facebook as the project's marketing and discussion channel. The decision on Second Life was also supported by the facts that EduFinland[1] offered us a favourable lease rate for teaching and research purposes as well as user support and training in Finnish.

Second Life (from here onwards the SL learning environment) became the object of our research project. In the spring 2009 we rented a virtual region of 9000 m2 from EduFinland in Second Life (http://slurl.com/secondlife/EduFinland%20II/64/53/26/?title=SaTaVa) for the use of the SaTaVa project. Our aim was to build on the

[1] The EduFinland Island (SLurl: EduFinland/174/108/29) created in Second Life by Suomen eOppimiskeskus ry offers an opportunity to get acquainted with the virtual environment and guidance without a great starting investment. Educational institutes may rent land from the EduFinland region for educational and research purposes and may use common premises. Suomen eOppimiskeskus ry is the responsible organisation for the regions' management and handles the payment transactions related to the region as well as organises user guidance. (http://edufinland.fi/)

region a virtual learning environment with an emphasis on entrepreneurship. At the moment, there are the buildings of Satakunta University of Applied Sciences Enterprise Accelerator and Innovation Learning Lab, the Entrepreneurship Library, a conference room, and the Business Hotel, all are located on our region. In the library there are downloadable electronic articles and guidebooks on entrepreneurship, founding a business, tax counselling, etc. available. The Business Hotel is meant to be used by the student entrepreneurs for their business presentations. There is also a SaTaVa Shop in the hotel that sells for example SaTaVa shirts Avatars. At the Innovation Learning Lab one can get further information of the ERDF project under the same name, or get acquainted with the OIBS website and for instance submit a business idea or look at ideas submitted by others. The Enterprise Accelerator offers further information about the services it produces and instructions on how to participate in the Accelerator's activities. The seaside view conference room provides Avatars with a free of charge environment for assembly.

Picture 1. The Business Hotel and Enterprise Accelerator located in the SaTaVa region
(Photographer: Ari-Pekka Kainu, 2010)

There are good examples of how to use Second Life for training purposes. For example, the Faculty of Medicine of the Imperial College of London has a virtual hospital in Second Life, where students can examine virtual patients in a department of pulmonary medicines. At the Auckland University, virtual hospital medicine students get to practise working at an intensive care unit and play the role of a patient. (www.med.helsinki.fi/tuke/tukevastiverkossa/arkisto/0902/090202.htm). Sosiaalinen media oppimisen tukena (Social media as a support for learning) is a Finnish example of international network http://sometu.ning.com/. However, social media in teaching and learning receives also a lot of criticism. In his column in Opettaja magazine 49/2009 Dr Mikko Lehtonen, professor of Media Culture, criticise social media and especially its sociality. Here is a quote:

"Social media is a wet dream for the person making money on digital media. Participatory economics (a rising trumpery) saves wage costs, as the users of the media are also the content co-providers. Political corners are thrilled also. The opponents of globalisation have for years organised their actions over the net. Now one can find Facebook pages for political parties and individual politicians. Some bloggers have succeeded in making themselves known also in other media. "I blog, therefore I am!" Is social media therefore more individualising than socialising after all?

4. First results of visitor counters in SaTaVa region

Since August 2009, the number of visitors has grown fast in SaTaVa region in Second Life. First launch took place in week 34, when we completed the Business Hotel and Library. In the beginning of March 2010, there have been more than hundred visitors (Avatars). Please note, that each Avatar is calculated only once. The most popular environment is the Entrepreneurship Library, where Avatars go and borrow to 'loan' articles and guide books for entrepreneurship. The second popular environment is the Enterprise Accelerator.

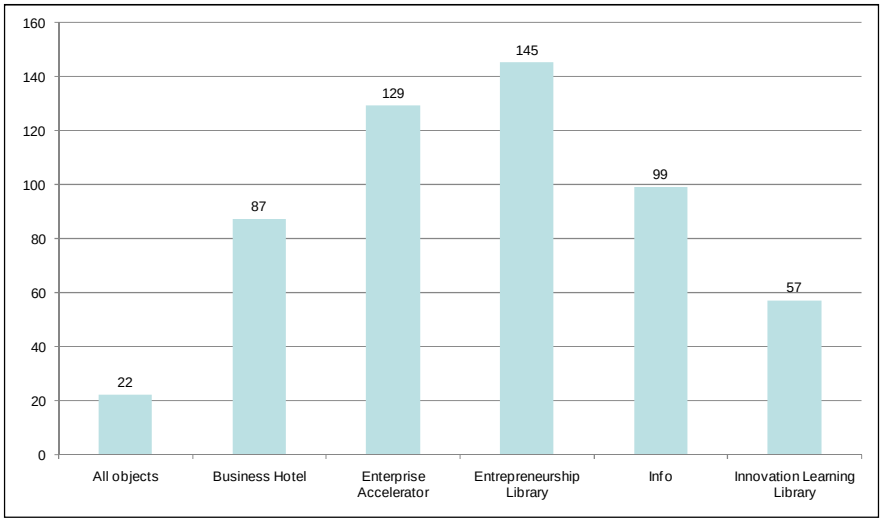


Figure 2. Avatar visitors in different places in SaTaVa region

The first results show that Avatars mainly visit one or two places when they come to region. In terms of future development, there is a challenge to build all the places more interactive one and with the existing virtual guide Avatar there.

5. Towards common entrepreneurship education strategy

The overarching principle behind this paper is that entrepreneurship education activities are operated in a fashion that replicates the business environment. This means that clear plans would be developed, roles and responsibilities would be assigned, metrics would be agreed to measure the effectiveness of the various initiatives and the efficiencies achieved, and a spirit of entrepreneurial action is engendered amongst all stakeholders. It should be an exemplar of practising what one preaches. This means either, that behind these activities, there should be a clear Entrepreneurship Education Strategy.

From the literature we noticed that the learning methods employed in entrepreneurship education and training programmes vary considerably from lectures, presentations and handouts to e-learning and case study-based learning, with group discussion and role-plays. In addition, both traditional and non-traditional approaches to learning are still valid. The idea that the learning needs of entrepreneurs will vary at different stages of development has been acknowledged for some time. Some researchers underlying assumption for using audience segmentation was that educational objectives, subject matter and pedagogical approach might be expected to vary depending on the nature of the target audience. We writers believe that the combination of traditional classroom training, social media and e-learning, mentoring and on-the-job training and with the strong supported personal study plan for entrepreneurship, university can offer new perspectives for the student to develop entrepreneurial skills and get the best out of the whole learning process. The authors are building guidelines for new strategy for each other universities, which would lead to the increase entrepreneurship activity of the students.

5.1. Approaches to Delivering Entrepreneurship Education at Satakunta University of Applied Sciences, SAMK

The Enterprise Accelerator of Satakunta University of Applied Sciences is a well known concept from real life. Enterprise Accelerator is an innovative pedagogical combination of research and development and higher education. It gives students the opportunity to become entrepreneurs already during their studies. Another option is to join in the accelerator activities with an already existing enterprise. Enterprise Accelerator has served student entrepreneurs in Satakunta University of Applied Sciences since 1997, with over 200 student entrepreneurs and over 170 enterprises from various disciplines. Nowadays nearly two new enterprises are

launched every month. The Finnish Ministry of Education awarded the Enterprise Accelerator of Satakunta University of Applied Sciences as a Centre of Excellence in Education 2005-2006.

The Enterprise Accelerator operates within all degree programs at Satakunta University of Applied Sciences. It helps students become entrepreneurs before their graduation. The Enterprise Accelerator helps students who have a business idea or an operating company. They will also be assisted in enterprise succession or in the acquisition of an enterprise. A cooperation agreement and an individual study plan in entrepreneurship will be prepared for each student in the Enterprise Accelerator.

The student will be supported by a mentor network. An expert mentor will encourage and advise the student entrepreneur. The student can obtain as many as 60 ECTS credits for completed studies related to the setting up and development of his or her own enterprise. The Enterprise Accelerator provides a unique opportunity for combining studying and entrepreneurship. Currently, the accelerator creates at least one enterprise each month.

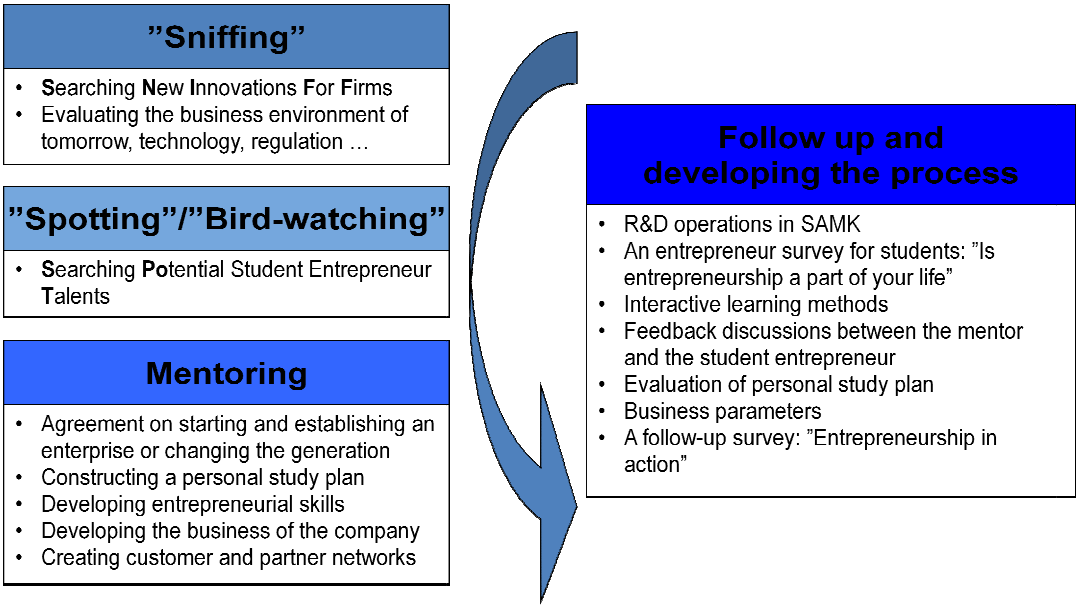


Figure 3. Incubator Process of Enterprise Accelerator - A modern combination of research and development and higher education

Mentor minds your business

Everybody needs support when starting an enterprise. A mentor is the key person to turn to when a beginner runs into problems. Enterprise Accelerator offers this kind of service to all its associates. Mentors work together with the student in developing and progressing. A business's life cycle goes on long after the idea has been carried out as a functioning enterprise. The mentor's role doesn't end, even though the business is running smoothly. The whole mentoring idea is based on an agreement and written contract. Later on this can be changed to a

partnership. It doesn’t obligate the student to anything, but adds extra value to the enterprise. Communication can be through e-learning environment and telephone conversations. The aim is to have longer face-to-face meetings at least twice a year.

Centre of Excellence in Education

The Ministry of Education designated the Enterprise Accelerator at Satakunta University of Applied Sciences a Centre of Excellence in Education in 2005–2006. This award was earned through hard work and made the entire university known as a good place to study. The evaluation of excellence in education aims to keep the level of education at universities of applied sciences high and to encourage them to long-term development work. According to the grounds given for the designation, the Enterprise Accelerator pursues constructive and persistent activities. Further-more, it has deepened and developed its innovative approach in the long term.

The Enterprise Accelerator is excellently integrated into the university’s overall task by promoting entrepreneurship within the university’s catchment area in a concrete manner. In particular, it should be accredited with the successful creation of new, sustainable business operations as one of the few promoters of entrepreneurship.

5.2. Approaches to Delivering Entrepreneurship Education at Tampere University of Applied Sciences, TAMK

Studies of the business of the first year: Practical business model

Studies will be completed in companies set up for training purposes. Students make a business plan and establish a company. Students practice trading, bookkeeping and contractual matters. Also marketing communication forms a significant part of the studies. The students are divided into groups and every group is responsible for a particular segment of the business. The aim is for the students to get the general - level understanding of different segments of the business and entrepreneurship. The studying in the companies lasts one year. At the final stage of the first year there will be an examination and the level of competence of every student will be assessed. Objectives of the study modules in the students' training companies:

1. Having completed the module, the student is able to create a business plan for the company independently. He/She understands the basic rules of entrepreneurship. The student perceives how companies are managed in

practice.

2. The objective of the module is to make the business work. The student will understand the significance of sales and marketing in the operation of the company. Furthermore, he/she takes control over the routines of the business, such as financial management and agreements.

3. The student can assess the economic state of the company and understands how to make the company profitable. He/She understands how entrepreneurship can be developed and how his/her business can be expanded internationally. Furthermore, he/she understands how a company can be managed. In addition the student understands how to organize and delegate work. The student can also independently take responsibility for an exhibition stand as a business fair and represent his/her own business there.

4. The student will understand after the module how entrepreneurship can be developed further and how his/her business can be expanded nationally as well as internationally. Furthermore, he/she understands which factors are to be taken into consideration when developing company's business operations. The student understands basic concepts and basic rules of the national economy. He/She can manage basic measures which are related to the accounting period of the company.

P*roAkatemia, a special unit of entrepreneurship*

ProAkatemia is a unit studied during the second and third year. The students will found a company immediately at the beginning of another year of the studies. ProAkatemia equips the student with good skills to work as an independent entrepreneur or employee of someone else's business. Some of the key focus areas of studies include project and teamwork. The student will find his focus by observing his/her own strengths and interests. His/Her personal learning path consists of this process. The studies consist of projects which carried out in the students' own companies, studying professional literature and regular team meetings. The study is team based learning and every team has its own trainer. Students can discuss their ideas, make experiments and practice various business related situations. The learning method is based on the learning by doing model where thoughts and ideas are shared within teams and they are transformed into plans of action in a concrete manner.

ProAkatemia's literature is chosen according to every learner's own interest areas. There are about 1 000 books on the list. The books are scored according to the standard scale of 1-3. An essay is written about the books and it needs to mirror student's experiences, the operation of the team and the practical projects. The essay will be returned to the team's own trainer. Professional studies include the literature of different subjects, seminar

lectures and company visits, network studies, team meetings, teamwork, production of new information and projects. The literature in the professional studies concentrates on subjects such as marketing, project management, learning skills, innovation and entrepreneurship as well as teamwork and IT.

5.3. Approaches to Delivering Entrepreneurship Education at Vaasa University of Applied Sciences, VAMK

VAMK's Business Clinic and Business Factory provide two different and innovative approaches for students and teachers who are interested in exploring innovative learning methods and deepen their knowledge about entrepreneurial thinking.

Business Clinic Process model

The Business Clinic offers students credit points if the realized product or service is approved by the company or organization and according to the teacher's fulfillment. Depending on the size and extent of the service companies pay a certain amount for the provided services. Statistics from the year 2007 show that 150 students took part in realizing different project coordinated by the Business Clinic collecting totally 480 credit units.

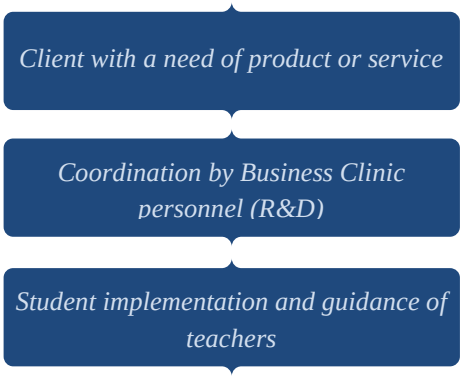


Figure 4. Business Clinic Process Model

The process model has received very positive feedback from students who have carried out the customized services according to companies' needs. Since VAMK is a multilingual organization, services have been carried out in Finnish, Swedish, English and German. Examples of services are market and image surveys, marketing plans, competitor analysis, product development, translating services and so on. During the last few years there has been a productive collaboration also with surrounding communities to Vaasa wanting more expansive

surveys and assistance with seminar arrangements. There is however the same process model used no matter if the client represents the private or the public sector. Here it is illustrated in a somewhat simplified way.

Future plans for the Business Clinic is to develop the business even further by motivating more teachers and students to participate and taking on larger services. Business Clinic doesn't yet have an own module supporting the entrepreneurial curriculum (unlike Business Factory). However, VAMK has taken a stand and decided to develop the Business Clinic, together with Business Factory, as the two main incubative environments for students interested in deepen their knowledge in entrepreneurship. According to internal and external surveys, both students at VAMK and companies/ organizations agree upon the importance of an existing Business Clinic providing alternative learning methods and simultaneously qualitative products and services to the business in Vaasa also in the future.

Business Factory Process model

Business Factory offers students credit points as well as when participating in Business Clinic. Almost 50 students have completed the course Team Entrepreneurship in Business Factory since it started in 2005 and total completion of credit units is about 550. 24 students have completed their internship arranged by Business Factory and 11 companies have been founded. Business Factory has similar background as Business Clinic since both started their businesses in one degree programme and has now expanded their availability to all students at VAMK. Business Factory is based on a group of young entrepreneurs who carry out their own business at VAMK. The main objective is that student learns entrepreneurship through active and practical work in multidisciplinary and multicultural team in an incubative environment. Among the objectives is also included profitable business operation and employment by creating own team companies.

Studies mix the concepts learning by doing, problem based education and teamwork thinking where students develop both their theoretical skills as well as their social and practical knowledge. Study methods involving marketing conservations, consultancy, management and internship are frequently used. Since the majority of students are studying International Business are the services provided in Finnish, Swedish and English. Students who are interested in participating in Business Factory get a study plan which fits their studies and personal objectives which are discussed with a teacher, or so called coach, at VAMK. Examples of courses integrated in Business Factory incubative environment are Development of Entrepreneurial thinking, Brainstorming, Event marketing, Budgeting and profitability and so on.

6. Conclusions and next phases of new pedagogical models

A survey by Growth Lab Consulting (2/21/2010) shows that in Finland, Enterprise 2.0 is currently at the early adoption stage, where competitive advantages will come to those who embrace the new tools and business models. But already 40% stated that spend will be made to prepare social media strategy. Our research as well as SaTaVa-project is taking first steps for developing common strategy for entrepreneurship education by using social media. Social Media makes new type approaching possible between a university and a student. The new media provide many different opportunities to communicate and to teach matters which are related to the entrepreneurship. It is possible for the students to learn and to develop its own business ideas irrespective of time and place. Second Life is one tool in this environment. Second Life is an interactive medium which gives the opportunity, the persons, Avatars to the discussions. Second Life as a challenge is the quick computer required for its usability. When the programme SL develops, in the future its problem also will arise to the loss. The possibilities offered by the social medium develop however so fast that it is difficult to predict what the operations models of the future are.

In the future, the SaTaVa region in the Second Life will be a venue for virtual information events for entrepreneur-to-be students. There will be short virtual seminars for instance, where entrepreneurs talk about their entrepreneurship and workshops on marketing, customer relations, and lines of action and methods of developing an enterprise, among others. But something else is going to happen in the field of new pedagogical models. Facebook is more and more linked to our learning environment. In the near future, it will be not only a marketing tool for us, but a real discussion channel, too. Discussion on entrepreneurship, and on challenges to start own enterprise, to meet first customers etc., shows that there is a need for social media. And social media offers us a tool to analyze future needs for developing our own entrepreneurship training. For example, Tampere University of Applied Sciences is now building for the SaTaVa project a new business environment KYKY, where students practice and learn how to establish, lead and do the operation control correct sells in the environment. The central objective is that the students adopt business both in theory and practice. The environment is built around the Pupesoft software. KYKY has own real business environment with a bank, an insurance company, trading partners and a warehouse etc. There is also an online magazine in connection with learning visual communication. The students design and build a virtual company in which they act as if they were working in a real company where money is only thing which do not move rightly. Everything else simulates real business.

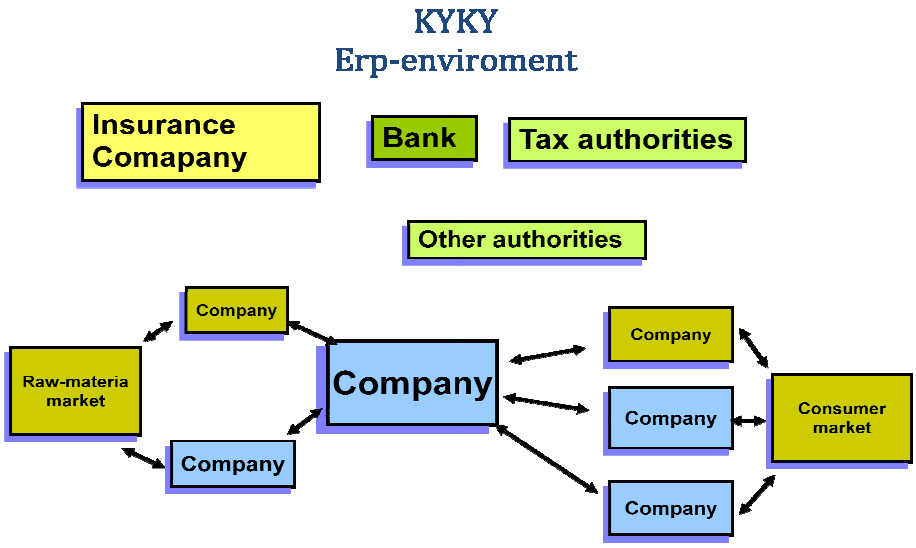


Figure 5. KYKY Erp-environment

This kind of learning environment is well suited for students from all of the education fields and it serves as teaching base for the basic studies of entrepreneurship and business. It is browser-based system, which makes remote login possible regardless of time and place. Thanks to open technologies, the system can be edited into a learning environment and properties can be added to it according to the teaching needs. The open environment makes development and enlarging of the learning environment possible. License fees are not connected to the systems of open source code. It has not been bound to one supplier or to any expert individual, but it can be developed or from the quarter an organization. Teacher may create events for the ability environment itself or may define automatic machine functions. Teacher gets information about the students' real action with the help of various reports: Events etc. made by the indicators of the firm, the user. Furthermore, the students' know-how can be tested. The subject of the examination is: open orders, situation of the bookkeeping, decreases late, balance of the bank account. KYKY environment will be ready completed in the spring of 2010 and the first pilot will begin in the autumn of 2010 when new students arrive.

References

Growth Lab Consulting/Winnovation Network. (2010) Enterprise 2.0 and Social Media in Business (Survey 2010 – Finland). 2/21/2010.

Koivunen, M-R. & Nieminen, M. (1994) Systeemityölehti 3/94.

Kyrö P. Ripatti A. (2006) Yrittäjyyskasvatuksen uusia tuulia. ISBN 951-44-6551-2.

Lehtonen, M. Sosiaalisen median sosiaalisuus. Opettaja -lehti nro 49/2009.

Rae, D., Gee, S. & Moon, R. (2009) The Role of Entrepreneurial Learning Team. Industry and Higher Education Volume 23, Number 3, June 2009. IP Publishing Ltd, UK.

http://slurl.com/secondlife/EduFinland%20II/64/53/26/?title=SaTaVa

http://fi.wikipedia.org/wiki/Second Life 8.1.2010

http://sometu.ning.com/

www.gartner.com

www.gartner.com/it/page.jsp?id=778814

www.med.helsinki.fi/tuke/tukevasti verkossa/arkisto/0902/090202.htm

www.opiskelijayrittaja.fi

www.palanapelissa.net/kayttajatutkimus/

www.webropol.com/P.aspx?id=385752&cid=74485503

An engineering approach to business model experimentation–an online investment research startup case study

Björn Kijl (b.kijl@utwente.nl), Durk Boersma (d.boersma@student.utwente.nl)

University of Twente – School of Management & Governance

Phone: +31(0)53 489 2350
Fax: +31(0) 53 489 2000

PO Box 217

7500 AE Enschede

The Netherlands

ABSTRACT

Every organization needs a viable business model. Strikingly, most of current literature is focused on business model design, whereas there is almost no attention for business model validation and implementation and related business model experimentation. The goal of the research as described in this paper is to develop a business model engineering tool for supporting business model management as a continuous design, validation and implementation cycle. The tool is applied to an online investment research startup in roll out and market phase. This paper describes the research as performed in a case study setting by focusing on the design, implementation and evaluation of the business model engineering tool. We also analyze the actual implementation and usage of the business model tool by the online investment research startup by focusing on the most critical actions related to actual business model implementation – i.e. actions with so-called 'Lollapalooza tendencies'.

Keywords

Business models, action design research, business model engineering, business model dynamics, business model experimentation, business model management, business model innovation, growth & deployment strategies, Lollapalooza tendencies, Internet services, service innovation, entrepreneurship, startups.

INTRODUCTION

With increasing marketplace dynamics, shorter time-to-market cycles and rapid technological developments, the ability to imagine and combine different, formerly separated, technological capabilities in order to facilitate new and useful value propositions for users and customers will be critical (Kijl et al. 2005). To be able to offer these value propositions with new Internet services in a sustainable manner, new viable business models need to be developed (Bouwman et al. 2008; Haaker et al. 2007; Haaker et al. 2006) – in the end, every service needs a viable business model.

The business model concept supports simulating, analyzing and understanding current or new business concepts as well as exploiting them (Osterwalder and Pigneur 2002a; Osterwalder and Pigneur 2009).

Although there are many publications on business models, most researchers consider business models as a static concepts and describe them mostly qualitatively (Kijl et al. 2005). However, in practice, business models constantly (need to) change and thus need to be managed actively, e.g. because of changing market or technological environments (Bouwman et al. 2008; Kijl et al. 2005) and they can be described quantitatively as well (Kijl and Nieuwenhuis 2010; Tennent and Friend 2005). With this research we strive for finding a way to monitor and manage a business model in a more structured, pro-active as well as quantitative way.

By making use of a business model engineering tool, business models could be managed more actively, which may lead to lower failure rates of new businesses or technologies (Mason and Rohner 2002). This is because the real strength of an organization may be strongly related to the quality of its underlying business model. In the end, a mediocre technology exploited with a great business model may be more valuable than a great technology pursued via a mediocre business model (Chesbrough).

RESEARCH OBJECTIVE AND CASE DESCRIPTION

The objective of this business model engineering case study with action design characteristics (Cole et al. 2005; Sein et al. 2010) was to build a business model engineering tool for an online investment research boutique, which evaluates investment opportunities related to investing in shares of companies listed on stock markets and sells related analyses to their clients. The boutique uses a so called freemium business model: it offers free information services to their readers as well as premium, paid information services to a subset of their readers (Anderson 2009; Osterwalder and Pigneur 2009). The company offers all people who subscribed to their mailing list via their website a free weekly investing column. Paying members also get a monthly analysis of three stocks that look interesting from a value investing perspective – these stocks have to be cheap and the companies behind them have to be sustainably profitable (Graham 2003). Essentially, the research boutique can be seen as an information service provider with a scalable business model that completely digitized and automated all information distribution by making use of online mailing systems, online membership and information protection systems as well as online payment systems.

Key driver of the business model concept has been the emergence of the commercial Internet which enabled ubiquitous communications and cheaper ways to convey vastly more rich amounts of information as well as making it possible for businesses to do things they simply never could before (McGrath). These characteristics make information services with scalable business models like that of the investment research company as described above ideally suited for business model experimentation.

The investment research company designed and implemented its business model by making use of the so-called STOF-framework – a common business model analysis framework (see also Section ‘What is a business model?’). Since the company moved from R&D and roll out to the market phase and is profitable, its business model can be considered as viable. But the company didn’t have the ability to test and experiment with its business model in different market scenarios.

Main aim of business model engineering tool is to help the founders of the investment research boutique to engineer (monitor, test, adapt and fine tune) their business model in order to discover strengths, weaknesses, opportunities and threats and to optimally capitalizing on one of their most important assets: their mailing list with thousands of investors. It is expected that the results from the engineering process could be used to find areas and actions for business model improvements. Furthermore, we expect that that the tool could also be used to predict sales and profit levels in different market scenarios.

RESEARCH APPROACH

An action design research approach (Cole et al. 2005; Sein et al. 2010) with iterative (problem identification, intervention, evaluation and reflection) cycles was used for developing the business model engineering tool, based on qualitative as well as quantitative analysis. Information from expert interviews, literature studies and quantitative modeling were combined in order to develop the business model engineering tool. After initial development, the tool was refined and improved in three design cycles based on expert interviews. The following iterative steps were used:

- Analyze the current – already viable – business model: The business model in use by the investment research company needs to be analyzed and the underlying logic needs to be clear.
- Build the engineering tool: In this step the business model engineering tool has to be built, by using the already viable and implemented business model design of the investment research company as analyzed in the previous steps as a basis.
- Analyze output: The output from the engineering tool could be used for adapting and fine tuning the business model of the investment research company, i.e. by discovering strengths and weaknesses as well as recognizing potential threats and finding new opportunities for growth.

After describing the results of a concise business model literature study in the next section, the development of the business model engineering research will be described, following the three steps as mentioned above. Subsequently, we will focus on concisely analyzing and evaluating the actual usage and implementation of the approach by the investment research start up.

BUSINESS MODEL LITERATURE REVIEW

Because the business model concept plays a critical role in developing a business model engineering tool, we need a clear understanding of this concept.

What is a business model?

Essentially, a business model describes the logic behind value creation (Bouwman et al. 2008; Kijl et al. 2005). A widely used business model definition within this context is the definition by Rosenbloom and Chesbrough (2002): “A business model is a blueprint for how a network of organizations co-operates in creating and capturing value from technological innovation”.

Initially, most attention has been paid to empirically defining and classifying business models (Hedman and Kalling 2003; Timmers 1998). More recently, literature focused more strongly on business model design and defining business model components (Bouwman et al. 2008; Kijl et al. 2005; Osterwalder et al. 2005; Pateli and Giaglis 2004).

A business model can be seen as a description of the manner by which an organization delivers value to customers, entices them to pay for value and converts those payments to profit (Teece). Afuah and Tucci (2000) describe business models as systems that are built from different components, such as value, revenue, sources and capabilities. They state that a business model is geared toward total value creation for all parties involved (Zott and Amit).

Osterwalder and Pigneur (2002b) define four fundamental business model components: product innovation, customer management, infrastructure management and financial management. These four

components are used to group all their subcomponents. Later, Osterwalder and Pigneur further specified these four components into the following nine components (2009): value proposition, customer relationship, distribution channel, target customer, core capabilities, partner network, value configuration and cost structure and revenue streams.

For this research, we use the so-called STOF-framework (Bouwman et al. 2008; Kijl et al. 2005). Though it has other components, it covers the same areas as the model of Osterwalder and Pigneur (2002b; 2009). The STOF-framework uses four different domains or business model components to describe the underlying logic of business model designs (see also Figure 1). Each domain has the generation of value for customers and end users as well as the other roles (mostly organizations) participating in the value network as a key point. The business model components are:

- Service (a description of the service concept an organization or group of organizations offers, its value proposition and the market segments that are targeted)
- Technology (a description of technical architecture, service platforms, devices, applications)
- Organization (a description of actors, roles, interactions, strategies and goals, value activities)
- Finance (a description of investment sources, cost sources, revenue sources, risk sources, pricing)

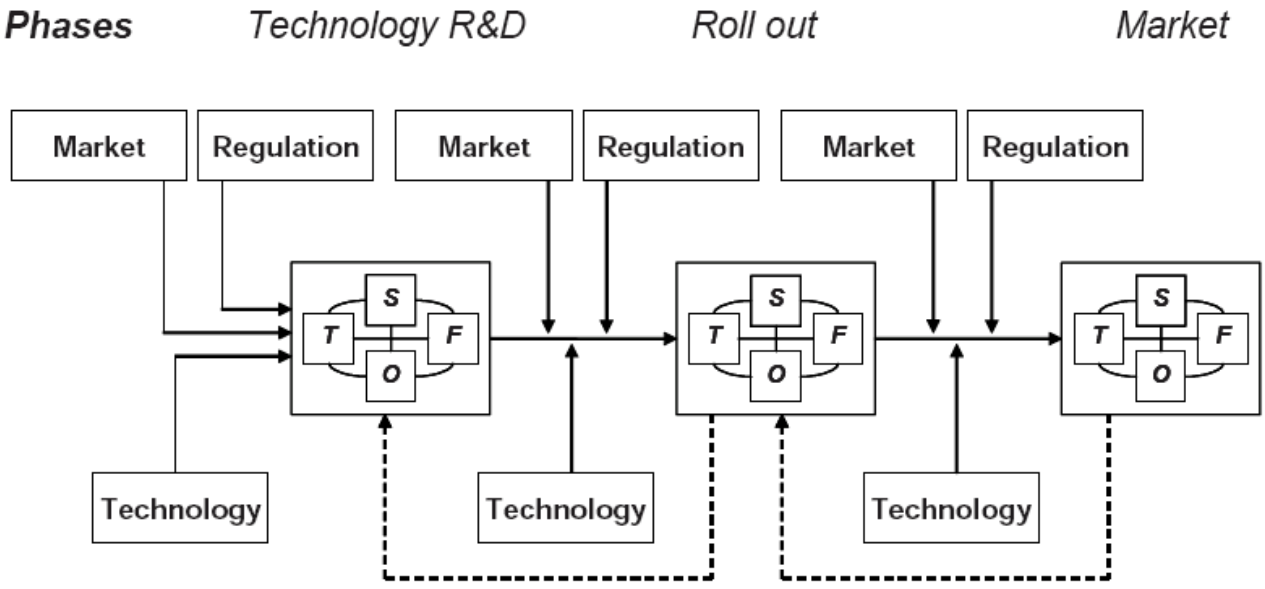


Figure 1 The dynamic STOF-framework from Bouwman et al [3]

Business models are dynamic

While most business model literature has a static and qualitative nature, early stage business model development and validation of business model designs is mostly lacking in literature as well as practice (Kijl et al. 2005). Because of continuously changing market, technology and regulatory environments, most business models have to change as well and can therefore be seen as dynamic concepts (Bouwman et al. 2008). This is also depicted in Figure 1. Sustainable business models, according Morris et al. (2005), have a consistent fit between external factors and the configuration of key activities. Also Porter (2001) related business models to market structures and how companies fit into these structures.

Business model design may take place in market phase, but also in the roll out as well as the technology/R&D phases of a product or service offering – it can be seen as an iterative process (Mason and Rohner 2002; Tennent and Friend 2005) – see also Figure 1. Actually, focusing on business model design only in implementation or market phase is very risky and costly (Mason and Rohner 2002). Not managing the business model at all may be even more risky and costly (Tennent and Friend 2005), and may lead to flawed business models.

In the next sections, the three steps as discussed in research approach section will form the basis for creating a business model engineering tool. Since the second step, the actual development of the business model engineering tool, is the most critical one in this context, the three steps are further specified into a seven step approach. This approach is depicted in Figure 2, and contains the following steps: 1) analyzing the (already existing) viable business model and obtain the related variables, 2) developing an analysis cockpit, 3) designing business model performance indicators and related calculations, 4) adding scenarios, 5) quantifying the scenarios, 6) generating the output from the business model engineering tool in the form of business model performance indicator calculations and 7) interpreting the model output and improving and fine tuning the business model. After the last step, the engineering cycle can start all over again. Each of these seven steps will be concisely discussed in the next sections.

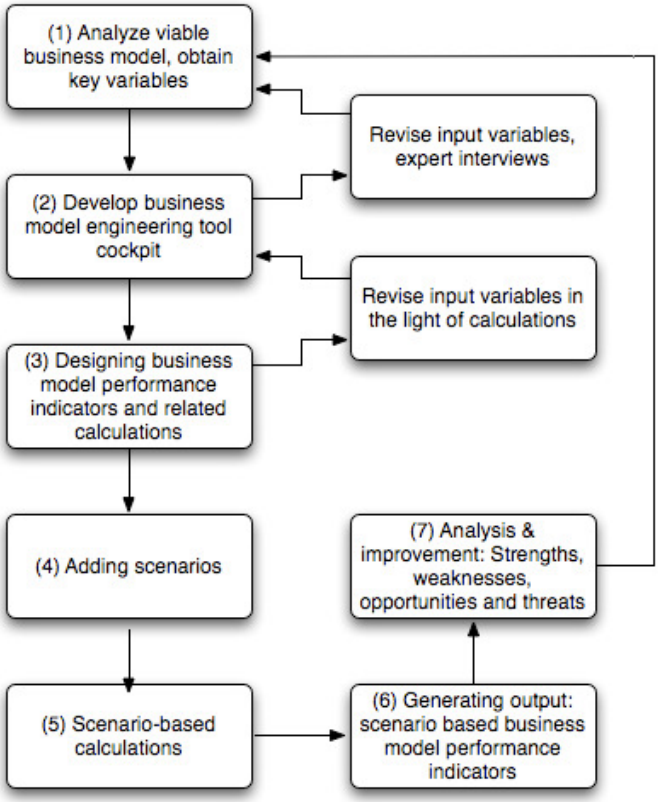


Figure 2 A seven step approach to business model engineering

STEP 1) DEFINING BUSINESS MODEL VARIABLES

The first step in developing a business model engineering tool for the investment research company was to find the most important underlying variables like mailing list size, sales prices and technology costs related to the business model design of the company by making use of the components of the STOF-framework (Bouwman et al. 2008; Kijl et al. 2005). In this case study, all variables were identified via expert interviews with one of the founders of the online investment research boutique. The STOF-framework from Bouwman et al. (2008) was used as a checklist and for grouping the variables. The variables were divided into the four components of the STOF-framework and with 'market environment' as most relevant external component. The other two external components as identified in the STOF-framework, the regulatory and technological environment, were not modeled because of their lower expected influence on the business model of the company as well as because they are relatively difficult to quantitatively model and define in terms of variables.

For the Service component, variables like mailing list size and amount of subscribers for the premium services were identified and for the Technology component the variables webhosting costs and payment processing costs. For the Organization domain, we identified variables like traveling costs, subscriptions costs of investment analysis services and marketing costs. In the Finance domain, subscription prices were identified as variables, next to some tax related variables. For the most critical external component, Market environment, market sentiment, amount of investors and economic growth were identified as main variables – when e.g. the market sentiment is good, the amount of subscriptions is expected to increase and vice versa. An overview of the main variables can be found in Table 1.

Once the variables are defined, we can start with step 2.

Table 1 Main variables derived from the business model of the online investment research boutique

Service	Technology	Organization	Financial	Market Environment
Size mailinglist	Inventory	Number of FTE	Service_1 Yearly Price	Market sentiment
Subscriptions Service_1 Yearly	Webhosting	Salary	Service_1 Quarterly Price	No. investors
Subscriptions Service_1 Quarterly	Payment_system 1	Traveling cost	Service_1 Monthly Price	Eco. growth
Subscriptions Service_1 Monthly	Payment_system 2	Subscriptions	Service_2 Yearly Price	
Subscriptions Service_2 Yearly		Marketing	Service_2 Quarterly Price	
Subscriptions Service_2 Quarterly			Service_2 Monthly Price	

Service	Technology	Organization	Financial	Market Environment
Subscriptions Service_2 Monthly			VAT	
Subscriptions Service_3			Tax on income	

STEP 2) DEVELOPING A COCKPIT

The variables as identified in the first step need to be implemented in the business model engineering tool. For this research, the engineering tool was built in Microsoft Office Excel – a popular spreadsheet application.

According to Tennent and Friend (2005), an effective way for showing the most important variables, is to use one sheet exclusively for these variables. This sheet will be called the cockpit. The variables can be shown in exactly the same way as they are found, using the business model components from the dynamic STOF-framework.

Since the main aim of the business model engineering tool is to monitor, test, adapt and fine tune the business model, a performance calculation over several – in this case five – years has to be made. Therefore, a starting year can be added to the cockpit. Figure 3 depicts the components of the business model and all related main variables, based on an expert interview with one of the founders of the online investment research boutique (next to the main variables as described in the previous step, some investment portfolio variables were added as well). During this interview, the variables were checked and the cockpit was checked for completeness as well.

Project name						
Starting year	2010					
Scenario	2	1	2	3	4	See: Scenario
						Standards
Service						
Size Mailinglist						
Growth Mailinglist						
Subscriptions Service_1 Yearly						
Subscriptions Service_1 Quarterly						
Subscriptions Service_1 Monthly						
Subscriptions Service_2 Yearly						
Subscriptions Service_2 Quarterly						
Subscriptions Service_2 Monthly						
Subscriptions Service_3						
Technology						
Inventory						
Webhosting and Backup						
Payment system 1 payments (#)						
Payment system 2 payments (#)						
Value payment system 2 payments						
Organization						
Number of FTE						
Payment per Hour						
Traveling Cost						
Subscriptions						
Marketing Cost						
Financial						
Price Service_1 Yearly						
Price Service_1 Quarterly						
Price Service_1 Monthly						
Price Service_2 Yearly						
Price Service_2 Quarterly						
Price Service_2 Monthly						
Price Service_3						
Value Added Tax						
Tax on Income						
Direct Mailing						
Value Service Investment Portfolio						
Value Management Investment Portfolio						
Return on Service Investment Portfolio						
Return on Management Investment Portfolio						
Price Per Payment System 1 Transaction						
Price Per Payment System 2 Transaction						

Figure 3 Anonymized cockpit of the business model engineering tool

STEP 3) IDENTIFYING CRITICAL BUSINESS MODEL PERFORMANCE INDICATORS

Business model performance indicators help to assess how well a business model is performing. By following the principles of Tennent and Friend (2005), we created a new sheet for these performance indicators. In this case study, the most important performance indicators identified were the turnover per mailing list e-mail address, the size of the mailing list, net profit after tax and the total value of a specific stock portfolio of the company.

Most of the business model performance indicators can be created by using one or more variables from the cockpit and adding a formula. For example, using the number of subscriptions for a certain service, the price people pay for their subscription, and multiplying these two, the turnover for that service can be calculated. Via expert interviews the following critical performance indicators were found:

- Total turnover: The total turnover is based on combining all the services and products that costumers use.
- Gross margin: The total turnover minus all of the organizational costs.
- Profit after tax: The total turnover minus all of the costs and taxes.
- Margin per e-mail address: The profit after tax divided by the size of the mailing list.
- Addition on management portfolio: The amount of money (profit) that can be re-invested the investment portfolio of the management of the company.
- Value management portfolio: The value of the of investment portfolio of the company's management. Because the money is mostly invested in stocks and related investments, the value can vary.
- Value VP: The value of a related investment portfolio that is specifically used for one of the premium analysis services the investment research boutique offers.

For each of these variables, charts can be easily created.

STEP 4) ADDING FUTURE SCENARIOS

Once the basics of the business model engineering tool are developed, the tool output can be made more dynamical by adding future scenarios influencing the variables as mention in Step 1. According to Tennent and Friend (2005), one of the most functional ways to create scenarios is by putting two main variables in a matrix. Predicting future scenarios is difficult and mostly doesn't make too much sense, however imagining different future scenarios and analyzing the consequences is regarded a valuable exercise because it may help to strengthen overall business model viability (Rietdijk and Van Winden 2003).

Investors simply need to have money available before they will subscribe to investment analysis services. A positive economic growth supports their willingness to subscribe. Next to that, people tend to invest more if stock markets are doing well. Considering these two findings, both market sentiment and economic growth are important, while both of them cannot be controlled by the investment research boutique, a critical prerequisite for scenario variables. Therefore, market sentiment and economic growth – both part of the external Market environment domain in the STOF-framework – were chosen as scenario variables, resulting in four scenarios: a good or bad market sentiment in combination with high or low economic growth (see also Figure 4).

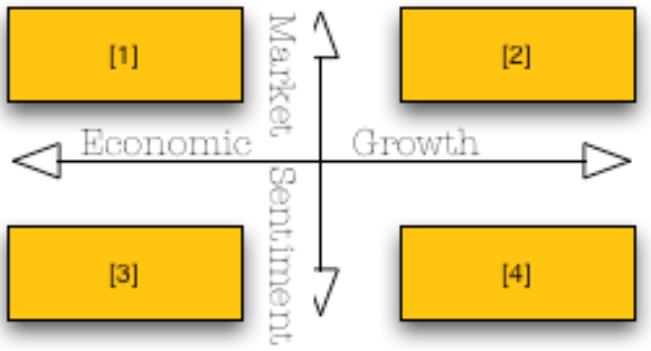


Figure 4 Scenario building based on two variables in a matrix

STEP 5) ADDING SCENARIO-BASED CALCULATIONS

As market sentiment and economic growth are set (optionally with different weights and multiplier factors in order to transform the standard variables as defined in Step 1 into scenario-based variables; see also Table 1), scenario-based calculations can be made – see Figure 5.

Market							Weight
Economic Growth	1,3	1,1	1,3	0,7	0,9		0,7
Market Sentiment	1,3	1,1	1,3	0,7	0,9		0,3
Multiplier	1,3	1,1	1,3	0,7	0,9		

Figure 5 Multiplying factor calculations – for both variables economic growth and market sentiment the weight can be set for each of the four scenarios.

Some of the standard variables are only influenced by one of the two scenario-factors. Therefore, it is also possible to make use of the market sentiment multiplier or economic growth multiplier only.

Based on calculations of e.g. turnover, profit, taxes and profit after tax, the 'behavior' of the business model performance indicators over a five year period can be shown by the tool. By changing the scenario and variables in the cockpit of the tool, outcomes can be generated for every scenario in different circumstances (e.g. with a large or small mailing list, high or low pricing of premium services, etc.).

STEP 6) GENERATING OUTPUT: SCENARIO BASED BUSINESS MODEL PERFORMANCE INDICATORS

Analogous to creating separate input and calculation sheets, the output results per scenario are projected on separate sheets in the form of graphical representations of business model performance indicators. Figure 6 shows an example of such a graphical representation in the form of one of the performance indicators as identified in Step 3. These graphical representations form the basis for the next step: analysis & improvement.

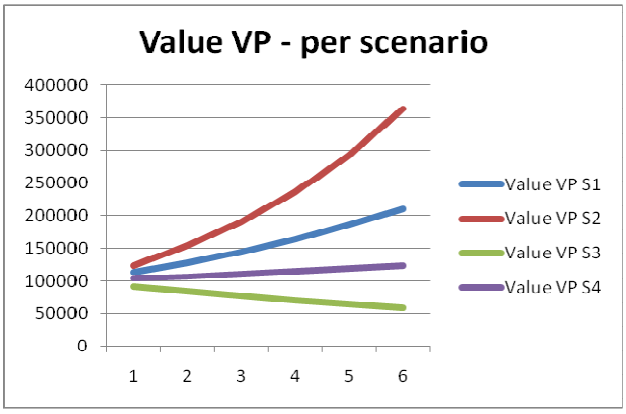


Figure 6 A graphical representation of one of the business model performance indicators – the value of an investment portfolio related to a premium service in four scenarios over a five year period.

STEP 7) ANALYSIS & IMPROVEMENT

Improving a business model design in such a way that it is expected to be viable in every scenario can only be done if the output of all of the scenarios is being analyzed. In this section, we will shortly discuss the main results of the business model analysis based on reviewing the performance indicators in each of the four scenarios as identified. Some suggestions for adaptation and fine tuning will be given as well.

It is important to mention that the calculations within each scenario are based on a grounded guess of the market sentiment and economic growth multipliers as well as the related business model variables. It is impossible to predict the future, so the figures won't be exactly correct, but as investor Warren Buffett, one of the examples of the founders of the company, once said: "It is better to be approximately right than precisely wrong."

After comparing the performance indicator results in each of the four scenarios during the five year period, we saw that the expected profit levels are relatively volatile: they may substantially increase in a positive scenario (with strong economic growth and a positive stock market sentiment) as well substantially decline in a negative scenario (with a slow or no economic growth combined with a negative stock market sentiment). Considering the most important business model performance indicator, the margin per e-mail address, we saw that different scenarios have a strong influence on this indicator. The margin may vary between less than EUR 1 and EUR 30.

Another important indicator is the value of the management investment portfolio (a money reserve owned by the founders based on 'excess profits' in earlier years). Although it initially could be used as a buffer, in good times it can become a valuable asset as well. The value in five years from now could vary between about EUR 150K in very though market circumstances and a few million EUR in good ones.

Because of its low operating costs and the existence of a management investment portfolio, the boutique can survive tough and difficult scenarios like one with no or negative economic growth and a negative stock market sentiment. Without such an investment portfolio the online investment research boutique could go bankrupt in the toughest scenario. But even then it is expected that e.g. increasing the mailing list size would probably generate more profit – even in bad economic situations, or probably exactly because of bad economic situations, investors may see great investment opportunities. Furthermore, the boutique itself could profit from the potential investment bargains that are expected to be found in such

a scenario. In order to capitalize on these opportunities, it could be wise to create a special money reserve during better times, next to the management investment portfolio.

Because of the relatively low underlying costs, the profitability of the business model is mostly dependent on the size of the mailing list and the number of investors with subscriptions. Although the costs are relatively low, in really tough market circumstances there are still some possibilities to save money on certain costs like traveling. Second, based on the business model engineering tool results it seems a good idea to invest the profit after tax in a buffer fund. A management investment portfolio as mentioned before definitely makes sense, but the value of such a buffer on the short term is relatively uncertain because of the risk of stock market crashes. So, creating an extra low risk buffer could be worthwhile as well, not only because it may lower risks but also because this buffer could also – at least partially – be used for 'extreme bargain investing' when markets go down significantly. Thus, in this way the company may profit in two ways from creating and maintaining such a buffer.

Overall, the analysis shows that it would be good to try to further increase the size of the mailing list because this variable has a positive influence on all business model performance indicators – it generally leads to higher profit levels because of increased scalability. Further increasing the amount of paid subscribers relative to the size of the total mailing list is expected to have a similar positive influence, but is expected to be more difficult to achieve because this ratio is already relatively high.

THE VALUE OF THE TOOL IN PRACTICE: SUPPORTING CONTINUOUS BUSINESS MODEL ENGINEERING

The development of the business model engineering tool and the related analysis as described in the previous sections proved to be valuable for the case company: it led to critical insights related to the viability of the business model in different scenarios as well as related business model improvement ideas.

Next to that, we found in practice that the business model engineering approach also supported thinking related to coming up with specific business model experiments that could lead to business growth: when looking back at growth spurts of the investment research company we found a strong correlation between business model experiments as performed during the life cycle of the company and actual improvements in business model performance indicators.

Before founding the company in 2007, the founders designed their scalable freemium business model by describing each of the components of the STOF-framework as discussed earlier. The company started with offering a free weekly investment column to a small mailing list of about 100 Dutch and Belgian investors and a related paid monthly stock analysis service based on the value investing principles as mentioned before (Graham 2003; Oude Nijhuis and Kijl 2009). Directly from the beginning, as many processes as possible were automated by making use of e.g. online payment systems, mailing systems, content protection systems and membership management systems. As a result, a potentially strong increase in mailing list size or amount of subscribers essentially wouldn't lead to more work for the founders of the company – in other words, income is not limited to personal output. In this way, the technological platform actually enabled the founders of the company to spend time on performing business model experimentation and effectuation actions – by focusing on creating nonlinear, so called 'lollapalooza' growth patterns (Bevelin 2007).

Lollapalooza tendencies

The term 'lollapalooza' comes from Charlie Munger, an American investor, and stands for 'the tendency to get extreme consequences from confluences of […] tendencies acting in favor of a particular outcome' (Bevelin 2007; Munger 2005). Let's have a look at the power of compounding (a confluence of time, investment return and money invested) to illustrate the power of such a lollapalooza tendency: a person who starts investing EUR 2,000 on a yearly basis with an average yearly return of 10% will have invested EUR 80,000 and will end up with EUR 973,704 when he or she gets 65 years old – the initial investment grew 11-fold; a person who starts investing EUR 2,000 a year with the same yearly return of 10% at an age of 19 and stops investing at age 26 will have invested EUR 14,000 in total but will end up with EUR 944,461 – in this case, the money grew 66-fold instead 11-fold, only because of a few compounding years extra (Russell).

Searching for 'lollapalooza confluence patterns'

After identifying the most critical variables for the performance indicators of their scalable business model as identified earlier (e.g. size of the mailing list, margin per address and investment return – see also Figure 3), the founders of the company started thinking of and implementing actions that could lead to a substantial increase of these variables. The idea was that the *combined* results of these 'lollapalooza confluence pattern actions' should lead to a substantial improvement of the most important business model performance indicators. Some examples of these, actually multidisciplinary, patterns are given below (with the change in critical business model variables italicized):

- Free weekly investing columns → first mailing list of investors → first customers of paid investment service → money invested in marketing + internet marketing courses → *bigger mailing list of investors*
- Free weekly investing columns → financial publisher published a book based on weekly columns → book became bestseller → free publicity → *bigger mailing list of investors*
- Free weekly investing columns → more and better knowledge about investment methods → *better investment returns*
- *Bigger mailing list of investors* → 'excess cash' for investment portfolio → new investment portfolio premium service next to analysis service → *more money for investment portfolio*
- …

Although each pattern in itself led to an increase of business model performance indicators, it was actually the *combination* of these and similar patterns that really led to a strong underlying growth. In about two years, the list size multiplied more than 300-fold and profitability strongly increased as well. And because of a higher profitability, more funds will be available for investments, which helps the founders to profit more strongly from the earlier mentioned power of compounding as well – another lollapalooza pattern in itself.

Of course, these 'lollapalooza confluence pattern actions' didn't always work out, e.g. an experiment with newspaper based advertisements failed miserably. However, because the cost and risk levels of these experiments were generally relatively low, the founders emphasized experimentation and action over in-depth analysis.

Although outcomes will not be known in advance, simple experiments like giving a digital version of the investment book as mentioned above away to all readers of the free weekly newsletter if they inform

three or more friends may lead to a strong increase in mailing list size, one of the critical performance indicators. Therefore, the founders intend to continue coming up with creative 'lollapalooza confluence pattern' experiments in order to try to further increase the business model performance indicators. Online information services like the ones offered by the investment research are ideally suited for experiments with e.g. pricing and reusing information.

Such an experimental approach matches quite nicely with the 'discovery driven' rather than analytical approach to business modeling as proposed by McGrath (2010) as well as the effectuation concept of Sarasvathy (2008).

CONCLUSIONS

In this paper, we concisely discussed the development as well as evaluation of a business model engineering approach in the form of a case study. We started from the premise that with the related engineering tool, organizations could monitor, test, adapt and fine tune their business models by analyzing the different business model performance indicators that formed the output of the tool.

The first results are encouraging: the investment research startup case study showed that the business model of the company indeed could be tested in different scenarios and strengths and weaknesses and related opportunities and threats were discovered as well. Based on this scenario-based business model analysis, opportunities for further business model improvements were also developed.

Next to that, the tool also supported continuous business model engineering: we saw that the tool supported the founders of the company in coming up with ideas for growth, by creating 'lollapalooza confluence pattern' experiments impacting the most critical business model variables and performance indicators.

Although the research as described in this paper had an experimental character, we do expect that continuous business model engineering with a scenario based support tool with business model performance indicators may lead to more viable and better business model implementation and healthier businesses in other cases as well.

Next steps in further developing the business model engineering tool could be to consequently combine several scenarios and related calculations into scenario storylines (2 years scenario 1, 1 year scenario 4, 2 years scenario 3, etc.) and to add more non-financial business model performance indicators as well. In order to further test and improve the added value of the business model engineering approach as well as the related 'lollapalooza confluence pattern' experiments, we also plan to do more case studies.

REFERENCES

1. Afuah, A., and Tucci, C. 2000. *Internet Business Models and Strategies: Text and Cases*. McGraw-Hill Higher Education.
2. Anderson, C. 2009. *Free: The Future of a Radical Price*. New York: Hyperion Books.
3. Bevelin, P. 2007. *Seeking Wisdom: From Darwin to Munger*, (3rd edition ed.). PCA Publications L.L.C.
4. Bouwman, H., Faber, E., Haaker, T., Kijl, B., and De Reuver, M. 2008. "Conceptualizing the Stof Model," in: *Mobile Service Innovation and Business Models,* H. Bouwman, T. Haaker and H. De Vos (eds.). Berlin: Springer Verlag, pp. 31-70.
5. Chesbrough, H. "Business Model Innovation: Opportunities and Barriers," *Long Range Planning* (In Press, Corrected Proof).

6. Chesbrough, H., and Rosenbloom, R.S. 2002. "The Role of the Business Model in Capturing Value from Innovation: Evidence from Xerox Corporation's Technology Spin-Off Companies," *Industrial and Corporate Change* (11:3), Jun, pp 529-555.
7. Cole, R., Purao, S., Rossi, M., and Sein, M. 2005. "Being Proactive: Where Action Research Meets Design Research," *ICIS 2005*, Las Vegas, USA, pp. 325-336.
8. Graham, B. 2003. *The Intelligent Investor*, (Revised edition ed.). United Kingdom: HarperCollins.
9. Haaker, T., Kijl, B., Galli, L., Killström, U., and Immonen, O. 2007. "Challenges in Designing Viable Business Models for Context-Aware Mobile Services," *CollECTeR Iberoamérica*, Córdoba, Argentina.
10. Haaker, T., Kijl, B., Galli, L., Killström, U., Immonen, O., and De Reuver, M. 2006. "Challenges in Designing Viable Business Models for Context-Aware Mobile Services," *3rd International CICT Conference (Mobile and Wireless Content, Services and Networks)*, Technical University of Denmark, Center for Information and Communication Technologies, Kongens Lyngby, Denmark.
11. Hedman, J., and Kalling, T. 2003. "The Business Model Concept: Theoretical Underpinnings and Empirical Illustrations," *European Journal of Information Systems* (12:1), Mar, pp 49-59.
12. Kijl, B., Bouwman, H., Haaker, T., and Faber, E. 2005. "Developing a Dynamic Business Model Framework for Emerging Mobile Services," in: *ITS 16th European Regional Conference*. Porto, Portugal.
13. Kijl, B., and Nieuwenhuis, L.J.M. 2010. "Deploying a Telerehabilitation Service Innovation: An Early Stage Business Model Engineering Approach," in: *HICSS-43*. Hawaii.
14. Mason, H., and Rohner, T. 2002. *The Venture Imperative: A New Model for Corporate Innovation*. Harvard Business School Press.
15. McGrath, R.G. "Business Models: A Discovery Driven Approach," *Long Range Planning* (In Press, Corrected Proof).
16. Morris, M., Schindehutte, M., and Allen, J. 2005. "The Entrepreneur's Business Model: Toward a Unified Perspective," *Journal of Business Research* (58:6), pp 726-735.
17. Munger, C.T. 2005. "The Psychology of Human Misjudgment."
18. Osterwalder, A., and Pigneur, Y. 2002a. "Business Models and Their Elements," pp. 15-16.
19. Osterwalder, A., and Pigneur, Y. 2002b. "An E-Business Model Ontology for Modeling E-Business," *15th Bled Electronic Commerce Conference*: Bled, Slovenia, pp. 17–19.
20. Osterwalder, A., and Pigneur, Y. 2009. *Business Model Generation: A Handbook for Visionaries, Game Changers, and Challengers*, (1st Edition ed.). OSF.
21. Osterwalder, A., Pigneur, Y., and Tucci, C. 2005. "Clarifying Business Models: Origins, Present, and Future of the Concept," *Communications of the Association for Information Systems* (16:1), pp 1-25.
22. Oude Nijhuis, H., and Kijl, B. 2009. *Leer Beleggen Als Warren Buffett - Zijn Beleggingsstrategie in Theorie & Praktijk*. Arnhem: Sonsbeek Publishers [Dutch].
23. Pateli, A.G., and Giaglis, G.M. 2004. "A Research Framework for Analysing Ebusiness Models," *European Journal of Information Systems* (13:4), pp 302-314.
24. Porter, M.E. 2001. "Strategy and the Internet," *Harvard Business Review* (79:3), Mar, pp 63-76.
25. Rietdijk, M.M., and Van Winden, M.T.M. 2003. *Slag Om De Toekomst - Bedrijfsstrategieen Voor Goede En Slechte Tijden (Dutch)*. Balans.
26. Russell, R. "Rich Man, Poor Man." Dow Theory Letters.
27. Sarasvathy, S. 2008. *Effectuation: Elements of Entrepreneurial Expertise*. Edward Elgar Publishing.
28. Sein, M., Purao, S., Rossi, M., Henfridsson, O., and Lindgren, R. 2010. "Action Design: Where Design Meets Action in Research," *MIS Quarterly* (conditionally accepted for publication).
29. Teece, D.J. "Business Models, Business Strategy and Innovation," *Long Range Planning* (In Press, Corrected Proof).
30. Tennent, J., and Friend, G. 2005. *Guide to Business Modelling*, (Second edition ed.). Profile Books.
31. Timmers, P. 1998. "Business Models for Electronic Markets," *Electronic markets* (8:2), pp 3-8.
32. Zott, C., and Amit, R. "Business Model Design: An Activity System Perspective," *Long Range Planning* (In Press, Corrected Proof).

Knowledge Transfer and Disseminative Capacity:
A review and propositions for further research on academic knowledge transfer[1]

Janna Kuiken & Peter van der Sijde
VU University Amsterdam
Faculty of Social Sciences
Department of Organization Science

***Abstract**: The process of knowledge transfer is extensively studied from a variety of theoretical orientations. In this study the authors adopt a communication theory point of view as their orientation and focus on the dissemination capacity. After a review of the literature the authors focus on the disseminative capacity of universities and formulate four propositions that give directions for further research.*

In the present day knowledge economy knowledge is a source of competitive advantage for companies (Grant, 1996; Argote & Ingram, 2000). This knowledge can generated by the company itself (Nonaka & Taguichi, 1995) or it can be acquired from a "knowledge source" (Cohen & Levinthal, 1990; Tsai, 2001). Many organizations take on the role of knowledge source: e.g. universities (Mowery & Sampat, 2005), companies in their role either "supplier" (Kotabe, Martin & Domoto, 2003), "customer" (Gibbert, Liebold & Probst, 2002) or even as "competitor" (Darr & Kurzberg, 2000). Transfer of knowledge is the process of giving other access to and exchanging (proprietary) knowledge. This process of knowledge transfer is described by Szulanski (1996) as the "dyadic exchange of organizational knowledge between a source and a recipient unit in which the identity of the recipient matters" (p.28). The overall objective of this study is to contribute to the effectiveness of technology transfer activities of universities and focus on the determinants of the university as a source of knowledge that enables it to transfer this to others ("disseminative capacity").

This contribution has the following structure: first a theoretical framework for studying university technology transfer is presented, then in the second part an overview of the disseminative capacity in the literature is given and it ends with an analysis of disseminative capacity and its implications

[1] This study has been made possible via a grant of the CCSS of the Faculty of Social Sciences of the VU University to the second author.

for university technology transfer.

University Knowledge transfer: a communication perspective

The transfer of knowledge from university to companies is a major issue for policy makers, theory development and (business) practice. A major issue for concern the problematic connection between the *exploration activities of universities* and the *exploitation activities of companies* (e.g. Ambos et al., 2008); an issue often referred to as the "European knowledge paradox" meaning that Europe develops new knowledge of a similar quality and quantity as the US and Japan, but lacks behind when it comes to exploiting the knowledge and bringing it to the market (e.g. Dosi et al., 2006). To be able to bring knowledge to the market universities need to be or become more entrepreneurial and to be more effective in knowledge transfer. Rothhaermel et al. (2007) mention these issues as important streams that has emerged in the research on university entrepreneurship.

Knowledge transfer can be conceptualised in many different ways: as an entrepreneurial process (Dakin & Lindsey, 1991), as a diffusion process (Rogers, 1995), a valorisation process (Leloux, Groen & Van der Sijde, 2009) or as a communication process (Szulanki, 1996). In this contribution knowledge transfer is regarded as a communication process in which knowledge is exchanged between universities and enterprises of any size. It also is an interactive and iterative process, where the roles of "sender" and receiver" alternate (Easteby-Smith et al., 2008; Lin et al., 2005). In a communication approach to knowledge transfer the capacity to send knowledge to others (the dissemination capacity) is crucial, although neglected until recently in the literature.

Knowledge transfer is characterised, according to Zellmer-Bruhn (2003) by false starts and wrong interpretations, which is rooted in the fact that the actors involved in the process have or may have incomplete and asymmetric information on both the knowledge and the other actor(s) involved (Lin et al., 2005) It is a complex process and to be successful the sending "actor" (university) needs to "wrap" and "distributes" its knowledge in such a manner that the receiving "actor" (market, company) can understand, absorb and use the knowledge ("absorptive capacity"; e.g. Cohen & Levinthal, 1990; Zahra & George, 2002; Todorova & Durisin, 2007). The sender must be able to disseminate the knowledge (Jongbloed & Van der Sijde, 2008a,b). Parent et al. (2007) describe this capacity as "the ability to contextualize, format, adapt, translate and diffuse knowledge through a social and/or technological network and to build commitment from stakeholders" (p 87; see also: Reagans & McEvily, 2003, and Tang et al., 2009). Minbaeva and Michailova (2004; Minbaeva, 2007) add "ability" and "willingness" as characteristics of the actors and the organisation to this ability.

This contribution focuses on research into the dissemination capacity of universities, their capacity to shape knowledge towards the needs of different target groups (industry versus SME, knowledge developing versus knowledge using companies, university spin-offs versus other knowledge intensive companies). Recognizing that hardly any research has been carried out with regard to universities the next section focuses on this disseminative capacity in general.

Defining Disseminative Capacity

In Table 1 definitions of knowledge transfer and/or disseminative capacity found in the literature are listed. Szulanski (1996) introduces a much quoted definition of knowledge transfer (see earlier in the paper; Google Scholar indicates that this article is quoted in 2972 other articles, an average of over 200 quotes annually since it was published) with elements as the characteristics of the knowledge, the source, the recipient and the context. Bapuji and Crossan (2005) use a dissemination capacity definition: '*the ability of a firm to externalize organizational knowledge and acquire legitimacy for organizational knowledge'*. Parent et al. (2007) describe this capacity as '*the ability to contextualize, format, adapt, translate and diffuse knowledge through a social and/or technological network and to build commitment from stakeholders*'. Reagans and McEvily (2003) discuss the features as tie strength and social cohesion; both tie strength and social cohesion are positively related with the ease of knowledge transfer. The network in which the organization operates is important in the process of transfer; most descriptions quoted in Table 1 incorporate elements of networks and networking.

Joshi, Sarker and Sarker (2007) emphasize the source's capability, credibility and extent of communication that play a role in determining the extent of knowledge transferred to recipients. Gupta and Govindarajan (2000) introduce a "knowledge flow" definition that complements Joshi et al.'s description: '*knowledge flow is a function of the following five factors: value of the source unit's knowledge stock, motivational disposition of the source unit, existence and richness of transmission channels, motivational disposition of the target unit, and absorptive capacity of the target*'. The source's capability and credibility are important aspects of the process of knowledge transfer and therefore of the disseminative capacity.

Ruggles (1997) discusses the process of "codification" in which knowledge is "translated" into a code that can be transferred. Martin and Salomon (2003) mention this articulation, while Oppat (2009) labels it as "encoding". Mu et al. (2010) summarize this as: *'the ability of people to efficiently, effectively and convincingly codify, articulate and communicate, spread knowledge in a way that other people can understand accurately, and finely, tactically put learning into practice'*.

According to Carlos & Park (undated) and Mu et al. (2010) knowledge transfer should have

a purpose (or in entrepreneurial terms: create value for the sender) either a commercial or/and learning outcome can be purposes of dissemination. In some situations these purposes can be mixed.

Based on the review of the literature we define dissemination capacity as: '*the capacity of an organization or institute to transform its knowledge into value for other actors in its network with a commercial and/or learning purpose'*. Core elements in this definition are "purpose", "transformation of knowledge", "value for other actors" and "network". In the next section these core elements are elaborated for the context of university knowledge transfer.

Table 1: Definitions of disseminative capacity

Author:	Definitions:
Szulanski (1996)	There are four sets of factors likely to influence the difficulty of knowledge transfer: characteristics of the knowledge transferred (causal ambiguity and unprovenness), of the source (lack of motivation and not perceived as reliable), *of the recipient (lack of motivation & lack of absorptive capacity & lack of retentive capacity)*, and of the context in which the transfer takes place (barren organizational context and arduous relationship).
Ruggles (1997)	Codification is the process by which knowledge is represented in a code that can be transferred.
Gupta & Govindarajan (2000)	Knowledge flow is a function of the following five factors: value of the source unit's knowledge stock, motivational disposition of the source unit, existence and richness of transmission channels, motivational disposition of the target unit, and absorptive capacity of the target.
Martin & Salomon (2003)	We define source transfer capacity (STC) as the ability of a firm (or the relevant business unit within it) to articulate uses of it's own knowledge, assess the needs and capabilities of the potential recipient thereof, and transmit knowledge so that it can be put to use in another location.
Reagans & McEvily (2003)	Tie strength is positively associated with the ease of knowledge transfer. Social cohesion around a relationship affects the willingness and motivation of individuals to invest time, energy, and effort in sharing knowledge with others.
Liao, Welsch & Stoica (2003)	Knowledge dissemination involves the communication of the generated knowledge to all relevant departments and individuals.
Bapuji & Crossan (2005)	The ability of a firm to externalize organizational knowledge and acquire legitimacy for organizational knowledge.
Carlos & Park (not dated)	The ability of a firm to recognize the value of new, external information, assimilate it, and apply it to commercial ends.
Minbaeva (2004 & 2007)	The ability (*well developed abilities to articulate and communicate knowledge*) and motivation (*the greater an individual's influence on the work carried out, how it is done, and by whom, the greater the sense of responsibility the individual tends to feel for these decisions and the greater commitment knowledge senders exhibit*) and the willingness of organizational actors to transfer knowledge where

	and when it is needed in the organization.
Joshi, Sarker, & Sarker, (2007)	Source's capability, credibility and extent of communication plays an important role in determining the extent of knowledge transferred to recipients.
Parent, Roy & St-Jacques (2007)	The ability to contextualize, format, adapt, translate and diffuse knowledge through a social and/or technological network and to build commitment from stakeholders.
Oppat (2009)	The ability to decontextualize knowledge, ability to encode knowledge, ability to design an appropriate communication approach.
Mu, Tang & MacLachlan (2010)	The ability of people to efficiently, effectively and convincingly codify, articulate and communicate, spread knowledge in a way that other people can understand accurately, and finely, tactically put learning into practice.

Purpose of knowledge transfer

Universities have in most countries three tasks by law: education, research and service to the community. This last task is formulated differently by different universities: technology transfer, exploitation of public sector research, exploitation of intellectual property (cf. Cuyvers & Zimmermann, 2002), commercialisation of research (cf. Van der Sijde & Cuyvers, 2003), the "third leg" activity of the university, contract research and strategic alliances, university outreach, university – region interaction (cf. Van der Sijde & Kekale, 2002) and science marketing (cf. Baake, 2002), or an expanded developmental periphery as coined by Clark (1998). In this contribution all these activities are captured under the label "technology transfer". Although it is a legal task, it needs objectives – just as research and education. Hameri (1996) summarizes the results of the technology transfer in this respect as "an errand with no clear understanding of the outcome". Carlos and Park (n.d.) and Mu et al. (2010) emphasize that this activity needs an objective. Theoretically, in view of the objectives with regard to education and research, technology transfer could have two major groups of objectives for knowledge transfer:

(1) For financial gain: In his discussion on entrepreneurial universities Clark (1998) mentions that these universities have a diversified funding base. Revenues coming from technology transfer might add to the income stream.

(2) For knowledge gain and learning: The process of knowledge transfer is an interactive process ("knowledge circulates", Van Vliet & Slotman, 2006) in which the involved actors learn from each other in this process.

From a study on the objectives of Dutch universities on the objectives with regard to technology transfer (Kuiken, in preparation) it becomes clear that there are "degrees" to which these objectives are made clear – leading towards ambiguity with regard to policy and its objectives with regard to

technology transfer to third parties. This leads us to the following proposition:

> *Proposition*: The degree of ambiguity in (university) policy and objectives regarding valorisation of its knowledge as *perceived* by the target group of organisations for the knowledge to be transferred, determines success.

Transformation of knowledge

In most situations, knowledge is distributed and scattered in different locations, embedded into different artefacts and procedures, and stored into different mediums (Bhatt, 2001). It is difficult to send knowledge to other actors, especially when the actors use other artefacts, procedures and mediums. Therefore, an organization has to choose to employ similar codification standards and programming schemes, or make use of predefined templates and schemas to present data, information and knowledge (Bhatt, 2001). Codification means the expression of knowledge in a standardized, fixed form (Håkanson, 2007). Gold et al. (2001) refers to this process as conversion: knowledge of many individuals can become useful. Without common representation standards, no consistency or common dialogue of knowledge would exist (Gold, 2001). There are a lot of possibilities to codify knowledge. Bhatt (2001) mentions prints, disks and optical media. Baskerville and Dulipovici (2006) list narratives, embedding knowledge systems and knowledge models. During the last decades, the two concepts codification and articulation have been used synonymously, however there is a little difference. Articulation presupposes codification, because knowledge can be articulated without codification, however knowledge cannot be codified without articulation (Håkanson, 2007).

There are some advantages of codification. Gold et. al (2001) mention the reduction of redundancy, enhancement of consistent presentation and the improvement of efficiency by eliminating excessive volume. Zollo and Winter (2002) add the opportunity of codification to see the weaknesses and the strengths of the currently available routines, and to change them when it is necessary. These advantages do not come for free. Zollo and Winter (2002) mention direct and indirect disadvantages. Direct costs include time, resources and the managerial attention to be invested in the development and updating of task-specific tools. Indirect costs include a possible increase in the rate of 'misfire' or inappropriate application of the routine if the codification is performed poorly, and the more general increase in organizational inertia consequent to the formalization and structuring of the task execution (Zollo & Winter, 2002). When the knowledge isn't codified in a standardized, fixed form, it has to be adapted to send the knowledge in a efficient

way. The degree in which this progress takes place is probably influenced by the *perceived knowledge distance*. Liyanage and Barnhard (2003) describe knowledge distance as a measure of the ease of transition from one knowledge system to another, especially when these knowledge bases contain technological knowledge. Presumably, the knowledge distance determines the degree of knowledge adaptation. Based on the background and motivations of studies mentioned above, this study posits the following proposition:

> *Proposition*: The *perceived* knowledge distance between the university ("sender") and *targeted* company ("receiver") by the university determines the degree of presumptive adaptation of the knowledge to be transferred.

Valuable knowledge from a respectable source

The second main aspect of the dissemination capacity definition is value. The value of the source and the value of the message have a huge influence on knowledge transfer. Source credibility refers to the extent to which a recipient perceives a source to be trustworthy and reputable (Joshi et al., 2007). When a source is perceived as credible, the recipients are more open and receptive to the message. When the source unit is not perceived as reliable, trustworthy or knowledgeable, initiating a transfer from that source will be more difficult and its advice and example are likely to be challenged and resisted (Szulanski, 1996).

> *Proposition*: The research reputation of the university (group) and its track record in valorisation determines its credibility as a source of valuable knowledge.

Network and inter-organizational dynamics

Parent, Roy and St-Jacques (2007) add a network aspect in the dissemination capacity definition: to diffuse knowledge through a social and/or technological network. Reagans and McEvily (2003) explored how different features of informal networks affect knowledge transfer. Easterby-Smith et al. (2008) describe the inter-organizational dynamics, such as power relations, trust and risk, structures and mechanisms, and social ties. Social cohesion refers to the extent to which a relationship is surrounded by strong third-party connections. Reagans and McEvily (2003) found support for this effect: social cohesion is positively associated with ease of knowledge transfer. This effect is primarily caused by the willingness of individuals to devote time and effort to assisting others. Especially for sources, this can be very costly. The source's willingness to transfer

knowledge despite these costs represents cooperative behaviour, and cooperation is more likely when strong third-party ties surround a relationship. A knowledge source may be reluctant to share knowledge for fear of losing ownership, a position of privilege or superiority (Szulanski, 2009). Szulanski also refers to the recipient's lack of motivation. Lack of motivation may result in "foot dragging, passivity, feigned acceptance, hidden sabotage, or outright rejection in the implementation and use of new knowledge" (Szulanski, 2009:31). Reagans & McEvily (2003) found support for another network feature: network range will be positively associated with the ease of knowledge transfer. Network range refers to the prevalence of ties that cross institutional, organizational or social boundaries. People who are connected to multiple bodies of knowledge are exposed to more worldviews, they are more likely to recognize the need for discussion, and to communicate in a language that a contact can understand. So, people with networks characterized by range should find it easier to transfer knowledge because the behaviours that ease knowledge transfer are part of their everyday network activity (Reagans & McEvily, 2003). Based on the background and motivations of studies mentioned above, this study posit the following proposition:

> *Proposition*: Social cohesion and network range of the university ("sender") and *targeted* company ("receiver") determines whether knowledge will be transferred and is moderated by (social) tie-strengths.

Conclusions and further research

The capacity of organizations, in particular universities, to disseminate knowledge to "third" parties is a neglected domain of study in knowledge and technology transfer. Only recently this capacity receives more attention. After its introduction in the mid-90s most studies regarding this capacity have been theoretical and only a few have addressed the topic from an empirical point of view. In this study four propositions are formulated, based on a definition derived from the existing studies on the topic. These propositions should become the starting point for empirical research in the future.

References

Ambos, T., Makela, K., Birkensaw, J. & DÉste, P. (2008) When does university research get commercialized? Creating ambidexterity in research institutions. Journal of management Studies, 45, 1425 – 1447.

Argote, L. & Ingram, P. (2000) Knowledge transfer in organizations: learning from experience of others. Organizational Behavior and Human Decision Processes, 82, 1 – 8.

Baaken, Th. (2002) Science marketing. Grant application the Ministery of Education of NordRhein-West Phalia.

Bapuij, H., & Crossan, M. (2005). Co-evolution of social capital and knowledge: an extension of the Nahapiet and Ghoshal (1998) framework. Academy of Management Best Conference Paper.

Baskerville, R. & Dulipovici, A. (2006). The theoretical foundations of knowledge management. *Knowledge Management Research & Practice, 4*, 83-105.

Bhatt, G.D. (2001). Knowledge management in organizations: examining the interaction between technologies, techniques, and people. *Journal of Knowledge Management, 5(1)*, 68-75.

Carlos & Park (undated). Dissemination Capacity in the commercialization of university technology.

Clark, B. (1998) *Creating entrepreneurial universities*. Oxford: Pergamon

Cohen, W. M., & Levinthal, D. A. (1990) Absorptive capacity: A new perspective on learning and innovation. *Administrative Science Quarterly, 35,* 128-152.

Cuyvers, R. & Zimmermann, E. (2002) KULeuven R&D als netwerkincubator voor nieuwe, kennisintensieve bedrijven [KULeuven R&D as networkincubator for new knowledge intensive companies]. In K. Debackere & R. de Bondt (eds), Leurven Research & Development. Leuven: Universitaire Pers Leuven.

Dakin, K.J. & Lindsey, J. (1991)

Darr, E. and Kurtzberg, T. (2000) 'An investigation of partner similarity dimensions on knowledge transfer', *Organizational Behavior and Human Decision Processes*, 82: 28-44.

Dosi, G., Llerena, P., Labini, M.S. (2006) The relationships between science, technologies and their industrial exploitation: an illustration through the myths and realities of the so-called 'European Paradox'. *Research Policy, 35*, 1450–1464.

Easterby, S.M., Lyles, M.A., & Tsang, E.W.K. (2008). Interorganizational knowledge transfer: current themes and future prospects. *Journal of Management Studies, 45(4*), 677-690.

Gibbert, M., Leibold, M. & Probst, G. (2002) Five styles of customer knowledge management and how smart companies use them to create value. *European Journal of Management, 20*, 459 – 469.

Gold, A.H., Malhotra, A. & Segars, A.H. (2001). Knowledge Management: an organizational capabilities perspective. *Journal of Management Information Systems, 18(1)*, 185-214.

Grant, R.M. (1996) Towards a knowledge-based theory of the firm. Strategic management Journal, 17, 109 – 122.

Gupta, A.K., & Govindarajan, V. (2000). Knowledge flows within multinational corporations. *Strategic Management Journal. 21,* 473-496.

Håkanson, L. (2007). Creating knowledge: the power and logic of articulation. *Industrial and Corporate Change, 16(1*), 51-88.

Hameri, A.P. (1996) Technology transfer between basic research and industry. Technovation, 16, 51 – 57.

Jongbloed, B. & Van der Sijde, P.C. (2008a) Over het slechten van barrières voor kennistransfer tussen Universiteit en MKB. *Tijdschrift voor Hoger Onderwijs, 26(3)*, 167 –179.

Jongbloed, B. & Van der Sijde, P.C. (2008b) Interacties tussen Universiteit en MKB – een verkenning in het kader van het 3TU Beleidsexperiment. Enschede, CHEPS/Nikos.

Joshi, K.D., Sarker, S., & Sarker, S. (2007). Knowledge transfer within information systems development teams: examing the role of knowledge source attributes. *Decision Support Systems, 43*, 322-335.

Kotabe,M. Martin, X. & Dormoto, H. (2003) Gaining from vertical partnerships: knowledge transfer relationships duration, and supplier performance improvement in the U.S. and Japanese automotive industry. *Strategic Management Journal, 24*, 293 – 316.

Leloux, M., Van der Sijde, P.C. & Groen, A. (2009) Evolutionary business valuation in technology transfer. In: Oakey, R., Groen, A., Cook, G. & Van der Sijde, P. (eds.), *New Technologies Based firms in the New Millenium Volume VII: the production and distribution of knowledge*.

Bingley: Emerald Group Publishing (p1-5; ISBN: 978-1-84855-782-6).
Liao, J., Welsch, H., & Stoica, M. (2003). Organizational absorptive capacity and responsiveness: an empirical investigation of growth-oriented SME's. *Entrepeneurship theory and practise*, 28(1), 63-85.
Lin, L., Geng, X., & Whinston, A.B. (2005). A sender-receiver framework for knowledge transfer. *MIS Quarterly, 29(2)*, 197-219.
Lyanage, S. & Barnhard, R. (2003). Valuing of firms' prior knowledge: a measure of knowledge distance. *Knowledge and Process Management, 10(2),* 85-98.
Martin, X.Y.F. & Salomon, R. (2003). Knowledge Transfer Capacity its Implications for the theory of multinational Corporation. *Journal of International Business Studies, 34(4),* 356-373.
Minbaeva, D.B. & Michailova, S. (2004). Knowledge transfer and expatriation in multinational corporations – the role of dissemination capacity. *Employee Relations, 26 (6)*, 663 – 679.
Minbaeva, D.B. (2007). Knowledge transfer in multinational cooperations. *Management International Review, 47 (4)*, 567 – 593.
Mowery, D.C. & Sampat, B.N. (2005) The Bayh-Dole Act of 1980 and university-industry technology transfer: A Model for other OECD governments? *Journal of Technology Transfer, 30 (1/2)*, 115-127.
Mu, J., Tang, F., & Maclachlan, D.L. (2010). Absorptive and disseminative capacity: Knowledge transfer in intra-organization network. *Expert Systems with Applications, 37*, 31-38.
Nonaka, I. & Taguichi, H. (1995) *The knowledge creating company.* Oxford: Oxford University Press.
Oppat, K. (2008). *Disseminative Capabilities: a case study of collaborative product development in the automotive industry*. Wiesbaden: GWV Fachverlage GmbH.
Parent, R., Roy, M. & St. Jacques, D. (2007). A systems-based dynamic knowledge transfer capacity model. *Journal of Knowledge Management, 11(6)*, 81 – 93.
Reagans, R. & McEvily, B. (2003). Network structure and knowledge transfer: the effects of cohesion and range. *Administrative Science Quarterly, 48*, 240 – 267.
Rogers, E.M. (1995) *Diffusion of knowledge*. New York: The Free Press.
Rothaermel, F. T., Agung, S.D. & Jiang, L. (2007). University entrepreneurship: a taxonomy of the literature. *Industrial and Corporate Change, 16*, 691-791.
Ruggels, R.L. (1997). *Knowledge Management Tools*. Boston:Butterworth-Heinemann.
Szulanski, G. (1996). Exploring Internal Stickiness: impediments to the transfer of best practice within the firm. *Strategic Management Journal, 17*, 27-43.
Tang, F., Mu, J. & MacLachlan, D.L. (2009). Disseminative capacity, organizational structure and knowledge transfer. *Expert Systems with Applications*, doi: 10.1016/j.eswa.2009.06.039
Todorova, G., Durisin, B., (2007). Absorptive capacity: valuing a reconceptualization. *Academy of Management Review 32 (3)*, 774–786.
Van der Sijde, P.C. & Cuyvers, R. (2003) Training researchers to commercialise the results of research. *Industry & Higher Education, 17 (1),* 29 -36.
Van der Sijde, P.C. & Kekale, J. (2002) The region and its university: European perspectives. Special issue *Industry & Higher Education, 16 (2)*, 73 – 121.
Van Vliet & Slotman (20006) De regio als basis voor innovatie in het MKB [The region as a basis for innovation in SMEs]. *TH&MA, 13*, 30 – 36.
Zahra, S. & George, G. (2002). Absorptive capacity, a review, reconceptualization and extension. *Academy of Management Review, 27 (2),* 185-203.
Zellmer-Bruhn, M.E. (2003). Interruptive events and team knowledge acquisition. *Management Science, 49,* 514 – 528.
Zolla, M. & Winter, S.G. (2002). Deliberate learning and the evolution of dynamic capabilities. *Organization Science, 13(3),* 339-351.

Cycles in causation and effectuation:

A case study of four metal-music ventures

Laura Laaksonen
laura.laaksonen@hse.fi
Aalto University School of Economics

Antti Ainamo
aainamo@utu.fi
IASM / Sociology, University of Turku

Toni-Matti Karjalainen
toni-matti.karjalainen@hse.fi
Aalto University School of Economics

In this paper we apply the entrepreneurial effectuation theory (Sarasvathy 2001) and theories in expertise (Read & Sarasvathy 2005) in an empirical study in a particular context: musicianship as a form of entrepreneurship in the popular music industry. We apply the theories and empirical evidence in our framework by using a qualitative case study to analyze four ventures, four Finnish music groups. Based on the analysis we find extensions on Sarasvathy's (2001) and Read and Sarasvathy's (2005) work on three levels. First we find that the causation process is more typical in the "deliberate practice" (Read & Sarasvathy 2005) that forms the foundation for superior expert practice, which is a requirement for building novel and authentic cultural products. Secondly, we find that in the beginning of the business activities, these ventures are more effectual, when the situation tends to be resource-poor. We also find that even though the companies' core teams are relatively small, once the business grows and the number of international partners increases the business processes and decision-making becomes inevitabely more causation driven.

INTRODUCTION

Effectuation, as conceptualized by Sarasvathy (2001), is an alternative process of decision making in comparison to the dominant one of causation in management literature. To study processes of both causation and effectuation, we examine in this paper entrepreneurial ventures whose existence springs from childhood dreams of the founders, on the one hand, and from the tightly knit experiences of these founders and their band members, on the other hand. We study rock music groups within the genre of music that is most commonly called "heavy metal". We report on four of these groups that we have studied, all of which have toured five continents and three of which have sold millions of albums globally. In this study we illustrate how these companies go through cycles in causation and effectuation in their life span. The contribution of our study is a specification of the theory of causation and effectuation, which has recently received new valence in managerial research literature (Wiltbank et al. 2006, Sarasvathy et al. 2008; Read et al. 2009).

LITERATURE REVIEW

According to Sarasvathy (2001), management literature has traditionally largely assumed the existence of firms, markets and economies than studied them or their existence. She argues that the explanation behind the creation of these "artifacts" requires what she calls the notion of effectuation.

Effectuation is a process of decision making that takes a set of means (e.g. traits, tastes, skills and networks) as given and focuses on selecting between possible effects of the process. As such, this process differs from causation, or what Sarasvathy considers the dominant process of decision making in management literature. Causation takes a particular effect as given and focuses on "how to achieve a preset goal" by selecting between means to create the effect. In her view, such new ventures could open up new markets and industries, while plugging into and exploiting social and technological contingencies that are difficult to plan for or to anticipate.

Where causation rests on logic of prediction, effectuation rests on logic of control. Effectuation processes are posited as the fundamental decision units in explanations how economic artifacts such as firms, markets and economies come to be. Effectuation begins with a given set of causes consisting of mostly unalterable characteristics and circumstances of the decision maker, and the focus is on choosing among alternative (desirable) effects that can be produced with the given set of means, thereby eliminating the assumption of preexistent goals. Both causation and effectuation are integral parts of human reasoning. They may even overlap and intertwine over different contexts of decisions and actions (Sarasvathy, 2001).

According to Sarasvahty, the effectuator's given set of means include *who I am*, *what I know* and *whom I know*. At individual level this includes *tastes, traits and abilities, knowledge corridors* and *social networks*. At the firm level this means *physical resources*, *human resources*, and

organizational resources. And at the level of economy this includes *demographics*, *technology regimes* and *sociopolitical institutions*.

The theory of effectuation is especially relevant in entrepreneurship research. Effectuation (decision) process takes a set of means as given and focus on selecting between possible effects that can be created with that se of means. The theory has implications at the level of the economy, at the level of the industry, at the level of the firm and at the individual (founder/decision maker) level. At the level of the economy, firms created through effectuation process fail early and at lower levels of investment than firms created through causation processes. At the level of the industry, successful early entrants in a new industry are more likely to use effectuation than causation processes. At the same industry level, this trend is often reversed when later entrants often revert to causation, improving upon the best practices of incumbents. At the level of the firm, Sarasvathy (2001) proposes that successful firms at their early stages are more likely to form alliances and partnerships than other types of competitive analysis. At the level of the founder/decision maker, Sarasvathy (2001) makes four conjectures about what effectuators are more likely than are causators:

- Effectuators are more likely to dive into marketing and selling activities and alliances, without traditional market research, such as surveys.
- Effectuators are more likely to rely on short term informal planning in financial decisions, abandoning formal long term planning.
- Effectuators are more likely to build strong participatory cultures, instead of hierarchies.
- Effectuators are more likely to fail often and to manage these failures more effectively so that in the long run they are more likely to build larger and more successful firms, even if they in the long term may need to hire professionals to help run any large firms they may have successfully created.

According to Sarasvathy (2001), effectuators imagine and create new cultural values, inspired by ambitions in sports, art, science or philosophy, for example. These cultural values may channel in a variety of ways to fulfill the aspirations of various audiences. It is up to the economic ingenuity of the entrepreneurs to translate and transform the products of his or her imagination into goods or services for customers or clients. In other words, first there are imaginings and good ideas that produce (the idea of) commercial offerings, then there may be human aspiration that builds the market. Imagining, creation and development of economic artifacts demand inspiration and protracted endeavor. The essential agent of such cultural entrepreneurship is the effectuator, who is an imaginative actor who seizes contingent opportunities and exploits any and all means at hand to fulfill current and future aspirations, which are created through and shaped by the process of economic decision making and not given a priori.

However, effectuators are according to Read & Sarasvathy not born, but made. Read & Sarasvathy (2005) first of all suggest that novices are more likely to be more causal in reasoning than experts. According to Read & Sarasvathy (2005), expertise, which leads to superior performance can be viewed as development through a special type of experience that

involves "deliberate practice", that requires motivation, understandability, feedback, repetition and fit. For an entrepreneur in creative and cultural industries this kind of motivation would consist of the satisfaction of, for example, writing and composing an album or just practicing a new technique on one's instrument. "The 10-year rule" suggests that it takes a minimum of 10 years of deliberate practice for a novice to ascend the rank of expert (e.g. McPherson 2005). Individuals must identify some larger instrumental objective for their practice in order to motivate themselves to engage it. Research has showed that deliberate practice can be moderated by inherent enjoyment of the activity (Ericsson, Krampe and Tesch-Römer, 1993; Ericsson & Lehmann 1996; Sloboda et al 1996). Especially in a situation where resources are scarce, effectual strategies are more likely than causal strategies, simply because the resources required for implementing causal strategies may not be available. Then again, when effectuation is met with success, more resources become available. When more resources become available, growth in the volume of high-quality activities become possible. Managing such growth, in turn, takes away from the founder's abilities to dedicate him- or herself to effectuation. Hence, there may be a return to causation.

To summarize, the basic differences of causal and effectual thought using six constructs: prediction, commitment, action, planning, risk and attitude toward outside firms, in Table 1, appendix (Read & Sarasvathy, 2005).

[Insert Table 1 about here]

At the intersections of these forms of thoughts and the processes by which these are carried out, Read & Sarasvathy (2005) define expertise "someone who has attained a high level of performance in the domain as a result of years of experience and deliberate practice. They discuss "strong-form" expertise, associated with deep personal ability and knowledge derived from extensive practice and experience based on immersion in the relevant domain. Expertise literature has identified four theoretical approaches to expertise, which are individual differences, knowledge structures, experience and deliberate practice. Deliberate practice is a sophisticated articulation of the experience view and suggests that the expertise that that leads to superior performance is developed through a special type of experience that involves "deliberate practice". Differences between experts and less proficient individuals within a domain nearly always reflect attributes acquired by experts during a lengthy period ("the 10 year-rule") of deliberate practice.

Sarasvathy (2001) and Read and Sarasvathy (2005) can be synthesized so that there are five necessary requirements of deliberate practice: motivation, understandability, feedback, repetition and fit. Development of expertise involves three phases or levels of analysis.

1. The first and most elementary level is what Read and Sarasvathy (2005) "deliberate practice"; that is, a phase of causation that forms the foundation for superior expert practice, which is a requirement for building novel and authentic cultural products.

2. Once a sufficient amount of deliberate practice has been carried out, entrepreneurs, their ventures, or both have necessary skills and competences to be more effectual in their decision making processes. Because their base of competence is still relatively a new one, the entrepreneurs and/or their ventures are not yet recognized for expertise; that is, a successful track record of success in their field of specialization. Hence, their actions and performance tend to be still constrained by scarce available resources.
3. If the high level of competence leads to the attraction and exploitation of resources, the venture grows in size and significance and the number of international partners increases so that the business processes and frequency of decision-making grow to a point whereby the limited information-processing capacity of the founder and his immediate band members require that processes of decision making revert back to causation that enables delegation and professional management.

Sarasvathy (2001) makes a call for empirical research on effectuation and furthermore, she points to possible phenomena for future studies: high likelihood of early failure processes of market creation, and partnering with other entrepreneurs, groups, or organizations. In this paper we apply the entrepreneurial effectuation theory (Sarasvathy 2001) and theories in expertise (Read & Sarasvathy 2005) in an empirical study in a particular context: musicianship as a form of entrepreneurship in the popular music industry. We apply the theories and empirical evidence in our framework by using a qualitative case study to analyze four ventures, four Finnish music groups.

DATA AND METHODOLOGY

Finnish rock and metal music is an appropriate phenomenon to study entrepreneurship, especially since in Finland, the music export has grown fivefold during the last decade and is on average a bit over 20 million € annually, making it a notable contribution to the Finnish economy (Statistics Finland, 2007). Most of the growth originates from the success of a handful of Finnish heavy metal bands. These bands (ventures) have managed to build audiences on five continents and a global network of business partners and associates within the popular music industry to make that happen, all of this with great speed. Also music business in Finland is a 700 million € business domestically.

For this study, we chose four internationally successful Finnish bands: Children of Bodom, HIM, Negative, and Nightwish. The study is based on the use of a qualitative in-depth case study approach. This approach is particularly suitable to the explorative and descriptive objectives (Yin 2003). Since the general population of internationally successful Finnish bands is very limited, a quantitative study was not an alternative (object of analysis being the band or the music group as the "venture"). Case selection has been purposeful and based on (a) the success of the bands in different foreign markets and (b) access to information and knowledge in the case of each of the four bands. Case study method has been chosen, because of the potential to deepen the understanding of a research phenomenon for it allows the researcher to take a longitudinal approach. One of the bands (Children of Bodom) histories is

described in more detail in order to demonstrate the context of popular music industry from the perspective of these entrepreneurs. Finally we present preliminary findings from our longitudinal analysis of the four cases and draw conclusions and implications for further research.

Case study method is an effective way of understanding the links between macro-environmental factors, industry –level relationships and firm decision-making (Ghauri and Holstius 1996, from Ghauri 2004). Multiple sources of data have/will be used (ethnography, interviews, and secondary data). The research is primarily conducted through ethnography and semi-structured in-depth interviews. The data deriving from observation helps elicit interesting questions, which in-depth interviews develop further (Rasmussen et al 2006).

Data collection and data analysis have been interweaved from the beginning as recommended by Miles and Huberman (1994), allowing theory development alongside the growing volume of data and allowing the research problem to be formulated and reformulated throughout the data gathering process. This leads to not having a definite phase of data analysis, as suggested by Ghauri (2004). The first two cases have been studied simultaneously and they have complemented each other as insights from all the cases have enriched the data.

The entrepreneurs in each of these four ventures, who are most responsible for creating the musical content, are without exception also the founders of these ventures and have been committed to developing as a musician and as a songwriter to a degree that they can unquestionably be considered experts in their field. Each of these ventures, when breakthrough happened, was a source of ideas and practices that were considered "authentic" in the field. These ventures all achieved international success and recognition and have learnt to work with a global distribution network of music industry MNE's and other partners and business associates. They work closely with a core team and associates to form together a group of actors that is very small in size considering their business volumes.

In this paper we chose to describe the data from one case in more detail (Children of Bodom) and the data from the other three cases are discussed in less detail. This choice was made to comprehensively demonstrate the nature of entrepreneurship in music industry, but to avoid unnecessary repetition.

EMPIRICAL CONTEXT

Heavy metal might be the single most successful and enduring musical genre in the past thirty years (Walser 1993). The business differs from mainstream popular music business in two important ways. First of all, the customer/audience spends more money on buying CD's, they are frequent concertgoers, they buy the merchandise at the concert, and most importantly, they are loyal to the bands they like. For these "kids", music means more than money. Another key difference is the marketing of the product. Popular music is traditionally been

marketed through radio airplay. Metal music "got rejected" by radio and it did not get the kind of radio airplay their popularity entitled it to. On the other hand this was good for the versatility and artistic development of the music because metal was therefore developed for the fans, not the mediators or the gatekeepers. The music remains under the control of the artist. Authenticity is equated in metal with disinterest in commercial appeal. Labels did not want to sign bands that did not fit one of the established radio station formats. They only wanted to sign metal bands that could generate their own promotion through touring to appreciative audiences. (Weinstein 2000) According to Billboard, metal attracts a greater proportion of live audiences than any other contemporary music form. (Walser 1993)

Metal bands are evaluated by labels in terms of their songwriting but also in terms of management, equipment and financing. Due to the circumstances described above, metal bands are able to bypass two sets of gatekeepers, the label A&R and the radio. This also means that the bands are more entrepreneurial because in the beginning, in many cases, they have to do everything themselves, without the support of the label. (Weinstein 2000) Even when the band has the support of the label the audiences must be gradually built by constant touring and it takes time before musicianship will provide living for the whole band. According to a metal label CEO, an estimation of 40 000 copies per album sold enables the band to barely support themselves with music. (Weinstein 2000)

According to Weistein (2000) the first step of becoming a heavy metal artist is a burning desire to be one, which is developed by being a member of the audience. There are more than enough members of the audience who would want their piece of the fame and admiration. Heavy metal artists are not neutral specialists but passionate lovers of the kind of music they play. For the artist heavy metal is a career that in its fullest realization becomes a vocation. This vocation includes total devotion to the music and deep loyalty to the subculture. Learning the skills of a performing heavy metal artist takes ingenuity and perseverance. The time devoted to such learning must be snatched from school and leisure time and is financed usually by the parents. Recruits are self-selected and in large part self-motivated. Becoming a heavy metal musician requires various abilities, most important ones being the skills to create and perform the music. The possession of musical talent and the willingness to develop it separates the developing artist from the air guitarists. Practicing is very hard word, but it can be gratifying with the opportunities for creativity, sense of mastery and experiences of social bonding. Heavy metal is a discipline and the artists must be willing and able to submit to that discipline. (Weinstein 2000)

We acknowledge that not all the case bands are considered necessarily "heavy metal" in today's world. After mid 80's the heavy metal genre divided into thrash metal and light metal, after which dozens of subgenres have emerged. We still find the musical and sociological roots of these bands in the heavy metal genre in 1980's and before. Therefore we consider them metal bands, thus this could be argued in today's genre divisions. This is not a relevant debate to take part in this paper. Thus with the digitalization and recent changes in the music industry structure, all bands and artists need to be increasingly entrepreneurial, since the roles of the gatekeepers are diminishing in all genres.

CASE 1: Children of Bodom (COB)

An early phase of deliberate practice of learning to play guitar. Children of Bodom (COB) is heavy-metal band that was formed in 1993 in Espoo (in the Helsinki region), by Alexi Laiho (guitars and vocals) and Jaska Raatikainen (drums) who were 14 years old at the time. Henkka Seppälä (bass, 1995), Alexander Kuoppala (guitars, 1995) and keyboardist Janne Wirman (1997) joined the band later. Laiho who is mainly responsible for creating the content, started playing guitar at the age of 12. He had played the violin for several years already, but listening to his older sister's heavy metal albums made him want to play the guitar instead. Eventually his father caved in and bought him his first guitar and an amplifier. After graduating from comprehensive school at the age of 16, Laiho concentrated on developing his musical skills, instead of continuing studies in upper secondary school, as the majority in this age group does. Laiho's musicianship was sponsored and supported only by his parents at this point.

Starting up the band. By 1996, COB had already recorded three demo tapes and played some gigs at youth clubs and schools in Espoo, Helsinki and Kauniainen and at one festival in Lappeenranta.
The band members sent their second and third demo tapes to several record companies, including Spinefarm and Nuclear Blast (who have later represented them), but none of them were interested in this melodic death metal band. Then the band got an offer from a Belgian record label. They took the deal, even though the label did not compensate the recording costs of the album nor did they have enough money to promote the album. On top of that, the band was forced to sell 1000 copies of the album themselves. This was still the only offer they had received so far, so they took it. They entered the studio to record the self-financed album called "Something Wild" with seven songs on it. The cost of this album was approximately 8000 FIM (approximately 1350 €). After the album was produced and raw mixed, Alexander Kuoppala gave a copy of the album demo to one of his workmates, Sami Tenez, who gave the album to Evo Rytkönen at Spinefarm Records, an independet Finnish metal label. At this point the the album was not cut yet. "After Spinefarm Records received Children Of Bodom's "Deadnight Warrior" demo, it didn't take long for the company to figure out what they had in their hands back in late 1996. Three spins of 'Deadnight Warrior' later, the band was signed and ready to knock a few heads off." COB signed a three-album deal with Spinefarm Records and changed the band's name to COB to escape the deal they had made with the Belgian label. The Belgians were told that Inearthed had split up. The contract included Alexi Laiho's, who wrote all the music of COB, publishing deal with Ranka records, the Spinefarm's sister company.

COB played their first gig at Lepakko as opener for Dimmu Borgir, a famous metal band from Norway. Someone from the German metal label, Nuclear Blast saw the gig and asked Spinefarm Records label manager for a licensing deal for Nuclear Blast to release the album in the rest of Europe. COB became a well known band in the Finnish metal underground scene and their track "Deadnight Warrior" was released on a compilation from Spinefarm called Metalliliitto. Spinefarm Records released "Something Wild" in November 1997. The

album debuted on number 35 on the Finnish album charts and climbed up to number 20 in the following weeks. This was highly exceptional for an extreme metal band. In early 1998 Nuclear Blast released the album in Central Europe and Toy's Factory in Japan. UK and US sales were based solely on imported albums and Spinefarm distributed the album in the nordic countries. COB filmed a promotional video of "Deadnight Warrior" with a budget of 5000 FIM (approximately 840 €).

Nuclear Blast released "Something Wild" in Europe on February 2nd in 1998. On March 3rd COB started a Eurpean tour, opening for Disbelief, Crack-up, Covenant, Hypocrisy and Benediction. Before this, the band had only played gigs in Finland. The tour was a success and "Something Wild" sold 5 000 copies in Finland and 12 000 copies internationally. According to COB frontman, Alexi Laiho the tour was extremely important for the band, because nobody outside Finland knew them before this tour. In August 1998 COB played at the Wacken Open-Air metal Festival, the biggest metal festival in the world and impressed more people with their unique style. In September 1998 COB opened for a Finnish metal band Impaled Nazarine in St. Petersburg in Russia. In September another Nuclear Blast European tour with Dismember and Racehell followed and this time they got a higher place in the billing. At this point "Something Wild" had sold already 40 000 copies internationally and less than 15 000 copies in Finland.

Later in 1998 COB entered the studio to record two new tracks. The track" Children of Bodom" was released as a single in Finland with two other Spinefarm bands' tracks and entered the number one spot on the Finnish single chart and stayed there for eight weeks. Later it sold gold (5 000 copies). The second album "Hatebreeder" was recorded between December 1998 and January 1999 in Astia Studio Lappeenranta. It was released in Finland in February 1999, hit number 20 on the album cart and climbed up to number six in the following weeks. Single release "Downfall" was released two weeks before the album went gold and hit the number one spot on the Finnish single chart. COB also filmed a promotional video for Downfall directed by Mika Lindberg. In March 1999 the album was released worldwide. In Germany it reached number 76 in the album charts.

During the summer 1999 COB toured Finland and Europe. In June they did three sold out gigs with an audience of 1500 each in Japan with Inflames and Sinergy and recorded a live CD: "Tokyo Warhearts-Live in Japan". "Tokyo Warhearts" came out as a limited digibook-edition in Europe in October 1999 and the 20 000 copies of it were sold out. (Spinefarm Records, 30.10.2008) The live album hit the Finnish album chart number 33. In September 1999 COB toured Europe with Dark Tranquility, Inflames and Arch Enemy.

In December 1999 COB entered the studio to record a new single, Hate me! which was released in 2000 and sold platinum (10 000 copies). In summer 2000 COB played at two festivals in Finland, at Ilosaarirock in Joensuu and at the metal festival Tuska in Helsinki. They also played one gig in Canada, in Montreal and in the US in Milwaukee Metal Fest XIV. In Milwaukee COB met with Nuclear Blast America that was a joint venture with Century Media to promote Nuclear Blast bands in the US. They were really excited about

COB and they had plans to start promoting them in the US market. Shortly after the feastival Nuclear Blast America was bankrupt and COB needed to find a new distributor in the US. At this point ”Hatebreeder” had sold approximately 70 000 copies internationally and less than 15 000 in Finland. The third studio album ”Follow the Reaper” was recorded in August 2000 in Sweden at Peter Tätgren’s legendary Abyss studio.

”Follow the Reaper” was released October 30th 2000 in Finland and January 22nd in the rest of the world, except for Japan, where the album was released December 20th 2000. The album landed number 3 in Finnish and 46 in German album charts. In December 2000 COB played some shows in Finland. In spring 2001 COB went on a double headlining tour with Primal Fear and Scared Steel in Europe. After the tour COB went back to Japan and played their first ever gig in South Korea. The gig was also aired in Korean television. On October COB played at the Polish Mystic Festival and they opened for Slayer in Italy in front of a massive crowd. Then the band played eight shows in South America and after that a couple of shows in Finland before taking a little break. The international sales of ”Follow the reaper” were 130 000 copies and on domestic markets less than 15 000 copies. By that time COB albums had already sold altogether 40 000 copies in the US as well. The band was looking for a new record deal, after releasing the three albums with Spinefarm in Finland, Nuclear Blast in Europe and Toy’s Factory in Japan. Toy’s Factory also released a best-of collection of COB from the first three albums in Japan called the Bestbreeder in 2002.

The touring that followed the first three albums did not bring any income to the band, but was rather seen as a marketing activity. The only income the band got at this point were the royalties from the record sales. Majority of the income went to Spinefarm Records, who had invested in the band, and the licencors abroad. The investments Spinefarm made in COB included the touring costs (expenses and fees to the headliners), marketing costs (promotional videos and advertisements) and recording costs (recording, cover art, photographs). These expenses were deducted from the royalties of the band.

COB’s breakthrough. In 2002 the band contacted a German management agency Continental Concerts, who was recommended to them by friends from another Finnish metal band, Stratovarius. They signed a managing contract with Continental Concerts after which all contracts and bookings were handled by professional managers. The band was also incorporated during that time. The next three album contract was signed with Universal Music (that had acquired Spinefarm) globally and the albums were distributed globally.

The releases of the fourth, fifth and sixth album were followed by massive global tours and the eventually the band was able to headline in all their markets, which meant more income for the band. All of these albums reached the number one spot on Finnish charts and good positions on many European charts as well. The sixth album “Blooddrunk”, even hit the U.S. Billboard chart on spot 22. Other chart positions were Canada: #7, Germany: #10, Japan: #12 (International chart #2), Austria: #19, Sweden: #28, UK: #44 (Rock chart #1) and Ireland: #51.

By 2010, COB had sold over 500,000 albums in the U.S. and over a million records globally. Alexi Laiho's innovative reinvention of many guitar-playing techniques were recognized in the U.S. music media, leading to his consecration in Guitar World magazine as the most promising young guitar player in 2006 and as the best metal guitarist in 2009.

CASE 2: Nightwish

A deliberate practice to learn to write songs. Nightwish was founded by Tuomas Holopainen (keyboards) in 1997 in Kitee, in the South-East of Finland, a small peripheral town of the country a few kilometres from to the Russian border. Holopainen discovered heavy metal music as an exchange student in the U.S. and started playing in keyboards in several bands after his return to Finland. He feels that music is a way of expressing his emotions since he finds it impossible to discuss difficult issues. He also has always had a drive for perfection as a songwriter: there are only two alternatives; something is either perfect or totally wrong. His talent as a songwriter is undeniable, as he has been even quoted in the heavy metal genre as *the Mozart* of Finland.

Starting up the band. Soon after recording their first demo, Nightwish was signed by the same company that signed COB, Spinefarm Records. Nightwish released their debut album *Angels Fall First* already the same year. Nightwish toured Europe, mostly as a headlining act. In fall 2001, Ewo Pohjola (Evo Rytkönen) who had been at Spinefarm started to work as the Nightwish manager, together with Toni Peiju, another long-term friend and business colleague. By then, Nightwish was already an established player in the European markets. In the years 2001 and 2002, 150,000 people saw the "Nightwish World Tour of the Century", and the band played their first ever shows in the U.S.

Nightwish's breakthrough. With their fifth album called *Once* (2004), Nightwish for the first time used an orchestra (instead of using a synthesizer to create a similar sound), the London Philharmonic Orchestra. Nightwish covered the weighty recording costs themselves and licensed the album distribution globally. By doing this, they took a conscious risk. In the end, this risk paid off. When released, *Once* hit the #1 the European album chart. A Finnish band had never hit #1 on the European album chart before - even though in 1999 and 2000, bands like Darude (trance music) and Bombfund MCs (techno/club) dominated the European single chart. HIM (already in 1999) and the Rasmus (in 2004) also made it to #1 in Germany. In 2007, Nightwish released their sixth studio album *Dark Passion Play* with a new (Swedish) singer Anette Olzon. The album sold over one million copies world-wide, including 100,000 copies in the U.S. Altogether Nightwsh sold a bit less than 500,000 albums in the U.S. by April 2009 and over 3 million albums globally (2007). Nightwish Inc (Scene Nation) made a profit of 1,2 million € in 2008. Holopainen's personal net income in 2008 was 380 000 €

CASE 3: HIM

A deliberate practice phase to learn to sing and to write songs. HIM was founded in 1991 by singer and songwriter Ville Valo in Helsinki. Valo had a burning desire to become a musician from an early age. With the support of his parents, he was able to live in the city centre and concentrate on song writing, instead of finishing upper secondary school, living on a very tight budget. Valo's charisma, gloomy lyrics and invention of new visual imaginery, such as HIM's "Heartagram" logo, are what crystallize HIM and love metal for the fans. Valo has put a lot of effort in creating the love metal concept and his musical ambitions involve writing original memorable lyrics.

Starting up the band. They sent their demo tapes to several record companies and labels in Finland and abroad. Many of these turned HIM down, including Nuclear Blast, Roadrunner, Spinefarm and Stupido Twins. Kai Hynninen who had his own small label called Zen Garden tried to help, as he was (and is) a friend of a friend of Ville Valo, the band's founder and undisputed leader. In 1996, Hynninen gave HIM's demo tape to Asko Kallonen at BMG, a large multinational record label. At this point, HIM had played only two live shows. The demo tape impressed Kallonen with its sound and vocals. He met with Valo. Still, Kallonen was not sure if the Finnish market was ready for this kind of Finnish rock with English language lyrics. He had not heard the band play live. Despite these doubts, BMG published HIM's music as an EP called *666 Ways to Love* in fall 1996. The first album *Greatest Lovesongs Vol. 666* came out in 1997. The album was licensed in Germany in November 1998 through an independent record label "Gun", because BMG Germany was not willing to release it, regardless of the contract that gave them the first hand right to the release. Silke Yli-Sirniö, a German music industry worker who was married to a Finnish musician at the time, played a big part in getting HIM released in Germany. When the record deal was being negotiated, Ville Valo and his band contacted Seppo Vesterinen. Vesterinen was (and is) a legendary manager of rock and popular culture in Finland, who had worked in the 1980s with Hanoi Rocks, a Finnish cult band who almost broke through in the 1980's glam rock scene in Los Angeles. Vesterinen advised HIM on contracting. Two months before the release HIM played a couple of festivals in Germany. The *Greatest Lovesongs Vol. 666* album sold 50,000 copies in Germany within a year of its release. HIM's second album *Razorblade Romance* was recorded in Wales. By the time this second album was released, the debut album had already sold 150,000 copies. After the album was released the band toured Germany. The album sold 500,000 copies in Germany alone.

HIM's breakthrough. After the album *Deep shadows and Brilliant Highlights* (2001) HIM visited for the first the U.S.A. Skateboarder and TV persona Bam Margera became a huge fan of the band and started promoting them in the U.S. using his status as a teenage icon. The collaboration paid off: *Dark Light* (2005) made HIM the first Finnish band to be granted a gold record in the U.S.A. (500 000 copies sold). With a new record in 2007, HIM had sold over 5,5 million albums globally by 2009 (Statistics Finland, 2009), with Ville Valo increasingly taking charge of also business development. In 2008 HIM's made a profit of 700 000 € in Finland.

CASE 4: Negative

A deliberate practice to learn to sing and to write songs. Negative was founded in 1997 in the City of Tampere, 185 km North of Helsinki, when Jonne Aaron (singer) and his friend Janne Himanen (aka Jay Slammer, drummer) met while still in high school. The band started off playing Nirvana cover songs. Jonne who is mainly responsible for creating the content got his first guitar at the age of 12. According to Jonne, he felt like he was complete with the guitar in his hands and that getting his first guitar was a life altering moment for him.

Starting up the band. After recording a promotional single at Cosmic Studios, they were offered a record deal with GBFarm records. At this point Jonne's older brother Tommi Liimatainen had already started managing the band. The lineup was finalized in summer 2003, after the release of the band's debut album *War of Love*. The band's style is "glam rock". While in this style of music some bands wrote and performed songs in Finnish, Jonne Aaron chose to use English lyrics from the start because of an explicit intent to internationalize his band. The first album was released in Scandinavia as well as in Japan, thanks to help from a Japanese visitor hearing and seeing the band in Finland that summer and relaying knowledge to Japan. Negative played their first shows outside Finland in the beginning of 2004 in Sweden, Germany, and Japan. The band's second album *Sweet and Deceitful* (2004) was released more or less simultaneously in Scandinavia, Russia, Germany, Japan, Austria and Switzerland. The band toured all these countries soon after the release. After the release of their third album *Anorectic*, Negative played some shows in China. Their fourth album *Karma Killer* was released in 2008.

Negative's breakthrough. In 2009, Negative signed a global record deal with Warner Music Group. They travelled to Los Angeles to record their fifth album to be released in spring 2010. Time will tell if the fifth album will be their ultimate breakthrough in the international markets.

Discussion and Conclusions

According to Sarasvathy (2001) the focus in management literature should shift from "How to build a successful firm?" or "How to become a successful Entrepreneur?" to "What types of ideas and opportunities should YOU pursue?" and "Given who you are, what you know, and whom you know, what kind of economic and/or social artefacts can you, would you want to, and should you create?" Within this spirit, in this paper, we applied Saravathy's (2001) effectuation theory and her theory of expertise (Read and Sarasvathy 2006) into an empirical setting where it has been not applied before, but which was in line with who we are, what we known, who we know, and in what we are interested: music entrepreneurs in the field of heavy metal music.

In our empirical study, we investigated the entrepreneurial effectuation within the cultural and creative industries, more specifically in the popular music industry. Based on our analysis, we find extensions on three levels. First of all, we find that the causation process in the bands that we have studied is more advantageous in the kind of "deliberate practice" (Read & Sarasvathy 2005, McPherson 2005) that forms the foundation phase upon which superior expert practice is built and that, in turn, is a necessity for building novel and authentic cultural products. In other words, the expertise in the field is acquired through a process of causation, when the entrepreneurs are novices. It is when they become experts in their field, their ventures are more likely to use the effectuation process. Consistent with the research literatures we have reviewed, we find that these ventures have not used traditional types of market research before or during their start-up phase and breakthrough, but rather have dived directly into marketing/selling activities and alliances. At the early phase of their development, their business models focused on short term planning, rather than long term planning or net present value (NPV) analysis, for example. Also, they have built participatory cultures of work instead of hierarchy- or procedure-based ones. Their processes of effectuation have evolved along with the growth in the size of their businesses and organizations. All of these features and dynamics are predicted by Sarasvathy (2001). Then as the business grows and the number of international business associates and partners grow, it becomes more difficult to use effectuation process, as suggested by Read and Sarasvathy (2005)

What makes the approach taken in this paper a novel one is that originally (from the 1960 to the 1990s), heavy metal bands got rejected by radio and by major labels. This forced them to be more entrepreneurial than artists in the mainstream of popular music, for example. Many of the gatekeepers in the cultural industry of popular music have been recently pushed to background as a result of technological advances of the internet that have shifted the social practices and buying behaviour patterns of consumers, not only in the field of popular music but also in other fields of music as well. We propose that our findings may hold not only in other cases in heavy metal music, but also more generally in popular music. In addition, we speculate that our findings may have valence also in other cultural industries than music, perhaps also in entrepreneurial ventures generally.

References

Ericsson, K.A.. R.T. Krampe. and C. Tesch-Romer (1993). The role of Deliberate Practice in the Acquisition *of* Expert Performance. *Psychohaical Review.* Vol. 100, No. 3. pp. 363-406.

Ericsson. K.A.. and A.C. Lehmann (1996). Expert and Exceptional Performance: Evidence on Maximal Adaptations on Task Constraints. *Annual Review of Psychology*, 47 pp. 273-305.

Ghauri and Holstius (1996) The role of Matching in the foreign market entry process in the Baltic
state, European Journal of Marketing, 30 (2), 75-88. In Ghauri, Pervez (2004) Designing and conducting case studies in international business research, In Marschan-Piekkari, R. & Welch, C.
(eds), *Handbook of Qualitative Research Methods for International Business*. Edward Elgar, Cheltenham, UK, pp. 109-124.

Marschan-Piekkari, R., & Welch, C. (eds.) 2004. *Handbook of Qualitative Research Methods for International Business*. Cheltenham, UK: Edward Elgar.

McPherson, G.E (2005) From child to musician: skill development during the beginning stages of
learning an instrument, *Psychology of Music*, Vol. 33, No. 1, pp. 5-35.

Miles M.B. and Huberman A.M. (1994), *Qualitative Data Analysis*, 2nd edn, Thousand Oaks, CA:
Sage.

Read, N. Dew, S, Sarasvathy (2005). Knowing What to Do and Doing What You Know: Effectuation as a Form of Entrepreneurial Expertise. *Journal of Private Equity.* Vol 9, No 1.

Read, N. Dew, S, Sarasvathy, Song, M. and Wiltbank (2009). Marketing Under Uncertainty: The
Logic of an Effectual Approach, *Journal of Marketing.* Chicago: May 2009. Vol. 73, No. 3.

Sarasvathy, S. (2001). Causation and effectuation: Toward a theoretical shift from economic inevitability to entrepreneurial contingency. *The Academy of Management Review*. Vol. 26, No. 2.
p. 243 (21 pages).

Saras D. Sarasvathy, Nicholas Dew, Stuart Read, and Robert Wiltbank (2008). Designing Organizations that Design Environments: Lessons from Entrepreneurial Expertise. *Organization Studies*, Vol. 29. pp. 331 - 350.

Sloboda. J.A.. J.W. Davidson. M.J.A. Howe, and D.G. Moore (1996). The Role of Practice in the Development of Performing Musicians. *British Journal of Psychology.* Vol. 87. pp. 27-309.

Statistics Finland (2009) Cultural Statistics 2007. Helsinki: Statistics Finland.

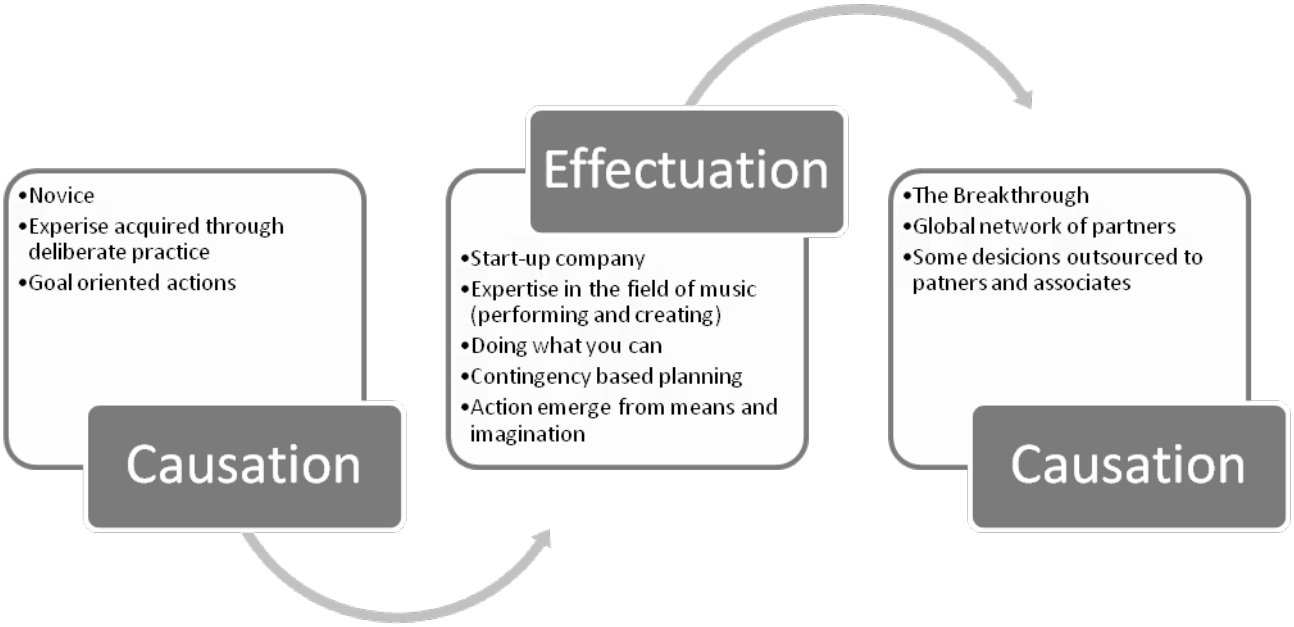
Wiltbank, R., Dew, N., Read, S., Sarasvathy S.D.(2006). What to do next? The case for non predictive strategy. *Strategic Management Journal*. Chichester: Oct 2006. Vol. 27, No. 10; p. 16.

Yin, R. K. 2003. Case study research: design and methods. Thousand Oaks, CA: Sage Publications.

TABLE 1. *Read & Sarasvathy (2005)*

Issue	Causal or predictive position	Effectual Position
View of the Future	Prediction. The causal approach views the future as a continuation of the past that can be acceptably and usefully predicted.	Creation. The effectual approach views the future as a contingent on actions by willfull agents, largely nonexistent and a residual of actions taken. Prediction is unimportant as a result.
Basis for Commitment	Should. Commit as a course of maximizing, analysis and what should should be done.	Can. The Effectual approach is to do what you can (what you are able to do) rather than what your prediction says you should.
Basis for taking action and acquiring stakeholders	Goals. The causaal approach is to let goals determine sub-goals. Commitment to particular sub-goals determined by larger goal constratined by means. Goals determine actions, including individuslids bought on board.	Means. Actions emerge from means and imagination. Stakeholder commitment and actions lead to specific sub-goals. Feedback from achievement/non-achievement of sub-goals lead to design of major goals.
Planning	Commitment. Path selection limited to those that support a commitment to an existing goal.	Contingency. Paths are chosen that allow more possible options later in the process, enabling strategy shift as necessary.
Predisposition Toward Risk	Expected return. The causal approach is to pursue the (risk adjusted) maximum opportunity but not focus on downside risk.	Affordable loss. The effectual approach is not to risk more than can be afford to be lost. Here the claculation is focused on the downside potential.
Attitude toward outside firm	Competition. The causal approach is to be concerned with competition and constrain task relationships with customers and suppliers to just what is necessary.	Partnership. The effectual approach is to create a market jointly, building Your market together with customers, suppliers and prospective competitors.

Figure 1. Causation and Effectuation process of these music industry ventures.



Effectively enacting disruptive technological change: Insights from an incumbent firm engaged in developing the ADSL architecture.

Desie Lenferink[1]
Bart Van Looy [1, 2]
Klaasjan Visscher[1]

[1] School of Management and Governance, University of Twente
[2]Faculty of Business and Economics, K.U.Leuven

Extended Abstract of Paper Submitted to HTSF Conference

University of Twente,
Enschede June 2010

Introduction

Disruptive technological change remains a challenge for incumbent firms. The conflicting demands stemming from focus and commitment on the one hand and experimentation and flexibility on the other hand remain difficult to reconcile.

Different solutions have been advanced to address this 'innovative dilemma', including the creation of separate entrepreneurial ventures (Bower & Christensen, 1995; Burgelman, 1983; Christensen & Overdorf, 2000) or the adoption of organizational structures of an ambidextrous nature (O'Reilly & Tushman, 2004, O'Reilly & Tushman, 2008).

At the same time, questions remain to what extent current theorizing provides a satisfactory account on how to deal with disruptive technological change effectively within the boundaries of an incumbent firm. Like outlined by Van Looy et al. (2005), sustainability of ambidexterity requires spillovers between different activities; how to reconcile such requirements with a strict separation between exploration and exploitation oriented activities – as advanced by O'Reilly and Tushman (2004, 2008) - remains unclear.

Within this contribution we want to add to our understanding of how and when large established firms can be effective when confronted with disruptive technological change by examining the trajectory of an incumbent firm (Alcatel) in the telecommunication industry that has been successful in exploring and exploiting the promises of broadband access technology.

Methodology

We engaged in an analysis of the events leading to the successful development[1] (and deployment) of the ADSL architecture within a large multinational telecommunication firm by adopting a longitudinal case study design (Pentland, 1999; Pettigrew, 1990). Data have been collected by means of semi-structured interviews (n=+/- 25) and document analysis for the time period 1986-1996. Document analysis included both internal documents (e.g. minutes of relevant meetings, strategy documents (n> 1500) and external documents (press releases, technology and industry reports, patent documents and scientific publications). Figure 1 and 2 provide an overview of major evolutions. Figure 1 depicts the amount of patent activity and major events related to the development of ISDN and ADSL technology based on patent data and technical and industrial reports. Figure 2 provides an overview of strategic themes pursued by the incumbent firm as identified by means of a content analysis of internal documents (annual corporate reports)

Findings

In the first period of the time frame under study (1986-1990), the incumbent firm focused on the development and commercialization of an ISDN oriented infrastructure (ISDN: Integrated Services Digital Network) which allows data transmission within the existing telecom infrastructure designed for the transmission of voice (the plain old telephone system or POTS).

[1] Above 50% market share figures in 2000 demonstrate the success of the firm (M2Presswire, 2000).

Within that time period, new technological platforms (including coax and optical fiber) emerged which promised superior data transmission capacity and by doing so, would enable totally new market applications, e.g. the delivery of video on demand (VOD). VOD was perceived to be the killer application, requiring more capacity than could be provided by ISDN. As a result the emerging technological platforms (coax and optical fiber) started to introduce a disruptive 'threat' for the existing telephone systems[2]. Confronted with these developments in the early 1990s, the incumbent firm did not opt for a separate, entrepreneurial venture that would focus on exploring these new developments. Rather, a multitude of competing technological platforms were explored and developed within one and the same research unit (including fiber, coax, and copper based product architectures).

Amongst these competing technologies, fiber was initially perceived as superior, as it enabled the fastest data transmission. ADSL on the other hand turned out to be more cost effective as it allows for the simultaneous transmission of digital data and voice over the existing twisted copper pair (Reusens, et al., 2001). The initial idea of ADSL dates back to 1979 (see figure 1) when Cioffi first introduced computations that suggest more capacity by using copper wire, and the early 1980s when Lechleider advanced asymmetry as an additional way to increase capacity (of copper based digital subscriber lines). Only in the early nineties, this possibility was taken seriously by the incumbent firm when several people within the central research department become knowledgeable of the outcomes of experiments undertaken by Bellcore (US) that confirmed the growth potential of copper wires combined with DSL technology[3].

Figure 2 further clarifies these dynamics by mapping the strategic themes within the incumbent firm (based on a content analysis of the incumbent's annual accounts in which future strategic directions are being discussed, time period 1986-1996). The figure shows the initial focus on ISDN, which eventually turned out to be insufficient for the perceived killer application VOD. As a result, the incumbent shifts attention towards fiber, coax and ADSL; these technologies however only become an explicit strategic theme from 1993 onwards.

As explained, ADSL turned out to be the most cost-effective and gradually emerged as the most promising technological platform within the incumbent. The initial perceived killer application VOD fades rather quickly (due to various technical reasons while also content players turned out to be reluctant to engage in cost effective license agreements) to become replaced by the subsequent growth of internet traffic which emerges as the new engine behind market demand.

These developments result in the creation of a dedicated 'virtual unit' geared towards the exploitation of ADSL situated within the boundaries of the existing firm in February 1996. The entrepreneurial team steering these developments, opted from the start to design ADSL in a modular way. Rather than integrating ADSL functionality within the existing switching products, a modular technological architecture was perceived as instrumental to speed up market development. The modular design implied that ADSL functionality could be offered independent of customer's historical choices or (current) preferences with respect to switching equipment.

Furthermore, within this 'virtual' unit, autonomous decision making authority- on the level of the product architecture, pursued business model and market development initiatives – was combined with a redeployment of resources and capabilities stemming from other parts of the

[2] Which relied heavily on copper wires and focused on voice transmission (for an overview of different technological platforms, see Ginsburg, 1999; Goralski, 2002; Reusens, et al., 2001; Van der Plas, Smets, Suard, & Verbiest, 1995)

[3] Alcatel engaged in a formal R&D collaboration with Bellcore in 1989.

organization, including the integration of ATM technology and the mobilization of hardware development capabilities. Stated otherwise, spillovers and complementarities - beyond the boundaries of the 'virtual unit'- are actively being pursued and result from the interplay between bottom-up entrepreneurial initiatives and supportive senior management decision making processes. This combination of entrepreneurial dynamics and the effective mobilization of corporate resources allowed the firm to create an integrated and scalable product architecture that outperformed competing offers and paved the way for effective market exploitation.[4] As a result, the incumbent firm was able to attain a contract with four Regional Bell Operating Companies (RBOCs) in the United States in 1996, enabling a breakthrough on the US market, followed by commercial success on a global scale.

Discussion – Preliminary conclusions

Analyzing the chronological case reveals several key findings that inform the current debate on how to organize 'radical' innovation within incumbent firms effectively.

First, Alcatel systematically invested in researching a broad variety of – at least partly competing – technological platforms notwithstanding the presence of a strategic focus favoring one (or a limited number of) technology platforms only. The portfolio of research projects addressing this variety of technological platforms was situated within one and the same central research unit; besides relying on internal R&D efforts, Alcatel systematically scouted its environment and engaged in R&D alliances with a variety of partners. While research ideas usually are being transferred to business units upon entering the development phase (after proof of concept or a first prototype has been delivered), a deliberate choice was made to create a separate, virtual, venture structure in order to develop the ADSL architecture ('virtual company'). This structure was considered more adequate in terms of ensuring sufficient levels of entrepreneurial dynamics. Such dynamics were considered critical as one is competing in a newly emerging field populated not only by larger incumbent firms, but also with smaller technology based entrepreneurial firms. Recent experiences on the market development efforts pertaining to ATM – undertaken by the Switching BU – reinforced this viewpoint.

While this virtual structure guaranteed considerable degrees of freedom (autonomy) on the level of business model choices, product design and marketing strategy, sourcing of critical resources/capabilities within the broader organization turned out to be as characteristic for the VC. As such the boundaries between the virtual company and the established organizations are of a semi-permeable nature. The entrepreneurial dynamics that unfold within this virtual company do resemble the ICV processes documented by Burgelman (1983), both in terms of combining bottom up, entrepreneurial dynamics with senior management support. In addition, technological design choices engrain organizational (entrepreneurial) practices and vice versa. This interplay between technological design and organizational dynamics manifests itself twofold: a) the choice for a modular ('stand alone') architecture results from and enables entrepreneurial activity at the same time; b) arriving at an effective technological architecture - which merges existing technologies with novel developments - only has been achieved by adopting an organizational design which combines entrepreneurial dynamics with corporate sourcing. Hence, neither complete separation, nor an organizational design of an ambidextrous

[4] A joint procurement consortium (JPC) formed by four regional bell operating companies (RBOCs) in the United States selected the multinational telecommunication firm as the supplier for ADSL equipment (BusinessWire, 1996).

nature accounts for the observed dynamics in a satisfactory manner. Rather, our findings substantiate the ingredients of hybrid or quasi-structures characterized by the simultaneous presence of entrepreneurial autonomy and the enactment of complementarities (Brown & Eisenhardt, 1997; O'Connor & DeMartino, 2006; Schoonhoven & Jellinek, 1990). Choices with respect to the technological architecture seem to be crucial in terms of constituting organizational and entrepreneurial dynamics within the boundaries of an existing firm.

Figure 1: Overview of major events and patent activity within the field of ISDN & ADSL

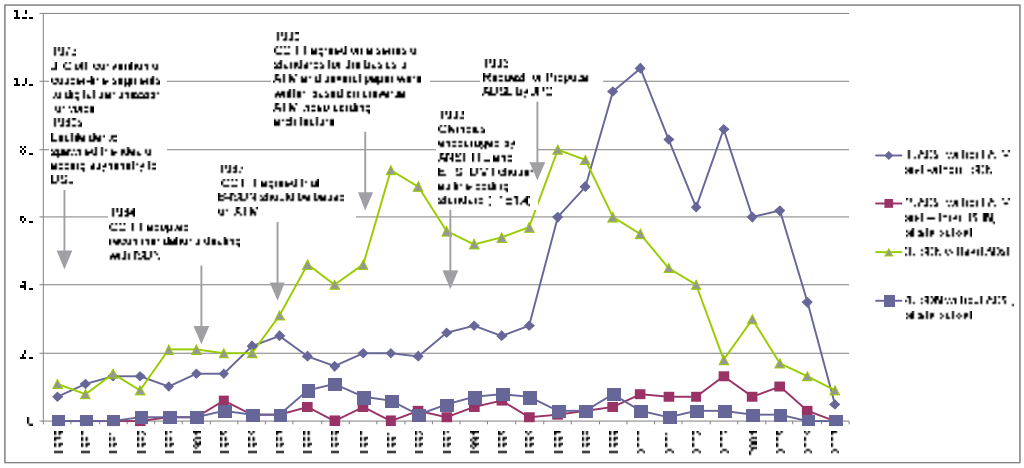
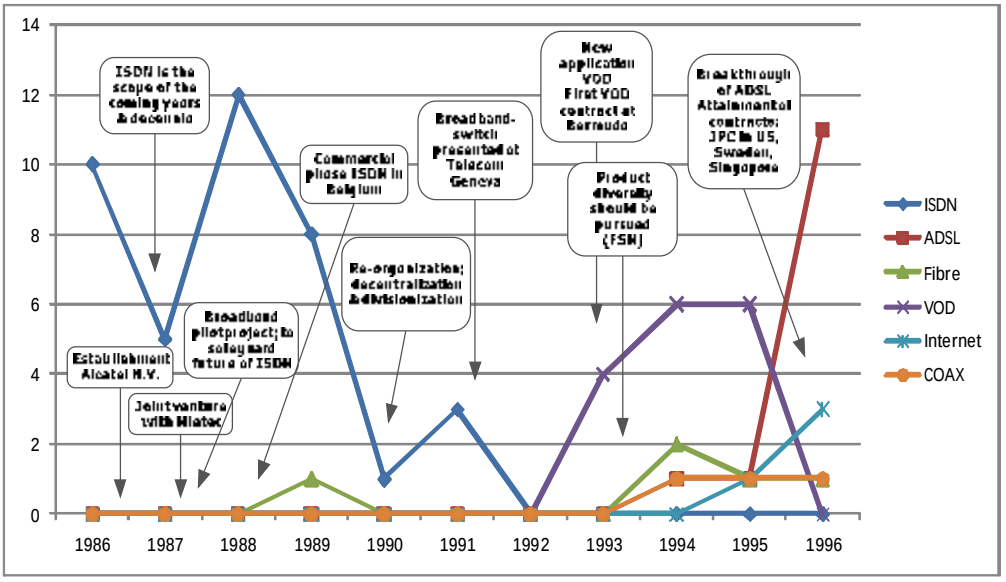


Figure 2: Strategic themes pursued over time by the incumbent firm: 'Technologies' and 'Market Applications'



References

Bower, J. L., & Christensen, C. M. (1995). Disruptive technologies: catching the wave. *Harvard business review, 73*(1).

Brown, S. L., & Eisenhardt, K. M. (1997). The Art of Continuous Change: Linking Complexity Theory and Time-paced Evolution in Relentlessly Shifting Organizations. *Administrative Science Quarterly, 42*(1), 1.

Burgelman, R. A. (1983). A Process Model of Internal Corporate Venturing in the Diversified Major Firm. *Administrative Science Quarterly, 28*(2), 223-244.

BusinessWire. (1996). Alcatel Telecom to supply end-to-end ADSL system to four Bell operating companies for high-speed Internet access. Retrieved 19-01, 2010, from http://www.encyclopedia.com/doc/1G1-18742791.html

Christensen, C. M., & Overdorf, M. (2000). Meeting the Challenge of Disruptive Change. *Harvard business review, 78*(2), 66.

Ginsburg, D. (1999). *Implementing ADSL*. Reading: Addison Wesley Longman, Inc.

Goralski, W. J. (2002). *ADSL & DSL Technologies* (Second ed.). Berkeley: McGraw-Hill.

M2Presswire. (2000). Alcatel reaffirmed by Dell'Oro as worldwide DSL market leader: ADSL market share for second quarter 2000 increases to 54%. Retrieved 20-01, 2010, from http://findarticles.com/p/articles/mi_hb5243/is_200008/ai_n19821109/

O'Connor, G. C., & DeMartino, R. (2006). Organizing for radical innovation: An exploratory study of the structural aspects of RI management systems in large established firms. *The journal of product innovation management, 23*(6), 475.

O'Reilly C. & Tushman M. (2004) The ambidextrous organization, *Harvard Business Review*, April 2004.

O'Reilly C. & Tushman M. (2008) Ambidexterity as a dynamic capability: Resolving the innovator's dilemma. *Research in Organizational Behavior* 28 (2008) 185–206

Pentland, B. T. (1999). Building Process Theory with Narrative: From Description to Explanation. *The Academy of Management review, 24*(4), 711-724.

Pettigrew, A. M. (1990). Longitudinal Field Research on Change: Theory and Practice. *Organization Science, 1*(3), 267-292.

Reusens, P., VanBruyssel, D., Sevenhans, J., VandenBergh, S., VanNimmen, B., & Spruyt, P. (2001). A practical ADSL technology following a decade of effort. *IEEE communications magazine*.

Schoonhoven, B. C., & Jellinek, M. (1990). Dynamic tension in innovative, high technology firms: managing rapid technological change through organizational culture. In M. L. Tushman & P. C. Anderson (Eds.), *Managing strategic innovation and change*. Oxford: Oxford University Press.

Van der Plas, G., Smets, R., Suard, B., & Verbiest, W. (1995). Demonstration of an ATM-based Passive Optical Network in the FTTH trail on Bermuda. *IEEE*

Van Looy B., Martens T. & Debackere K. (2005) Organizing for Continuous Innovation: On the sustainability of Ambidextrous Organizing. *Journal of Creativity and Innovation Management*, 14, 3, 208-22.

LABOUR MOBILITY AND INFORMAL CONTACTS AS MECHANISMS OF KNOWLEDGE DIFFUSION

Erik Lundmark* & Magnus Klofsten
HELIX Excellence Centre & Department of Management and Engineering,
Linköping University

*Corresponding author at: Linköping University (IEI), SE-581 83, Linköping, Sweden.
Telephone: +4613284431, E-mail: erik.lundmark@liu.se

Abstract
This article is positioned in the debate regarding the relative importance of labour mobility and informal contacts as mechanisms for knowledge diffusion between organisations. Empirically, the article assesses the importance of different knowledge sources utilised by 219 participants in two high-tech, R&D driven, non-incremental, product development projects in large corporations, located in local labour markets highly specialised in their respective industry clusters. The results show that the most important knowledge sources for the respondents are colleagues within the organisation. Informal contacts outside the organisation, although prevalent, are rather unimportant as knowledge sources. External contacts are related to creative contributions in the projects regardless of whether the contributions are self-assessed or peer assessed. However, the support for informal contacts in particular, being related to creative contributions in the projects, is rather weak. Implications for the understanding of knowledge diffusion are discussed and directions for future research suggested.

1. Introduction
Krugman's (1991a) model, attributing agglomeration of manufacturing to economies of scale and lower transportation costs, have been followed by an increasing interest in knowledge spillovers as drivers of agglomeration of innovative (e.g. Kim et al., 2006; Almeida & Kogut, 1999; Saxenian, 1994) and entrepreneurial activity (Acs et al., 2008).

At a macro-level of analysis, the academic debate has been concerned with the extent to which specialisation (Marshall, 1890/1920; Arrow, 1962; Romer, 1986) and diversity (Jacobs, 1969; Glaeser et al., 1992) of organisations within a geographical area are associated with knowledge spillovers, innovation and growth. The empirical results are mixed and depend on e.g. the levels of industrial and geographical aggregation (Beaudry & Schiffauerova, 2009).

Defying Carter's (1989) statement that information exchange "*leaves no paper trail to inform research*"(p 162)[1], many studies have been directed at patent citation patterns (e.g. Jaffe, Trajtenberg & Henderson, 1993; Almeida & Kogut, 1999). However, these approaches have been criticised for failing to prove the claimed importance of knowledge spillovers in agglomeration of innovative activity (c.f. Breschi & Lissoni, 2001a). Furthermore, Breschi & Lissoni (2001a) expressed concerns that the term knowledge spillover often is used carelessly for any kind of knowledge flow, even those that are not externalities. In order to move our understanding of knowledge spillovers forward, Breschi and Lissoni (2001b) called for more research on how knowledge is actually transmitted and among whom.

Consequently, at a meso- and micro-level, the academic debate has focused on the relative importance of the mechanisms by which knowledge and ideas diffuse between existing organisations and from existing organisations to new business start-ups.

This article is positioned in the debate regarding the relative importance of labour mobility and informal contacts as mechanisms of knowledge diffusion in innovative and entrepreneurial processes. Labour mobility refers here to employees changing employers and informal contacts refer to contacts on an unofficial basis with people outside the employing organisation.

This debate has been particularly salient in relation to regional development, where e.g. Power & Lundmark (2004, p. 1027) argued that labour mobility is the main source of knowledge transfer as opposed to informal contacts between firms:

> *"Thus rather than focusing on diffuse and vague notions that knowledge and innovation reside in the 'Bohemian' nature (Florida, 2002), 'in the air' (Marshall, 1920) or in the 'buzz' (Storper and Venables, 2002) of urban life, we believe [...] that knowledge and innovation most commonly develop through interaction located in the workplace itself."*

On the other hand we have Dahl & Pedersen (2004, p. 1685) who argued that:

> *"informal contacts are potentially an important source of knowledge for the engineers in their daily working lives. Even specific knowledge about new products, which is likely to be very firm-specific and which the firms are likely to want to protect from competitors, is shared among these engineers."*

These phenomena, i.e. mobility between employers and informal contacts between organisations, are not independent mechanisms but related in the sense that informal contacts are often kept between former colleagues even after one or both have changed employer (c.f. Zellner & Fornahl 2002). Consequently, it is argued that labour mobility is potentially a more potent mechanism for knowledge diffusion in large labour markets where job changers are likely to stay within the same region and thus more likely to keep informal contacts with former employers and colleagues (e.g. Power & Lundmark 2004).

The importance of studying these mechanisms has been stressed by many scholars (e.g. Fornahl et al., 2005; Pennings & Wezel, 2007). Dahl & Pedersen (2004) specifically called for research comparing the importance of informal contacts as a source of knowledge to other sources e.g. colleagues within the organisation, internet and technical journals. In this study we heed this call.

Empirically, this study focuses on knowledge sources utilised by employees in innovative high-tech projects in large corporations. More specifically, we assess the relation between utilised knowledge sources and self-perceived as well as peer-perceived contributions by employees in these projects. The corporations are located in highly specialised local labour markets, identified as local clusters by Lindqvist et al. (2002). We describe the specific setting of the projects because contextual factors influence the extent to which different knowledge sources are used (c.f. Ibrahim et al., 2009). However, this study is not specifically focused on cluster phenomena.

The article is structured as follows: In the next section we review the literature on individual learning in an organisational context and propose our hypotheses. In section 3 we present the empirical setting and our methodology. In section 4 we present the results and lastly, in section 5, we discuss our findings and propose directions for future research.

2. Types of knowledge & diffusion mechanisms

Learning in an organisational context has been studied at various levels of analysis, from the individual level through groups and organisations to inter-organisational learning, e.g. clusters, innovation systems and partnerships (c.f. Ellström, 2010). In this article, we study knowledge sources utilised by individual participants in high-tech product development projects. Consequently, the literature review primarily focuses on knowledge frameworks applicable at an individual level of analysis.

In typologies of knowledge, a common distinction is between what is tacit and what is explicit[2] (c.f. Polanyi, 1966). The alleged "tacitness" of scientific and technical knowledge implies that this knowledge is transferred between people mainly through face-to-face interaction. This feature is frequently suggested as a factor that contributes to agglomeration of innovative activity (See Breschi & Lissoni 2001a; b for a critical review).

However, some tacit knowledge can be externalised, i.e. converted to explicit knowledge in the form of e.g. written documents (Nonaka & Toyama, 2003). This type of explicit knowledge can be transferred over long distances. Particularly, this process has been facilitated by information and communication technology (ICT) (Audretsch & Keilbach, 2005). In order for an agent to successfully utilise explicit knowledge, two processes remain: firstly, the combination of sources of explicit knowledge, i.e. the gathering and integration of explicit knowledge sources; secondly, the internalisation of the explicit sources through experimentation and reflection (Nonaka & Toyama, 2003). These processes draw heavily on the tacit knowledge of the learner; therefore, "all knowledge is either tacit or rooted in tacit knowledge" (Polanyi, 1966 p 7). These processes are rarely, if ever, leading to perfect transfer of practices between organisations. In fact, much of the early diffusion literature has been criticised for not paying due attention to the imperfect translations that are associated with the diffusion of practices (c.f. Rogers 2003).

Recent literature underlined that the readiness to adapt practices to local conditions is vital to successful transfer of practices between organisations (c.f. Klofsten et al. 2009). Other factors that have been found important to transfer patterns are the complexity of the knowledge and the social proximity of the sender and the receiver (Sorenson et al., 2006). Sorenson et al. (2006) find that knowledge of intermediate complexity spreads more easily between people who are socially close than between more socially distant people. Knowledge high in complexity hardly diffuses at all and knowledge low in complexity diffuses easily both between people who are socially close and between people who are more distant (Ibid).

In describing knowledge transfer, Sorenson et al. (2006) used the metaphor of a recipe, which contains many implicit steps (e.g. a recipe usually does not describe how to boil water or chop vegetables). Consequently, a reader must share a frame of reference with the originator to be able to successfully use the recipe. Breschi and Lissoni (2001b) argued that scientists and engineers often belong to what they referred to as epistemic communities, in which a basic frame of reference exists. Therefore, knowledge that would be perceived as highly complex

by anyone outside the epistemic community can relatively easily be externalised and shared within the community. Consequently, having scientists and engineers who belong to relevant epistemic communities, is vital to a firm's absorptive capacity, i.e. the ability to absorb external knowledge (c.f. Cohen & Levinthal, 1990).

Barriers to knowledge flows are not only found between but also within organisations (c.f. Ensign & Hébert, 2010). Szulanski (1996) found that the absorptive capacity of the recipient, the nature of the knowledge and the nature of the relationship between source and recipient are the most important factors affecting knowledge transfer within firms. Although firms can spend resources on facilitating internal knowledge transfer, e.g. by codifying knowledge, this is a double-edged sword since "*capabilities which can be easily communicated within the firm are more likely to be easily imitated by competitors.*" Zander & Kogut (1995, p. 76).

Zellner & Fornahl (2002) go beyond the tacit explicit dichotomy and create a typology of six types of scientific knowledge. (1) Broad, general knowledge and familiarity with the scientific discipline (BKG – in practice only transferable through hiring). (2) Substantive knowledge about scientific facts and theories (SFK), i.e. high-end knowledge, embodied in scientific publications and patents (can be transferred through hiring as well as formal and informal contacts). (3) Specialised methodological knowledge of techniques, experimental methods and testing procedures (SPK) (in practice only transferable through hiring). (4) Knowledge of specialised instrumentation and laboratory equipment (INS – can be transferred through hiring as well as formal and informal contacts). (5) Non-subject specific analytical skills (NSA - Only transferable through hiring). (6) Data analysis and processing skills (DPS - only transferable through hiring). Accordingly, all of their six categories can be transferred through labour mobility, but only a limited subset can, in practice, be transferred through formal or informal contacts between people inside and outside the organisation.

2.1. Informal contacts

Dahl & Pedersen (2004), surveying employees in firms in the NorCOM cluster in northern Denmark, found that 76% of the respondents had informal contacts with employees in other firms in the cluster. 41% of the people with informal contacts extracted knowledge that was useful in the present job. However, less than 10% of the people who extracted knowledge from their informal contacts rated the value as high.

In line with Von Hippel (1987), Schrader (1991) found that information is traded between employees in different firms in the specialty steel and mini-mill industry in the US. In particular, Schrader (1991) found that 61% of technically oriented mid-level managers in the mini-mill industry regarded informal contacts with people outside their firms as being an important or very important information source. Only colleagues within the same firm were considered, on average, to be a more important source of information (other assessed sources were vendors, customers, professional journals and books, and presentations at conferences). Important to note, these firms were not generally located in clusters. Similar results have been found in the aerospace industry (Gavrilis, 1989, through Schrader, 1991). Von Hippel (1987) also referred to preliminary evidence of similar behaviours among aerospace firms and waferboard manufacturing firms. Consequently, informal contacts as a mechanism for diffusing knowledge between organisations is not constrained to a cluster phenomenon (c.f. Malmberg & Power, 2005).

Carter (1989) argued that the non rivalry nature of knowledge and the difficulties involved in valuating knowledge make barter a suitable mechanism for knowledge exchange. In this

bartering process, Schrader (1991) claimed that employees are mindful of the economic interest of their employers. He suggested three parameters that influence decisions whether to supply information to employees in other firms: (1) the degree of competition between the firms (high competition lowers likelihood of sharing knowledge); (2) alternative ways of obtaining the information (increases the likelihood of sharing knowledge); and (3) whether the information relates to areas in which the firms compete (if it does not, that increases the likelihood of sharing knowledge).

Notwithstanding peoples' propensity to form relationships with people similar to themselves (c.f. Westelius, 1996; McPherson et al., 2001), it is reasonable to assume that informal contacts with people outside the organisation, as compared with contacts with people inside the organisation, are more likely to span structural holes and consequently to contribute to the development of ideas (c.f. Burt 2004). Burt (2004) found, among other things, that positive performance evaluations and good ideas were disproportionately sited with people who span structural holes within the supply chain of a large electronics company in the US.

2.2. Labour mobility

Labour mobility, i.e. employees changing employers, is an aggregate measure of organisational employee turnover. These measures are inversely related to the average employee tenure, i.e. length of employment, measured at an individual level. Consequently, ceteris paribus, increasing labour mobility implies shorter average tenure.

Theoretically, March (1991) modelled organisational learning through labour mobility. His model illustrates that new employees learn from the organisation at the same time as the organisations learn from new employees. The model demonstrates how new employees might be sources of new knowledge even though they on average have less knowledge than long term employees.

Empirically, Song et al. (2001) found that international mobility of engineers (i.e. engineers moving from US firms to non-US firms) can play a substantial role in firms' technological catching-up. Song et al. (2003) showed that knowledge transfer is more likely to take place if the recruit possesses expertise in a field distant from the hiring firm and if s/he works in non-core areas of the new firm. This might be due to intentions to actively learn from a recruit, if s/he is employed to expand rather than reinforce the knowledge base. Willingness to learn from recruits is probably important. Westelius & Askenäs (2004) noted how recruits in low-status administrative positions were discouraged from changing procedures and routines, and were limited to faithfully reproducing the way their predecessor worked. Further linking labour mobility of highly skilled employees to knowledge diffusion, Zander & Kogut (1995) found that key employees leaving the organisation are associated with faster imitation by competitors.

Although many studies focus on knowledge flows to the new employer, Agrawal, Cockburn & McHale (2006) assessed knowledge flows from a job changer's new location to his or her former location, using patent citations. These types of knowledge flows are based on enduring social relationships. They found that knowledge flows to an inventor's prior location are approximately 50% greater than what would be expected should s/he never have lived there. They also found that knowledge flows are stronger across fields than within. The explanation for this, according to Agrawal et al. (2006), is that inventors in the same field often are part of the same "community of practice" and consequently meet and form ties even when not co-

located. I.e. for inventors in different fields, co-location increases the chance of forming ties more than for people in the same field.

On an individual level, higher salaries for more mobile workers are seen as an indication that individuals bring knowledge with them across organisational borders (Dahl, 2002). Further linking labour mobility to agglomeration, Almeida and Kogut (1999) showed that the mobility of engineers and inventors in the US semiconductor industry is higher in Silicon Valley than within other US regions. Other studies have confirmed that mobility is higher in clusters than in the general labour market (Dahl, 2002; Power & Lundmark, 2004). However, here we have to be careful with ascribing a causal relationship. At a national level, growth and labour mobility are correlated (e.g. Israelsson et al., 2003), but that could, perhaps, better be explained by people changing jobs more frequently when there is a pull in the vacancy chain rather than growth being caused by labour mobility.

Other scholars have taken a critical stance to the alleged positive effects of labour mobility. E.g. Michie and Sheehan (2003) found that employee turnover is negatively related to firm innovativeness. Furthermore, high inflows of new employees might lead to firms conserving their current practices (Madsen et al., 2003); and at an aggregate level – the national average employee tenure has an inverted U-shaped relation to countries' productivity per capita (Auer, et al., 2005). The latter authors' data suggest that "*there is no general problem of excessively long tenure in Europe*" (Auer et al., 2005, p. 329). However, these studies focus on mobility in general, not on mobility of key employees in particular. Lastly, even though attempts at encouraging voluntary labour mobility are known (Bienkowska 2007), most firms see the mobility of employees rather as a problem than as an advantage (c.f. Malmberg & Power, 2005; Bienkowska, 2007).

2.3. Knowledge-seeking behaviour & hypotheses

Homing in on how engineers and scientists actually seek knowledge, Anderson et al. (2001) found that aerospace scientists and engineers prefer oral sources of knowledge over written sources. Furthermore, they found that there is a preference for sources within the organisation to sources outside the organisation. In short, engineers seem to follow the principle of least effort in searching for information.

Further assessing sources of knowledge, Ibrahim et al. (2009), showed that inventors located inside clusters, as compared to inventors outside clusters, rely more on firm external but local sources of knowledge for their inventions. However, inventors rely more on corporate sources of knowledge than external sources in coming up with their inventions, regardless of location (Ibid). In Ibrahim's et al. (2009) study only local sources and corporate/organisational sources were assessed. Consequently, it is possible that engineers not in clusters compensated with informal contact that were neither organisational nor local.

As mentioned, as far as informal contacts with people outside the organisation are concerned, information is commonly traded and the interests of the employer are considered (Schrader, 1991; Dahl & Pedersen, 2004, Ensign & Hébert, 2009). Also within firms, people tally knowledge exchanges (Ensign & Hébert, 2010). However, within firms, uniqueness and value of the knowledge are positively related to the propensity to share it (Ensign & Hébert, 2010). One reason could be that within firms, the employer's interest more often works in favour of sharing knowledge. Inquiries for information or requests for training (e.g. "can you teach me how to...") are generally more legitimate and common between co-workers than through informal contacts outside the organisation. Furthermore, co-workers are likely to have similar

frames of reference, e.g. they are likely to belong to the same epistemic community and also to share a large part of organisation-specific knowledge. Last but not least, oral sources are preferred to written sources and colleagues are usually spatially close, allowing both planned meetings and higher probability of chance encounters. Consequently, from the perspective of an employee in a large organisation, co-workers are likely to be the most important source of knowledge regardless of whether the organisation is located in a cluster or not.

This leads to our first hypothesis:

H1: The most important source of knowledge is colleagues within the organisation

The literature suggests that informal contacts with people outside the organisation is an important knowledge sources in many organisations (e.g. Dahl & Pedersen, 2004; Schrader, 1991). Although the importance of informal contacts outside the organisation as a knowledge source has rarely been juxtaposed to other sources of knowledge, the literature suggests that they are more important than codified sources, both internal and external (Anderson et al., 2001). Thus:

H2: Informal contacts outside the organisation is a more important knowledge source than codified sources such as internal or external databases or scientific literature.

Furthermore, since people with contacts outside the organisations are more likely to span structural holes they are more likely to contribute creatively to product development projects (c.f. Burt, 2004). Therefore, hypothesis 3 (H3) suggests a positive relation between an employee's creative contribution to the project and the importance attributed to external sources of knowledge, such as suppliers, customers, partner organisations, and to informal contacts outside the organisation. This is separated into two hypotheses:

H3a: The higher an employee rates the importance of external parties, such as suppliers, customers and partner organisations as a knowledge source, the higher the employee's creative contribution to the project.

H3b: The higher an employee rates the importance of informal contacts outside the organisation as a knowledge source, the higher the employee's creative contribution to the project.

3. Empirical Setting & Methodology

This article assesses importance of different knowledge sources utilised by 219 participants in two high-tech, R&D driven, non-incremental, product development projects in large corporations. The projects are focused on the design and construction of what Moodysson et al. (2008, p. 1044) describe as "functional systems shaped as tangible and useful artifacts [sic] and technologies", e.g. the development of a new car or aeroplane.

Both corporations are located in local labour markets highly specialised in their respective industry clusters. They were identified as local clusters in an assessment by Lindqvist et al. (2002), which in turn is based on a translation of Michael E. Porter's model and categorisation of industry clusters (c.f. Porter 1990). The local labour markets are characterised by both employing a substantial part of the Swedish labour market within the respective industry cluster (>25%) and by being highly specialised in the industry cluster (the proportion of

people employed in the industry cluster is more than ten times higher than the national average, c.f. Lindqvist et al. (2002)).

Both corporations are important actors in their region and are partners in a regional network based on the Triple Helix principles (i.e. strengthened relationships between university, industry, and government to promote knowledge exchanges, innovation and entrepreneurship c.f. Etzkowitz & Klofsten, (2005)). Furthermore, both corporations are international and cooperate with both public and private organisations in developing new products; although the assessed projects are mainly local.

Both projects involved a vast majority of men (89% and 84%). Average age was 41 and 43 years old. Education was predominantly in science and engineering in both projects and the median education was 4.5 years of university in project A and 3 years of university in project B. 24% of the participants in project A and 9% in project B had at least one patent.

Through an interactive approach, in a group of academic researchers and practitioners from the focal organisations and other organisations in the above mentioned network based on the Triple Helix principles, a questionnaire was developed and tested by employees in four different organisations (by people neither involved in the focal projects nor included in the survey sample). The interactive group was also involved in discussing and interpreting results.

The questionnaire was sent, in the form of a web-based questionnaire accessible through e-mail invitation, to participants in four innovative projects in the participating organisations. Two of these projects fitted the criterion high-technology R&D-based non-incremental product development in large organisations and are the focal projects of this article. The other two projects focused on entrepreneurial projects in the public sector and are not covered in this article.

In project A, we sent 3 reminders resulting in a response rate of (124/149) 83%. In project B we were not allowed to send any reminders, leading to a considerably lower, but still acceptable, response rate of (158/499) 32% in project B. Respondents who where active less than 20% of full time (i.e. less than 8 h a week) in the projects were excluded from the analysis, since lower participation was deemed to jeopardise reliability. Consequently, we obtained 94 usable responses in project A and 125 in project B.

The questionnaire addressed background data of the respondents (e.g. age, education, time of employment and length of work experience); questions addressing the importance of different knowledge sources to the respondents acquisition of knowledge during the project; questions regarding their own self-assessed creative contributions to the projects; and we also asked the respondents to name people who they thought contributed particularly creatively to the project (e.g. contributed with new ideas or solutions). The questions regarding importance of knowledge sources and self-assessed creative contribution to the projects were measured using 7 point Likert-type scales. Respondents were informed that answers would be analysed exclusively by a group of independent researchers and that no answers traceable to single individuals would be released outside this group.

There was a difference between the people who were mentioned by co-workers as particularly creative and self-reported creative contribution of about half a standard deviation (*d*), i.e. a medium effect (Cohen, 1988), when measured in all four projects who responded to the survey, In the projects that we focus on in this article, the results were mixed. In project A,

there was no significant difference in self-reported creative contribution between people who were mentioned by others and people who were not. In project B this difference was significant (d= 0.7; n= 110, mean score=4.9/3.9 SD=1.4, t(108)=3.3, p<.001 [two-tailed]).

Assessing creative contributions in teams is difficult and assessments vary depending on perspective (c.f. Moneta et al. 2009). Particularly in large projects like these, participants will have limited knowledge about the contributions of all other participants. Furthermore, people's contributions are visible to other project members to various degrees, adding further noise to the peer-assessed measure. In order to compensate for this, the peer-assessed measure, i.e. number of mentions by others, was aggregated to a binary variable, where 0 means not mentioned and 1 means mentioned by at least one other participant. Since both peer and self-ratings are potentially biased, they should be seen as complimentary assessments of actual creative contributions to the projects.

In both projects, people mentioned on average one person each as particularly creative. Since there was a considerable discrepancy in response rate and people sometimes mentioned non-respondents, 33% in project A and 22% in project B were mentioned by at least one person.

One of the main reasons for asking people to mention others, whom they considered contributed particularly creatively to the project, was to attain alternative measures of the dependent variable, i.e. creative contributions to the projects. Despite our possibility to triangulate, potential common method variance (CMV, c.f. Podsakoff et al., 2003) should be addressed when assessing the relationship between the self-reported variables. Using Harman's method as described by Podsakoff et al. (2003), we conducted an exploratory factor analysis on all variables where CMV could be an issue. The results showed that the variables loaded on several factors and no one factor explained the majority of the variance. This indicates that CMV is not excessively influential in our dataset (Spector, 2006).

Hypotheses 1 and 2 were tested comparing the assessments of the importance of the different knowledge sources using paired sample t-tests. Hypotheses 3a and 3b were tested using two measures of creative contribution to the projects, self-assessed and peer-assessed. The samples are large enough for linear multiple regressions with a few independent variables (c.f. Tabachnick & Fidell 1996). Consequently, hypotheses 3a and 3b are firstly tested through a multiple regression where self-assessed creative contribution to the project is the dependent variable and the importance of external parties and informal contacts are independent variables (presented in Table A1. see Appendix A). Furthermore, we tested the solution in a stepwise regression controlling for tenure, number of hours spent on the projects ("time") and gender (presented in Table 1.). Preliminary analyses indicated no violation of the assumptions of linearity, normality of error terms, homoscedasticity and multicollinearity.

Since logistic regression is not advisable for samples of this size, in particular not for the sample in project A (c.f. Long, 1997; Peduzzi et al., 1996), we compared the importance of external parties and informal contacts as knowledge sources between participants who were mentioned by others as particularly creative with participants who were not, using independent sample t-tests (presented in Table 2.). Nevertheless, we tested if the differences found were robust to a logistic regression, despite the limited sample sizes. In line with the t-tests, only external parties came out as a significant predictor for both projects. However, for project A, the Omnibus Tests of Model Coefficients was just outside of the 5% significance level (p=.088).

In order to compensate for possible acquiescence biases/common scale formats bias, i.e. biases that could inflate relations between variables measured using Likert-type scales (c.f Podsakoff et al, 2003), we ran zero order correlations between the dependent variable and normalised ratings of the knowledge sources. We normalised the ratings of the sources by subtracting the respondents mean rating on all the rated sources. Consequently, normalised sources represent relative importance to other sources, where negative values represent below average value. This will arguably overcompensate for acquiescence biases/common scale formats bias, since using one source more does not necessarily mean using less of another, e.g. some people might actually use more sources than others. The results, shown in Table B1. (see Appendix B), indicate a significant positive relation between self-assessed creative contribution to the project and the relative importance of external parties (e.g. customers/partners/suppliers) as knowledge sources in both projects; and a significant positive relation between self-assessed creative contribution to the project and the relative importance of informal contacts outside the organisation as knowledge sources in project B. Self-assessed creative contribution was unrelated or negatively related to all other normalised knowledge sources. Correlation matrixes for the original knowledge sources and measures of creative contributions to the projects are shown in Table C1 and C2 in Appendix C.

4. Results

The ratings of the importance of the knowledge sources are depicted in Figure 1. On average, the highest rated knowledge source in both samples is colleagues within the organisation. This difference is statistically significant at the $p<.001$ level, using paired sample t-tests, in comparison with all other knowledge sources respectively for both projects.

In line with Dahl & Pedersen (2004) we find that informal contacts gained during the participant's career are prevalent. In project A, 87% report having at least one informal contact (with former colleagues, employers, class mates or customers/suppliers to previous employers), in project B this proportion is 86%. Of the people with at least one contact, 55%/77% report that the contact(s) is (are) of importance to their present work; 17%/19% report that the contact(s) is (are) of great importance to their present work.

Despite the prevalence and importance of informal contacts – they are not rated as important knowledge sources in the project. As shown in Figure 1., informal contacts got the lowest average ratings of all knowledge sources in both projects. The difference between informal contacts outside the organisation and all other knowledge sources respectively, is statistically significant (at the $p<.0005$ level, using paired sample t-tests) in project A. In project B informal contacts are significantly lower rated than all other knowledge sources (at the $p<.01$ level, using paired sample t-tests) except books/Specialist literature, (mean 2.6/2.8 *SD* 1.6/1.6 $t(112)=1.24$, $p=.22$, $d=0.14$).

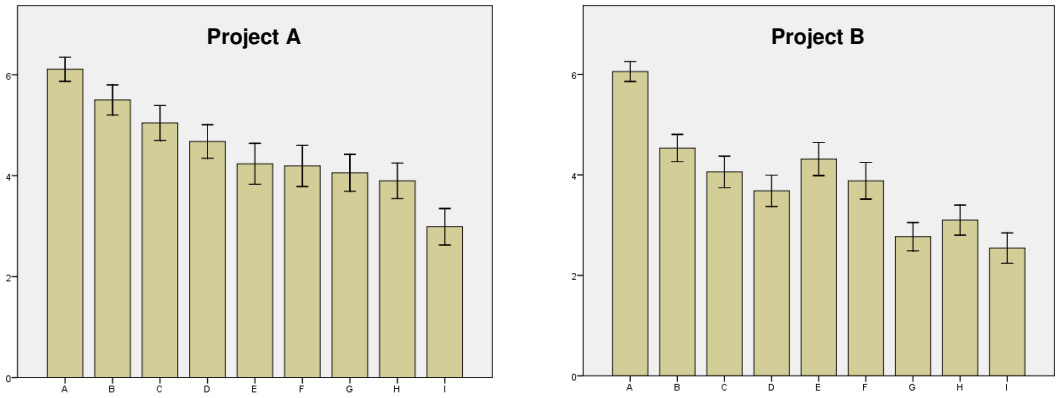


Figure 1. Assessment of knowledge sources. *Note:* Fig.1. depicts the ratings of knowledge sources in each project sorted ascending, based on the results in project A (A-Colleagues within the organisation; B-Time to reflect and think; C-Time to experiment/trial and error; D-Education; E-Intranet/internal documentation; F-External parties [e.g. customers/partners/suppliers]; G-Books/Specialist literature; H-Internet; I-Informal contacts outside the organisation). A 95% confidence interval is shown for each rating.

Table 1. Results from a hierarchical multiple regression, using self-assessed creative contribution in the project as the dependent variable.

	Project A				Project B			
Variable	Step 1	*P*	Step 2	*P*	Step1	*P*	Step 2	*P*
Tenure	-0.15	0.20	-0.092	0.40	0.20	0.045	0.13	0.15
Time	0.18	0.13	0.016	0.89	0.15	0.12	0.13	0.15
Gender	0.052	0.64	0.043	0.67	0.16	0.10	0.18	0.054
External parties			0.32	0.012			0.18	0.10
Infomal contacts			0.22	0.067			0.23	0.038
R^2	0.077	0.11	0.27	0.0005	0.091	0.020	0.21	0.0005
Adj- R^2	0.040		0.22		0.065		0.17	
F-value	2.10		5.33		3.42		5.44	
ΔR^2			0.19	0.0005			0.12	0.001
F-value for ΔR^2			9.47				7.79	

Table 2. Results from t-tests comparing the participants who were mentioned by others as contributing particularly creatively to the projects with participants who were not mentioned in each project, on their ratings of knowledge sources, using an independent-samples t-test (two-tailed).

	Project A					Project B				
Variable	Mean mentioned/ non-mentioned	*SD* mentioned/ non-mentioned	*t*	*d*	*p*	Mean mentioned/ non-mentioned	*SD* mentioned/ non-mentioned	*t*	*d*	*P*
External parties	4.7/3.9	1.5/2.1	(77.5) =2.13	0.5	.037	5.2/3.5	1.8/1.9	(115) =4.06	0.9	.0005
Infomal contacts	3.1/2.9	1.5/1.8	(84) =0.31	0.1	.76	3.0/2.4	2.1/1.5	(32.9) =1.32	0.3	.20

Comparisons between participants, who were mentioned by others as contributing particularly creatively to the projects, with participants who were not mentioned on the ratings of the other knowledge sources, gave no significant results in project A. In project B, mentioned participants had higher ratings of "Time to reflect and think" (mean= 5.2/4.4, *SD*=1.3/1.5, $t(119)=2.70$, $d=0.6$, $p=.008$) and "Time to experiment/trial and error" (mean= 4.8/3.8, *SD*=1.7/1.7, $t(117)=2.56$ $d=0.6$, $p=.012$). However, here we should consider that 14 comparisons were made, which has implications for the significance of these results.

In summary, the results show that, in these large R&D driven, non-incremental product development projects, the most important knowledge source is colleagues within the organisation (H1 supported). Informal contacts outside the organisation, although prevalent, are rather unimportant as knowledge sources for the participants (H2 rejected). External contacts are related to creative contributions in the projects regardless of whether the contributions are self-assessed or peer-assessed (H3 supported). The support for H3a is rather strong (See Table 1; 2; A1 & B1). However, the support for informal contacts outside the organisation being related to creative contributions to the project is limited to self-assessed contributions and even so, the link is marginally significant in project A (see Table 1; A1 & B1).

5. Discussion & Conclusion

Dahl and Pedersen (2004), who found that informal contacts are important channels of knowledge diffusion, specifically called for studies juxtaposing informal contacts to other knowledge sources. In doing so, we find that, despite reporting contacts from previous and present employments as important to their present work, the importance of informal contacts as a knowledge source is small, when compared to other knowledge sources. This clearly puts earlier findings (e.g. Dahl & Pedersen, 2004), not juxtaposing knowledge sources, in a new light. Thus, at first glance, the results in this study seem to side with Power & Lundmark (2004), in that knowledge at an individual level most commonly develops through interaction located in the workplace and not through informal contacts with people outside the organisation.

Are there idiosyncrasies related to the samples, e.g. the assessed industries as suggested by e.g. Von Hippel (1987)? In fact, one of our projects is in an industry that has been suggested as particularly rich in knowledge flows through informal contacts (e.g. Von Hippel, 1987; Schrader, 1991; Anderson et al., 2001). Regarding the difference to the results obtained by Dahl and Pedersen (2004), they surveyed 19 firms from the general population of members in NorCOM; our focal projects in this study are located in large organisations, dominant in their region. This might skew the balance required in knowledge trading, e.g. employees in the large dominant firms might consider other organisations having little to offer. Furthermore, non-competition clauses in the employment contracts are negatively related to the propensity to have informal contacts outside the firm (Dahl & Pedersen, 2004). In the focal projects of the present study both firms have such clauses in their contracts. However, a very high proportion of our respondents still reported keeping in touch with contacts made during their previous employments and benefitting from them in their present work.

Interestingly, Dahl & Pedersen (2004) reported that respondents in R&D had higher frequency of informal contacts than respondents in production, but respondents in production where more likely to acquire knowledge through their contacts. It is possible that the different patterns are due to the ease with which the types of knowledge relevant to work in production

and R&D respectively can be shared outside the organisation (c.f. Zellner & Fornahl, 2002). However, an alternative, and perhaps more probable, explanation for this is that unique knowledge, which can be assumed to be more common in R&D projects, is less likely to be shared outside the firm (c.f. Schrader, 1991).

This is in line with recent research arguing that high-technology small firms are unlikely to benefit from local research collaboration since much of their R&D *"is highly confidential, competitive and wholly internalised. This tendency [...] minimises the likelihood that local management collaboration between co-located firms will improve the performance of R&D projects."* (Oakey, 2007, p. 237). Bramwell et al. (2008), studying the Waterloo ICT cluster in Canada, also found little support for local actors being drivers of innovation; rather, they emphasise that innovation is driven "*primarily by global customers in conjunction with in-house R&D departments*"(p. 112).

Turning to Power's & Lundmark's (2004) statement that *"knowledge and innovation most commonly develop through interaction located in the workplace itself"*, we believe our results only partly supports it. It is clear that the individuals responding to our survey find the knowledge sources associated with the workplace as the most important e.g. colleagues within the organisation and time to reflect and think. However, studying knowledge flows at an individual level is but one piece in the puzzle; individual learning is not equivalent to organisational learning (Ellström, 2010).

Arguably, learning should be manifested in organisational routines, practices or action to contribute to organisational learning (c.f. Nelson & Winter, 1982). From an organisational perspective, required knowledge (for some context) might exist in the organisation but might not be embodied in people facing the context or different types of knowledge might not be coordinated to solve a problem (c.f. Zellner & Fornahl, 2002). Consequently, organisational learning is about creating new knowledge endogenously, absorbing knowledge from the outside as well as disseminating knowledge within the organisation.

To exemplify – a newly graduated student will most certainly learn much during his or her first year of employment. Notwithstanding the possibility that s/he might contribute to organisational learning (c.f. March, 1991), it is arguable that the individual will learn much and the organisation little during this year. This distinction is important since failing to make it can blur our understanding of knowledge flows.

What is learned from colleagues is by definition not new to the organisation. However, new knowledge can be created endogenously by e.g. experimentation and reflection. It can also be brought in from the outside. Our results indicate that external contacts are positively related to creative contributions, e.g. coming up with new ideas and solutions. Consequently, even though external contacts are not excessively important for individual learning it could be quite important for organisational learning. Interestingly, the people mentioned by others as particularly creative in project B were distinguished not only by significantly higher ratings of external parties as knowledge sources but also by significantly higher ratings of time to reflect and think and time to experiment/trial and error[3], i.e. potential sources of knowledge new to the organisation.

Thus, we argue that, although knowledge can be created endogenously within the organisation or through hiring, external contacts can be of higher importance to organisational learning than to individual learning. I.e. we side with Power & Lundmark (2004) with regards to

individual level knowledge development, but more research is needed before generalising this statement to organisational learning. In fact, our results suggest that external contacts are important to bringing new ideas into the organisation.

In line with the discussion above, labour mobility is often associated with substantial individual learning but only sometimes associated with substantial organisational learning. Furthermore, much knowledge is highly organisation specific and might be of no or little use in another organisation and consequently labour mobility might be associated with a loss of certain types of knowledge for the former employer without necessarily benefitting the new employer (c.f. Breschi & Lissoni 2001a). As a result, labour mobility can be wasteful from an organisational learning perspective. Knowledge gains and losses are difficult to measure or even to conceptualise. Although there is an abundance of knowledge typologies, better models are needed to develop our understanding of the effects of labour mobility and informal contacts for the diffusion of knowledge at different levels.

Notes

[1] Perhaps better known, Krugman (1991b) argues similarly that knowledge flows "leave no paper trail" (p. 53).
[2] Explicit knowledge is sometimes referred to as information (c.f. Zellner & Fornahl, 2002).
[3] However, the reader should note the high number of comparisons that were made when these results were found (see results section).

References

Acs, Zoltan J.; Braunerhjelm, Pontus; Audretsch, David B. & Carlsson, Bo (2009). The knowledge spillover theory of entrepreneurship. Small Business Economics, Vol. 32, No. 1, pp. 15-30.

Agrawal, Ajay; Cockburn, Iain & McHale, John (2006). Gone but not forgotten: knowledge flows, labor mobility, and enduring social relationships. Journal of Economic Geography, Vol. 6, pp. 571–591.

Almeida, Paul & Kogut, Bruce (1999). Localization of Knowledge and the Mobility of Engineers in Regional Networks. Management Science, Vol. 45, No. 7, pp. 905-917.

Anderson, Claire, J.; Glassman, Myron; McAfee, R. Bruce & Pinelli, Thomas (2001). An investigation of factors affecting how engineers and scientists seek information. Journal of Engineering and Technology Management, Vol. 18, No. 2, pp. 131 - 155"

Arrow, K. (1962). The economic implications of learning by doing. Reviewof Economic Studies 29, 155–172.

Audretsch, David, B. & Keilbach, Max (2005). The Moblity of Economic Agents as Conduits of Knowledge Spillovers. In Fornahl, Dirk, Zellner, Christian & Audretsch, David, B. (Eds.). The Role of Labour Mobility and Informal Networks for Knowledge Transfer. Springer Science/Business Media, Inc., Boston. ISBN 0-387-2314-2.

Auer, Peter; Berg, Janine & Coulibaly, Ibrahim (2005). Is a stable workforce good for productivity? International Labour Review, Vol. 144, No. 3.

Beaudry, Catherine & Schiffauerova, Andrea (2009). Who's right, Marshall or Jacobs? The localization versus urbanization debate. Research Policy, Vol. 38, No. 2, pp. 318–337

Bienkowska, D. 2007. 'Arbetskraftens rörlighet och klusterdynamik. En studie av IT-och telekomklustren i Kista och Mjärdevi'. [Labour mobility and cluster dynamics. A study

of ICT clusters in Kista and Mjärdevi, Sweden]. PhD Thesis Uppsala University. ISBN 978-91-506-1947-8.

Bramwell, Allison; Nelles, Jen & Wolfe, David, A. (2008). Knowledge, Innovation and Institutions: Global and Local Dimensions of the ICT Cluster in Waterloo, Canada. Regional Studies, Vol. 42, No. 1, pp. 101–116.

Breschi, Stefano & Lissoni, Francesco, (2001a). Knowledge spillovers and local innovation systems: a critical survey. Industrial and Corporate Change, Vol. 10, No. 4, pp. 975–1005.

Breschi, Stefano & Lissoni, Francesco, (2001b). Localised knowledge spillovers vs. innovative milieux: knowledge "tacitness" reconsidered. Papers in Regional Science Vol. 90, pp. 255–273.

Burt, Ronald, S. (2004). Structural Holes and Good Ideas. The American Journal of Sociology, Vol. 110, No. 2, pp. 349-399.

Carter, Anne, P. (1989). Knowhow trading as economic exchange. Research Policy, Vol. 18, No. 3, pp. 155–163.

Cohen, Jacob (1988). Statistical Power Analysis for the Behavioral Sciences (second ed.). Lawrence Erlbaum Associates.

Cohen, Wesley, M. & Levinthal, Daniel, A. (1990). Absorptive Capacity: A New Perspective on Learning and Innovation. Administrative Science Quarterly, Vol. 35, No. 1, pp. 128-152.

Dahl, Michael, S. & Pedersen, Christian Ø., R. (2004). Knowledge flows through informal contacts in industrial clusters: myth or reality? Research Policy Vol. 33, No. 10, pp. 1673–1686.

Dahl, Michael, S. (2002). Embedded knowledge flows through labor mobility in regional clusters in Denmark. Paper presented at DRUID's New Economy Conference, Copenhagen, 6-8 June.

Ellström, Per-Erik (2010). Organizational Learning.In B. McGaw, P. L. Peterson, & E. Baker (Eds.) (forthcoming). International Encyclopedia of Education, 3rd Edition. Amsterdam: Elsevier

Ensign, Prescott, C. & Hébert, Louis (2009). Competing explanations for knowledge exchange: Technology sharing within the globally dispersed R&D of the multinational enterprise. Journal of High Technology Management Research, Vol. 20, No. 1, pp. 75–85

Ensign, Prescott, C. & Hébert, Louis (2010). How Reputation Affects Knowledge Sharing Among Colleagues. MIT Sloan Managment Review, Vol. 51, No. 2, pp. 78-81.

Etzkowitz, Henry & Klofsten, Magnus (2005). The innovating region: toward a theory of knowledge-based regional development. R&D Management, Vol.35, No. 3, pp. 243-255.

Florida, Richard (2002). The economic geography of talent, Annals of the Association of American Geographers, 92(4), pp. 743–755.

Fornahl, Dirk; Zellner, Christian & Audretsch, David, B. (2005). The Role of Labour Mobility and Informal Networks for Knowledge Transfer. Springer Science/Business Media, Inc., Boston. ISBN 0-387-2314-2.

Gavrilis, Theofanis G. (1989). Information Transfer Networks in Aerospace, Master's Thesis, Sloan School of Management, Massachusetts Institute of Technology.

Glaeser, Edward, L.; Kallal,Hedi, D.; Scheinkman, Jose, A. & Shleifer, Andrei (1992). Growth in Cities. Journal of Political Economy, Vol. 100, No. 6, pp. 1126-1152.

Ibrahim, Sherwat E.; Fallah, M., Hosein & Reilly, Richard, R. (2009). Localized sources of knowledge and the effect of knowledge spillovers: an empirical study of inventors in the telecommunications industry. Journal of Economic Geography, Vol. 9, No. 3, pp. 405–431.

Israelsson, Torbjörn; Strannefors, Tord & Tydén, Hans (2003). Geografisk rörlighet och arbetsgivarbyten [Geographical Mobility and Changes of Employer]. Stockholm: Arbetsmarknadsstyrelsen.

Jacobs, Jane., 1969. The Economies of Cities. Random House, New York.

Jaffe, Adam, B.; Trajtenberg, Manuel, & Henderson, Rebecca (1993). Geographic localization of knowledge flows as evidenced by patent citations. Quarterly Journal of Economics, Vol. 108, No. 3, pp. 577-598.

Kim, Jinyoung; Lee, Sangjoon, John & Marschke, Gerald (2006). International Knowledge Flows: Evidence from an Inventor-Firm Matched Data Set. Working paper available at http://www.nber.org/papers/w12692.

Klofsten, Magnus; Heydebreck, Peter & Jones-Evans, Dylan (2009). Transferring good practice beyond organizational borders: Lessons from transferring an entrepreneurship programme, Regional Studies, Regional Studies, First published on: 14 September 2009 (iFirst) pp. 1-9.

Krugman, Paul (1991a). Increasing Returns and Economic Geography. The Journal of Political Economy, Vol. 99, No. 3, pp. 483-499. http://www.jstor.org/stable/2937739

Krugman, Paul, R. (1991b). Geography and Trade. Leuven University Press, Leuven, Belgium. ISBN: 0262111594

Lindqvist, Göran; Malmberg, Anders & Sölvell, Örjan (2002). Svenska klusterkartor En statistisk inventering av kluster i Sverige 2002 [In Swedish: Swedish cluster maps a statistical assessment of clusters in Sweden 2002]. Centre for Research on Innovation and Industrial Dynamics, Uppsala Universitet

Long, J., Scott (1997) Regression Models for categorical and limited dependent variables. Sage Publications, Thousand Oaks London.

Madsen, Tammy L.; Mosakowski, Elaine & Zaheer, Srilata (2003). Knowledge Retention and Personnel Mobility: The Nondisruptive Effects of Inflows of Experience. Organization Science, Vol. 14, No. 2, pp. 173-191.

Malmberg, Anders & Power, Dominic (2005). (How) Do (Firms in) Clusters Create Knowledge? Industry and Innovation, Vol. 12, No. 4, pp. 409–431.

March, James G. (1991) Exploration and Exploitation in Organizational Learning. Organization Science, Vol. 2, No. 1, pp. 71-87.

Marshall, Alfred (1890/1920). Principles of Economics. MacMillan, London.

McPherson, Miller; Smith-Lovin, Lynn & Cook, James, M. (2001). Birds of a Feather: Homophily in Social Networks. Annual Review of Sociology, Vol. 27, pp. 415-444

Michie, Jonathan & Sheehan, Maura (2003). Labour market deregulation, 'flexibility', and innovation. Cambridge Journal of Economics, Vol, 27, pp. 123-143.

Moneta, Giovanni B.; Amabile, Teresa M.; Schatzel, Elizabeth A. & Kramer, Steven J.(2009). Multirater assessment of creative contributions to team projects in organizations. European Journal of Work and Organizational Psychology, forthcoming http://dx.doi.org/10.1080/13594320902815312.

Nelson, Richard, R. & Winter, Sidney, G. (1982). An Evolutionary Theory of Economic Change. Harvard University Press Cambridge, MA.

Nonaka, Ikujiro & Toyama, Ryoko (2003). The knowledge-creating theory revisited: knowledge creation as a synthesizing process. Knowledge Management Research & Practice Vol. 1, No. 1, pp. 2–10

Oakey, Ray (2007). Clustering and the R&D management of high-technology small firms: in theory and practice. R&D Management, Vol. 37, No. 3, pp. 237-248.

Peduzzi, Peter; Concato, John; Kemper, Elizabeth; Holford, Theodore, R. & Feinstein Alvan, R. (1996). A simulation study of the number of events per variable in logistic regression analysis. Journal of Clinical Epidemiology Vol. 49, No. 12, pp. 1373-1379.

Pennings, Johannes, M. & Wezel, Filippo Carlo (2007). Human Capital, Inter-firm Mobility and Organizational Evolution. Edward Elgar Publishing, Inc. Northampton, Massachusetts, USA. ISBN 9781845427573

Podsakoff, Philip, M.; MacKenzie, Scott, B.; Lee, Jeong-Yeon & Podsakoff, Nathan, P. (2003). Common method biases in behavioral research: a critical review of the literature and recommended remedies. Journal of Applied Psychology 88 (5), 879–903.

Polanyi, Michael (1966). The Logic of Tacit Inference. Philosophy, Vol. 41, No. 155, pp. 1–18.

Porter, Michael E, 1990. The competitive advantage of nations, Simon & Schuster: New York.

Power, Dominic & Lundmark, Mats (2004) Working through knowledge pools: labour market dynamics, the tranference of knowledge and ideas, and industrial clusters, Urban studies, Vol. 41, No. 5&6 pp. 1025-1044.

Rogers, Everett M. (2003) Diffusion of Innovations, 5th ed, The Free Press, New York, USA

Romer, Paul, M. 1986. Increasing returns and long-run growth. Journal of Political Economy 94, 1002–1037.

Saxenian, AnnaLee (1994). Regional Advantage: Culture and Competition in Silicon Valley and Route 128. Harvard University Press, Cambridge.

Schrader, Stephan (1991). Informal technology transfer between firms: co-operation through information trading. Research Policy Vol. 20, No.2, pp. 153–170.

Song, Jaeyong; Almeida, Paul & Wu, Geraldine (2001). Mobility of engineers and cross-border knowledge building: The technological catching-up case of Korean and Taiwanese semiconductor firms. Henry Chesbrough, Robert Burgelman, (Eds.). Research on Technological Innovation, Management and Policy, Vol. 7, pp. 59-84. Elsevier, New York.

Song, Jaeyong; Almeida, Paul & Wu, Geraldine (2003). Learning-by-Hiring: When Is Mobility More Likely to Facilitate Interfirm Knowledge Transfer? Management Science, Vol. 49, No. 4, pp. 351–365.

Sorenson, Olav; Rivkin, Jan, W. & Fleming, Lee (2006). Complexity, networks and knowledge flow. Research Policy Vol.35, No. 7, pp. 994–1017

Spector, Paul, E. (2006). Method variance in organizational research: truth or urban legend? Organizational Research Methods, Vol. 9, No. 2, pp. 221–232.

Storper, Michael & Venables, Anthony, J. (2002). Buzz: the economic force of the city. Paper presented at DRUID Summer Conference on "Industrial Dynamics of the New and Old Economy—Who Is Embracing Whom?", Copenhagen/Elsinore, June.

Szulanski, Gabriel (1996). Exploring Internal Stickiness: Impediments to the Transfer of Best Practice Within the Firm. Strategic Management Journal, Vol. 17, No. pp. 27-43

Tabachnick, Barbara G. & Linda, S. Fidell. 1996. Using multivariate statistics (third edition). HarperCollins, New York, New York, USA.

Westelius, Alf & Askenäs, Linda (2004). Getting to know your job – a social actor perspective on using information technology, Information Technology Journal, Vol. 3, No. 3, pp. 227-239.

Westelius, Alf (1996). A study of patterns of communication in management accounting and control projects, EFI, Stockholm.

Von Hippel, Eric (1987). Cooperation between rivals: informal knowhow trading. Research Policy, Vol. 16, No. 6, pp. 291–302.

Zander, Udo & Kogut, Bruce (1995). Knowledge and the Speed of the Transfer and Imitation of Organizational Capabilities: An Empirical Test. Organization Science Vol. 6, No. 1, pp. 76-92.

Zellner, Christian & Fornahl, Dirk (2002). Scientific Knowledge and Implications for its Diffusion. Journal of Knowledge Management, Vol. 6, No. 2 pp. 190-198.

Appendix A

Table A1. Results from a standard multiple regression, dependent variable self-assessed creative contribution in the project.

	Project A		Project B	
Variable	Beta/value	*p*	Beta/value	*P*
External parties	0.35	.003	0.16	.15
Infomal contacts	0.22	.059	0.27	.014
R^2	0.26		0.14	
F	13.2	.0005	8.7	.0005

Appendix B

Table B1. Correlations between normalised ratings of the knowledge sources and the self assessed creative contribution of the projects.

Normalised knowledge sources	Self-assessed creative contribution (Project A)	Self-assessed creative contribution (Project B)
Colleagues within the organisation	-.30**	-.33**
External parties (e.g. customers/partners/suppliers)	.26*	.20*
Informal contacts outside the organisation	Ns	.22*
Education	-.24*	Ns
Internet	Ns	Ns
Intranet/internal documentation	Ns	-.29**
Books/Specialist literature	Ns	Ns
Time to experiment/trial and error	Ns	Ns
Time to reflect and think	Ns	Ns

*$p < .05$, **$p < .01$. *Note:* The ratings of the knowledge sources are normalised by subtracting the respondents mean rating on all the rated sources. Thus, normalised sources represent relative importance to other sources, where negative values represent below average value.

Appendix C

Table C1. Correlation matrix project A

Variable	1	2	3	4	5	6	7	8	9	10
1 Self-rated creative contribution										
2 Mentioned as creative (binary)	.05									
3 Colleagues within the organisation	.10	-,07								
4 External parties (e.g. customers/partners/suppliers)	.47**	.20	.08							
5 Informal contacts outside the organisation	.40**	.03	-.18	.52**						
6 Education	.12	-.11	.21	.13	.35**					
7 Internet	.37**	.03	.06	.51**	.53**	.32**				
8 Intranet/internal documentation	.31**	.09	.25*	.38**	.24*	.24*	.46**			
9 Books/Specialist literature	.27*	-.11	.14	.17	.37**	.49**	.37**	.37**		
10 Time to experiment/trial and error	.31**	-.14	.37**	.20	.23*	.27*	.30**	.29**	.52**	
11 Time to reflect and think	.38**	-.08	.24*	.27*	.23*	.10	.21	.25*	.40**	.77**

*$p < .05$, **$p < .01$.

Table C2. Correlation matrix project B

Variable	1	2	3	4	5	6	7	8	9	10
1 Self-rated creative contribution										
2 Mentioned as creative (binary)	.30**									
3 Colleagues within the organisation	-.10	.10								
4 External parties (e.g. customers/partners/suppliers)	.31**	.35**	.08							
5 Informal contacts outside the organisation	.36**	.15	-.23*	.54**						
6 Education	0.11	-.13	-.02	.20*	.33**					
7 Internet	.21*	.08	-.02	.42**	.35**	.27**				
8 Intranet/internal documentation	-.09	.00	.29**	.04	-.04	.33**	.24**			
9 Books/Specialist literature	.22*	.08	.10	.20	.29**	.43**	.41**	.19*		
10 Time to experiment/trial and error	.28**	.23*	.13	.37**	.31**	.39**	.32**	.14	.31**	
11 Time to reflect and think	.30**	.24**	-.01	.35**	.27**	.29**	.22*	.06	.14	.67**

*$p < .05$, **$p < .01$.

CONFIGURATIONS OF NEW VENTURES AND SMES: A LITERATURE REVIEW OF EMPIRICAL RESEARCH

Lukas Michor

Rainer Harms

Erich Schwarz

Robert Breitenecker

School of Management and Economics

Department of Innovation Management and Entrepreneurship

Klagenfurt University

Universitätsstrasse 65-67, 9020 Klagenfurt, Austria

Email: Lukas.Michor@uni-klu.ac.at

Klagenfurt, April 2010

Abstract

This article aims at analyzing configuration studies and their respective variable selection in the context of entrepreneurship and SMEs. New ventures as well as SMEs are both confronted with a high amount of dynamism and complexity. The configuration approach is well suited to capture that and allows researchers to model and analyze the performance and change of these ventures. This perspective focuses on identifying classifications of firms that resemble each other along mutual interactive dimensions (Short et al., 2008). In the first part, the theoretical background of this paper is presented. Following that, the existing configuration literature is reviewed. 34 articles meet the tight selection criteria, which determine an article's inclusion. In a next step, the characteristics of the whole sample are discussed and the variable selection of the papers is analyzed in detail. Similarities as well as varieties between the different articles are highlighted and if available the reasoning behind the variable selection is also presented. In order to provide a systematic overview, the variables are categorized in four domains (person, structure and resources, strategy, environment), which encompass contextually related variables. It shows that strategy and environment are the two domains, which were examined most often. More than 90% of the analyzed articles incorporated variables within these domains. However, not even half of the studies focused on the person. Furthermore, factors that are intensively discussed in entrepreneurship literature but were not included in any study are described in this paper.

1 Introduction

Over the past several decades, the identification of factors that determine new venture performance such as survival, growth or profitability has been one of the most central fields of entrepreneurship research (Sarasvathy, 2004). A multitude of research papers has focused on exploring various variables and their impact on performance (Bamford et al., 2004). However, in order to be able to analyze and model the performance of new ventures and SMEs, the complexity and dynamism they are facing as well as the fact that they may not be a homogenous group but significantly different in regard to many characteristics (Gartner et al., 1989) have to be taken into account.

Different approaches to analyze venture performance exist and can be distinguished by their complexity. The most basic model is the universal effects approach, which assumes that only one exclusive best strategy exits to successfully manage a venture. The contingency approach is more complex and assumes that the scope and direction of the performance impact of a certain success factor are influenced by the environment. The configuration approach is even more elaborated and regards companies as complex entities, whose performance depends on the interaction of different factors.

The comparison of these approaches, which are well established in the management as well as entrepreneurship literature, shows that the configuration approach is best suited to analyze and model the performance of new ventures and SMEs. This perspective assumes that ventures can be better understood by developing distinctive, internally consistent sets of organizations than by seeking to expose relationships that hold across all ventures (Ketchen et al., 1993). Hence, the configuration approach focuses on identifying classifications of firms that resemble each other along conceptual domains such as person, structure, strategy and environment, which ought to be analyzed as a whole (Miller, 1996).

One of the most crucial issues determining the outcome of studies applying the configuration approach is the selection of the variables. Significant differences in the variable sets applied appear between most of the articles. Although papers that focused on providing an overview of empirical configuration studies in entrepreneurship research already exist (e.g. Harms et al., 2007), the variable selection within these studies may still cause occasion for detailed analysis.

Consequently, this paper attempts to provide an extensive overview of the variable selection and the underlying reasoning of configuration studies in the context of new ventures and SMEs. In order to review the existing literature systematically, a search pattern was developed and tight selection criteria were applied. The literature review resulted in 34 articles, which are analyzed in detail. First, general characteristics of the sample are presented. Second, the variable selection of the articles is examined separately for each domain.

Following the introduction, the theoretical background of the paper and the suitability of the configuration approach in the context of new ventures and SMEs are discussed in detail. In the next section, the method and results of the literature review are presented. Lastly, factors are explored, which were not yet included in any configuration study, and final conclusions are drawn.

2 Theoretical Background

A key topic in entrepreneurship research is the explanation and modeling of new venture performance and development (Sarasvathy, 2004). However, the process of starting and running a business is a complex task involving many influencing factors, which imposes high methodological requirements. Different approaches to analyze new venture performance exist and can be differentiated according to the kind of the relationship between the analyzed variables and new venture performance.

2.1 The Universal Effects Perspective and the Contingency Approach

The *universal effects perspective* assumes that linear relationships between mutually independent success factors and the new venture performance exist and hold under any circumstances (March & Sutton, 1997; Scherer & Beyer, 1998). This rather simplistic approach was applied to probe various relationships as for example between entrepreneurship and performance (e.g. Miller & Friesen, 1982a; Covin & Slevin 1986, 1988) or entrepreneurship and organizational structure (e.g. Khandwalla, 1977; Miller, 1983).

The *contingency approach* is a more elaborated approach compared to the universal effects perspective since it assumes that the strength and direction of the performance impact of a certain success factor are affected by the environment (Harms et al., 2007). In other words, there is no longer one exclusive best way to manage a venture but one best way for the respective context the company is operating in (Scherer & Beyer, 1998). For instance, Hofer and Sandberg (1987) found that the success rate of new venture entry is significantly higher if the respective industry is dominated by a major competitor (i.e. >49% market share) than if the largest existing player has less than 25% market share.

However, researchers applying one of these traditional approaches may face severe shortcomings. According to Miller (1981), five major points of criticism exist concerning the assumptions behind most contingency approaches. Two of them are that no attempt is made to segment the sample to discover whether differences in the nature of relationships within the sample exist and that only one way to succeed in a certain environment is assumed to be relevant and is searched for. By the same token, Hambrick and Mason (1984) argue that some success factors applied in combination might influence performance negatively when used together or their impact may depend on factors, which are not included in the study. Moreover, the contingency approach ignores changes in contingencies and is consequently not capable of illustrating organizational development (Harms et al., 2007). Dess et al. (1993) provide an overview of the main benefits and the limitations associated with the number of domains examined within an approach.

Nevertheless, traditional approaches are yet widely adopted by entrepreneurship research. On a methodological level, Bouckenooghe et al. (2004) found that from 1999 through 2003 about 60% of the empirical studies in leading entrepreneurship journals applied inadequate statistical techniques. On a theoretical level, Sarasvathy (2004) argues that a shift in entrepreneurship research is needed away from a separated analysis of the impact of the inner and outer environment on performance towards a focus on the interface between them.

To sum up, assumptions and orientations of the traditional approaches are inadequate to model and consequently explain the multiple and significantly interdependent contingencies such as strategy, leadership or technology, which most of the firms have to face (Burton & Obel, 2004; Galunic & Eisenhardt, 1994). Accordingly, a clear need is identified to move beyond simple contingency approaches towards an approach, which takes into account the complexity and dynamism that entrepreneurs and SMEs are confronted with – the configuration approach.

2.2 The Configuration Approach

The configuration approach was developed in the early nineteen-seventies and made a serious impact on business studies. At the early stage many researchers conducted research in this field albeit under different labels. Examples therefore are Mintzberg's (1973) modes, Miller and Friesen's (1978) archetypes, Miles and Snow's (1978) typologies, Porter's (1980) generic strategies and strategic groups or Miller's (1981) gestalts, which have built the base for many subsequent studies. Researchers did not agree on a common definition of the term configuration, which hampered the development of the configuration research (Miller, 1996). Following Meyer et al. (1993, p. 1175), a configuration is "…any multidimensional constellation of conceptually distinctive characteristics that commonly occur together". The configuration approach describes an organization as a complex entity, which can be characterized by four domains consisting of a certain number of variables mutually influencing each other (Miller, 1987a). Hence, domain can be understood as a superordinate term that encompasses variables that contextually relate.

Miller (1987a) selected four domains or imperatives as he labeled them according to the following three criteria. Firstly, their vital and driving force within organizations has to be unquestionable. Secondly, domains must have proven empirically that they engender integral relationships among strategy, structure and environment. Thirdly, their central role in generating organizational configurations that occur several times has to be undeniable. Four domains, namely environment, organizational structure, leadership and strategy meet these

criteria (Miller, 1987a). Since the variables within each domain are not necessarily linked linearly, the configuration approach is able to model not only dependencies but also interdependencies between them (Reeves et al. 2003; Harms et al., 2009).

The configuration approach builds on a number of assumptions that are closely related to each other. A key idea of this perspective, which is known as the concept of *equifinality*, is that different ways exist to succeed in the same environment (Katz & Kahn, 1978). Not only one optimal path but a number of successful or unsuccessful models of adaption to a given surrounding are assumed to be relevant. By the same token, Harms et al. (2009, p. 33) state: "Equifinality is a necessary condition for the existence of various firm types, since without various possibilities to be effective, economic forces tend to eliminate inefficient firm types".

Another key assumption is the concept of *fit*, which proposes that it is the fit that is related to performance. Fit can be described as the degree of consistency between multiple domains, internal factors as well as external demands (Nadler & Thusman, 1979). This concept is of crucial importance for the configuration approach since it reduces the multitude of potential variable patterns to a few "fitting" firms (Miller, 1992). Closely related to the concept of fit is the assumption of *reductive mechanisms,* which states that there will be a limited number of empirically observable firm types (Miller, 1981). Economic, institutional and technical forces limit the quantity of conceivable organizational forms and strategy options to a rather small number of configurations that have the potential to survive on the market (Wolf, 2000).

In addition, the configuration perspective enables researchers to identify and model *organizational change*. For example, Bennebroek Gravenhorst et al. (2003) developed organizational change taxonomies and found that the acceptance of change differs between firm types. The configuration approach assumes that ventures do not adapt incrementally to changes in their environment but rather in large dramatic jumps. In contrast to many studies, which argue in favor of slow gradual changes that they regard as less risky, it was found that companies that change concertedly and dramatically are more likely to be associated with high performance (Miller & Friesen, 1982b). Following this perspective, Harms et al. (2009) argue that the development of a venture can be described as a punctuated equilibrium process.

Configurations can either be discovered via typologies, meaning theoretical reasoning, or via taxonomies, meaning qualitative and quantitative methods. *Typologies* refer to a conceptually derived, interrelated set of ideal types, each of them representing a unique combination of the organizational attributes that ought to affect the relevant outcomes (Dess et al., 1993). Examples for well reputed typologies in the configuration literature are the ones by Weber (1947), Miles and Snow (1978), Mintzberg (1979) or Porter (1980, 1985). On the one hand, typologies proved to be very popular probably because they provide a parsimonious framework for describing complex organizational entities. On the other hand, they have been massively criticized. For instance, Hambrick (1984, p. 28) argues: "Pure typologies are largely the product of rather personal insight [and] may not accurately reflect reality". Nevertheless, typologies are in many cases grounded on empirical knowledge and experience (Short et al., 2008). *Taxonomies* are the second way to discover configurations by applying qualitative methods such as case studies or quantitative methods such as real types (Scherer & Beyer, 1998). Miller and Friesen's (1977) study was based on the taxonomy approach and is a good example for a popular paradigm. However, unless theoretically substantiated, taxonomies may contain statistical artifacts and are not useful beyond a single sample (Short et al., 2008). Although typologies and taxonomies seem to be very different at the first sight, they have a lot in common (Meyer et al, 1993). Short et al. (2008, p. 1058) describe both as

"…the products of cycling induction and deduction. While one is the result of conceptual ideas based on empirical experience, the other is a result of empirical techniques only made useful through conceptualization". It can be argued that both methods rely on each other to a certain degree (Doty & Glick, 1994). While typologies may be of limited value for research and practice unless empirically tested, taxonomies need to be theoretically substantiated in order to claim this value (Wolf, 2000).

Despite the aforementioned advantages of the configuration approach compared to the universal effects perspective or contingency approaches, methodological and theoretical challenges also have to be brought forward (Harms et al., 2009). The main challenge on the methodological level is basically the decision between typologies and taxonomies, which were discussed in the last preceding paragraph. On the theoretical level, Harms et al. (2009) identify two major challenges, which researchers applying the configuration approach have to face. Firstly, a number of assumptions (equifinality, fit, reductive mechanisms and configuration change) needs to hold. The second important issue concerns the variable selection. In this regard, Ketchen et al. (1997) distinguish between the essentialist approach using a narrow range of variables and the empiricist approach using a broad range of variables. Both approaches can be grounded on an inductive or deductive concept. As already mentioned above, the selection of a variable set for each domain is of crucial importance for the outcome of a configuration study. However, configuration research has not yet been able to solve this particular challenge since, to the knowledge of the authors, no article has been published so far, which analyzes the variable selection and the reasoning behind it. The authors attempt to close this research gap by an analysis of the existing studies in this field.

In summary, the main advantages of the configuration approach are that complex multivariate relationships between variables are incorporated, more detail is provided, organizational change can be modeled and that different ways to succeed are acknowledged. Although this perspective on the one hand certainly offers immense potential for findings that have normative implications (Dess et al., 1993), on the other hand it imposes high methodological as well as theoretical demands on researchers.

2.3 Suitability of the Configuration Approach in the Context of New Ventures

Having presented how beneficial the application of the configuration approach can be in business studies in general, the advantages and challenges of this approach are now discussed in the context of entrepreneurship research.

The analysis of mutual interaction between the four domains can be regarded as a particular strength of the configuration approach (Dess et al., 1993). Miller (1996, p. 507) stresses the importance of the aforementioned interface: "Since configurations are about organizational wholes, more should be done to discover their thematic and systematic aspects – to probe into just why and how their elements interrelate and complete each other to produce the driving character to drive an enterprise". In other words, the complex nature of new ventures and SMEs can be analyzed by applying the configuration approach. Another reason why the configuration perspective can contribute to entrepreneurship research is that it allows to model and analyze a firm's development over time, which is of great interest in the entrepreneurship literature (e.g. Bennebroek Gravenhorst et al., 2003).

In general, the configuration approach is well suited for entrepreneurship research since it captures the holistic nature of new ventures and offers the opportunity to model their performance and development (Harms et al., 2009).

3 Method

A systematic literature review is provided in order to analyze the variables used within empirical configuration studies published from 1989 through 2009. The search pattern applied builds up on the one developed by Harms et al. (2007) and can be described as follows. As a first step, the research was narrowed down to the five leading entrepreneurship journals according to Katz (2003), namely Entrepreneurship & Regional Development, Entrepreneurship Theory & Practice, Journal of Business Venturing, Small Business Economics and Journal of Small Business Management. An initial search in the EBSCOhost database using the terms configuration, taxonomies, typologies, gestalts, archetypes, strategic groups and generic strategies was conducted. As a next step, the following criteria were established to determine an article's inclusion: (1) More than two factors had to be examined simultaneously as otherwise universal effects or simple contingencies would have been analyzed, (2) cluster analysis and/or three-way interaction had to be applied to empirically identify firm types (Aiken & West, 1991) and (3) the focus of the study had to be put on young firms and/or SMEs. The articles found were analyzed in order to check their suitability in regard to these three criteria. As a further step, papers, which were not published in one of the five specified journals but were referred to in the resulting articles, as well as papers, which were known to the authors, were also included in the analysis if they met the three criteria. In addition, all the journals, which published one of these articles, were also integrated in the search pattern in order to initiate a snowball effect and consequently minimize the risk of ignoring any valuable studies. Since it is difficult to decide whether a case study in fact represents a firm type, there was a focus on quantitative taxonomies. Even though case studies can offer rich descriptions of firms using multiple domains, it would be difficult to achieve generalizable results.

4 Results

4.1 Characteristics of the Sample

The literature review resulted in 34 articles that met the aforementioned selection criteria. Table 1 gives an overview of the authors, the publication dates, the domains examined (P-person, S&R-structure and resources, St-strategy, E-environment), the characteristics of the samples and the industry foci of the papers as well as of the journals they were published in.

Author	Year	Domains				Sample	Sample Size	Industry (Ind.)	Journal
		P	S&R	St	E				
Bantel, K.A.	1998		✗	✗	✗	Adolescent firms (5-12 y.)	162	Several rapidly changing tech-based ind.	JBV
Barth, H.	2003		✗	✗	✗	Firms with <200 employees (ee)	171	Software & mechanical engineering ind.	JSBM
Beneito, P.	2002		✗	✗	✗	Firms with >10 ee	1488	Manufacturing ind.	ERD
Birley, S., Westhead, P.	1990	✗	✗	✗	✗	Small firms	222	Multi-ind.	SMJ
Borch, O.J. et al.	1999	✗	✗	✗	✗	Small firms	660	Multi-ind.	ETP
Carter, N.M. et al.	1994			✗	✗	Nascent entrepreneurs	2653	Multi-ind.	SMJ
Conant, J.S. et al.	1990		✗	✗		Entire industry	150	American health care maintenance	SMJ
Covin, J.G. et al.	1990			✗	✗	Small firms (<500 ee)	103	High- & low-tech ind.	JBV
Covin, J.G. et al.	1999		✗	✗	✗	Medium firms (>50 ee)	57	Manufacturing ind.	JBV
Dess, G.G. et al.	1995		✗	✗	✗	[i]	32	Multi-ind.	SMJ
Frank, H. et al.	2006		✗	✗	✗	Entire industry	85	Electrical & electronics ind.	[ii]
Galbraith, C.S. et al.	2008			✗	✗	SMEs	44	High-tech ind.	JSBM
Gartner, W.B. et al.	1989	✗	✗	✗	✗	Startups	106	Multi-ind.	JBV
Heirman, A. et al.	2004	✗	✗	✗	✗	Research-based startups (5-12 y.)	83	High-tech ind.	JTT
Hill, S.A., Birkinshaw, J.	2008		✗	✗		Corporate ventures	95	Multi-ind.	JBV
Julien, P.-A., Raymond, L.	1994		✗	✗	✗	SMEs	79	Retail ind.	ETP
Kessler, A., Hienerth, C.	2002	✗	✗	✗	✗	Startups	918	Multi-ind.	[iii]
Khan, A.M., Manopichetwattana, V.	1989	✗	✗	✗	✗	Small firms (<500 ee)	50	Manufacturing ind.	MS
Korunka, C. et al.	2003	✗	✗	✗	✗	Nascent entrepreneurs & startups	1169	Multi-ind.	ETP
Lafuente, A., Salas, V.	1989	✗	✗	✗	✗	50% <5 y. 50% >5 y.	360	Manufacturing, trade & service ind.	SMJ
Meijaard, J. et al.	2002		✗	✗	✗	SMEs (<100 ee)	1411	Multi-ind.	SBE
Merz, G.R. et al.	1994		✗	✗	✗	Small firms (>3 y.)	216	Business services, construction, wholesaling & manufacturing ind.	JSBM
Miller, N.J., Besser, T.L.	2000	✗		✗	✗	Small firms	844	Multi-ind.	JSBM
Miller, N.J. et al.	2001	✗	✗	✗	✗	Small family businesses	384	Multi-ind.	JSBM
Mitra, R., Pingal, V.	1999	✗	✗	✗	✗	SMEs (majority <150 ee)	40	Automobile ancillaries	JSBM
Mugler, J., Kessler, A.	2004	✗	✗	✗	✗	Startups	1405	Multi-ind.	JEC

Ostgaard, T.A., Birley, S.	1994			✗	✗	Small (<50 ee) & young firms (2-10 y.)	159	Manufacturing, engineering & software development ind.	JBV
Paige, R.C., Littrell, M.A.	2002	✗		✗	✗	Every 2nd firm in the ind.	278	Craft retail ind.	JSBM
Payne, G.T. et al.	2009		✗	✗	✗	Service-intensive SMEs (<50 ee)	1030	Healthcare ind.	JSBM
Stearns, T.M. et al.	1995			✗	✗	Startups (1-6 y.)	2653	Multi-ind.	JBV
Westhead, P.	1995	✗		✗	✗	Owner-managed firms	93	High-tech ind.	ETP
Wiklung, J., Shepherd, D.	2005		✗	✗	✗	Small businesses (50% 10-19 ee; 50% 20-29 ee)	413	Knowledge-intensive manufacturing, labor-intensive manufacturing, professional services & retail ind.	JBV
Woo, C.Y. et al.	1991	✗	✗			Startups	510	Retail & personal services ind.	JBV
Yiu, D.W., Lau, C.-M.	2008			✗	✗	Random sample of Chinese firms	458	Multi-ind.	ETP

[i] Nondiversified firms and firms in which a member of the Business Advisory Board holds a seat of one of the two universities that sponsored the research
[ii] RENT XX Research in Entrepreneurship and Small Business (CD)
[iii] ICSB World Conference, Puerto Rico 2002

Legend:

ERD	Entrepreneurship & Regional Development
ETP	Entrepreneurship: Theory & Practice
JBV	Journal of Business Venturing
JEC	Journal of Enterprising Culture
JSBM	Journal of Small Business Management
JTT	Journal of Technology Transfer
MS	Management Science
SBE	Small Business Economics
SMJ	Strategic Management Journal

Table 1: Review of configuration studies

In terms of outlets, nine articles (27%) were published in the *Journal of Business Venturing* and eight articles (24%) in the *Journal of Small Business Management,* which shows a propensity for configuration research in the context of young firms and SMEs in these two journals. While *Entrepreneurship Theory and Practice* as well as the *Strategic Management Journal* both published five articles (15%), which met the selection criteria, the remaining ones were released each by a different medium. Concerning the dates of publication, it can be said that during the second analyzed decade slightly more articles were published than during the first decade (41% before and 59% after the year 1999). No more than four articles were published in one single year.

A categorization of the companies, which were analyzed in the articles, turned out to be rather complex since the authors applied many different selection criteria to their samples. While some authors used the age of the firms as a criterion (e.g. Bantel, 1998; Carter et al., 1994), others applied the company size (e.g. Barth, 2003; Covin et al., 1999), whereas some

other researchers chose again different criteria (e.g. Dess et al., 1995; Westhead, 1995). Furthermore, the definitions of the sample characteristics varied widely between the articles. As table 1 shows, some papers defined small firms as enterprises with less than 500 employees, whereas others subsumed all companies with more than 30 employees as medium ones.

Analyzing the industry foci, on the one hand there were studies that included companies from a large number of different industries and on the other hand some papers focused on only a couple of or in some cases solely on one particular industry. Almost half of the papers (47%) examined less than 200 companies. From the remaining 18 papers, nine decided on a sample of 201 through 800 firms and nine on a sample of more than 800 companies.

When analyzing the results of studies, the sample size always deserves critical consideration. In strategic management research the value of the configuration approach was criticized, since many studies did not detect a link between configurations and performance indicators. Ferguson and Ketchen (1999) conducted a study to analyze the lack of findings and found that that only 8% of the 24 articles examined by them employed large enough samples to detect all important relationships. Consequently, the level of statistical power, which is determined by effect size, significance level (α) and sample size, needs to be adequate in order to discover all possible relationships between configurations and performance. Possible ways to ensure sufficient statistical power for future configurations research are to either increase the sample size, the number of configurations or the significance level (α) or to postpone the study until the effect size detection attains a sufficient level (Ferguson and Ketchen, 1999).

4.2 Variable Selection

In general, it can be said that there was a vast variety of variables applied. In order to provide a systematic overview, all variables adopted in the articles were categorized in one of the following four domains: person, structure and resources, strategy as well as environment. The domains are based on an adaption of Miller's (1987a) imperative influences on configurations. Although several articles categorized their variables in a similar way, others used different schemes or did not sort them at all. In order to ensure consistency within this review, in some cases variables were categorized differently than in the original paper. Nevertheless, it also needs to be mentioned that some factors could have been attributed to two domains.

Comparing the number of articles integrating certain domains, it appears that strategy was the domain that was researched into the most (see figure 1). Only two of the examined articles did not devote attention to strategic factors. Environmental influences were almost as extensively researched with 91% of all studies incorporating this domain. While structure and resources were discussed in 77% of the articles, not even half of the articles explicitly focused on the person. In the following part of the paper the variable selection and the underlying reasoning will be discussed for each domain in detail.

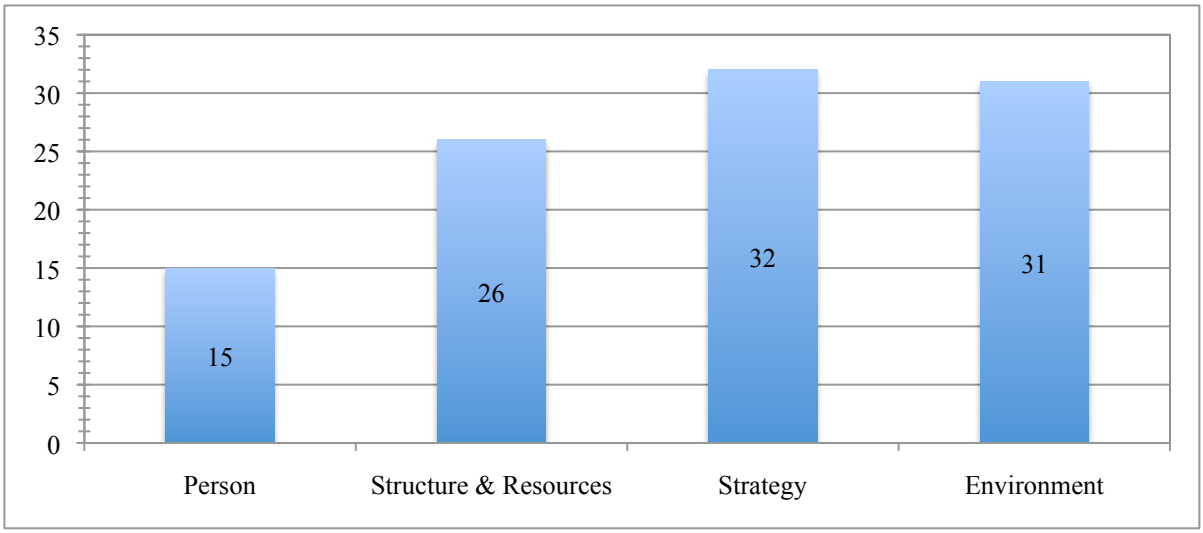


Figure 1: Number of articles analyzing the four domains

➢ ***Person***

As mentioned before, "person" was the least researched domain with only 15 of the total 34 papers analyzing it (44%). Three of these articles integrated only a single or a couple of variables targeting at the personal characteristics. The remaining twelve articles applied different sets of variables, which basically can be summarized by the personal characteristics of the founder, his/her motives to found the business and the experience he/she possesses. Nevertheless, the range of variables to evaluate the *characteristics of the founder* was extensive. While education was examined most often, the interest in basic characteristics such as age, gender or marital status was limited. Other variables that were used to specify traits of the entrepreneur are need for achievement, risk-taking propensity, self-initiative or internal locus of control.

In order to probe the *motivation for setting up a company*, entrepreneurs were for example asked whether they were mainly motivated by the opportunity to satisfy their goals, to do the kind of work they always aspired, to make money or by the threat of loosing their previous job or by their unwillingness to work for somebody else.

The level of entrepreneurial, managerial and industry-related *experience* of the founder can be identified as the third main group of variables that was of great interest. Kessler and Hienerth (2002), Korunka et al. (2003) as well as Mugler and Kessler (2004) used virtually the same set of personal variables, which always included need for achievement, risk-taking propensity, internal locus of control, self-initiative and motivation. The first three of these variables were chosen by the authors since a number of studies investigating the differences between entrepreneurs and non-entrepreneurs showed their crucial importance in this regard (Korunka at al. 2003). Each of these variables builds on a different theory and was measured by seven or eight items (e.g. internal locus of control – Rotter, 1966). Except for this variable set, no other one was identified to be applied repeatedly in different papers.

A reason for the comparatively low level of interest in this domain is certainly that many studies focused on relatively mature companies. Consequently, a great number of the articles placed emphasis rather on the management style adopted than on the founder of the venture. In addition to that, some of the articles analyzing new ventures examined industries in which companies are usually set up by entrepreneurial teams, which complicates the evaluation

significantly. On the contrary, the configuration studies that included this domain were analyzing startups in most cases.

- ***Structure and Resources***

26 articles (77%) examined how the firms are structured and from which resources they can draw. The variables were allocated to administrative structure, planning and control as well as resources. The main issue about the *administrative structure* lies in the degree to which the firm implemented a centralized or decentralized structure, which was queried in many different ways. Furthermore, the standardization of products, services and processes, the specialization of people working for the firm and the use of formal communication procedures were of great interest in this domain. In addition, the way the hierarchy was set up and the degree to which work roles were defined were probed in some of the studies. The term *administrative planning* refers to all variables that are related to strategic, business and product planning, which appeared occasionally. In most cases, articles that examined the firm's planning propensity analyzed *administrative controls* (cost control, quality control etc.) at the same time. Most variables, which aimed at discovering the firm's *resources,* enquired into its financial circumstances as for example sources of capital, involvement of venture capital, total amount of money needed to set up the company, debt ratio or ratio of R&D expenditures to cost of goods sold. However, several studies also focused on non-financial resources such as manpower and the skills they possess, technology or patents. Moreover, certain variables were only found in specific studies like the importance of computing in a firm (e.g. business-, point-of-sale- or telecomputing) or the nature of the startup being an academic or corporate spin-off.

While some papers solely presented the variables applied in their study, others also discussed the reasoning underlying their choice. Although most articles created their own sets, they often referred to previous papers concerning specific variables. Examples therefore are Frank et al. (2006) as well as Wiklund and Shepherd (2005), who both measured the access to financial capital of small businesses as suggested by Robinson et al. (1991) or Merz et al. (1994) who adapted Miller and Droge's (1986) scale of measuring decentralization, specialization and formality. The great variety of the measures applied in the articles might be partly explained by the different industry foci. Researchers who for instance aimed at analyzing research-intensive startups (e.g. Beneito, 2002) of course integrated other variables than those who defined retail or service-orientated firms as their topic of research (e.g. Woo et al, 1991).

- ***Strategy***

32 of the 34 articles analyzed in this paper examined the strategies chosen by the companies in their sample. Although the number of variables was substantial, it was possible to allocate them to three categories: the companies' entry/growth strategy, market positioning and the importance of research and development for them. In order to identify the *entry strategy*, researchers for example asked their sample if they perceive themselves as pioneers in their field or rather as followers, who strive to differentiate themselves in other ways. One article (Covin et al., 1999) explicitly focused on examining the tactical differences between pioneers and followers in two distinctive environmental settings as well as the differences in their relationship to performance. In addition to that, some articles researched the companies' definition of their target market (e.g. niche, high-end). Studies, which did not focus on startups but on existing firms, often integrated measures of the growth strategy in their questionnaires (e.g. organic vs. fast growth). Since the *competitive positioning* is one of the

most crucial factors for a successful strategy, it was analyzed by the majority of the studies. The four elements of the competitive positioning that were applied most frequently are: the company's pricing strategy, the quality of the product or service relative to competition, the marketing strategy as well as the product or service portfolio breadth. Moreover, a number of papers wanted to discover how many firms try to differentiate themselves by offering a distinctively new product, i.e. outperforming competition through innovativeness. This directly leads to the third main group that summarizes all measures related to *R&D and technology*. The focus that companies put on R&D turned out to be one of the most important issues with several articles applying different variables. For researchers it was of interest not only how innovative and/or sophisticated the companies' products are, but also what kinds of new technologies are utilized in current processes and how the process of developing new business ideas is organized. Furthermore, other opportunities to differentiate were discussed such as brand image, design, after-sales-services etc.

As with the domains discussed before, some papers partly based their variable selection on existing theories and some partly designed it on their own. Again others did not discuss the origins of the respective variables at all. However, compared to the other three dimensions, strategic variables were most often adopted from existing research papers. Miller (e.g. 1983, 1987b) was the most frequently quoted author, who published several articles in this field of research and developed a scale to measure the characteristics of strategic decision making. Several articles were also influenced by Porter's (1980, 1985) generic strategies. While on the one hand some papers directly referred to Porter in their selection, on the other hand many articles indirectly referred to him as his work served as the basis for other studies that were quoted in the articles analyzed. Another interesting observation is that only a small number of papers completely relied on one single theory.

- ***Environment***

91% of the papers analyzed included environmental factors in their studies. Beside a broad variety of variables to probe the *basic characteristics* of the market, measures were adopted to understand the competitive situation the companies have to face, the importance of networks as well as the dynamism, hostility, munificence and heterogeneity of the environment. The industry affiliation of the companies was by far the most frequently examined factor within all studies. In this context, several articles also researched the stage of development and growth potential of the respective industry. Variables that aimed at measuring the geographic scope the companies are operating in were also commonly applied. In addition to that, a few articles included the companies' location in their questionnaires (e.g. Birley & Westhead, 1990). The competitive structure and intensity were also investigated in a multitude of papers. While some researchers focused on the number and size of the regular competitors as well as the dynamism of the situation, others examined the market share of the four biggest companies in the industry or the growth rates of the market leader.

Although in some cases (existing network, networking propensity) the *network aspect* could as well have been discussed in the domain exploring the characteristics of the founder, it was decided to place it in this domain since these variables do not necessarily relate to the founder but may also connect to the employees of the company. In addition, the overall importance of networking within the respective industry and the network structure of the company were of interest for some studies (e.g. Mugler & Kessler, 2004; Ostgaard & Birley, 1994).

In order to gather more detailed information about the firms' environment, many articles adopted Miller's (1982) scale to measure *environmental dynamism, hostility and heterogeneity*. Whereas some articles completely relied on Miller's scale, which consists of 15 items, others used only a selected number of these items and added their own ones. The need to change to keep up with the market and the competitors as well as the rate at which products or services are getting obsolete were researched extensively. Moreover, it was interesting to observe that a small number of articles exclusively focused on networking-related variables. Similar to the three already presented domains, the variables derived from a broad variety of theoretical papers. Apart from Miller (1982), who was already mentioned before, Khandwalla (1977) or Aldrich et al. (1987) are important examples in this regard.

4.3 Unexplored Factors

Although the papers analyzed in this article explored an exceptionally broad range of variables, some factors that are intensively discussed in entrepreneurship literature were not included in the configuration studies. A few of them will be briefly presented in the following section of the paper.

The *social skills* of entrepreneurs can be defined as the competencies that enable them to effectively interact with others. Social skills are assumed to play a key role in the successful launch of new ventures, wherefore they are examined by a large body of research (e.g. Segrin & Kinney, 1995; Baron & Markman, 2000). While broad social skills are obviously valuable in diverse contexts, they might be especially helpful to entrepreneurs, who usually have to establish new relationships with many different people (Baron, 2004). Baron and Markman (2000) reviewed the existing literature concerning social skills and adopted two criteria: relevance to outcomes in business settings and relevance to tasks performed by entrepreneurs. On this basis four specific social skills were identified that are especially important for entrepreneurs: (1) the ability to correctly gauge current moods, intensions, motives and personal characteristics of others, (2) impression management, which refers to skills that help to induce positive reactions in others, (3) the ability to change others' desires or attitudes in one's own favor, (4) the ability to adjust to different social situations and to feel comfortable in the company of individuals from various backgrounds (Baron & Markman, 2000).

The *decision making process* of entrepreneurs is another topic of entrepreneurship research, which was not examined in any of the analyzed articles. Sarasvathy (2001) outlines the differences between a decision making process involving causation versus one involving effectuation along a number of categories. Examples therefore are that the causation process takes effects as given and focuses on the means necessary to create these effects. In contrast, the effectuation process takes means as given and focuses on the effects that can be created with them. Furthermore, the causation process is excellent at exploiting preexisting knowledge, while the effectuation process is excellent at exploiting unexpected contingencies. In addition, the causation process focuses on the predictable aspects of an uncertain future rather than on the controllable aspects of an unpredictable future as the effectuation process does. Sarasvathy (2001) argues that both types of processes can emerge together and are constitutive parts of human reasoning. However, which one of the two decision making processes suits which entrepreneur better is an issue to be addressed by future entrepreneurship research.

Another construct that was not researched by any article is the *future expectations* of the venture. When analyzing new or small businesses, in many cases objective performance

measurements are not available. Literature suggests that subjective perceptions of organizational performance are consistent with objective indicators of performance (Dess & Robinson, 1984). Hence, surveying subjective future expectations in regard to business performance has the potential of providing valuable predictions of the actual outcome (Chandler & Hanks, 1993).

5 Conclusion

In the first part of the article the configuration approach was compared to traditional approaches and its suitability for entrepreneurship research was discussed. After concluding that the configuration approach is superior to the others in many perspectives, a literature review was conducted to discover configuration articles in the field of entrepreneurship and SMEs. By applying tight selection criteria, the research resulted in a total of 34 articles, which were then analyzed in detail. Regarding the sample size, which is vital in order to ensure sufficient statistical power that is needed to discover all possible relationships between configurations and performance, it shows that almost half of the papers examined less than 200 companies, while approximately a quarter decided on a sample of 201 through 800 firms and the remaining quarter on a sample of more than 800 companies. The main focus was put on the variables, which were incorporated in the studies. The articles were analyzed in regard to the four domains person, structure and resources, strategy as well as environment. It became obvious that a considerably high percentage of the papers examined the strategy as well as the environment of the business, while the factors concerning the founder of the venture were researched in only about 50% of the articles. Within the four domains a broad variety of factors was analyzed. The respective foci of the studies differed due to the research objectives and the examined samples. Furthermore, factors that are intensively discussed in entrepreneurship literature but were not integrated in any study were presented. It is hoped that this article provides assistance in obtaining an overview of configuration studies in the field of entrepreneurship and SMEs. By presenting variables, which were applied in configuration studies over the past 20 years, hopefully an auxiliary basis for the variable selection can be provided for scholars planning to conduct research in this field.

References

Aiken, L.S., West, S.G. (1991): “Multiple Regression: Testing and Interpreting Interactions”, Newbury Park: Sage.

Aldrich, H., Rosen, B., Woodward, W. (1987): “The impact of social networks on business foundings and profit: a longitudinal study”, in: Churchill, N.C. et al., (Eds), Frontiers of Entrepreneurship Research. Wellesley: Babson College, pp. 154-168.

Bamford, C.E., Dean, T.J., Douglas, T.J. (2004): “The temporal nature of growth determinants in new bank foundings: implications for new venture research design”, in: Journal of Business Venturing 19(6), pp. 899-919.

Bantel, K.A. (1998): “Technology-based “adolescent” firm configurations: strategy identification, context, and performance”, in: Journal of Business Venturing 13, pp. 205-230.

Barth, H. (2003): “Fit among competitive strategy, administrative mechanisms, and performance: a comparative study of small firms in mature and new industries”, in: Journal of Small Business Management 41(2), pp. 133-147.

Baron, R.A. (2004): “Social skills”, in: Gartner, W. B., Shaver, K. G., Carter, N. M., Reynolds, P. D (Eds), Handbook of Entrepreneurial Dynamics. The Process of Business Creation, pp. 220-234, Thousand Oaks: Sage.
Baron, R.A., Markman, G.D. (2000): “Beyond social capital: how social skills can enhance entrepreneurs’ success”, in: Academy of Management Executive 14(1), pp. 106-116.
Bennebroek Gravenhorst, K.M., Werkman, R.A., Boonstra, J.J. (2003): “Change capacity of organisations”, in: Applied Psychology: An International Review 52(1), pp. 83-105.
Beneito, P. (2002): “Technological patterns among Spanish manufacturing firms”, in: Entrepreneurship & Regional Development 14, pp. 89-115.
Birley, S., Westhead, P. (1990): “Growth and performance contrast between ‘types’ of small firms”, in: Strategic Management Journal 11, pp. 535-557.
Borch, O.J., Huse, M., Senneseth, K. (1999): “Resource configuration, competitive strategies, and corporate entrepreneurship: an empirical examination of small firms”, in: Entrepreneurship: Theory & Practice (Fall), pp. 49-70.
Bouckenooghe, D., Buelens, M., De Clercq, D., Willem, A. (2004): “A review of research methodology in entrepreneurship: current practices and trends (1999-2003)”, paper presented at the XVIII RENT Conference, Copenhagen.
Burton, R.M., Obel, B. (2004): “Strategic organizational diagnosis and design: The dynamics of fit”, (3rd ed.), Dordrecht: Kluwer.
Carter, N.M., Stearns, T.M., Reynolds, P.D., Miller, B.A. (1994): “New venture strategies: theory development with an empirical base”, in: Strategic Management Journal 15, pp. 21-41.
Chandler, G.N., Hanks, S.H. (1993): “Measuring the performance of emerging businesses: a validation study”, in: Journal of Business Venturing 8, pp. 391-408.
Conant, J.S., Mokwa, M.P., Varadarajan, P.R. (1990): “Strategic types, distinctive marketing competencies and organizational performance: a multiple measures-based study”, in: Strategic Management Journal 11, pp. 365-383.
Covin, J.G., Slevin, D.P. (1986): “The development and testing of an organizational-level entrepreneurship scale”, in: Ronstadt, R., Hornaday, J.A., Peterson, R., Vesper, K.H., Frontiers of Entrepreneurship Research 1986. Wellesley: Center for Entrepreneurial Studies, Babson College, pp. 628-639.
Covin, J.G., Slevin, D.P. (1988): “The influence of organization structure on the utility of an entrepreneurial top management style”, in: Journal of Management Studies 25(3), pp. 217-234.
Covin, J.G., Slevin, D.P., Covin, T.J. (1990): “Content and performance of growth-seeking strategies: a comparison of small firms in high- and low-technology industries”, in: Journal of Business Venturing 5, pp. 391-412.
Covin, J.G., Slevin, D.P., Heeley, M.B. (1999): “Pioneers and followers: competitive tactics, environment, and firm growth”, in: Journal of Business Venturing 15, pp. 175-210.
Dess, G.G., Lumpkin, G.T., Covin, J.G. (1995): “Entrepreneurial strategy making and firm performance: tests of contingency and configurational models”, in: Strategic Management Journal 18, pp. 677-696.
Dess, G.G., Newport, S., Rasheed, A.M.A. (1993): “Configuration research in strategic management: key issues and suggestions“, in: Journal of Management 19(4), pp. 775-795.
Dess, G.G., Robinson, R.B., Jr. (1984): “Measuring organizational performance in the absence of objective measures: the case of privately held firm and conglomerate business unit“, in: Strategic Management Journal 5, pp. 265-273.
Doty, D.H., Glick, W.H. (1994): “Typologies as a unique form of theory building: toward improved understanding and modeling”, in: Academy of Management Review 19(2), pp. 230-251.

Ferguson, T.D., Ketchen, Jr., D.J. (1999): “Organizational configurations and performance: The role of statistical power in extant research”, in: Strategic Management Journal 20, pp. 385-395.
Frank, H., Kessler, A., Fink, M. (2006): “Corporate entrepreneurship: the relationship between entrepreneurial orientation and firm performance - a configurational approach”, in: Laveren, E., Crijns, H., (Eds), RENT XX Research in Entrepreneurship and Small Business, Antwerpen, Oxford: Intersentia, CD-ROM.
Galbraith, C.S., Rodriguez, C.L., DeNoblem A.F. (2008): “SME competitive strategy and location behavior: an exploratory study of high-technology manufacturing”, in: Journal of Small Business Management 46(2), pp. 183-202.
Galunic, D.C., Eisenhardt, K.M. (1994): “Reviewing the strategy-structure-performance paradigm”, in: Research in Organizational Behavior 16, pp. 215-255.
Gartner, W.B., Mitchell, T.R., Vesper, K.H. (1989): “A taxonomy of new business ventures”, in: Journal of Business Venturing 4, pp. 169-186.
Hambrick, D.C., Mason, P.A. (1984): “Upper echelons: the organization as a reflection of its top managers”, in: Academy of Management Review 9(2), pp. 193-206.
Hambrick, D.C. (1984): “Taxonomic approaches to studying strategy”, in: Journal of Management 10, pp. 27-41.
Harms, R., Kraus, S., Reschke, C.H. (2007): “Configurations of new ventures in entrepreneurship research: contributions and research gaps”, in: Management Research News 30(9), pp. 661-673.
Harms, R., Kraus, S., Schwarz, E. (2009): “The Suitability of the Configuration Approach in Entrepreneurship Research”, in: Entrepreneurship and Regional Development 21(1), pp. 25-47.
Heirman, A., Clarysse, B., Van Den Haute, V. (2004): “Starting resource configuration of research-based start-ups and the interaction with technology, institutional background, and industrial dynamics”, in: Vlerick Leuven Gent Working Paper Series 22, pp. 1-40.
Hill, S.A., Birkinshaw, J. (2008): “Strategy-organization in corporate venture units: impact on performance and survival”, in: Journal of Business Venturing 23, pp. 423-444.
Hofer, C.W., Sandberg, W.R. (1987): “Improving New Venture Performance: Some Guidelines for Success”, in: American Journal of Small Business (Summer), pp. 11-25.
Julien, P.-A., Raymond, L. (1994): “Factors of new technology adaption in retail sector”, in: Entrepreneurship: Theory & Practice (Summer), pp. 79-90.
Katz, J.A. (2003): ‘‘Core publications in entrepreneurship and related fields: a guide to getting published’’, Version 4.1.1 June 24, 2003, available at http://www.slu.edu/x17970.xml (accessed 5 March 2010).
Katz, D., Kahn, R.L. (1978): “The social psychology of organizations”, (2nd ed.), New York: Wiley.
Kessler, A., Hienerth, C. (2002): “Entrepreneurial SMEs in economies of transition: the building of strategic configurations”, paper presented at 47th ICSB World Conference, Puerto Rico.
Ketchen, Jr., D. J., Thomas, J. B., Snow, C. C. (1993): “Organizational configurations and performance: a comparison of theoretical approaches“, in: Academy of Management Journal 36, pp. 1278-1313.
Ketchen, Jr., D.J., Combs, J.G., Russell, C.J., Shook, C., Dean, M.A., Runge, J., Lohrke, F.T., Naumann, S.E., Haptonstahl, D.E., Baker, R., Beckstein, B.A., Handler, C., Honig, H., Lamoureux, S. (1997): “Organizational configurations and performance: a meta-analysis”, in: Academy of Management Journal 40(1), pp. 223-40.
Khan, A.M., Manopichetwattana, V. (1989): “Innovative and noninnovative small firms: types and characteristics“, in: Management Science 35(5), pp. 597-606.

Khandwalla, P.N. (1977): “The design of organizations“, New York: Harcourt, Brace, Jovanovich.
Korunka, C., Frank, H., Lueger, M., Mugler, J. (2003): “The entrepreneurial personality in the context of resources, environment, and the startup process - a configurational approach“, in: Entrepreneurship: Theory & Practice (Fall), pp. 23-40.
Lafuente, A., Salas, V. (1989): “Types of entrepreneurs and firms: the case of new Spanish firms“, in: Strategic Management Journal 19, pp. 17-30.
March, J.G., Sutton, J. (1997): “Organizational performance as a dependent variable“, in: Organization Science 8(6), pp. 698-706.
Meyer, A. D., Tsui, A. S., Hinings, C. R. (1993): “Configurational approaches to organizational analysis“, in: Academy of Management Journal 36, pp. 1175–1195.
Meijaard, J., Brand, M.J., Mosselman, M. (2002): “Strategy, structure and performance in Dutch SME's“, in: Small Business Economics 25, pp. 83-96.
Merz, G.R., Weber, P.B., Laetz, V.B. (1994): “Linking small business management with entrepreneurial growth“, in: Journal of Small Business Management (October), pp. 48-60.
Miles, R.E., Snow, C.C. (1978): “Organizational strategy, structure, and process”, New York: McGraw-Hill.
Miller, D. (1981): “Towards a new contingency approach: the search for organizational gestalts”, in: Journal of Management Studies 18(1), pp. 1-26.
Miller, D. (1982): “Evolution and revolution: a quantum view of structural change in organizations“, in: Journal of Management Studies 19(2), pp. 131-151.
Miller, D. (1983): “The correlates of entrepreneurship in three types of firms”, in: Management Science 29(7), pp. 770-791.
Miller, D. (1987a): “The genesis of configuration”, in: Academy of Management Journal 12(1), pp. 686-701.
Miller, D. (1987b): “Strategy making and structure: analysis and implication for performance“, in: Academic Management Journal 30(1), pp. 7-32.
Miller, D. (1992): “Environmental fit versus internal fit”, in: Organization Science 3, pp. 159-78.
Miller, D. (1996): “Configuration revisited”, in: Strategic Management Journal 17, pp. 505-512.
Miller, D., Droge, G. (1986): “Psychological and traditional determinants of structure”, in: Administrative Science Quarterly 31, pp. 539-560.
Miller, N.J., Besser, T.L. (2000): “The importance of community values in small business strategy formation: evidence from rural Iowa”, in: Journal of Small Business Management (January), pp. 68-87.
Miller, D., Friesen, P.H. (1977): “Strategy making in the context: ten empirical archetypes”, in: The Journal of Management Studies 14(10), pp. 253-280.
Miller, D., Friesen, P.H. (1978): “Archetypes of strategy formulation”, in: Management Science 24, pp. 921-933.
Miller, D., Friesen, P.H. (1982a): “Innovation in conservative and entrepreneurial firms: two models of strategic momentum”, in: Strategic Management Journal 3, pp. l-25.
Miller, D., Friesen, P.H. (1982b): “Structural change and performance: quantum vs. piecemeal-incremental approaches“, in: Academy of Management Journal 25(4), pp. 867-892.
Miller, N.J., McLeod, H., Oh, K.Y. (2001): “Managing family business in small communities”, in: Journal of Small Business Management 39(1), pp. 73-87.
Mintzberg, H. (1973): “Strategy making in three modes”, in: California Management Review 16(2), pp. 44-53.
Mintzberg, H. (1979): “The Structuring of Organizations”, Englewood Cliffs: Prentice Hall.

Mitra, R., Pingal, V. (1999): “Analysis of growth stages in small firms: a case study of automobile ancillaries in India”, in: Journal of Small Business Management (July), pp. 62-75.
Mugler, J., Kessler, A. (2004): “Comparison of business start-ups in a transition economy and in a traditional market economy: the case of the Czech Republic and Austria“, in: Journal of Enterprising Culture 12(3), pp. 225-251.
Nadler, D.A., Tushman, M.L. (1979): “A Congruence Model for Diagnosing Organizational Behavior”, Englewood Cliffs: Prentice-Hall.
Ostgaard, T.A., Birley, S. (1994): “Personal networks and firm competitive strategy - a strategic or coincidental match?“, in: Journal of Business Venturing 9, pp. 281-305.
Paige, R.C., Littrell, M.A. (2002): “Craft retailer's criteria for success and associated business strategies“, in: Journal of Small Business Management 40(4), pp. 314-331.
Payne, G.T., Kennedy, K.H., Davis, J.L. (2009): „Competitive dynamics among service SMEs“, in: Journal of Small Business Management 47(4), pp. 421-442.
Porter, M.E. (1980): “Competitive strategy: techniques for analyzing industries and competitors”, New York: The Free Press.
Porter, M.E. (1985): “Competitive advantage: creating and sustaining superior performance“, New York: The Free Press.
Reeves, T.C., Duncan, W.J., Ginter, P.M. (2003): “Strategic configurations in health service organizations”, in: Journal of Business Research 56(1), pp. 31-43.
Robinson, J.P., Shaver, P.R., Wrightsman, L.S. (1991): “Criteria for scale selection and evaluation”, in: Robinson, J.P., Shaver, P.R., Wrightsman, L.S. (eds), Measures of Personality and Social Psychological Attitudes, pp. 1-16, San Diego: Academic Press.
Rotter, J. (1966): “Generalized expectancies for internal versus external control of reinforcement”, in: Psychological Monographs 80(609), whole number.
Sarasvathy, S.D. (2001): “Causation and Effectuation: Toward a theoretical shift from economic inevitability to entrepreneurial contingency”, in: Academy of Management Review (25)2, pp. 243-263.
Sarasvathy, S.D. (2004): “The questions we ask and the questions we care about: reformulating some problems in entrepreneurship research”, in: Journal of Business Venturing 19(5), pp. 707-717.
Scherer, A.G., Beyer, R. (1998): “Der Konfigurationsansatz im strategischen Management – Rekonstruktion und Kritik”, in: Die Betriebswirtschaft 58(3), pp. 332-347.
Segrin, C., Kinney, T. (1995): “Social skills deficits among the socially anxious: Rejection from others and loneliness”, in: Motivation and Emotion 19, pp. 1-24.
Short, J.C., Payne, G.T., Ketchen, Jr., D.J. (2008): “Research on organizational configurations: past accomplishments and future challenges“, in: Journal of Management 34(6), pp. 1053-1079.
Stearns, T.M., Carter, N.M., Reynolds, P.D., Williams, M.L. (1995): “New firm survival: industry, strategy and location“, in: Journal of Business Venturing 10, pp. 23-42.
Weber, M. (1947): “The theory of social and economic organization”, New York: Oxford University Press.
Westhead, P. (1995): “Survival and employment growth contrasts between types of owner-managed high-technology firms“, in: Entrepreneurship: Theory & Practice (Fall), pp. 5-25.
Wiklund, J., Shepherd, D. (2005): “Entrepreneurial orientation and small business performance: a configurational approach“, in: Journal of Business Venturing 20, pp. 71-91.
Wolf, J. (2000): “Der Gestaltansatz in der Management- und Organisationslehre“, Wiesbaden: Deutscher Universitätsverlag.

Woo, C.Y., Cooper, A.C., Dunkelberg, W.C. (1991): “The development and interpretation of entrepreneurial typologies“, in: Journal of Business Venturing 6, pp. 93-114.
Yiu, D.W., Lau, C.-M. (2008): “Corporate entrepreneurship as resource capital configuration in emerging market firms“, in: Entrepreneurship: Theory & Practice (January), pp. 37-57.

Resources-based hyper-growth of firms

Lucio Cassia[*] *and Tommaso Minola*[**]

Abstract

High-growth firms deserve a relevant role in the 'real-word' economy: many scholars have proved that these firms create employment, wealth, and economic growth. For example, in the US, the 'gazelles' (i.e., firms in the highest percentiles of the growth rate distribution) account for the largest part of the total increase in the employment rate, although they represent only a very small share of all companies (Birch, 1987). Many scholars have also suggested and proved that firm growth creates employment, wealth and general economic development (e.g. Birch, 1979), so that by understanding high-growth firms, researchers may better understand the features involved with growth and success in general.

A significant interest in high-growth firms from academics occurred in the late 90s (e.g. Blixt, 1997; Cooper et al., 1994; Davidsson and Delmar, 1997; Lohmann, 1998; Storey, 1996; Welbourne, 1997; Zhao and Aram, 1995) focusing mainly on two aspects: (a) the heterogeneity of growth patterns (Delmar and Davidsson, 1998; Chan et al., 2006) and whether those firms are inherently different from those that grow more modestly from a process perspective (Delmar et al., 2003); (b) determinants analysis in search for factors explaining (e.g. Wiklund et al., 2009; Moreno and Casillas, 2007; Baum and Smith, 2001; Feeser and Willard, 1990).

High-growth firms represent a challenging research topic, particularly relevant to SMEs since the high-growth phenomenon may not be fully described by the structured consequential stage suggested by corporate life cycle models (Miller and Friesen, 1984) and is still largely disregarded by academic research, especially in EU. Hyper-growth, as a specific case of high and abnormal growth was first introduced by Markman and Gartner (2002) stating that 'a very surprisingly conclusion is that despite its economic upside potential, growth research has focused predominantly on 'normal' to 'high' growth rates … while overlooking formidably high growth or hyper-growth firms' (Markman and Gartner, 2002).

In our empirical analysis we chose sales growth as growth indicator, mainly because it is the most common indicator used in literature and because it can be shown that growth in sales are antecedent of other forms of growth (employees, profit, assets,…) (Flamholtz, 1986). Our definition of hyper-growth, which is coherent with Birch (1979), suggested firms had to show a minimum of 20% annual growth, at least 5 year consecutively. In addition, since we were interested in SMEs hyper-growth, firms had to be small-sized at t0 (i.e., firm's turnover should be lower than 10 mln €), but it should be large at t4 (i.e., turnover should be higher than 50 mln €).

Seminal work by Delmar et al. (2003), who provided an interesting and new contribution to the understanding on how different firms can experience rapid growth, based on a study of demographics of firms in Sweden, conclude suggesting that causal explanations for why firms end up with different (rapid) growth patterns, should be a

[*] Full Professor, University of Bergamo (lucio.cassia@unibg.it)
[**] Research Assistant, University of Bergamo (tommaso.minola@unibg.it)

relevant topic for future research. All this creates, as suggested by Eisenhardt and Graebner (2007), the condition for the present research, which aims to move, from qualitative research based on multiple case studies, some steps for a theory building process.

The present research addresses a topic that has been largely ignored by extant literature, although relevant both in terms of managerial understanding of firm development and from policy perspective. Many researchers suggest that a particular strategic orientation, referred to as Entrepreneurial Orientation (EO), may play a key role in enhancing performance (e.g., Brown, 1996; Covin, Slevin and Covin, 1990; Dess, Lumpkin and Covin, 1997; Lumpkin and Dess, 1996; Merz, Weber and Laetz, 1994; Zahra and Covin, 1995). EO represent a complex and articulated theoretical framework, built on different variables regarding strategic posture and behaviour, that capture the entrepreneurial attitude of a firm, and aims at explaining firm performance dynamics. The EO concept is very useful because it's meant to capture entrepreneurship as a firm-level behaviour (Covin and Slevin, 1991). Considering the level-of-analysis issue first, a firm-level model is appropriate because entrepreneurial effectiveness is arguably a firm-level phenomenon. That is, an entrepreneur's effectiveness can best be measured in terms of his or her firm's performance. Second, and related to the first point, firm performance is a function of organizational-level behaviour. Third EO as firm behaviour can be to a certain extent managed and reproduced. No research exercise has been performed so far on the explicit link between EO and hyper-growth. The first research question this paper addresses is how much of hyper-growth can be explained by entrepreneurship (EO).

Consistent with the seminal work by Penrose (1959), Moreno and Casillas (2007) suggest that rapid-growth can be explained in terms of existence of unallocated resources within the firm; these (non financial) indivisibles resources, available in quantities greater than necessary, are called slack resources, and are one of the main causes and incentives for growth. Firms are in fact forced to find a use for these resources; this helps firms to increase their efficiency. The existence of slack resources, and especially of those characterized by higher indivisibility, is proposed as major cause of higher growth performances for the SMEs. Stemming from the different type of research available to the hyper-growth of firms, we come back to the Resource Based View (RBV) of firm and its empirical formulation by Moreno and Casillas (2007). Slack is an available resource that can be used to improve organizational performance (George, 2005); asset turnover (ratio of firm sales and total assets) can be used as a measure of the efficiency in the use of a firm resources and therefore a suitable indicator of the amount of slack resources in the firm. Our second research perspective addresses therefore potential differences as to the availability of slack resources between hyper-growth firms and non- hyper-growth firms.

The paper is based on a multiple case study on three Italian hyper-growth firms. The selection strategy followed the indications of Pettegrew (1988), who suggested the importance of choosing cases diametrically opposed ('Polar Type' theoretical sampling approach) to facilitate the emergence of conflicts in the data, for an overall view of the problem and to generalize the emerging theory. Company 1 is a highly internationalized leading player in the added value service and content for mobile industry which exploited the dot com bubble, Company 2 is a local low tech private ferry service provider and Company 3 is a very interesting case of a furniture

designer, which switched to yacht furniture design and then integrated competencies and engineering know-how in order to become yacht designer and eventually manufacturer in the very promising market of luxury yacht.

The companies are defined by common features; first, they all show a tremendous access to resources, both financial and not, as well as a higher investment intensity compared to industry average. The abnormal rate of access to resources appears to be the first factor which significantly may distinguish hyper-growth firms from other firms. From the financial point of view it can be stated that firm have in common a low (or negative) profit growth, are cash starving and show quite risky behaviour (in terms of exposure to external capital). We also checked for the indicator of slack resources which in all the three cases robustly respects the pattern suggested by Moreno and Casillas (2007): the efficiency of hyper-growth companies is strongly lower than other firms in the industry and increases during the growth, suggesting slack resources are put in use and exploited to grow.

As to the strategic posture of firms, which is the main focus of this paper, we must acknowledge that selected companies have grown through very different approaches. There is an entrepreneurial approach to hyper-growth in Companies 1 and 3, which are characterized by relevant EO, change driven management style and which move in a dynamic and hostile environment. A different approach is shown by Company 2, whose main focus is on exploitation of accumulated resources: the firm is unambiguously not well provided with EO and its competitive environment is rather munificent.

We have analyzed very detailed information on the companies and have shown different paths to hyper-growth. We have verified the consistency of extant literature, and in agree with it we could suggest that in any case both EO and resource can play a role in explaining firm hyper-growth. What sounds as an interesting evidence, though, is the fact that we don't assist to the typical and well known in literature juxtaposition (Moreno and Casillas, 2007; Harms and Ehrman, 2009) between entrepreneurial behaviour dedicated to opportunity exploitation and managerial one, stressing resource accumulation and optimizing. Conversely, entrepreneurial companies have both a strong asset accumulation and a high value for the slack resources indicator. Therefore we add to literature by suggesting that it's the alignment between EO and resource, and the use of EO as antecedent to resource acquisition, that may really explain firm extra performance.

The paper is organized as follows: in section 2 we present a review of research literature investigating high-growth and rapid-growth phenomena, which positions our contribution and the novelty of the approach. Section 3 formulates, based on extant research, the framework for our analysis and suggests the inquiry perspective. Section 4 describes the methodology and reports in detail the data collection and main evidences from selected companies; Section 5 discuss main evidences emerging from the case studies, through commonalities and differences and concludes with the suggestion of a novel research framework as main contribution of this paper. Section 6 concludes, acknowledges for limitation and suggests future research development.

Keywords: hyper-growth, SMEs growth, Entrepreneurial Orientation, RBV, contingent approach, strategic management, strategic entrepreneurship

DECISION MAKING PROCESS: A COMPARISON BETWEEN FAMILY BUSINESS AND NON-FAMILY BUSINESS IN THE CONSTRUCTION INDUSTRY USING THE BAYESIAN CAUSAL MAP

by

Leilanie Mohd Nor

Toulouse Business School, France
(Groupe ESC Toulouse)

and

University Tun Abdul Razak, Malaysia

leilanie@unirazak.edu.my

Phone number: +603-7627-7127 (Office) / +6010-226-8117 (mobile)

.

Abstract

This is a conceptual paper in exploring the differences in decision making process between family business and non-family business in the construction industry in Malaysia. The understanding of the complexity and dynamics of a family business is becoming more prevalent among researchers. Fast decision making is not only seen as necessary but crucial to ensure speed and efficiency in responding to market opportunities and maneuvering through market uncertainties and tumultuous environment, with the intention to diversify their businesses by finding opportunities towards new venture creation. This study intends to suggest how to simplify decision making and find tactics to have quality decision making. Hence, this study will focus primarily on the decision making process which is mapped against the Bayesian causal map.

Keywords : Business ownership, Entrepreneurial cognition, Decision making, Decision making process, Family business, Entrepreneurial orientation, Opportunity recognition, New venture creation, Bayesian causal map.

1. Introduction

The headline reads, "Escada sold to India's Mittal Group". Escada, the Munich-based, iconic European luxury fashion is sold to Megha Mittal, daughter-in-law of India-born billionaire Lakshmi Mittal. His son, Aditya Mittal, is the finance director and president of the family corporation Arcelor Mittal, the world's largest steel firm.

This is a unique case of diversifying from its core business, something which is seen as a masculine industry, into something somewhat feminine, the fashion industry. This kind of strategy is not common in non-family businesses. Non-family businesses tend to acquire or merge with businesses of the likes, in their effort towards being competitive and pursuing its growth strategy. For non-family businesses, it is about keeping to their core business, what they do best, their bottom line and their responsibility towards their shareholders.

Even though family businesses are stereotypically known for conservative planning and organic expansion which could limit their growth compared to non-family enterprises (Astrachan, 2010), of late, more family businesses are either acquiring or diversifying their businesses, not only to sustain their growth, but also to create wealth for and within the family, and to ultimately continue their business legacy (Malaysia's NAZA Group, diversifying from Automotive industry to property development (July 2009), Germany's Merck Group acquiring Millipore Corp. (March 2010), and America's Mars, Inc. taking over Wrigley (October 2008)).

What then, is the motivation behind family businesses when decisions such as these take place? How, why (and possibly for whom) are these decisions made? How different is the decision making process between family businesses and non-family business?

1.1 Background

The global economic outlook is gloomy and this affects consumer confidence and spending. The direction for the property market is challenging and although the property prices in Malaysia seem to be hanging on but business owners and investors nationwide is holding their breath for the economy to pick up in a year or two.

These challenging times will hit contractors and property developers hard and force them to evaluate and re-evaluate their investment opportunities and staying risk-averse. Only the willed with perseverance and those with continuous innovation may stay ahead of the pack.

For these business owners in the construction and property development industry, staying vigil is key during these trying times. Therefore, in order to continue leveraging on domestic opportunities and competing in the global marketplace, Malaysian construction industry players need to address a number of key strategic and operational challenges. There is a need to take a holistic approach in reviewing the factors impacting the construction industry value chain.

Improvements need to be implemented by all parties along the entire construction industry value chain for lasting transformation to occur. Therefore, in addition to contractors, clients, approving authorities, consultants, and other stakeholders must be involved in this transformation (Malaysian Construction Industry Masterplan 2008).

The construction industry contributes almost 4% to the GDP and expected to increase by 5% by year 2015. Globally, 70% of businesses are family owned (STEP 2007). In Malaysia, out of 7,622 G5-G7 registered contractors, there are 88% active contractors. And if the ratio of businesses to family businesses is mapped, there are potentially 4,695 active contractors in Malaysia which are family owned.

Family businesses are an important segment to the global economy, whereby they contribute towards more than 75% of the gross domestic product (GDP) in most countries and employ more than 85% of the working population around the world (Poza, EJ, 2007). In the World Competitive Report 2000 produced by the Lausanne Management Centre, 80% of the enterprises around the world are more or less considered family enterprises (Lee & Li, 2009). In the US, family enterprises contribute half of the job opportunities. In Germany, family enterprises create 66% of GDP and account for 75% of the total national employment. In Great Britain, the number of employees in family enterprise is 50% of the country's workforce. Family enterprises contribute a lot to GDP of Southeast Asian nations and the region, with Korea reaching 48.2%, Taiwan 61.6% and Malaysia 67.2%.

In his book, *Family Business*, Poza (2007) explained that approximately 85% new businesses fail within their first five years of operation and among those that survive; only 30% are successfully transferred to the second generation of the founding-family owners. And the odds get worse in the transition between the second and the third generations, and the third to the fourth generations, when only 12% and 4% of such businesses, respectively, remain in the same family. This phenomenon is also prevalent but many others have shown to be even stronger as they maneuver towards their 4th and 5th generation. How do companies such as the Lee family from China (5th generation), the Deague family from Australia (into its 6th

generation), the Dunn family of USA (into its 5th generation) or even the Frescobaldi family of Italy date back to 1300, remain strong up to this day?

Limited research has been carried out to understand the intricacies of family-owned businesses; this in turn inhibits the development of an integrated theory of family firms (Brice, 2007). In 2003, Dyer explained that business researchers usually overlook the family dimension even when it strongly exists in the firm they study and he further suggested that a number of research areas would benefit from including variables such as strategy, governance, competitive advantage, organization culture, social capital/networks, groups/teams, conflict, leadership succession, and change. And in 2010, Astrachan highlighted that the field of family business needed greater attention and more outlets for theory and research. He further explained that the proportion of family businesses to all other businesses is overwhelming as is the contribution of family businesses to Gross World Product (GWP), employment and employment growth (IFERA, 2003).

Therefore, a study on the decision making made by entrepreneurs within a family business will enrich the knowledge of mechanisms that drive the companies to participate in the economy, thus creating growth and prosperity for society. With such small survival rate in transgenerational entrepreneurship, it is imperative that one necessity for business survival is the family members' ability to make sound decisions together (Tisue, 1996) .

1.2 Problem Statement

The challenges and complexity of the ever-changing business environment in the construction industry, the unique make-up of familiness, and the lack of research that can tailor to specific situations in the orientation of decision making process, calls for this study to be generated.

1.3 Scope

This study is limited to respondents from the construction industry. The selected businesses fall within the G5-G7 categories as classified by the Construction Industry Development Board Malaysia (CIDB). The reasons why G5-G7 categories are chosen are because these companies are big enough to exhibit sizeable revenue, business growth, and innovativeness in their product or services.

1.4 Research Focus

In this study, the main focus would be on the entrepreneur, within a business group (Lehner & Leyronas, 2009), and his multiple activities ("portfolio entrepreneurship") in order to exploit new opportunities and examining his entrepreneurial cognition, how he functions as an entrepreneur, the dynamics of his family environment, and how he makes and arrive at such a decision.

In doing so, the entrepreneur needs to be intuitive, creative and able to forecast, as these are essential elements of decision making (Fontela, Guzman, Perez & Santos, 2006). However, these entrepreneurs are somewhat motivated by what surrounds him, i.e. the family context, therefore, it is also necessary to understand the way the family works as a system, and how this affects the entrepreneurs and the individual family members.

1.5 Purpose and Objectives

The understanding of the complexity and dynamics of a family business is becoming more prevalent among researchers. Fast decision making is not only seen as necessary but crucial to ensure speed and efficiency in responding to market opportunities and maneuvering through market uncertainties and tumultuous environment. The ability to make creative decisions with the flexibility to lower operational cost could reduce operational risks and achieve rapid growth (Lee and Li, 2009).

Although strategic decisions may be intentionally rational, overall the process of making the decision may be incremental. ("Logical incrementalism" and the process by fragmentation, constant evaluation, intuition and political behaviour) (Quinn, 1980). Rationality may be said to characterize behaviour that is logical in pursuing goals (Dean & Sharfman, 1993). However, entrepreneurs simply do not have the time to go through a thorough, rational decision making process (Bhuin, 2003). Entrepreneurs often deal with a situation without planning in advance, which decreases the firm performance when confronting with more complex problems (Levander & Raccuia, 2001). Complexity of the environment will lead to increased use of complete planning, but changeability of the environment will lead to less frequent use of rationality (Gelderen, Frese & Thurik, 2001).

This study uses the cognitive perspective (Matlin, 2002), an emerging perspective within the field of entrepreneurship to understand entrepreneurs in making decisions and solving problems (Sternberg, 1999). Furtherance to that, Mitchell and Busenitz (2002, 2007) defined entrepreneurial cognition as the knowledge structure that people use to make assessments, judgments, or decisions involving opportunity evaluation, venture creation, and growth. In 2004, Baron described decision making and reasoning, and how people use stored knowledge for making decision and in reasoning about the situation. Baron suggested that due to these complexities, future researches need to suggest how to simplify decision making and find tactics to have quality decision making.

Hence, this study will focus primarily on the entrepreneur's decision making process, within the business group (Lehner & Leyronas, 2009) and his multiple activities ("portfolio entrepreneurship") in order to exploit new opportunities, which is then, mapped against a Bayesian causal map. The Bayesian causal map considers reasoning (deductive versus adductive) which underlies the cause-effect relations perceived by the individual, taking into consideration the uncertainty variable and effects of the variable (Nadkarni & Shenoy, 2003). This study shall examine potential causes (uncertainty variable) which comprise of family resource pool, industry, family life stage and family involvement, and how these causes moderate the entrepreneurs' decision making process in creating new ventures.

Therefore, following is the objective of the study:

To identify the process of and factors that affect decision making by entrepreneurs in the construction industry. In doing so, it is with the intention to understand how the entrepreneurs decide (heuristic or systematic thinkers) when creating new ventures and to compare that between family businesses and non-family businesses using the Bayesian causal map.

New venture creation (as a diversification strategy) is chosen as the outcome variable because there may be a unique reason to why and how family businesses are embarking into such strategy. Among the possible reasons which may differentiate family businesses to non-family businesses are:
(a) the expectation of wealth creation for the family, and within the family; and
(b) preserving their family legacy.

This pattern is not seen in non-family businesses because wealth creation is not the goal of the business owners, neither is legacy, because their names are not tied to the company. Instead, non-family business owners may be concern of the company's reputation rather than legacy.

Decision specific characteristics influence the decision making process more than any other environmental, organizational and managerial factors (Papadakis, Lioukas & Chambers, 1998). A lot of the decision making process is controlled by the family patriarch (Lee & Li, 2009). In most cases, the decision making by the founder is liken to the authoritarian style, and everyone follows it without questioning the decision or the process of carrying out the decision (Tisue, 1999). However, other influences may also affect the founder's decision making, such as his experiences and abilities and the team that backs him up (Wells, 1974); the size of investment, cash out potential, geographic location and product differentiation (Tyebjee & Bruno, 1984); and knowledge and personal psychology (values) (Harris, 1998). Nonetheless, one cannot separate the entrepreneur from the family context because the contribution of the family members and the significance of the family dynamics; and despite the ideology of individualism, entrepreneurs belong to households that are emotional and economic units (Cramton, 1994).

Therefore, what motivates entrepreneurs to decide on such strategies? Aldrich & Zimmers (1986) and Caroll & Mosakowski (1987) describes entrepreneurial activity can be conceptualized as a function of opportunity structures and motivated entrepreneurs with access to the resources (Shane, Locke & Collins, 2003). And there are different levels of motivation as the entrepreneur is influenced not only by his perception of risk but also evaluating the opportunity (Shane & Ventakamaran, 2000).

The idea behind the family firm research is that the family could be the critical variable that must be explored (Astrachan, 2003; Dyer Jr., 2003; Habbershon, Williams & MacMillan, 2003; Rogoff & Heck, 2003; Zahra, 2003). In identifying what this "critical variable" is, Habbershon et al (2003) introduced a new perspective called "familiness" which describes unique, inseparable, and synergistic resources and capabilities emerging from family involvement and interactions.

2. Literature Review

2.1 Introduction

Richard Cantillion (1680-1734) who, in 1975 was credited for being the first to introduce the term "entreprendre", which means, "to undertake" (Jones & Wadhwani, 2006). The term later evolved from the function that the individual undertakes to the individual himself. In 1934, Schumpeter defined entrepreneurship as "carrying out new combinations", which see the entrepreneur as someone who seeks opportunities for profits and by doing so; he comes out with new opportunities by innovating.

Frank Knight (1921) defined entrepreneurship as someone who is able to successfully predict the future. Knights intuitive entrepreneur initiated the early notion of entrepreneurial thinking and the pivotal role of information that later became the essential elements in the cognitive perspective of entrepreneurship and venture creation (McMullen & Sherperd, 2006). In was in the late 1990's that researchers had begun to look at entrepreneurial thinking, entrepreneurial research domain, that comes from the cognitive stream. In a landmark journal article, Mitchell, Busenitz & Lant (2002) defined entrepreneurial cognition as "the knowledge structures that people used to make assessments, judgments or decisions involving opportunity evaluation and venture creation and growth.

2.2 Business Ownership

Family businesses and non family businesses make up the sphere for habitual entrepreneurs. The term "portfolio entrepreneurs" and serial entrepreneurs were further explored by Ucbasaran, Westhead, Wright and Flores (2009). They suggested that experience needs to be considered when looking at an entrepreneur's prior business ownership(s); whether past experience(s) is associated with business failure and whether this business ownership experience is acquired sequentially (i.e., sequential entrepreneurs or serial entrepreneurs) or concurrently (i.e., portfolio entrepreneurs).

2.3 Family Business

In 1995, Wakefield indicated that family firms originate from any business activity. However, researchers have come up with many different definitions, either looking at the individual level, i.e. individual founder (Kelly, Athanassiou & Crittenden, 2000), and the next generation member (Eckrich & Loughead, 1996) or the group level, i.e. conflict among family members (Kellermanns & Eddleston, 2006), and succession in business (Cadieux, Lorrain & Hugron, 2002). However, of late, researchers are becoming more interested in the field of family business, hence, there is a clearer line separating between family business and non-family business. The line separating a firm which is clearly a family firm as opposed to those which are clearly not is now easier to draw. The ones in between, i.e. the grey area, is one which is hard for researchers to shade (Westhead & Cowling, 1998).

Hence, Poza (2007) adopts an inclusive theoretical definition of a family business that focuses on the vision, intention, and behaviour, vis-à-vis succession, of the owner : (a)

ownership control (15% or higher) by two or more members of a family or a partnership of families; (b) Strategic influence by family members on the management of the firm, whether by being active in management, by continuing to shape the culture, by serving as advisors or board members, or by being active shareholders; (c) concern for family relationship; and (d) the dream (possibilities) of continuity across generations.

In 2003, Anderson and Reeb found that family firms listed in the S&P 500 whose firms are influence by the founding family, tend to outperform their counterparts. In the Successful Trans-generational Entrepreneurship Practices (STEP) 2008 report, it is found that more than 60% businesses worldwide are family owned or/and and was also highlighted that 85 of these businesses are well established companies. Family-owned businesses such as the LG Group from Korea, Bosch Group from Germany, L'oreal Group from France, Tata Enterprise from India, Cheung Kong from HK-China, Asian Pacific Buildings Corporation from Australia are examples of large and successful businesses located around the globe and are common brands we can associate ourselves with.

In delving into the lifespan of family businesses, many researchers found that they are often relatively short, as only a limited number survives the transition to the second generation, and hardly one-third even into the third (Beckhard & Dyer, 1983; Shanker & Astrachan, 1996; Neubauer & Lank, 1998; Paisner, 1999). In 2003, Dyer found that the field of management studies has paid insufficient attention the family firms' unique theoretical and practical problems so far and further iterated in 2006 that due to this high importance of family firms, academia has finally recently begun to recognize their necessity as a research object (Chrisman, Steier & Chua, 2006).

2.4 Decision Making

Decision Making is the act which marks out the businessman from all those who collaborate with him in production (Shackle, 1966). Historically, corporate America's decision making is modeled from the military decision making. Hence, the authoritarian style of leadership where decision is made by the founder and no one questions the decision or the process of carrying out the decision (Tisue, 1999). However, as an entrepreneur, he does not merely live in the context of the present, he needs be able to sense and have the foresight because the implications of the decisions he make today will only be realized tomorrow (Thaler, 2000). Alvarez and Busenitz (2001) explored the coordinating role of entrepreneurship on the collection and use of organization knowledge that leads to heterogeneous outputs and, ultimately, to a firm's competitive advantage. This substantiate that the capability of the entrepreneur, his behaviour, the way he thinks and the way he makes his decision in using and leveraging on the available resources, does impact the organization performance. Mitchell (2002) defined entrepreneurial cognition as "the knowledge structures that people used to make assessments, judgements or decisions involving opportunity evaluation and venture creation and growth".

2.5 Rationality

Rationality may be said to characterize behaviour that is logical in pursuing goals (Dean & Sharfman, 1993). Although strategic decisions may be intentionally rational, overall the process of making the decision may be incremental as Quinn in 1980 described it as a "Logical incrementalism" and the process by fragmentation, constant evaluation, intuition and political behaviour. Olson and Broker (1995) explained that the strategy process focuses on the formulation and implementation of the strategic decision, and is connected to formal planning (detailed business plan elaboration).

However, entrepreneurs tend to have tight deadlines and the entrepreneurs simply do not have the time to go through a thorough, rational decision making process (Bhuian, 1997). In 1998, Papadakis, Lioukas and Chambers observed that strategic decisions for new business investments and marketing type seem to be subject to a less comprehensive analysis than strategic decisions on capital investment and internal reorganisation. Entrepreneurs often deal with a situation without planning in advance, which decreases the firm performance when confronting with more complex problems (Levander & Raccuia, 2001). However, as the going gets tough, and environment becomes too complex to comprehend, entrepreneurs will tend to use complete planning, but when the environment tend to change too rapidly, the entrepreneurs will lead to less frequent use of rationality (Gelderen et al, 2001).

Observations of entrepreneurs in various countries (USA, UK, Canada, Hong Kong, New Zealand and Singapore), Cunningham, Gerrard, Schoch, Chung (2002) showed that there is a kind of logic that is neither functionally nor substantially rational, and thus, concluded that there is a way of thinking and decision making that might be appropriate in creatively making decisions in highly turbulent environment, which is known as "the new economy".

2.6 Entrepreneurial Cognition

Entrepreneurial cognition (Mitchell, Busenitz, et al, 2002) is defined as the knowledge structure that people use to make assessments, judgments or decisions involving opportunity evaluation, and venture creation and growth. Over the years, researchers continue to understand "how do entrepreneurs think", what makes them better entrepreneurs compared to others. And thus, the interest by researchers were moving towards understanding the structure (whether heuristic or systematic thinking) and how the entrepreneurs process the information to come up with better decisions.

The research done by Baron in 2004 where he focused on entrepreneurial process, where he asked three basic questions, i.e. (1) Why do some persons but not others choose to become entrepreneurs? (2) Why do some persons but not others recognize opportunities for new products or services that can be profitably exploited? (3) Why are some entrepreneurs so much more successful than others. It is at this point that Baron's work serves as a nucleus for other researchers to explore in the area of entrepreneurial cognition, a way of thinking and behaving.

2.7 Decision making process

Wells (1978) observed that an entrepreneur's abilities and those of the entrepreneurial team are decisive in the strategic decision-making process: their background, previous experience and level of commitment. In making decisions, it was found that size of the investment, the cash out potential, the geographic location and the product differentiation as most influential for the strategic choice (Tyebjee & Bruno, 1984). The research which was carried out by Harris (1998) found that the decision making process focuses the attention on factors like: time available for making the decision, cost involved with alternative solutions, availability of resources**,** knowledge and personal psychology (values). It was also found that entrepreneurs use the approach of concentrating on the most difficult, most unclear, and most important point first. Only after solving this first critical point further steps are planned (Frese, Gelderen & Ombach, 2000).

2.8 Family Business and Decision Making

In most family businesses, there is a prevalent leadership style, i.e. authoritarian decision making, whereby decision is made by the founder, i.e. the father, and no one questions his decision or the process of carrying out that decision (Tisue, 1999). However, there are many definitions to explain what decision making is in the context of a family business. Thus, due to their dissatisfaction with existing definitions, several authors have recently shifted their approach to identifying the "essence" of a family firm, e.g. through the question of the family's influence in strategic decision making (Davis & Tagiuri, 1989; Handler, 1989; Shanker et al, 1996).

Historically, the concept of decision making is made by only one person, i.e. the business owner, with little or no input from other (Gersick, Davis, Hampton, & Lansberg, 1997), However as time moved on, the dynamics of a family-owned business becomes complex and in surviving through the course of times, it is crucial to make effective decision making (Tisue, 1999).

In later studies conducted in 2003 by various researchers, (Astrachan, Dyer, Habbershon et al., Rogoff et al., Zahra), it was concluded that there could be a common idea behind this and that the family could be the critical variable in family firm research. In identifying what this "critical variable" is, Habbershon, Williams & Macmillan (2003) introduced a new perspective called "familiness" which describes unique, inseparable, and synergistic resources and capabilities emerging from family involvement and interactions.

2.9 Conceptual Framework

Resourced- based View

The resource-based view (RBV) of the firm argues that firms are able to outperform others if they can develop valuable resources or capabilities which cannot be easily imitated or substituted by its competitors (Barney, 1991; Teece, Pisano & Shuen, 1997). The RBV can contribute to investigating how family firms identify and develop distinct unique capabilities,

and how those might be transferred (e.g. during business succession) to new owners and structures (Habbershon & Williams, 1999). Further studies carried out between the years 1999 to 2003 prove that the connection between family and business may lead to unique advantages in the acquisition of resources. An appropriate method for doing that is to assess the family influence on the resources of an organization (Haynes, Walker, Rowe & Hong, 1999). Family ties may provide an advantage in opportunity identification due to a higher willingness to share information with each other between members of the same family (Barney, Clark & Alvarez, 2002).

Thus, family influence, which is defined as "familiness" is one of the main inputs in the system as a way to assess family influence on performance outcomes (Aldrich & Cliff, 2003; Stewart, 2003). Sirmon & Hitt (2003) applied the RBV to family firms, and distinguish between five sources of so called "family firm capital": human, social, survivability, patient, and governance structures. The authors argue that family firms acquire, bundle and leverage their resources differently to non family firms. However, Nordgvist (2005) concluded that not all firms have unique resources, and it is possible to survive without them. It can thus also be argued that not all family firms have such a "familiness" capability which is are unique and inseparable, and lead to a competitive advantage.

Entrepreneurial Orientation

Entrepreneurial Orientation (EO) is a firm level construct that is closely linked to strategic management and the strategic decision making process (Covin & Slevin, 1991). In 1996, Lumpkin & Dess explored the constructs of EO and defined a firm's EO as its propensity to act autonomously, innovate, take risks, and act proactively when confronted with market opportunities. They also concluded that EO is a process construct and concerns the methods, practices and decision making styles managers use. In 2005, Aloulou & Fayolle explored a firm's strategic orientation, and concluded that it involves capturing specific entrepreneurial aspects of decision making styles, methods and practices. Habberson et all, (2007) introduces the EO framework that provides five established constructs to explore as antecedents to entrepreneurial performance – proactiveness, innovativeness, autonomy, riskiness, and aggressiveness

Decision Making Process

Mintzberg, Raisinghani & Theoret (1976) introduced the decision making structure and described it by seven elements, comprising three central phases' (identification, development and selection), three sets of 'supporting routines' (decision control, decision communication and political) and six sets of 'dynamic factors' (interrupt, scheduling delays, timing delays and speedups, feedback delays, comprehension cycles and failure recycles). The general model describes the interrelationships among them and the decision processes studied are shown to fall into seven types of 'path configurations'. Three decision stimuli sit in a continuum, namely 'opportunities' (voluntary decisions to improve a secure position) at one end, 'crises' (decision responses to intense pressures) at the other and 'problems' in the middle; each capable of integrating or moving along the continuum.

Further research on the decision making process which was conducted by Mullins and Foriani (2000) proposed a model to show that whilst strategic decisions are immensely complex and dynamic, it is possible to give them conceptual structuring. Mintzberg later revised his viewpoint and continued his research on decision making process with Westley, in 2001. In this study, they did not deny the rational approach, however, they defended the thesis that the conventional rationality is not anymore the only advisable way to determine the course of action. They came up with 3 approaches, i.e. Good decisions are the output of careful analytical thinking combined with two other possible 'ingredients' of decision-making, namely intuition and pro-active behaviour (see table 1).

"Thinking First" (rational) features the qualities of	**"Seeing First" (intuitive) features the qualities of**	**"Doing First" (action-oriented) features the qualities of**
Science	Arts	Crafts
Planning	Visioning	Venturing, Learning
The verbal	The visual	The visceral
Facts	Ideas	Experiences
define -> diagnose -> design -> decide	preparation -> incubation -> illumination -> verification.	enactment -> selection -> retention
Ready reviewed path	subconscious manner of decision-making, which requires a significant amount of prior experience	If rationality is helpless and strategic vision is not present. This approach is advisable when the situation is novel and confusing, and things need to be worked out.

Source : Mintzberg and Westley, 2001.

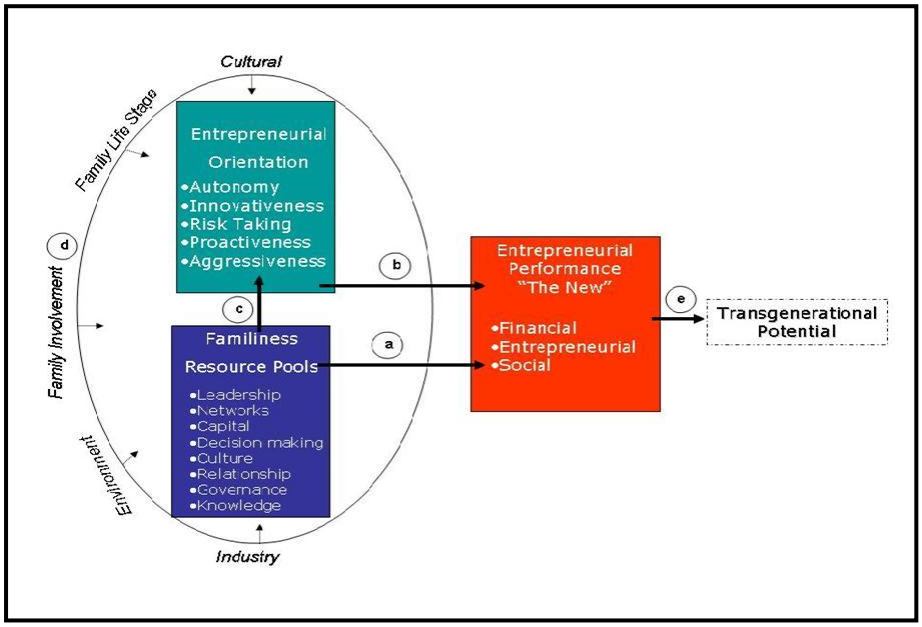
Table 1 : Characteristics of the 3 Approaches to Making Decision by Mintzberg & Westley (2002)

Additionally, Lee & Li (2009) also suggested that formalization of professional management system should be developed with objectivity and rationality in decision-making. The set-up of scientific decision-making mechanism would help to reduce risk and failure in the decision making process. Factors effecting decision making mechanism are mainly structural elements including leadership, organization to employee profile, and procedural elements ranging from decision making procedure, decision making methods to communication and information transfer. Therefore, it is suggested that, besides having the board, there should be another platform to facilitate decision making, i.e. the Family Representative Committee.

STEP Research Model

The STEP Research Model, redefined in 2008 by the STEP Project, owned by Babson College (see Figure 1) is used to explore on corporate entrepreneurship study in the context of the family form of business organizations (versus a family business studies).

In this research proposal, focus in drawn to the decision making process within the element of "familiness" which is defined as a resource pool, i.e. RBV theory. Looking at who makes what decisions and how they are made is a critical part of strategy development and execution. Decision making is also tied to family and governance practices and structures. Noting how family influences decision practices to create an advantage (e.g. streamlined decisions) or constraint (e.g. disenfranchising certain family members from the process) highlights the speed, quality and commitment of decision-making.



Source : STEP Research Model 2007.

Figure 1 : The STEP Research Model

This study will compare family business with non-family business, therefore, context of corporate entrepreneurship with regard to entrepreneurial orientation and RBV are taken as suggested by scholars. And the dependant variable for both family business and non-family business is the outcome of the decision making, i.e. new venture creation.

On top of that, in both family business and non-family business, the mediating influences are:
(a) Cultural – this refers to the ethnic or country cultural influences;
(b) Environment – this refers to the externalities of the economy, region, country etc;
(c) Industry – this refers to the specific factors related to the industry or industries of the business group;

However, the uniqueness of family business, whereby it may influence "families", two additional mediating influences are included (as per what is suggested by the STEP model).

(d) Family life stage – this refers to the generation and development of the family and business;

(e) Family involvement – this refers to the role family members play in ownership and or management of the group. (note that the last two family categories strongly relate to the governance resource pool of the firm).

By addressing these five categories, it allows us to investigate and answer the question of what mediating influences have on entrepreneurial orientation and resource pools.

Entrepreneurial Motivation

Shane, Scott & Collin (2003) suggest how human motivations might influence the entrepreneurial process and how at each stage of the process, the level, inclusion of or exclusion of some or all of the motivation may matter, or change, to the entrepreneur. See figure 2 below :

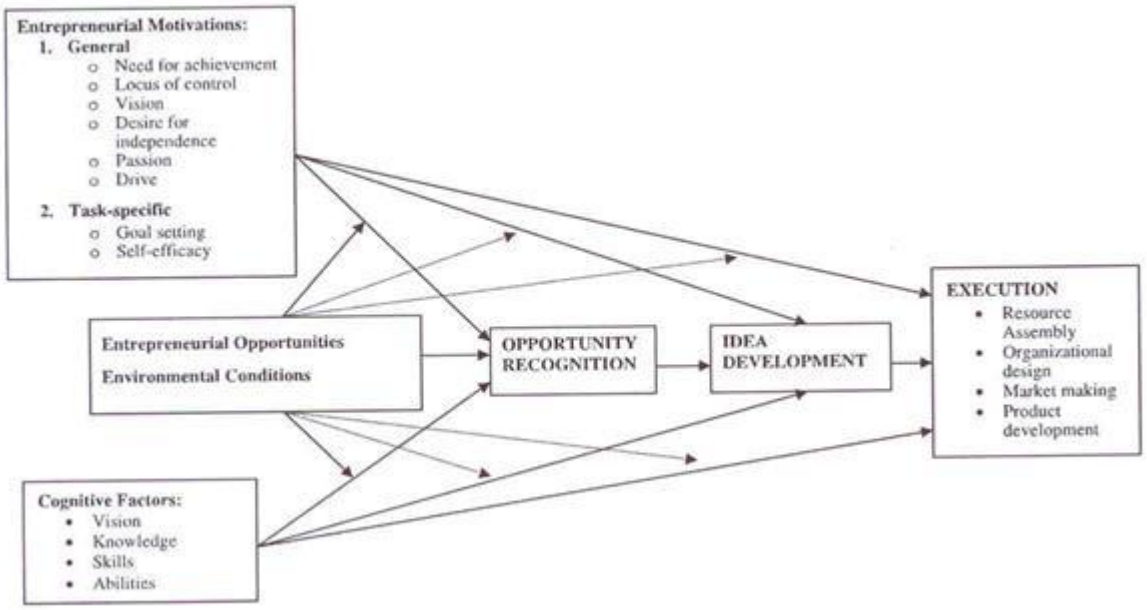


Figure 2: Model of Entrepreneurial Motivation and the Entrepreneurship Process

In exploring motivation and the entrepreneurial process, this study hopes to better understand entrepreneurial cognition and the entrepreneurs' decision making process, and would be able to identify how differently or similarly decisions are made between family businesses and non-family businesses.

Bayesian Causal Mapping

(a) Causal Map

The use of causal map, which are also described as cognitive maps, are directed graphs that represent the cause-effect relations embedded in experts' thinking, whereby certain events or actions, will lead to particular outcomes. The interest seems to be prevalent of late, in using causal map to represent domain knowledge of decision-makers (Anderson & Gerbing; Huff, 1990; Laukkanen, 1996), especially in the area of policy analysis (Axelrod, 1976) and management sciences (Klein & Cooper, 1982; Ross & Hall, 1980).

(b) Bayesian Networks

Bayesian networks, which is based on probability, represents expert knowledge in domains where expert knowledge is uncertain, ambiguous, and/or incomplete (Speigelhalter, David, Lauritzen & Cowel, 1993). The Bayesian network model is depicted through qualitative (directed acrylic graph in which nodes represents variables, and directed arcs depicts conditional independence relations embedded in the model) and quantitative (the dependence relations are expressed in terms of conditional probability distributions for each variables in the network) levels.

(c) Bayesian Causal Map

Both causal maps and Bayesian networks are causal models that represent cause-effect beliefs of experts. However, when combining causal map and Bayesian networks, the advantages of the two methods is seen and it reduces the limitation of either (Nadkarni & Shenoy, 2004). There are three main advantages to using the Bayesian causal main. The first advantage of using the Bayesian causal map is it assists the decision-maker to support his initial decision-making (Kemmerer, Mishra & Shenoy, 2002). Secondly, it also helps the decision-maker to scrutinize his decisions from those which was made based on tacit decisions, and thus reduces decision bias (Hodgkinson, Brown, Maule, Glaiser & Pearson, 1999). And finally, as described by Hodgkinson et. al (1999), inexperienced decision-makers can become experts in decision-making as they would learn from their experiences because Bayesian causal map stores variables assessments and decision drivers, hence, the decision-maker is able to, later, compare their decisions with reality.

Therefore, based on the literature review above, the following conceptual framework (see Figure 3 and research questions are illustrated below:

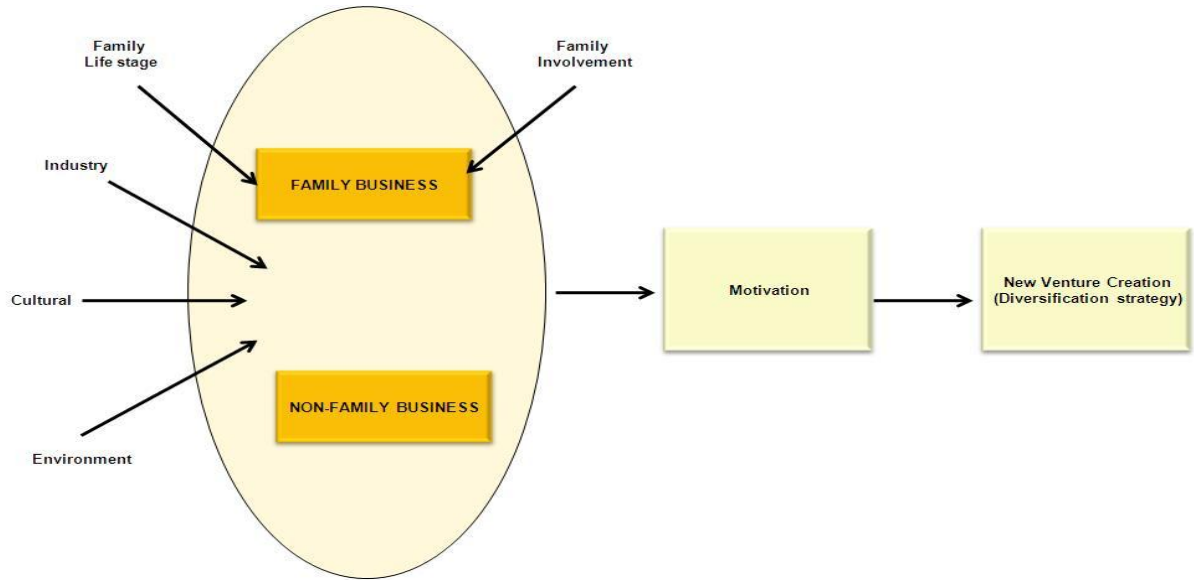


Figure 3 : Proposed Conceptual Framework

2.10 Research Questions

There is limited family business literature that explores on decision making process and what may be the factors that influence the entrepreneurs to come to such a decision, and taking "familiness" into the context of the study.

In embarking to investigate this phenomenon, the research question for this study is:

Do family business owners reason and make decision differently from non-family business owners when they create new ventures? If so, are they heuristic thinkers or systematic thinkers in coming to a decision when the element of "familiness" comes into the picture? And what are the factors (for example, motivation) and processes to their decision making? If the decision is not rational, is there "cognitive biasness" in family businesses?

This goes back to Baron (2004) whereby he suggested that in expanding the research on entrepreneurial cognition, researchers in this area may find the appropriate tools which he has brought forth, as described in Table 2 below :

Issues	Description	Description	Measures (tools)
1	Do entrepreneurs prefer heuristic to systematic thinking?	Entrepreneurs are persons who can "think on their feet" and who prefer action to reflection and thought (e.g., Markman & Baron, 2003).	<u>Reaction time:</u> Defined as the amount of time that passes between a stimulus event and an individual's overt response to the event.

Issues	Description	Description	Measures (tools)
		Entrepreneurs prefer to think *heuristically*, following quick rules for making decisions and planning actions, rather than to think *analytically* or *systematically* (e.g., Petty et al., 1994). Successful entrepreneurs are more adept at switching between these two modes of thought as the need arises.	<u>Number and pattern of correct responses and errors:</u> Just as shorter reaction times may be taken as indicators of better execution of particular cognitive processes, few errors and many correct responses can serve as indicators of proficiency.
2	Do entrepreneurs possess knowledge structures that differ from those of other persons (e.g., knowledge structures that are richer, better interconnected; different in specific content), and do they apply that knowledge more effectively in a wide range of situations?	Entrepreneurs have knowledge structures (i.e., the sum of their stored information and knowledge) that differ from those of other persons has frequently been suggested in the entrepreneurial cognition literature. In short, entrepreneurs' knowledge structures may play a key role in the entrepreneurial process.	<u>Reaction time :</u> If entrepreneurs possess more fully developed knowledge structures in certain domains, they would be expected to respond more quickly than other persons to stimuli relating to these domains. <u>Number and pattern of correct responses and errors :</u> Just as shorter reaction times may be taken as indicators of better execution of particular cognitive processes, few errors and many correct responses can serve as indicators of proficiency. <u>Categorisation :</u> Several measures for assessing or mapping the knowledge possessed by individuals and, more important, how such knowledge is organized, have been developed by cognitive scientists. <u>Priming (Prime and target) :</u> A valuable tool for mapping the knowledge structures of entrepreneurs. how they make decisions (Issue #4), and their ability to

Issues	Description	Description	Measures (tools)
			recognize complex patterns of change in the external world (Issue #5). <u>Memory:</u> Relates to that from Issue#2 <u>Generative task:</u> New ideas and innovation.
3	Do entrepreneurs have greater capacity than other persons to focus their attention on pertinent information?	*Working memory* - the cognitive system in which our stored knowledge and experience (in a sense, our consciousness) interacts with incoming information from the external world. It seems possible that entrepreneurs—and especially successful ones - may show greater working memory capacity, and hence greater ability to "zero in" on key information, than other persons.	<u>Memory:</u> Relates to entrepreneurs' capacity to focus their attention on relevant information.
4	Do entrepreneurs reason or make decisions differently than other persons?	Making decisions is a key task faced by all entrepreneurs, and it is often far from an easy one. Do they employ different decision-making strategies or reason about available information differently? For instance, given the fact that they must often make decisions quickly, it seems possible that entrepreneurs are more likely to rely on heuristics in making decisions, or to *satisfice*—accepting the first decision that works, rather than resorting to more analytical procedures. These are important issues, because the success or failure of new ventures often depends heavily on decisions reached by entrepreneurs.	<u>Reaction time :</u> perhaps to reach decisions concerning them more rapidly (Issue #4) <u>Priming (Prime and target) :</u> A valuable tool for mapping how they make decisions. <u>Memory:</u> Their decision-making abilities. Presumably, the more effectively entrepreneurs can focus their attention on pertinent information, the more readily can such information enter into memory, and the better, ultimately, will be their decisions. <u>Decision making & reasoning:</u>

Issues	Description	Description	Measures (tools)
			In *decision-making* or *choice* (the question of whether entrepreneurs reason or make decisions differently than other persons).
5	Are entrepreneurs better than other persons at recognizing complex patterns— at "connecting the dots" or seemingly unrelated factors and events into identifiable opportunities?	Do opportunities "exist" in the external world, or are they "created" in the minds of specific individuals?	<u>Categorisation:</u> Insights into these question may also shed important light on Issue #5. (better, in a sense, at "connecting the dots"). <u>Priming (Prime and target) :</u> A valuable tool for mapping the ability to recognize complex patterns of change in the external world.

Table 2 : Summary of Baron's 5 Issues and suggestions in researching on Entrepreneurial Cognition.

Hence, on Baron's Issue#1, Issue#4, and Issue#5, the research questions proposed above look at successful entrepreneurs, and to investigate whether there are any differences or commonalities between family business owners and non-family business owners in the creation of new ventures. The research question further looks into Baron's Issue#4, of whether the family business owners are heuristic thinkers or systematic thinking in coming to a decision when the element of "familiness" comes into the picture. Baron's Issues #2 and #3 may not be directly referred to in this research, but in coming to Issue#4, it does require Issues #2 and #3.

In concluding this proposed conceptual framework, and tying up all these together, this study is proposing to use the Bayesian causal map as a tool to map decision making process, with the intention that it will help to simplify decision making and find tactics to have quality decision making.

3. Methodology

3.1 Introduction

The research will primarily use the case study approach. The case study approach according to Yin (1989), "investigate the contemporary within its real life context; when the boundaries between the phenomenon and the context are not clearly evident; and in which multiple sources of evident are used. The use of case study is to develop critical thinking and it gives a holistic understanding of the cultural system (Alvarez, Binkley, Bivens, Highers, Poole & Walker, 1990). Case study is the best design to answer the question of "why and how" whenever the researcher is not having control of the event.

Stake (1994) advises that when choosing a site for a study, "the primary criterion is the opportunity to learn. Stake further adds that, "qualitative study is characterized by the main researcher spending substantial time, on site, personally in contact with activities and operations of the case, reflecting, revising meanings of what is going on".

Bachor in 2002 pointed out that case study is a convenient and meaningful technique to take a snap shot of what is being observed. And he further explained that case studies also appeal to people because they have what might be termed as 'face-value credibility'. Wiersma (2005) highlighted that a case study design is used as it allows detailed examination on the phenomenon.

Upon further readings on cases related to entrepreneurial cognition, decision making and family business, the literature review shows that most of the methodologies carried out by the researchers are done through case studies. Sarasvathy in 2004, suggested that when one is investigating more than the entrepreneurs motivation, i.e. "plunge decision", whereby issues such as emotional endurance, strength, efficacy of spousal, familial, friendship ties and sheer physical energy, one must do qualitative analysis. These are only some issues highlighted by Sarasvathy, however, the complexity and dynamics of a family business goes beyond what was highlighted.

Hence, a case study analysis is ideal for this study. It is also noted that a case study has to be carefully done to ensure that the objectives are met, and that, to maximize what can be learn and taking into consideration the time available for the research.

3.2 Research Design

The database of the family-business owners in the construction industry will be derived from the CIDB (Construction Industry Development Board, Malaysia) database and the database from the Statistic Department of Malaysia. The selection of the business owners will be based on the CIDB Contractor Grading (see Table 3), those under Grade G5, G6 and G7. The reason for selecting only those under these categories is for its capabilities and possibilities for business growth, innovativeness and transgenerational entrepreneurship.

GRADE	TENDERING CAPACITY	PAID-UP CAPITAL*/ NET CAPITAL WORTH ** (RM)	PERSONNEL TECHNICAL REQUIREMENT#
G7	No Limit	750,000.00	1 Group A & 1 Group B (Both minimum 5 years experience), or 2 A Groups (one of them must minimum 5 years experience).
G6	Not exceeding 10 million	500,000.00	1 Group A & Â 1 Group B (one of them must minimum 3 years experience)
G5	Not exceeding 5 million	250,000.00	1 Group A or 1 Group B (minimum 5 years experience)
G4	Not exceeding 3 million	150,000.00	1 Group B
G3	Not exceeding 1 million	50,000.00	Course Certificate In Construction Related Fields / Experience
G2	Not exceeding 500,000.00	25,000.00	Course Certificate In Construction Related Fields / Experience
G1	Not exceeding 200,000.00	5,000.00	Course Certificate In Construction Related Fields / Experience

Source : CIDB Malaysia

Table 3 : CIDB Malaysia Grading

In Malaysia, out of 7,622 G5-G7 registered contractors, there are 6,447 active contractors. And if the ratio of businesses to family businesses is mapped, there are potentially 4,695 active contractors in Malaysia which are family owned. However, the exact number is yet to be determined upon communication with the CIBD Malaysia.

GRADE	Active	Family Business
G7	3,457	?
G6	795	?
G5	2,195	?

Table 4 : Number of Active Construction Businesses According to Grading

The research will be carried out using the case study approach, whereby between four to eight construction firms will be selected based on :

1) Annual sales turnover
2) Innovativeness towards products or process
3) Transgenerational entrepreneurship

According to Yin (1994), research case design can either be single-case design or multiple-case design. Robson (2002) indicated that multiple-case design is appropriate for making analytical generalizations from a sample of cases; and he further concluded that the evidence gained from multiple cases is usually more extensive and the results obtained from the cases are therefore more compelling (Robson, 2002; Yin, 1994).

The interview questions will be using open-ended questions modeled after the STEP Research Model and modified to fit the purpose of this research, and will be carried out on family-business owners and for selected two to three top management personnel. The method of gathering the information will be by way of one-to-one interview, observation and visit the day-to-day practices and examination of documents.

3.3 Study Population

The entrepreneur will be the main focal point to gather information through a series of interviews using open ended questionnaire, which will be designed at a later stage. Additionally, request to observe the day-to-day activities within the organization's premises including the consent to refer to selected documents and information is vital in ensuring that the study not only concentrate on the entrepreneur, his family, but also on the environment he is in.

3.4 Data Collection Tools

According to Ritchie and Louise (2003), the characteristics of the population should be used as the basis of selection in order to make them suitable for small scale and in-depth studies. The results are not meant to be statistically representative, thus, units are selected to reflect the particular features of the sampled population (Par, 2008). Therefore, the unit of analysis is the entrepreneur and the decision making, i.e. family owned business in the construction industry.

The decision making process will be depicted using the Bayesian causal map. There are four softwares which have been identified, however, it is yet to be reviewed and tested to fit this study. The proposed softwares are :

Software Name / website	Free / Proprietary	Price	Developed by
Hugin Expert www.hugin.com	Proprietary	Euro 863 (Academic version)	Hugin Expert

Software Name / website	Free / Proprietary	Price	Developed by
Bayes Server 2.2 www.bayesserver.com	Proprietary	Euro 490 (Academic version)	Imperial College, UK
AI Space www.aispace.org/bayes	Free	NIL	University of British Columbia, USA
Bayesian Network Tool http://sourgeforge.net/projects/bnj	Free	NIL	Kansas State University, USA

Table 5: List of Bayesian Causal Map (to be reviewed and tested)

3.5 Survey Instrument

For the case study, the questionnaire from the STEP Research Model will be used with some modification done on it to fit the purpose of this study especially in unraveling entrepreneurial cognition, and understanding how decision making is in the context of the family-owned business and non-family business.

3.6 Reliability and Validity

Boyatzis (1989) explained that reliability and validity of data in a case study can be done in the following manner, "each code was described and checked for differentiation from other codes for purpose of validity" putting a code to describe each differentiation and theme.

3.7 Scope and Limitation

1) Focus on one industry, i.e. construction. Hence, may not be applicable for other industries.
2) Focus on the "intangible" component (where "familiness" falls into) of the RBV.

3.8 Research Gap

1) Little or limited research done on the relationship between rational thinking vs entrepreneurial logic to in the process of a decision making
2) Little or limited research done on family business and its relationship to decision making.
3) No similar research done in Malaysia

3.9 Work Schedule

Phases	Description	Duration
Research design	To analyze research domain and define scope of research	**4 months**
Literature Review	Information gathering from journals, articles, news clips, and research papers of previous works	**6 months**
Design and implementation	Design of overall concept and scope of work	**3 month**
Survey - **Case study**	Conduct case study	**6 months**
Data analysis and findings	Collect and Analysis data	**6 months**
Findings and Conclusion	Write up on the findings and conclusion that can be shared	**6 months**
Finalized thesis		**3 months**
Submission and defense of the Thesis		**2 months**
Total duration		36 months

Table 6 : Work Schedule

Contribution to the body of research

The use of Bayesian causal map to assess the decision making process among entrepreneurs in the construction industry and its comparison among the decision makers of family businesses and non-family businesses will add richness in the area of family business. This study will also provide a better understanding on how "familiness" may (or may not) affect the decision making process.

The use of Bayesian causal map to assess the decision making process among entrepreneurs will enable decision makers to make inferences to reality. In doing so, future decisions can be simplified, made more efficiently and enhance the quality of decision making to weather the new economy.

4. Bibliography

Alvarez, M. Binkley, E. Bivens, J. Highers, P. Poole, C. & Walker, P. "Case-based Instruction and Learning: An Interdisciplinary Project. Proceedings of 34th Annual Conference. College Reading Association. Reprint. 1990. pp.2-18.

Anderson, J.C. Gerbing, D.W. "Some Methods of Respecifying Measurement Models to Obtain Unidimensional Construct Measurement." *Journal of Marketing Research.*

Anderson, R. Reeb, D. "Founding-family Ownership and Firm Performance: Evidence froom S&P500." *Journal of Finance,* 2003, 58(3). 1301-1327.

Aldrich, H. Cliff, J. "The Pervasive Effects of Families on Entrepreneurship: Towards a Family Embeddedness Perspective." *Journal of Business Venturing,* 2003, 18(5). 573-597.

Astrachan, J. "Strategy in Family Business: Towards a Multidimensional Research Agenda"." *Journal of Family Business Strategy,* 2010. 6-14.

Astrachan, J. "The Emergence of a Field. Commentary on the Special Issue, "The Evolving Family/Entrepreneurship Relationship"." *Journal of Business Venturing,* 2003, 18(5). 567-572.

Axelrod, R. "*Structure of Decision: The Cognitive Maps of Political Elites*." Princeton University Press, Princeton, NJ. 1976.

Baron, R.A. Ward, T.B. "Expanding Entrepreneurial Cognition's Toolbox: Potential Contributions from the Field of Cognitive Science." *Entrepreneurship: Theory and Practice,* Winter 2004, 553-573.

Barney, J. "Firm Resources and Sustained Competitive Advantage." *Journal of Management,* 1991, 17, 99-120.

Barney, J.B. Clark, C. Alvarez, S. "Where Does Entrepreneurship Come From: Network Models of Opportunity Recognition and Resource Acquisition with Application to the Family Firms." Proceedings of the Second Annual Conference on Theories of the Family Enterprise, University of Pennsylvania, Philadelphia, 2002.

Beckhard, R. Dyer, W. "Managing Change in the Family Firms – Issues and Strategies." *Sloan Management Review,* 1983, 24, 59-65.

Brice, William D. "The Cultural Basis of Management Strategy – Professional vs. Family Business Management in Three Countries." Ph.D. diss., University of Hawai'i, 2005.

Cadieux, L. Lorrain, J. Hugron, P. "Succession in Women Owned Family Businesses: A case Study." *Family Business Review,* 2002, 15(1), 17-30.

Chrisman, J.J. Steier, L.P. Chua, J.H. "Personalism, Particularism, and the Competitive Behaviours and the Advantages of Family Firms: An Introduction." *Entrepreneurship Theory and Practice,* 2006, 30(3). 719-730.

Construction Industry Development Board of Malaysia (CIDB). http://www.cidb.gov.my, accessed January 2009.

Cramton, Catherine Durnell. "The Entrepreneurial Family." Ph.D. diss., Yale University, 1994.

Cunningham, J.B. Garrard, P. Schoch, H. Chung, L.H. "An Entrepreneurial Logic for the New Economy." *Management Decision,* 2002, 40/8.

Cunningham, J.B. MacGregor, J.N. "Training Insightful Problem Solving: Effects of Realistic and Puzzle-Like Contexts." *Creativity Research Journal,* 2008, 20(3), 291-296.

Davis, J. Tagiuri, R. "The Influence of Life-stage on Father-son Work Relationships in Family Companies." *Family Business Review,* 1989, 2(1), 47-74.

Dean, J.W., Jr. Sharfman, M.P. "The Relationship of Procedural Rationality and Political Behaviour in Strategic Decision Making." *Decision Sciences,* 1993, 24, 1069-1083.

Dean, J.W., Jr. Sharfman, M.P. "Procedural Rationality in Strategic Decision Making Process." *Journal of Management Studies*, 1993, 30, 607-630.

Department of Statistics Malaysia, http://www.statistics.gov.my/, accessed May 2008.

Dyer, William G. "The Family: The Missing Variable in Organisational Research." *Entrepreneurship Theory and Practice*, 2003, 27(4), 401-416.

Eckrich, C. Loughead, T. "Effects of Family Business Membership and Psychological Separation on the Career Development of Late Adolescents." *Family Business Review,* 1996, 9(4), 369-386.

Frese, M. Gelderen, M.van. Ombach, M. "How to Plan as a Small Scale Business Owner: Psychological Process Characteristics of Action Strategies and Success." *Journal of Small Business Management,* 2000, 38, 1-18.

Fontela, E. Guzman, J. Perez, M. Santos, F.J. "The Art of Entrepreneurial Foresight." *Emerald Group Publishing Limited*, 2006, 8(6), 3-13.

Gersick, K. Davis, J. Hampton, M. Lansberg, I. "Generation to Generation: Life Cycle of the Family Business." *Harvard Business School Press,* Boston, MA, 1997.

Gelderen, M.van. Frese, M. Thurik R. "Strategies, Uncertainty and Performance of Small Business Start-ups." *Small Business Economics*, 2001, 15, 165-181.

Habbershon, T.G. Williams, M.L. MacMillan, I.C. "Familiness: A Unified Systems Perspective of Family Firm Performance." *Journal of Business Venturing*, 2003, 18, 451-465.

Habbershon, T.G. Williams, M.L. "A Resource-Based Framework for Accessing the Strategic Advantages of Family Firms." *Family Business Review*, 1999, 12, 1-25.

Handler, W. "Methodological Issues and Considerations in Studying Family Businesses." *Family Business Review*, 1989, 2(3), 257-276.

Harris, R. *Introduction to Decision Making.* 1998. www.virtualsalt.com/crebook5.htm, accessed January 2009.

Hayes, G. Walker, R. Rowe, B. Hong, G . "The Intermingling of Business and Family Finances in Family-owned Businesses." *Family Business Review*, 1999, 12(3), 225-239.

Huff, A.S. *Mapping Strategic Thought*,Wiley, Chichester, UK, 1990.

Hodgkinson, G.P. Brown, N.J. Maule, A.J. Glaiser, K.W. Pearson, A.D. "Breaking the Frame: An Analysis of Strategic Cognition and Decision Making Under Uncertainty." *Strategic Management Journal*, 1999, 20, 977-985.

Kellermanns, F.W. Eddleston, K. "Corporate Entrepreneurship in Family Firms: A Family Perspective." *Entrepreneurship Theory and Practice*, 2006, 30(6), 809-830.

Kelly, L. Athanassiou, N. Crittenden, W. "Founder Centrality and Strategic Behavior in Family Owned Firm." *Entrepreneurship Theory and Practice*, 2000, 25(2), 27-42.

Kemmerer, B. Mishra, S. Shenoy, P.P. "*Bayesian Causal Maps as Decision Aids in Venture Capital Decision Making: Methods and Application*." Proceedings- Academy of Management, 2002.

Klein, J.H. Cooper, D.F. "*Cognition Maps on Decision Workers in Complex Games*." The Journal of the Operational Research Society, 33 (1982).

Laukkanen, M. *Comparative Cause Mapping of Organizational Cognition*, in Meindl, J.R. Stubbart, C. Porac, J.F. *Cognition Within and Between Organisations*, Sage, CA, 1996.

Lee, Jean, and Hong Li. *Wealth Doesn't Last 3 Generations – How Family Businesses Can Maintain Prosperity*. World Scientific, 2009.

Lechner, C. Leyronas, C. "Small-Business Group Formation as an Entrepreneurial Development Model." *Entrepreneurship Theory and Practices*, 2009.

Levander, A. Raccuia, I. "Entrepreneurial Profiling – A Cognitive Approach to Entrepreneurship." *Stockholm Business School*, 2001.

Lumpkin, G.T. Dess, G.G. ‘‘Clarifying the Entrepreneurial Orientation to Construct and Linking it to Performance’’, *Academy of Management Review,* 1996, 21(1), 135-72.

Malaysian Construction Industry Masterplan 2009, http://www.cidb.gov.my/v6/?q=en/content/ibs-centre/construction-industry-master-plan-cimp-malaysia, accessed January 2009.

Ministry of Finance, http://www.treasury.gov.my/, accessed May 2008.

Mintzberg, H. Raisinghani, D. Theoret, A. “The Structure of Unstructured Decision Processes.” *Administrative Science Quarterly*, 1976, 21, 247-275.

Mintzberg, H. Westley, F. “Decision Making: It’s Not What You Think.” *MIT Sloan Management Review*, 2001, 42(3), 89-93.

Mitchell, R.K. Busenitz, and Bird, B. Gaglio, C.M. Jeffery, S.M. Morse, E.A., Smith, J.B. “The Central Question in Entrepreneurial Cognition Research 2007”. *Entrepreneurship Theory and Practice*, 2007, 1042-2587, 1-27.

Mitchell, R.K. Busenitz, L.W. Lant, T. McDougall, P.P. Morse, E.A., Smith, J.B. “The Distinctive and Inclusive Domain of Entrepreneurial Cognition Research.” *Entrepreneurship Theory and Practice*, 2004, 505- 93-518.

Mitchell, R.K. Busenitz, L.W. Lant, T. McDougall, P.P. Morse, E.A., Smith, J.B. “Toward a Theory of Entrepreneurial Cognition: Rethinking the People Side of Entrepreneurship Research.” *Entrepreneurship Theory and Practice*, 2004, 1042-258, 93-104.

Mullins, J. Forlani, D. “Perceived Risks and Choices in Entrepreneurs’ New Venture Decisions.” *Journal of Business Venturing*, 2000, 15, 305-322.

Nadkarni, S. Shenoy, P.P. “A Causal Mapping Approach to Constructing Bayesian Networks*.” Decision Support Systems*, 2004 (8), 259-281.

Neubauer, F. and Lank, A. *The Family Business – Its Governance for Sustainability*. Macmillan-London. 1998.

Nordqvist, M. “Familiness in Top Management Teams: Commentary on Ensley and Pearson’s “An Exploratory Comparison of the Behavioural Dynamics of Top Management Teams in Family and Non-Family New Ventures: Cohesion, Conflict, Potency and Consensus”.” *Entrepreneurship Theory and Practice*, 2005, 29(3), 285-291.

Paisner, M. *Sustaining the Family Business*. Perseus Reading, MA, 1999.

Papadakis, V. Lioukas, S. Chambers, D. “Strategic Decision Making Processes: The Role of Management and Context.” *Strategic Management Journal*, 1998, 9, 115-132.

Poza, Ernesto J. *Family Business.* 2nd edition. Thomson South-Western, 2007.

Quinn, J.B. *Strategies for Change: Logical Incrementalism*. Homewood, IL: Irwin, 1980.

Rogoff, E.G. Heck, R.K.Z. "Evolving Research in Entrepreneurship and Family Business: Recognising Family as the Oxygen that Feeds on the Fire of Entrepreneurship." *Journal of Business Venturing*, 2003, 18(5), 559-566.

Ross, L.L. Hall, R.I. "*Influence Diagrams and Organisational Power*." Administrative Science Quarterly 25 (1980).

Sarasvathy, S.D. "Making it Happen: Beyond Theories of the Firm to Theories of Firm Design." *Entrepreneurship: Theory and Practice*, 2004, 519-531.

Schumpeter, J.A. *The Theory of Economic Development*. Harvard University Press, Cambridge, MA, 1934. (first publish in German in 1911).

Shane, S. Cocke, E.A. Collins, C.J. "Entrepreneurial Motivation". *Humans Resource Review*, 2003. 257-279.

Shackle, G. *The Nature of Economic Thought*. Cambridge University Press, Cambridge, 1966.

Shanker, M.C. Astrachan, J.H. "Myths and Realities: Family Businesses' Contribution to the US Economy – A Framework in Accessing Family Business Statistics." *Family Business Review*, 1996, 9(2). 107-123.

Sirmon, D. Hitt, M. "Managing Resources: Linking Unique Resources, Management and Wealth Creation in Family Firms." *Entrepreneurship Theory and Practice*, 2003, 27(4), 339-359.

Speigelhalter, D.J. Dawid, A.P. Lauritzen, Cowell, R.G. "*Bayesian Analysis in Expert Systems*." Statistical Science, 8(3), 1993.

Stake, R. *The Art of Case Research*. Thousand Oaks, CA: Sage Publications, 1995.

Steward, A. "Help One Another, Use One Another: Toward an Anthropology of Family Business." *Entrepreneurship Theory and Practice*, 2003, 27(4), 383-396.

Successful Transgenerational Entrepreneurship Practices (STEP) 2007 Report.

Successful Transgenerational Entrepreneurship Practices (STEP) 2008 Report.

Teece, D. Pisano, G. Shuen, A. "Dynamic Capabilities and Strategic Management." *Strategic Management Journal*, 1997, 18(7), 509-533.

Thaler, R.H. "From *Homo* Economicus to *Homo* Sapiens." *Journal of Economics Perspective*, 2000, 14(1), 133-141.

Tisue, Linda. "Facilitating Dialogue and Decision-Making in a Family Business." Ph.D. diss., The University of Tennessee, Knoxville, 1999.

Tyebjee, T. Bruno, A. "A Model of Venture Capitalist Investment Activity." *Management Science*, 1984, 30, 1051-1066.

Wakefield, M.W. "Antecedents of Conflicts in Family Firms – An Empirical Study." *University of Nebraska, Lincoln* 1995.

Wells, A. "Venture Capital Decision Making." Unpublished Ph.D. diss., Carnegie Mellon University, Pittsburgh, 1974.

Westhead, P. Cowling, M. "Family Business Research: The Need for a Methodological Rethink." *Entrepreneurship: Theory and Practice*, 1998, 23(1). 31-57.

Yin, R. *Case Study Research: Design and Methods* (Rev. ed.). Beverly Hills, CA: Sage Publishing, 1989.

Yin, R. *Case Study Research: Design and Methods.* 2nd edition. Newbury Park, CA. Sage, 1994.

Ucbasaran, D., et al. "The Nature of Entrepreneurial Experience, Business Failure and Comparative Optimism." *Journal of Business Venturing*, 2009, doi:10.1016/j.jbusvent.2009.04.001

Zahra, S.A. "International Expansion of US Manufacturing Family Businesses: The Effect of Ownership and Involvement." *Journal of Business Venturing*, 2003, 18(4), 495-512.

Additional Reading

Alvarez, S.A. Busenitz, L.W. (2004), "The Entrepreneurship of Resource-Based Theory." *Journal of Management 27*, 2004, (2001), 755–775

Bachor, D. "Reformating Reporting Methods of Case Studies." *The Australian Association for Research in Education*, Sydney, New South Wales, Australia. December, 2000.

Bhuian, S.N. Menguc, B. Bell, S.J. "Just Entrepreneurial Enough : The Moderating Effect of Entrepreneurship on the Relationship Between Market Orientation and Performance." *Journal of Business Research*, 2005, 58, 9– 17.

Day, J. Reynolds, P. "Entrepreneurship and the Small to Medium Sized Enterprise: A Divergent / Convergent Paradox in Thinking Patterns Between Advisers and SME Owner-Managers." *Management Decision*, 2006, 44(5), 581-597, Emerald Group Publishing Limited.

Fielden, S.L. Dawe, E. "Entrepreneurship and Social Inclusive." *Women in Management Review*, 2004, 19(3). 139-142, Emerald Group Publishing Limited.

Fillis, I. " A Biographical Approach to Researching Entrepreneurship in the Smaller Firm." *Management Decision*, 2006, 44(2), 198-212, Emerald Group Publishing Limited.

Langowitz, N. *Myths-and-Realities-of-Women-Entrepreneurs*, Babson College, 2004.

Sarasvathy, S.D. *What Makes Entrepreneurs Entrepreneurial*, 2001.

Tarabishy, A. *Identifying Entrepreneurial Leaders*, Today's Dynamic Markets

Verstraete, P.T. "Dialectic Modeling of the Entrepreneurial Phenomenon: A French Point of View." Maitre de Conferences a IÍAE de Lille, 2000.

Politis, D. "The Process of Entrepreneurial Learning : A Conceptual Framework." *Entrepreneurship Theory & Practice*, 2005.

Wickham, P.M. "The Representativeness Heuristics in Judgment in Involving Entrepreneurial Success and Failure." *Management Decision*, 2003.

Zahra, S.A. "International Expansion of U.S. Manufacturing Family Businesses: The Effect of Ownership and Involvement". *Journal of Business Venturing*, 2003. 495-512.

Zahra, S.A. Korri, J.S. Yu, J. "Cognition and International Entrepreneurship: Implications for Research on International Opportunity Recognition and Exploitation". *International Business Review*, 2005. 129-146.

Family Business, Summer 2009, Vol. 20, No.3.

Family Business, Spring 2009, Vol. 20, No.2.

Summary: Co-Solving Entrepreneurial Problems within Business Incubators

Terrence Ogenio, Tiago Ratinho, Rainer Harms

Nikos, School of Management and Governance, University of Twente

The mission of business incubators is to facilitate the creation of new companies as well as providing support in early stages of their development. Research has suggested that this can be achieved by: i) providing tenants with the appropriate resources lowering their liability of newness; ii) helping to create capabilities within the new firm. Yet few studies have discussed the dynamics of resource provision and the potential role of business incubators in creating capabilities within their tenants. In this theoretical contribution, we discuss how incubators can support their tenants' development by helping those solving developmental problems. The supportive environment under which the incubated firms will be studied is located within the University Business Incubator of the University of Twente in Enschede, the Netherlands. The TOP (Temporary Entrepreneurial Placements) programme is an initiative of the University of Twente to provide support to new start-up firms.

The main research question is: How do nascent firms solve problems under business supportive environment? The unit of analyses is the "problem", and can be defined as follows: a problem yields desirable knowledge and capability that improves the efficiency and effectiveness of the firm's development, if successfully solved. Other research questions include; (1) what are the main and secondary problems being confronted by the firms during the incubation stage? (2) Which resources are utilized by the firm in order to solve the problem? (3) What is the effectiveness of the solution found?

We argue that business incubators support new firm development by helping new firms solve critical problems during the incubation period. The conceptualization of opportunity recognition poses problems as the gap between the opportunity and the solution. Business incubators facilitate capability development by providing the firm with additional resources to fill in these gaps. The gap is defined as a problem that yields desirable knowledge and capability which improves the efficiency and effectiveness of the firm's development, if successfully solved. We present three dimensions of problem; the degree of complexity, the type of problem (managerial, technical, financial etc) and the distinction between problems that are deliberately chosen by the firm to solve (the main problems), and problems that firms stumble upon after the main problem is chosen (secondary problems). We further argue that the search strategy a firm pursuits to find an effective solution is related to the complexity and type of the main and secondary problems. The effectiveness of the problem co-solving is the extent to which a problem is solved after the utilization of the business incubators resources by the firm.

A multiple case study strategy will be used to analyze the events that occurred during the incubation phase. Data will be collected through in-depth interviews, additional data will be collected through analyzes of business plans and other documents produced during the incubation phase. The research is currently in the data collection phase. This study differentiates itself by focusing on the dynamics of resource provision and the potential role of business incubators in creating capabilities within their tenants. Results of this study will contribute to the incubatee development research stream.

SMALL FIRMS MORE OFTEN DEVELOP STRATEGIES FOR OPPORTUNITIES INSTEAD OF OPPORTUNITIES FOR STRATEGIES, WHICH FREQUENTLY LEADS TO NO-GO DECISIONS

A comparative case study on foreign entry into China

Maud Oortwijn

Warwick Business School
The University of Warwick
Coventry, CV4 7AL
United Kingdom
E-mail: maud_oortwijn@hotmail.com

Small firms often develop strategies for opportunities instead of opportunities for strategies, which frequently leads to No-Go decisions;

A comparative case study on foreign entry into China

Abstract

In an uncertain, unknown foreign business environment small firms face a high chance of faillure, as they base international expansion more often on one local opportunity.

A total of 25 Dutch firms are studied while making Go/No-Go decisions for 54 business activities in or with China. The research is unique in that it follows firms of different size over time, while they make highly strategic choices in an uncertain and unknown foreign business environment. Insight is gathered on firm characteristics, opportunity identification, the strategic advantage, the Go/No-Go decision and the strategy process leading to these choices.

The study shows how small firms more often build an international business strategy around one concrete opportunity in China. Other firms first identify a strategic advantage beneficial for the firm, after which they search for opportunities in China to fulfill these. When faced with disappointment, firms who seek opportunities in China for a strategic need, frequently postpone plans or continue to search for opportunities elsewhere. Small firms who develop a strategy that is triggered by a concrete opportunity in China, cancel the internationalization plan entirely when the opportunity considered is disappointing.

§ 1. Introduction

Entrepreneurial behaviour is necessary for firms to establish, improve or maintain position in competitive environments (Miller, 1983; Entrialgo, 2000). The need to innovate increased in the past decade due to technological advancements, strong global competition and a financially constrained environment (Phan, 2009). Managers in firms of all firm size and firm age need to be entrepreneurial to develop and realize profitable strategic change (Entrialgo, 2000). An objective of this study is to learn more about the process and outcome of entrepreneurial behaviour within small firms compared to larger firms.

Entrepreneurial behaviour is strategic behaviour to renew a company and create new businesses (Baron, 2006). *Opportunity recognition* is thus at the heart of the entrepreneurial process (Baron, 2006; Puhakka, 2007). Entrepreneurship focuses on newness and novelty in the form of new products, new processes, new markets or new geographical regions (Ireland, 2003). It concerns identification and exploitation of previously unexplored opportunities in order to increase profitability (Hitt, 2001; Ireland, 2003).

To realize potential wealth from opportunities, another key aspect of entrepreneurial behaviour is *strategic advantage creation*. The exploitation of new opportunities contributes to the creation of sustainable competitive advantage and wealth. It involves development and realization of strategic change, requiring strategic management capabilities within the firm.

Opportunity recognition and strategic advantage creation (strategy idea development and strategy realization) are essential for growth and survival of all firms, both small and large, new and established (Ireland, 2003). Opportunity recognition and strategic advantage creation are not necessarily two separate steps in the strategy process that follow eachother in this order.

International expansion

Internationalization provides a good opportunity to study the entrepreneurial strategy process within firms of various size and age (Dess, 2003). Globalization and increased competitiveness encourages firms of all size and age to expand internationally. As the internationalization of business continues to accelerate, companies need to invest in developing capabilities to identify and exploit new opportunities abroad (Zahra, 2001). The entrepreneurial strategy process of internationalization typically requires advanced levels of entrepreneurial capabilities for both opportunity identification and strategic advantage creation (Zahra, 2005). Both aspects are challenging in an unknown, uncertain environment.

Until recently the general opinion was that firm age positively relates to international business success (Oviatt, 2005). The well-known Uppsala theory of internationalization (Johanson, 1977) claims that SME can not internationalize from the outset, as firms need to first build resources and experience in the domestic market (Wright, 2007). The basic premise of the internationalization process view is that firms increase commitment to foreign markets with growing experience in international business (Johanson, 1977). Traditionally, International Business scholars assumed that especially larger and more experienced firms expand into new and unknown markets, as these have the resources and capabilities to invest in development of uncertain strategic plans abroad.

Recent work on international new ventures shows that in present times, international expansion is not exclusively an activity for larger and established firms (Kuemmerle, 2002; Oviatt, 2005; Zahra, 2005). Technological advancements and the growing international experience of people increases the geographical scope accessible for small firms (Oviatt, 2005). The success rate of these international new ventures creates renewed attention for the relation between firm maturity and international business activities (Autio, 2002; Oviatt, 2005; Zahra, 2005). It changes how the Internationalization process is studied and opens the way to more complex analysis on international expansion of both small and larger firms with more or less experience in international business (Oortwijn, 2006).

Strategy process for SME and larger firms

Strategic management capabilities and entrepreneurial capabilities are essential for international expansion of firms (Hitt, 2001; Ireland, 2003). Entrepreneurial small firms tend to excel in opportunity-identification, but are less effective in developing competitive advantages needed to appropriate value from those opportunities (Hitt, 2001; Ireland, 2003). Established, large firms typically better create strategic advantage, but focus less on identification of new opportunities (Ireland, 2003).

Entrepreneurs inside organizations and independent entrepreneurs should spend sufficient time on opportunity discovery, because time invested in this phase affects performance of the

furture business (Puhakka, 2007). The growth of new business is highly dependent on proactive behaviour in the opportunity discovery phase (Puhakka, 2007). In identification and exploitation of opportunities larger established firms should have an advantage, given their access to human and financial resources, social networks, knowledge and experience (Phan, 2009).This allows larger corporations to scan the environment and pro-acticely search for *new opportunities*. In practice, entrepreneurs often possess special talents for opportunity identification.

During the *strategy development* process, managers and entrepreneurs conceptualize rough ideas into business models (Baron, 2006). Firm size influences the strategy development process, as larger firms can afford to invest more in information gathering on markets abroad. They have the resources to evaluate the potential more realistically and can realize the benefits before any small firm or startup could (Phan, 2009). For complex decisions, the amount of information to be processed is enormous. Strategy development for an international business plan within small firms is often extra challenging (Knight, 2009). Given the limited financial and human resources available, international strategies are more often based on know-how, skills and general business competences of the individual decision maker (Knight, 2009). Small firms also have advantages, as they are less burdened with organizational inertial forces, they have founders in control so that new opportunities do not have to struggle for management attention and, moreover, information is processed quicker throughout the organization (Oviatt, 1994). Despite the fact that the chance of success for larger firms might be higher, exploring new opportunities remains an uncertain activity in which not all managers in large corporations prefer to participate. Entrance into foreign and unknown territories is a highly uncertain and high risk strategic move. Entrepreneurs are known to take higher risk compared to managers in larger firms (Stewart, 1999; Entrialgo, 2000; McMullen, 2006). Furthermore, within established firms, new opportunities might limit the value of the firm's current goods or services.

In implementation, small firms often lack spare resources to realize uncertain plans, decreasing the likeliness of *strategy realization*. Small firms less often have spare human resources available and are generally less experienced in managing business expansion. With increasing firm size, there is better access to financial assets to support investments abroad and realize strategic change (Davis, 2000). Larger firms tend to opt for higher commitment and higher risk entry modes, while SMEs often decide on low equity and cooperative strategies (Kogut, 1988; Agarwal, 1992; Brouthers, 2004; Gemser, 2004). On the other hand, established companies face added complexity which needs to be managed when internationalizing (Zahra, 2005).

Both opportunity identification and strategic management capabilities are required to generate competitive advantage in international expansion. Differences in performance occur from the quality of the opportunity, the location and context, and the modus of strategy realization (Zahra, 2005). Small and larger firms have different capabilities in these areas and manage the strategy process differently.

Scope and research questions

International expansion is ideally suited to study how firms of different firm size organize the strategy process to reap new opportunities. The decision of conducting business in or with

foreign countries is highly strategic and full of uncertainties. Especially in foreign markets, firm expansion requires advanced skills in opportunity identification and advantage creation.

The main aim of this study is to learn how firm size, firm age and international experience relate to the entrance Go/No-Go decision outcome and the strategy process towards it.

- *How does firm size relate to the outcome of the entrance Go/No-Go decision?*
- *What process leads to a decision to cancel the international business plans?*
- *What is the relation between firm size, firm age, previous business experience and the origin of the plan to the outcome of the entrance Go/No-Go decision?*

The present paper reports on the strategy process of internationalization, including both the process and the outcome of foreign entry choices. The research conducted contains longitidunal comparative case studies of 54 plans from Dutch firms for business activities in or with China. These international expansion plans all concern new activities in foreign territories. Data is gathered on firm characteristics, opportunity identification, strategic advantage seeking, the Go/No-Go decision and the strategy process leading to this choice.

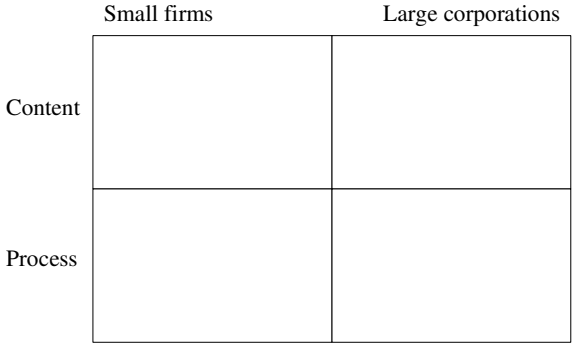


Figure 1: Typology of internationalization research

The academic domain of research on internationalization can be defined according to figure 1. Existing work on internationalization mostly concerns the content of choices and is conducted with larger firms, though some studies focus on small and/or startup firms (Dess, 2003; Oviatt, 2005; Zahra, 2005). Hardly any work covers the full range of firm size and age (Osborn, 1990; Dess, 2003; Keupp, 2009; Knight, 2009). So far, to the best of my knowledge, no studies report on small and larger firms, covering both the process and outcome of internationalization decisions (Dess, 2003). The present work is unique in that it allows for comparison of the strategy process and outcome of firms of different size, firm age and international business experience.

§ 2. Method

The study reports on the process and the outcome of the foreign entrance decision process. During 2006 and 2007, a number of 25 Dutch firms are studied while they consider to conduct business in or with China. This results in a comparative case study on a total of 54

entrance plans for business activities in or with China. Data is gathered by conductinhg several short telephonic interviews with the main decision maker during the time period, followed by an in-depth semi-structured interview of several hours conducted after choices for entrance are made by the firm. Before any interviews takes place, documentation on the company background is collected through desk research, e.g. internet search, company website, and if available annual report.

The process and outcome of the entrance plans are compared for firms of various *firm size*, *firm age* and *international business experience*.

The number of employees is measured to capture *firm size* (Coviello, 2003), applying below definition of firm size:

- Small firm: 1-50 employees
- Medium sized firm: 51-250 employees
- Large firm: 251-1000 employees
- Large corporations: >1000 employees

Previous business experience is made operational in *firm age* and *international business experience*. The definition for the level of international business experience is simply a division between firms with no previous international business activities and firms with previous international business activities (sales, production or purchasing).

The set of cases studied is well balanced with regard to firm and investment characteristics (Eisenhardt, 1989; Bell, 2004). The selection criteria for the cases are well-known influencing factors for foreign entry choices, e.g. foreign entrance motivation, firm size, industry and level of international business experience of the firm. As a result, findings are grounded in varied empirical evidence (Eisenhardt, 2007).

An important limitation in existing internationalization research is that most data is gathered post entrance. Due to the origin of the statistical data for these studies, the companies analyzed are those that indeed decided on entrance into the host country and are still present. This paper provides unique access to companies *before* the entrance decision. The findings reveal four different outcomes of the Go/No-Go decision, e.g. cancel, postpone, continue, alter.

§ 3. Results

A total of 54 entrance plans are studied as evolved within 25 firms of varying firm size. This paper reports on the process and outcome of 54 Go/No-Go decisions. The 20 entrance plans within small firms are discussed more in-depth below, covering the origin, the process and the outcome of the entrance decisions. Small firms more often than larger firms decide not to continue business activities in or with China. The results reveal what circumstances lead to cancelation of plans for small firms.

Outcome of the Go/No-Go decision

Of the 54 investment plans under consideration, only 33 continue in a manner similar to what was intended. Seven plans are seriously altered, e.g. continue in a different host country or with a different entry mode. Six plans are postponed and eight plans cancelled altogether. Especially small firms have a low rate of continuation for plans (figure 2).

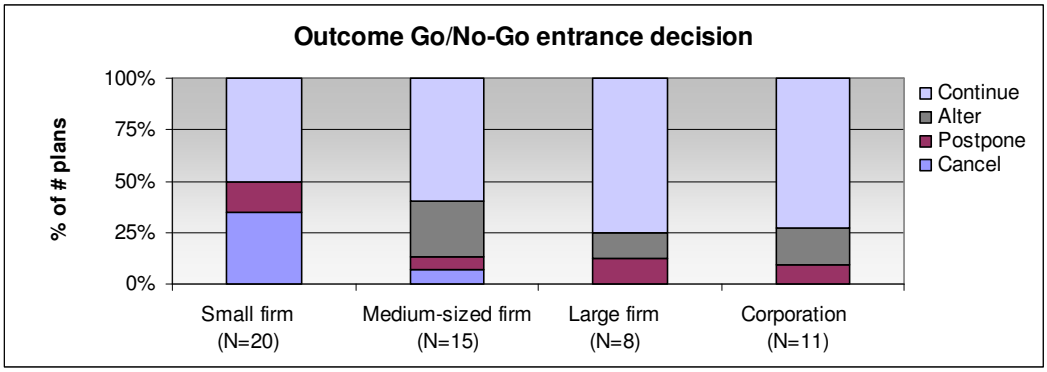


Figure 2: Outcome Go/No-Go decisions for 54 investment plans

The analysis of the outcomes of the Go/No-Go decision reveals how ten of the twenty plans of small firms do not continue, e.g. either are canceled (seven plans) or postponed for an unknown period of time (three plans). None of the small firms seriously alter a plan, e.g. moving forward with a plan with an entry mode or host country different from what is considered initially.

Large firms and corporations do not cancel any of the plans, while they do alter or postpone plans. The percentage of plans that continue increases with firm size.

How entrance choices are canceled

The three small firms who cancel in total seven plans for China, went through a similar process. All three firms are startups with an international business plan, e.g. they would have been born globals. The plans are based on an existing personal relationship in China. This personal relationship is considered an unique advantage and it in fact triggers the intention to develop business activities in China.

Below event flow matrix presents the events that occur in order of appearance (Miles, 1984).

Event flow	Firm 1	Firm 2	Firm 3
Become aware of network	Parents and brother of a Dutch entrepreneur live in China (and are Chinese).	Two Dutch brothers have a Dutch-Chinese friend with family in China.	Former boss of a Dutch entrepreneur joins a Chinese firm in China.
Share intentions business	The brother in China is searching for a job opportunity in business, and his Dutch-Chinese	The two Dutch brothers together with the Dutch-Chinese friend decide to start a business in China.	The former boss offers the Dutch entrepreneur a sales channel through the Chinese firm he

	sister wants to help.		now works for.
Develop business context	The Dutch entrepreneur meets exporter of silk Chinese sjawls and develops a plan to import certain silk products.	Local family invests in retail real estate and offers this at no rent if their daughter can become (local) manager.	The entrepreneur becomes a member of the local organization to gain legitimacy in the Chinese network.
Define opportunity	The Chinese operations are considered "easy", as the family/brother takes care of everything local, which helps her brother.	Decisions are made on the product category. Future position of the Dutch entrepreneurs (trade or retail) remain uncertain.	Business plan is to export products to China and import products to Europe, to sell through TellSell.
Start implementation	After the brother agrees, they together select the manufacturers in China.	After the retail location is bought by the local family partner, the Dutch entrepreneurs select an import agent in China.	An office is set-up in China at low cost and the first employee hired.
Define business plan	Then the Dutch entrepreneur starts developing the product business positioning and Marketing & Sales plan.	Four different business plans are developed. How the two firms divide roles and work together is still unclear.	Searching the markets for products that are suitable for EU TellSell or Chinese TellSell channels.
Perceive hurddles	Marketing & Sales is difficult in a business sector they normally do not work in.	The family in China is not moving forward and this is causing serious delays.	The EU TellSell channel is largely mature and products are difficult to find.
Decide to cancel	The entrepreneur hands over the plans to another Dutch entrepreneur, due to a lack of time.	The plan is canceled alltogether, as success depends on involvement of the local partner.	A refocus to a new business opportunity elsewhere, which seems more promising.

Table 1: Event flow analysis for small firms that cancel plans

The firms that cancel plans for China are all startups with limited international business experience and limited experience in China. The opportunities they pursue, are triggered by a personal relationship. When progress is dissatisfying or the relationship is perceived less as an advantage, the entrepreneurs do not continue the plans and stop the startup entirely. They do not have the time, experience, or resources to develop the business opportunity independently of the preferred local partner.

Below, the 20 entrance Go/No-Go decision of all small firms are compared, based on the firm experience, firm age and origin of the entrance plan.

Opportunity versus strategy driven plans of small firms

Table 2 reports on a comparison across all small firm cases. It reveals how opportunity driven startup firms, regularly *cancel* their plans for international business activities in China. These small firms who cancel plans: a) are not experienced in international business, b) are younger than 5 years and c) base the entrance plan on a specific local opportunity.

Small firms that a) are not experienced in international business, b) are younger than 5 years but c) do base the entrance plan on a strategic need from within the firm, generally do find ways to continue business activities, despite any hurddles along the way. They search for local partners with whom they can work and simply continue the search until a solution is

found. These firms, despite a lack of a social network and international business experience, are determined to find opportunities to realize their strategic objectives in China.

	Firm experience IB	Firm age	Origin of the plan	Go/No-Go decision
1	No activities IB	<5 years	Opportunity driven	Cancel
2	No activities IB	<5 years	Opportunity driven	Cancel
3	No activities IB	<5 years	Opportunity driven	Cancel
4	No activities IB	<5 years	Opportunity driven	Cancel
5	No activities IB	<5 years	Opportunity driven	Cancel
6	No activities IB	<5 years	Opportunity driven	Cancel
7	No activities IB	<5 years	Opportunity driven	Cancel
8	Experienced in IB	5-15 years	Strategy driven	Postpone
9	Experienced in IB	15-25 years	Strategy driven	Postpone
10	Experienced in IB	15-25 years	Strategy driven	Postpone
11	No activities IB	<5 years	Strategy driven	Continue
12	No activities IB	<5 years	Strategy driven	Continue
13	Experienced in IB	15-25 years	Strategy driven	Continue
14	Experienced in IB	5-15 years	Strategy driven	Continue
15	Experienced in IB	15-25 years	Strategy driven	Continue
16	Experienced in IB	15-25 years	Strategy driven	Continue
17	No activities IB	<5 years	Strategy driven	Continue
18	Experienced in IB	5-15 years	Strategy driven	Continue
19	Experienced in IB	5-15 years	Strategy driven	Continue
20	No activities IB	<5 years	Strategy driven	Continue

Table 2: Small firm characteristics, origin and outcome of the entrance plan Go/No-Go decision

Firms that *postpone* activities, are more experienced firms with an existing strategic plan for which they seek opportunities. The firms that postpone plans are a) more experienced in international business, b) older than 5 years, and c) search for opportunities to fulfil an strategic objective (table 2). The strategic need is formulated within the firm and triggers a search for business opportunities in China.

The firms who simply *continue* plans in China are a varied mixture in terms of international business experience and firm age. Small firms that continue have in common with firms that postpone, that they develop entrance plans to fulfill an existing strategic need of the firm, instead of developing an entrance plan around an opportunity in China.

Of the firms that are medium-sized, large, or a large corporation, only one other firm did not seek opportunities in China based on an existing strategic firm needs. This was a medium-

sized firm with no previous international business experience. It resulted in cancelation of their entrance plan.

§4. Discussion and Conclusion

The general perception is that entrepreneurs are better in realizing wealth from new opportunities. The present study shows how in an uncertain, foreign enviroment entrepreneurs have a lower chance of realizing a strategic advantage from new opportunities. The cases reveal how entrepreneurs often do not invest beyond a major dissapointment. A closer analysis comparing various cases shows how specifically strategic plans triggered by a concrete local opportunity have a smaller chance of realization.

Outcome of the entrance decision

Small firms more often cancel plans. Of the 20 international business plans of small firms, seven are canceled. These are small startup firms with no previous international business experience. What the companies also have in common is that a concrete opportunity in China triggered the intention to conduct business in or with China. The perceived opportunity is often based on a personal relationship, which is seen as a unique competitive advantage for business. It triggers the entrepreneurs to develop a strategic advantage from this opportunity (Zain, 2006). When the local contact does not deliver or the relationship is less solid than expected, these small firms do not search for new opportunities (with or without other local partners) to realize a strategic advantage. Small firms rely more on local partners -with whom they often have a personal relationship- to help set up international business activities (Coveillo, 1995; Oviatt, 2005; Zain, 2006). This more often results in a No-Go decision.

Entry commitment is related to firm size (Padmanabhan, 1999; Cho, 2005). Due to limited resources, the continuation rate of entrance within small firms is lower compared to larger and more experienced firms (table 1). Smaller firms often do not have the resources to invest beyond the initial disappointment or are simply less committed to international expansion to make the additional resources available (Davis, 2000; Graves, 2008). Larger firms more often decide to postpone or alter approaches to invest further in a search for new opportunities and fulfil strategic needs. Small firms can not afford to commit more resources to high risk projects. Larger firms do have slack resources which they not only can dedicate to the high-risk foreign expansion, but also can risk loosing. This makes them less vulnerable to failure (Osborn, 1990).

Internationalization process

The study reveals how increasing international business experience, firm age and firm size relate to a higher continuation rate in the Go/No-Go decision (figure 2 and table 2). Entry commitment is related to firm age, firm size and firm experience (Padmanabhan, 1999; Cho, 2005). The present study confirms that firm size relates to a positive entrance Go/No-Go decision (figure 1). Increasing firm age relates to a higher tendency to commit to an investment plan (table 2). And small firms with limited international business experience

more often cancel plans (table 2). All firms who cancel plans are firms with no international business experience.

The question remains: Is it firm age, size or experience that creates the advantage associated with international expansion (Zahra, 2005). The findings do not support without any doubt the traditional Internationalization process theory premise that firms should first build resources and experience in the domestic market, before international business experience can be developed (Wright, 2004). While all firms who cancel are relatively young and inexperienced in international business, these characteristics do not automatically lead to cancelation in this phase. Table 2 shows how entrepreneurs can and do start international new ventures (Zahra, 2005). A different factor that might explain the outcome of cancellation is found in the order in which steps in the strategy process are taken.

Strategy driven versus opportunity driven

When reviewing the entire population of firms studied, most firms already have strategic advantages defined for international business activities before searching for opportunities available abroad (table 2). Generally, firms aim to realize a specific strategic advantage in international territory. This awareness of a firm's strategic need is what initiates the search for opportunities abroad, while simultaniously the strategic plan is developed in more detail. This is different for firms who cancel. Small firms more often initiate international business plans when triggered by a perceived opportunity in the form of a strong network relationship in China. These are the small firms that cancel plans for China. The findings suggest this is why more young, small, inexperienced firms arrive at a No-Go decision.

Previous work finds that large multinational firms generally adopt a process based approach for internationalization choices, while SME decisions are strongly influenced by the perspectives of individual decision makers within the firm (Collinson, 2005). We confirm small firms more often start internationalization based on one perceived opportunity. These small firms end up canceling plans. Other small start-up firms however, do initiate an active search for opportunities to realize an identified strategic advantage in international business. These small firms in our study decide to continue to conduct business in or with China. The higher rate of cancelation is related to firms that develop the internationalization plan because of a concrete local opportunity.

Suggestions for future research

An awareness and understanding of entrepreneurial behaviour within small and larger, new and established firms, helps to gain insight in economic growth, wealth creation and firm survival (Chandler, 2009). The present work reveals how certain small firms arrive at No-Go decisions. A limitation of the work is that it is conducted on foreign entry decisions of only 25 Dutch firms evaluating business opportunities for China. Additional research is recommended with larger sample sizes including various home and host countries, to make sure the most relevant factors for the outcome of the entrance decision are identified.

The present study reports on what triggers the strategy process for developing opportunities in China. For future work, a more detailed process analysis on the entire entry strategy

process is recommended comparing firms of different firm size, to understand how various firms arrive at entry choices (Harris, 2000; Sarasvathy, 2001; Chandler, 2009).

References

Agarwal, S., Ramaswami, S.N. (1992). "Choice of foreign market entry mode: Impact of Ownership, Location and Internationalization factors." Journal of International Business Studies **23**(1): 1-27.

Autio, E., Lummaa, H., Arenius, P. (2002). Emergent "Born globals": Crafting early and rapid internationalization strategies in technology-based new firms. Working paper, Espoo, Finland.

Baron, R. A. (2006). "Opportunity recognition as pattern recognition: How entrepreneurs "connect the dots" to identify new business opportunities." Academy of Management perspectives **20**(1): 104-119.

Bell, J., Crick, D., Young, S. (2004). "Small firm internationalization and business strategy." International Small Business Journal **22**(1): 23-56.

Brouthers, K. D., Nakos, G. (2004). "SME entry mode choice and performance: A transaction cost perspective." Entrepreneurship Theory and Practice **28**(3): 229-247.

Chandler, G. N., DeTienne, D.R., McKelvie, A., Mumford, T.V. (2009). "Causation and effectuation processes: A validation study." Journal of Business Venturing.

Cho, K. R., Padmanabhan, P. (2005). "Revisiting the role of cultural distance in MNC's foreign ownership mode choice: The moderating effect of experience attributes." International Marketing Review **14**(3): 307-324.

Collinson, S., Houlden, J. (2005). "Decision-making and market orientation in the internationalization process of small and medium-sized firms." Management International Review **45**(4): 413-436.

Coveillo, N. E., Munro, H.J. (1995). "Growing the entrepreneurial firm: Networking for international market development." European Journal of Marketing **29**(7): 49-61.

Coviello, N. E., Jones, M.V. (2003). "Methodological issues in international entrepreneurship research." Journal of Business Venturing **19**(4): 485-508.

Davis, P. S., Desai, A.B., Francis, J.D. (2000). "Mode of international entry: An isomorphism perspective." Journal of International Business Studies **31**(2): 239-258.

Dess, G. G., Ireland, R.D., Zahra, S.A., Floyd, S.W., Janney, J.J., Lane, P.J. (2003). "Emerging issues in corporate entrepreneurship." Journal of Management **29**(3): 351-378.

Eisenhardt, K. M. (1989). "Building theories from case study research." Academy of Management Review **14**(4): 532-550.

Eisenhardt, K. M., Graebner, M. E (2007). "Theory building from cases: Opportunities and challenges." Academy of Management Journal **50**(1): 25-32.

Entrialgo, M., Fernández, E., Vázquez, C.J. (2000). "Linking entrepreneurship and strategic management: evidence from Spanish SMEs." Technovation **20**(8): 427-436.

Gemser, G., Brand, M.J., Sorge, A. (2004). "Exploring the internationalisation process of small businesses: A study of Dutch old and new economy firms." Management International Review **44**(2): 127-150.

Graves, C., Thomas, J. (2008). "Determinants of the internationalization path of family firms: An examination of family influence." Family Business Review **21**(2): 151-167.

Harris, S., Forbes, T. (2000). "Taught and enacted strategic approaches in young enterprises." International Journal of Entrepreneurial Behaviour & Research **6**(3): 125-144.

Hitt, M. A., Ireland, R.D., Camp, S.M., Sexton, D.L. (2001). "Strategic entrepreneurship: Entrepreneurial strategies for wealth creation." Strategic Management Journal **22**: 479-491.

Ireland, R. D., Hitt, M.A., Sirmon, D.G. (2003). "A model of strategic entrepreneurship: The construct and its dimensions " Journal of Management **29**: 963-989.
Johanson, J., Vahlne, J.E. (1977). "The internationalization process of the firm: A model of knowledge development and increasing foreign market commitment." Journal of International Business Studies **8**(1): 23-32.
Keupp, M. M., Gassmann, O. (2009). "The Past and the Future of International Entrepreneurship: A Review and Suggestions for Developing the Field." Journal of Management **35**: 600 - 633.
Knight, G. A., Kim, D. (2009). "International business competence and the contemporary firm." Journal of International Business Studies **40**(2): 255-273.
Kogut, B., Singh, H. (1988). "The effect of national culture on the choice of entry mode." Journal of International Business Studies **19**(3): 411-432.
Kuemmerle, W. (2002). "Home base and knowledge management in international ventures." Journal of Business Venturing **17**(2): 99-122.
McMullen, J. S., Shepherd, D.A. (2006). "Entrepreneurial action and the role of uncertainty in the theory of the entrepreneur." Academy of Management Review **31**(1): 132-152.
Miles, M. B., Huberman, A.M. (1984). Qualitative data analysis: A sourcebook of new methods. Beverly Hills (USA), Sage Publishing.
Miller, D. (1983). "The correlates of entrepreneurship in three types of firms." Management Science **29**(7): 770-791.
Oortwijn, M. (2006). How do companies arrive at entry mode choices? A multilevel process analysis of entry mode decision making of Dutch companies' entry into China. Judge Business School. Cambridge, University of Cambridge. **MPhil:** 63.
Osborn, R. N., Baughn, C.C. (1990). "Forms of interorganizational governance for multinational alliances." Academy of Management Journal **33**(3): 503-519.
Oviatt, B., McDougall, P.P. (1994). "Towards a theory of international new ventures." Journal of International Business Studies **25**(1): 45-64.
Oviatt, B., McDougall, P.P. (2005). "Towards a theory of international new ventures." Journal of International Business Studies **36**: 29-41.
Padmanabhan, P., Cho, K.R. (1999). "Decision specific experience in foreign ownership and establishment strategies: Evidence from Japanese Firms." Journal of International Business Studies **30**(1): 25-41.
Phan, P. H., Wright, M., Ucbasaran, D., Tan, W.-L. (2009). "Corporate entrepreneurship: Current research and future directions." Journal of Business Venturing **24**(3): 197-205.
Puhakka, V. (2007). "Effects of opportunity discovery strategies of entrepreneurs on performance of new ventures." Journal of Entrepreneurship **16**(1): 19-51.
Sarasvathy, S. (2001). "Causation and effectuation: toward a theoretical shift from economic inevitability to entrepreneurial contingency." Academy of Management Journal Review **26**(2): 243–263.
Stewart, W. H. J., Watson, W.E., Carland, J.C., Carland, J.W. (1999). " A proclivity for entrepreneurship: A comparison of entrepreneurs, small business owners, and corporate managers." Journal of Business Venturing **14**(2): 189-214.
Wright, M., Westhead, P., Ucbasaran, D. (2007). "Internationalization of small and medium-sized enterprises (SMEs) and international entrepreneurship: A critique and policy implication." Regional Studies **41**(7): 1013-1029.
Wright, R. (2004). "Top managers' strategic cognitions of the strategy making process: Differences between high and low performing firms." Journal of General Management **30**(1): 61-78.

Zahra, S. A. (2005). "A theory of international new ventures: A decade of research." Journal of International Business Studies **36**: 20-28.
Zahra, S. A., Hayton, J., Marcel, J., O`Neill, H. (2001). "Fostering entrepreneurship during international expansion: Managing key challenges." European Management Journal **19**(4): 359-369.
Zahra, S. A., Korri, J.S., Yu, J. (2005). "Cognition and international entrepreneurship: Implications for research on international opportunity recognition and exploitation." International Business Review **14**: 129-146.
Zahra, S. A., Santeri Korri, J.S., Yu, J.F. (2005). "Cognition and international entrepreneurship: implications for research on international opportunity recognition and exploitation." International Business Review **14**(2): 129-146.
Zain, M., Ng, S.I. (2006). "The impact of network relationships on SMEs' internationalization process." Thunderbird International Business Review **48**(2): 183-205.

AN OPPORTUNITY-BASED APPROACH TO INTERNATIONAL ENTREPRENEURSHIP: PURSUING OPPORTUNITIES INTERNATIONALLY THROUGH PROSPECTION

Manjo Oyson[1], D. Hugh Whittaker[2]

[1]University of Auckland Business School, Auckland, New Zealand, m.oyson@auckland.ac.nz
[2]University of Auckland, New Zealand, h.whittaker@auckland.ac.nz

This paper argues for a better understanding of entrepreneurship in international entrepreneurship – the 'E in IE'. The paper suggests that the central role of opportunity formation and exploitation in entrepreneurship research should be fully explored in IE. The entrepreneur-firm-opportunity nexus in internationalisation is examined through an opportunity-based approach (OBA). This suggests that the process of internationalisation may be conceived as the formation and exploitation of international entrepreneurial opportunities. The subjective, entrepreneurial ability to create an imagined future – 'prospection' – is examined to show how entrepreneurs use prospection to: creatively imagine combinations of firm capabilities and market opportunities to form entrepreneurial opportunities. A typology of entrepreneurial opportunity formation is advanced which distinguishes between opportunity discovery, development, construction, and creation. The paper concludes by suggesting how the OBA can help explain the choice of foreign markets, early internationalisation, speed of internationalisation, and foreign entry modes.

Keywords
Entrepreneurship; entrepreneurial opportunity; firm capability; international entrepreneurship; opportunity discovery; opportunity creation

1. Introduction

The increasing number of small firms actively pursuing internationalisation strategies (McDougall and Oviatt, 2000) and venturing into international markets has led to greater interest in international entrepreneurship (Chandra, et al., 2009). Many small firms also appear to be internationalising at an earlier age (Andersson, et al., 2004), even at or near inception (McDougall, et al., 1994). The need to understand the phenomenon of firm internationalisation better has led to research along three areas: the process of internationalisation (Bilkey and Tesar, 1977; Cavusgil, 1980; Bell, 1995), the drivers of internationalisation (Zucchella, et al., 2007), and the mediating factors that influence internationalisation (Cavusgil and Naor, 1987; Andersson, et al, 2004).

Johanson and Vahlne (1977) proposed a *process* model of internationalisation (the 'Uppsala model') that showed the internationalisation process as evolving through stages whereby

internationalising firms first export 'to a country via an agent, later establish a sales subsidiary, and eventually, in some cases, begin production in the host country' (p. 24). Bilkey and Tesar (1977), Czinkota (1982), and Cavusgil (1980), introduced alternative internationalisation models (innovation-related models: Andersen, 1993) that also described firm internationalisation as evolving through different stages. Such internationalising firms were thought to go international 'in a slow and incremental manner' like 'rings in the water', to gradually gain market knowledge in order to reduce uncertainty and risk (Madsen and Servais, 1997: 561-562). While gaining considerable support, these models have also drawn criticism (Bell, 1995). Cannon and Willis (1981) questioned the assumptions of incremental, step-by-step internationalisation, arguing that many internationalising firms jump stages to hasten the internationalisation process. Reid (1984) found existing models too deterministic and suggested a contingent view of internationalisation. McDougall, Shane et al. (1994) pointed to the failure of the stage-model and innovation-related models to account for the rise of international new ventures (INVs) that not only skipped stages of internationalisation, but went international from inception.

Other scholars have sought to analyse firm internationalisation on the basis of *drivers* of firm internationalisation. The acquisition of experiential knowledge to deal with uncertainty associated with internationalisation has been cited by both the Uppsala and innovation-related model researches as influencing the gradual pattern of firm internationalisation (Andersen, 1993). But the emergence of INVs that have successfully internationalised despite the absence of experiential knowledge casts doubts on this theory. Resources, following the resource-based view of Barney (1991), have also been examined. Kundu and Katz (2003) reported that entrepreneurial resources such as higher levels of education of the entrepreneur correlated with greater willingness to explore foreign markets. Westhead, et al. (2001) pointed to the specific industry know-how of firm founders as strong predictors of firm internationalisation. Yet there is also evidence that highly-resourced firms do not necessarily internationalise, and that some under-resourced firms have overcome resource constraints (Coviello and Munro, 1995). A network-view has been suggested by Johanson and Mattson (1988) to show that building networks with other independent firms facilitates internationalisation. Still, not all firms internationalise, with the benefit of networks, either (McDougall, et al., 1994).

Studies on mediating factors that influence internationalisation have focused on the objective dimensions of the entrepreneur such as education, experience from living abroad, internationally-oriented jobs, and international work experience (Bloodgood, et al., 1996; Madsen and Servais, 1997), to determine whether they correspond with likelihood of firm internationalisation. However, Cavusgil and Naor (1987) showed age, education, place of college education, and foreign language skills to be poor discriminating variables between exporters and nonexporters. Andersson et al. (2004) found no support for the link between the age of the entrepreneur and international activities.

While objective factors have been explored, the subjective dimensions of the entrepreneur – how the entrepreneur perceives and decides to pursue international entrepreneurial opportunities – remain largely unexplored. An argument can be made for greater attention to these entrepreneurial subjective dimensions. The complaint of Baumol (1968: 66) that an 'entrepreneurship study that does not take into account the entrepreneur is like a study of Shakespeare in which the Prince of Denmark has been expunged from the discussion of *Hamlet*'

is just as applicable to international entrepreneurship. There is a need to bring the entrepreneur back into international entrepreneurship, as there can be no international entrepreneurship without the entrepreneur. Oviatt and McDougall (2005: 540) had defined international entrepreneurship as *'the discovery, enactment, evaluation, and exploitation of opportunities – across national borders – to create future goods and services'***;** it is the entrepreneur who discovers, enacts, and evaluates opportunities, and who decides whether the firm should exploit international opportunities.

Drawing on the entrepreneurship literature, and building on IE literature, the emphasis of this paper is on the role of opportunities and the entrepreneur-firm-opportunity nexus in internationalisation. An *opportunity-based approach* (OBA) to international entrepreneurship is advanced to argue that the process of internationalisation may be seen as the formation and exploitation of international entrepreneurial opportunities. The subjective, entrepreneurial ability to create an imagined future – 'prospection' – is examined to show how entrepreneurs use prospection to: creatively imagine combinations of firm capabilities and market opportunities to form entrepreneurial opportunities, and deal with the uncertainty inherent in internationalisation. A typology of entrepreneurial opportunity formation is advanced to explore opportunity discovery and the dimensions of opportunity creation: opportunity development, construction, and creation. It concludes by showing how an OBA can help explain the choice of foreign markets, early internationalisation, speed of internationalisation, and foreign entry modes.

2. Opportunity-Based Approach to Entrepreneurship

The theories of internationalisation and entrepreneurship have generally been pursued along distinct paths (Madsen and Servais, 1997), the result of a 'demarcation segregating international business and entrepreneurship' (McDougall and Oviatt, 2000: 902). Yet, international entrepreneurship research will be enhanced 'by importing concepts from the field of entrepreneurship' (Jones and Coviello, 2005: 285) and by better integrating it with the entrepreneurship literature (Madsen and Servais, 1997). If we are to understand international entrepreneurship better, we must understand the 'entrepreneurship' in international entrepreneurship first.

Shane and Venkataraman (2000) argue that the discovery and exploitation of profitable opportunities is the central concern of entrepreneurship research. This view is similar to Timmons' (1994: 7) conception of entrepreneurship as the 'process of creating or seizing an opportunity and pursuing it'. Shane and Eckhardt (2003: 218) set out an 'individual-opportunity' nexus in entrepreneurship and argued that 'entrepreneurship involves the nexus of two phenomena: the presence of lucrative opportunities and the presence of enterprising individuals'. These scholars, like Stevenson and Jarillo (1990), view opportunity formation and exploitation as being at the heart of entrepreneurship.

Entrepreneurship starts with the formation of opportunities which is domain of the entrepreneur (Shane, 2000; Katz and Shepherd, 2003) while opportunity exploitation – a process dependent on the decision of the entrepreneur – is typically the province of the firm which, through its capabilities, turns opportunities into market outcomes (Whittaker et al., 2009). Bringing the

entrepreneur and the firm together is responsive to Gartner's (1985) call for multi-level, multi-dimensional entrepreneurship research.

Opportunity-Based Approach to Entrepreneurship

(Figure 1)

Figure 1 indicates that opportunity processes can be studied along three dimensions: 1) opportunity formation; 2) opportunity decision; and 3) opportunity exploitation. These correspond broadly to Shane and Venkataraman's (2000: 218) key research questions about entrepreneurship: '(1) why, when, and how opportunities for the creation of goods and services come into existence; (2) why, when, and how some people and not others discover and exploit these opportunities; and (3) why, when, and how different modes of action are used to exploit entrepreneurial opportunities.' The OBA tells us that to understand entrepreneurship fully, the three dimensions must be examined. Applying the OBA to IE, it suggests further that the research focus of international entrepreneurship should not be limited to the internationalisation ('opportunity exploitation') aspect but to why, when, and how international opportunities are formed and the decision is made to pursue international opportunities.

3. Opportunity Formation and the Nature of Opportunity

How opportunities are formed – whether opportunities are like mountains 'just waiting to be discovered and exploited' or are mountains to be built – is an important question in entrepreneurship research (Alvarez and Barney, 2007: 11). The dominant paradigm in economics has been that opportunities are 'out there' to be discovered by an alert entrepreneur (Gaglio and Katz, 2001; Alvarez and Barney, 2007). Under the 'discovery theory', the failure of some to discover opportunities stems from entrepreneurial alertness that is not uniformly distributed in the population (Kirzner, 1985; 1992; 1997), information asymmetry (Shane and Venkataraman, 2000), or idiosyncratic knowledge that is contextually-defined (Hayek, 1945; Holcombe, 2003). As a consequence, not all individuals who are exposed to the same opportunity will discover it (Shane, 2000).

Kirzner (1997: 72) clarified that discovery is 'midway between that of the deliberately produced information in standard search theory, and that of sheer windfall gain generated by pure chance' and involves the discovery of opportunities that are often '*utterly* overlooked, i.e., that one is not aware at all that one has missed the grasping of any profit'. Discovery is different from successful search because the former 'involves the *surprise* which accompanies the realization

that one had overlooked something in fact readily available. ("It was under my very nose!")' (*ibid.*). Kirzner's concept of discovery is the result of entrepreneurial alertness – 'the attitude of receptiveness to available (but hitherto overlooked) opportunities' (Kirzner, 1997: 72).

Opportunities, however, are not just discovered; they are created (Endres and Woods, 2007). 'Creation theory' [or the 'creative view' of Venkataraman (2003)] 'assumes that entrepreneur's actions are the essential source of these opportunities – they build mountains' (Alvarez and Barney, 2007: 15). Alvarez and Barney (*ibid.*) argued that 'opportunities are not assumed to be objective phenomena formed by exogenous shocks to an industry or market. Rather, they are created, endogenously, by the actions, reactions, and enactment of entrepreneurs exploring ways to produce new products or services'.

Venkataraman and Sarasvathy (2001: 9) argued that 'entrepreneurial opportunities often have to be "created" by using the entrepreneurial imagination to *embody* human aspirations in concrete products and markets'. The creative entrepreneurial act brings new realities and artifacts into existence (Buchanan and Vanberg, 1991). Buchanan and Vanberg (1991: 176) pointed out that future 'parts of a market simply do not exist; they are, by definition, not present. There are, at any point in time, many *potential* futures imaginable, based on more or less informed reflections. Yet, which future will come into existence will depend on choices that are yet to be made'. This suggests that entrepreneurial opportunities are endogenously formed by the entrepreneur through the process of discovery or creation.

The tensions between these views of opportunity are compounded by a diversity in terminology. Writers speak of: economic opportunities (Kor, et al., 2007), profit opportunities (Holcombe, 203), market opportunities (Gruber, et al., 2008), marketing opportunities (Kotler, et al., 1999), business opportunities (Longnecker, et al., 2010), innovative opportunities (Drucker, 1985), entrepreneurial opportunities (Shane and Venkataraman, 2000; Venkataraman and Sarasvathy, 2000; 2001; Sarasvathy, et al., 2003), and (plain) opportunities (Ansoff, 1980; Timmons, 1999; Katz and Green, 2009). We heed Bygrave and Hofer's (1991) admonition to pursue entrepreneurship research as 'good science', through the use of concepts with greater precision, by delineating our notion of entrepreneurial opportunity here.

Webster's New World Dictionary (1990) defines *opportunity* as 'a combination of circumstances favourable for the purpose', pointing to three important elements: 1) a *combination of circumstances*; 2) the combination of circumstances that are *favourable*; and 3) favourable *for the purpose*. In the context of an entrepreneurial opportunity, the combination of circumstances can be favourable for the purpose of *'formation of economic value'*, such as: 'creation of future goods and services' (Sarasvathy, et al., 2003: 143); introduction of 'new or future goods, services, inputs, resources, and ways of organizing' (Plummer, et al., 2007: 365); creating 'future economic artifacts' (Venkataraman and Sarasvathy: 2001: 5); or bringing 'into existence new goods, services, raw materials, and organizing methods' (Shane, 2000: 451). Regarding a *combination of circumstances that are favourable,* such circumstances must be located: 1) inside the firm from which the (potential) economic value is formed; and 2) outside the firm – in the market – where the economic value is realised. The combination of two circumstances that are favourable for the formation of economic value may be said to require: inside the firm – firm capabilities; and outside the firm – market opportunity – which individually viewed, may be

deemed *nascent* opportunity elements. For an entrepreneurial opportunity to be formed, firm capabilities and market opportunity must be connected. The idiosyncratic nature of what is favourable implies that not all entrepreneurs perceive it in the same way. An *entrepreneurial opportunity* may then be defined as *'*the creative combination of firm capabilities and market opportunity for the formation of economic value'. Conceptualised in this manner, the possible combinations of firm capabilities and market opportunity – conceived by the entrepreneur – towards an entrepreneurial opportunity are potentially extensive.

4. Typology of Entrepreneurial Opportunity Formation

We have said that the entrepreneur drives the formation of entrepreneurial opportunities through the creative combination of firm capabilities[1] and market opportunities[2]. We advance a conceptual framework (*Figure 2*) that captures how an entrepreneur forms entrepreneurial opportunities through opportunity discovery and the dimensions of opportunity creation, namely: opportunity development, opportunity construction, and opportunity creation using a *typology of entrepreneurial opportunity formation*.

		Market Opportunities	
		Current	New
Firm Capability	Current	**1** Opportunity Discovery	**3** Opportunity Construction
	New	**2** Opportunity Development	**4** Opportunity Creation

Entrepreneurial Opportunity Formation Quadrant

(Figure 2)

The perception by an entrepreneur of an existing entrepreneurial opportunity (where both firm capabilities and market opportunities exist) can be called *opportunity discovery* (quadrant 1). For example, CBA, a New Zealand firm, embarked on rapid internationalisation into Australia on account of Australian partners ready to distribute its products in that country (Coviello and Munro, 1995).

The development of new firm capabilities to pursue a current market opportunity (e.g. export order or market demand) can be called o*pportunity development* (quadrant 2). This is exemplified by the development of software manufacturing capabilities of IXI in order to meet a need in the international market for a desktop windowing computer software for UNIX operating systems (McDougall, et al., 1994).

The construction of a new market opportunity that a firm has the present ability to meet involves *opportunity construction* (quadrant 3). SPEA Software AG engaged in opportunity construction to venture abroad. Relying on its capabilities to manufacture computer graphic boards, it entered international markets without waiting for customer orders to be in place (McDougall, et al., 1994).

The creation of both new firm capabilities and a new market opportunity involves *opportunity creation* (quadrant 4) – a process that comes close to Lachmann's creation '*ex nihilo*' (Chiles, et al., 2007: 240). L.S. Shoen, founder of U-Haul, the largest rental fleet company in the world, created the do-it-yourself moving industry by building the first U-Haul trailers (firm capabilities) and creating the market for it (Sarasvathy, 2001).

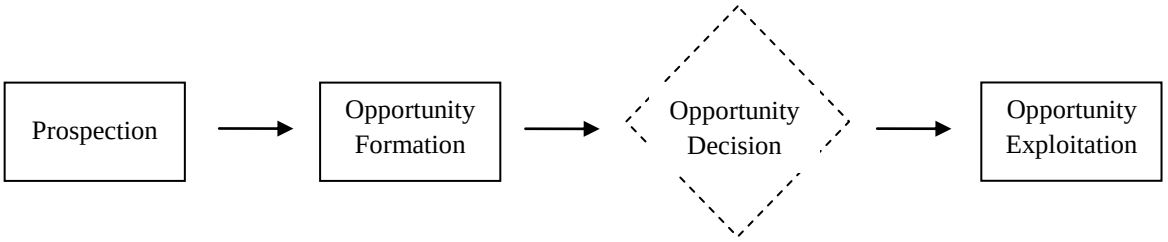
The process of entrepreneurial opportunity formation influences both opportunity decision and opportunity exploitation as suggested by *Figure 1*. The entrepreneurial decision to pursue an opportunity is enhanced by the presence of both firm capabilities and market opportunity (quadrant 1). Where both entrepreneurial opportunity elements have to be created (quadrant 4), a task that is undoubtedly more complex, perhaps daunting, the entrepreneur may hedge a bit more. Opportunity development (quadrant 2) and opportunity construction (quadrant 3) lie midway between opportunity discovery and opportunity creation in terms of influencing the entrepreneur's decision to exploit an opportunity. Speed of opportunity exploitation is also affected by the process of entrepreneurial opportunity formation. Opportunity exploitation will be more rapid when opportunity discovery (quadrant 1) is involved. Both firm capabilities and the market opportunity are already in place. Opportunity exploitation will take longer when opportunity creation (quadrant 4) is involved since both elements of the entrepreneurial opportunity – firm capabilities and market opportunity – have to be created. The speed of exploiting a developed entrepreneurial opportunity (quadrant 2) depends on the complexities of developing firm capabilities. The impact of constructed opportunities (quadrant 3) on the speed of opportunity exploitation hinges on the challenges in constructing a market opportunity.

5. Creating the Imagined Future: Prospection and the Entrepreneur

The *opportunity-based approach* recognises the important role of the entrepreneur in the formation of, and the decision to, pursue entrepreneurial opportunities. Much has been written on the objective dimensions of entrepreneurs (age, level of education, language, etc.) Our interest lies in the subjective entrepreneurial dimensions in opportunity formation and opportunity decision. Endres and Woods (2007) had argued for a more 'subjectivist' orientation to understand the process of opportunity creation. A subjectivist orientation can draw on Lachmann, an Austrian economist who stated that social phenomena are 'the outcome of human action guided by plans (even though these often fail) and prompted by mental acts' (Lachmann, 1986: 22-23). According to Lachmann (1990: 246), the entrepreneur creates, 'by conjecture and reasoned imagination', an imagined future that, though unknown, is 'not unimaginable' (Lachmann, 1976: 59).

This entrepreneurial ability to create the imagined future, an entrepreneurial attribute we call *prospection,* is important in opportunity formation, opportunity decision, and opportunity exploitation *(Figure 3).* It is by prospection that the entrepreneur creatively imagines the possible

combinations of firm capabilities and market opportunities to form entrepreneurial opportunities. Creative imagination is an imagination that 'creates or fabricates' (Engell, 1981: 172) and 'extrapolates from context, sifts out and disregards elements from the confusing welter of experience that would otherwise distract effort and blur focus' (Engell, 1981: 59).



(Figure 3)

It is also by creating the imagined future – by prospection – that the entrepreneur deals with the uncertainties inherent in opportunity exploitation. What is not known is creatively imagined. Prospection breaks through the constraints of present knowledge by imagining the future – a future both desired and alluring. Prospection is expansive and unfettered by reason, logic, knowledge, or experience. This may be what Baron (1999) alluded to as a cognitive bias in entrepreneurs, which often leads to excessive optimism and overconfidence. He acknowledged that a sense of optimism may be needed if entrepreneurs are to overcome the risks associated with entrepreneurship by exaggerating the odds of success. Prospection may also account for the high tolerance for ambiguity of entrepreneurs (Dickson and Giglierano, 1986). Entrepreneurs are able to tolerate ambiguity because they have in a sense reduced it by supplying the missing pieces of an ambiguous, uncertain world through prospection. Prospection may be associated with entrepreneurial orientation (Lumpkin and Dess, 1996), especially the dimensions of autonomy and proactiveness, and to self-efficacy (Bandura, 1986).

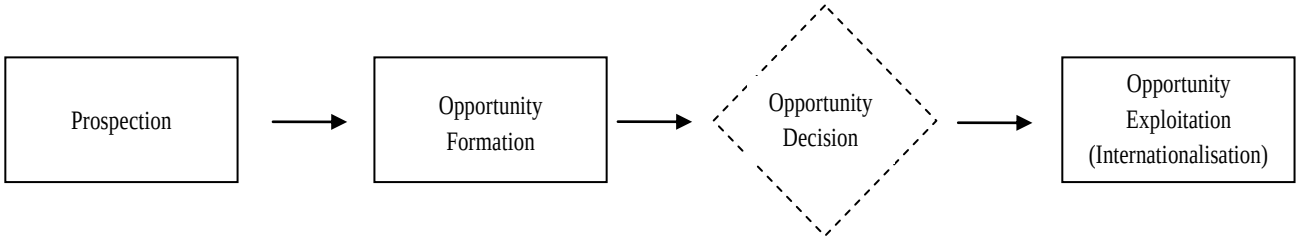
Prospection bears some similarities to effectuation. Effectuation, like prospection, seeks to transform the future through the process of opportunity creation (Sarasvathy, 2008: 17). But while effectuation propounds that entrepreneurs do not begin with specific goals but with available means which they use to negotiate and achieve emergent goals (Sarasvathy, 2001), prospection sees goals as *a priori* preceding human action. Prospection also shares some commonalities with Weick's enactment in that both are creative. Prospection, however, is future-oriented, and rooted in creative imaginations of the future while enactment is grounded in retrospective sensemaking (Weick, 1995).

Prospection may be important in international entrepreneurship since it might allow the entrepreneur to overcome the constraints of experiential knowledge and uncertainty that are central to stage- and innovation-related models of internationalisation. That which is not known can be creatively imagined by the entrepreneur through prospection. Prospection also drives the entrepreneur to pursue international opportunities despite limited resources and firm capabilities. Prospection involves the creation of the means to create the imagined future. What fails the test of reason is sustained by the moving and inspiring power of prospection.

6. Opportunity-Based Approach to IE: Internationalisation as Opportunity Exploitation

There is a need to better understand entrepreneurship in international entrepreneurship, and the role of opportunities in international entrepreneurship (Chandra, et al., 2009). Johanson and Vahlne (2006: 167) themselves have admitted that 'the opportunity side of the internationalization process is not very well developed in our earlier papers.' This neglected dimension of international entrepreneurship – the 'E in IE' – may provide new insights and better understanding of the process of internationalisation. Acknowledging the fundamental role of opportunities in international entrepreneurship follows the views of Zahra et al. (2005) and Oviatt and McDougall (2005) that international entrepreneurship is centred on the recognition and exploitation of opportunities.

The study of opportunity formation and exploitation in international entrepreneurship, which we call the *opportunity-based approach* (OBA), suggests that the process of internationalisation itself may be viewed as the formation and exploitation of international entrepreneurial opportunities. It is the entrepreneur, using prospection, who forms entrepreneurial opportunities and makes the decision to exploit them through the firm. This can be conceptualised through *Figure 4*:



(Figure 4)

The model suggests that preceding the process of firm internationalisation are the distinct entrepreneurial processes of prospection, opportunity formation, and opportunity decision. In other words, firm internationalisation – as the exploitation of international entrepreneurial opportunities – can be understood by examining the other antecedent entrepreneurial processes. Under the opportunity-based approach to IE, both the entrepreneur and the firm are legitimate subjects of inquiry. The entrepreneur is involved with prospection, opportunity formation, and opportunity decision while the firm is the vehicle for the exploitation of international entrepreneurial opportunities and possesses the capabilities to transform entrepreneurial opportunities into market outcomes (Whittaker et al., 2009).

The OBA differs from the conventional IE approaches which emphasise the process of firm internationalisation and stages of internationalisation. The OBA focuses on the entire process of prospection, opportunity formation, decision, and exploitation, and regards internationalisation as a constituent, end process – the pursuit of international entrepreneurial opportunities that have been formed by the entrepreneur. This latter point makes the argument that domestic entrepreneurship and international entrepreneurship are similar, rather than distinct, phenomena. Domestic entrepreneurship involves the pursuit of domestic entrepreneurial opportunities while

international entrepreneurship involves the pursuit of international entrepreneurial opportunities. The locus of an entrepreneurial opportunity determines whether opportunity exploitation takes place domestically or internationally. Furthermore, under the OBA, the choice of foreign markets is determined by the locus of the entrepreneurial opportunity. If an export order, for instance, emanates from the Netherlands, internationalisation will take place in that country.

Conceptualising internationalisation under the OBA as the exploitation of international entrepreneurial opportunities can also provide an explanation as to how some internationalising firms seem to skip internationalisation stages, even becoming global at inception. Johanson and Vahlne (1977: 24) had reported that internationalising firms generally begin by 'exporting to a country via an agent, later establish a sales subsidiary, and eventually, in some cases, begin production in the host country'. Bilkey and Tesar (1977) introduced a six-stage model that showed how internationalisation began by firms delivering on an unsolicited export order, and then moving on to regular exports to a psychologically close country, and finally to exporting to additional countries that are psychologically further away. But the nature of the entrepreneurial opportunity might actually determine the process of internationalisation. For example, if an internationalising firm with existing firm capabilities perceives a market opportunity in an international market, it may decide to establish a foreign sales subsidiary at the outset. A manufacturing company may also determine that production in an international market may be more attractive because of cost-advantages and availability of specialised resources. Under the OBA, internationalisation is non-deterministic.

The opportunity-based approach can also theorise on speed, early internationalisation, and entry mode of internationalisation. A discovered opportunity (quadrant 1 in *Figure 2*) would imply more rapid internationalisation than opportunity creation. A domestic firm that responds to an unsolicited export order can internationalise much faster than a firm that has to build its capabilities or construct a market opportunity in order to internationalise. A new domestic firm that has strategic partners abroad can internationalise earlier than an established firm seeking to pursue international opportunities on its own. The latter will have to amass the resources necessary for internationalisation – which takes considerable time – and acquire experiential knowledge before internationalising. Mode of entry will also be determined by the nature of the entrepreneurial opportunity. An export order will trigger exporting as the entry mode while a strategic alliance can lead to licensing/franchising or joint ventures.

7. Conclusion

This paper has sought to better understand the entrepreneurship in international entrepreneurship – the 'E in IE' – by exploring the central role of opportunity formation and exploitation in international entrepreneurship. In particular, through an opportunity-based approach (OBA) to international entrepreneurship, the paper has explored the entrepreneur-firm-opportunity nexus in internationalisation and suggested that the process of internationalisation may be conceived as the formation and exploitation of international entrepreneurial opportunities. The subjective, entrepreneurial ability to create an imagined future – 'prospection' – was also examined to show how entrepreneurs use prospection to: creatively imagine combinations of firm capabilities and market opportunities to form entrepreneurial opportunities, and deal with the uncertainty inherent in internationalisation. A typology of entrepreneurial opportunity formation was advanced to

explore opportunity discovery and the dimensions of opportunity creation: opportunity development, construction, and creation. Finally, the paper outlined how the OBA can explain the choice of foreign markets, early internationalisation, speed of internationalisation, and foreign entry modes.

NOTES

[1] Firm capability refers to the capacity of a firm to undertake some task or activity (Grant, 2002) and involves 'adapting, integrating, and reconfiguring internal and external organizational skills, resources, and functional competences to match the requirements of a changing environment' (Teece, et al., 1997: 515). Firm capability is distinct from firm resources. Resources 'are inputs into the product process' (Grant, 2002: 118) and require firm capability for them to be integrated to strengthen a firm's ability to compete (Longnecker, et al., 2010).

[2] Market opportunities emerge from: exogenous shocks, market disequilibrating factors, production-enhancing factors (Holcombe, 2003); the unexpected, incongruities, process needs, changes in industry or market structure, demographic changes, changes in perception, mood, and meaning, new knowledge (Drucker, 1985); changes in the global market place, inflationary trends, technology, growth saturation, emergence of new industries, rich customers, changes in customer demographics, government controls, consumer pressures (Ansoff, 1980); and changes in culture, wants, and perceptions (Schumpeter, 1934; Kirzner, 1979).

[3] Opportunity recognition is located in the same quadrant as opportunity discovery (quadrant 1 in *Figure 2*). Opportunity recognition involves sifting through data and searching for patterns (Timmons, 1994) to recognise existing entrepreneurial opportunities.

REFERENCES

Alvarez, S. A. and J. B. Barney (2007). "Discovery and creation: Alternative theories of entrepreneurial action." Strategic Entrepreneurship Journal **1**: 11-26.

Andersen, O. (1993). "On ther internationalization process of firms: A critical analysis." Journal of International Business Studies **2**: 209-228.

Andersson, S., Gabrielsson, J. and Wictor, I. (2004). "International activities in small firms: Examining factors influencing the internationalization and export growth of small firms." Canadian Journal of Administrative Sciences **21**(1): 22-34.

Ansoff, H. I. (1980). "Strategic issue management." Strategic Management Journal **1**(2): 131-148.

Bandura, A. (1986). The social foundations of thought and action. Englewood Cliffs, Prentice-Hall.

Barney, J. (1991). "Firm resources and sustained competitive advantage." Journal of Management **17**: 99-119.

Baron, R. A. (1999). "Counterfactual thinking and venture formation: The potential effects of thinking about "what might have been"." Journal of Business Venturing **15**: 79-91.

Baumol, W. (1968). "Entrepreneurship in economic theory." American Economic Review **58**(2): 64-71.

Bell, J. (1995). "The internationalization of small computer software firms: A further challenge to 'stage' theories." European Journal of Marketing **29**(8): 60-75.

Bilkey, W. J. and G. Tesar (1977). "The export behavior of smaller sized Wisconsin manufacturing firms." Journal of International Business Studies **3**(Spring/Summer): 93-93.

Bloodgood, J., Sapienza, H.J. and Almeida, J.G. (1996). "The internationalization of new high-potential U.S. ventures: Antecedents and outcomes." Entrepreneurship Theory and Practice **20**: 61-76.

Buchanan, J. M. and V. Vanberg (1991). "The market as a creative process." Economics and Philosophy **7**(1): 167-186.

Bygrave, W. and C. Hofer (1991). "Theorizing about entrepreneurship." Entrepreneurship Theory and Practice **16**(2): 13-22.

Cannon, T. and M. Willis (1981). "The smaller firm in international trade." European Small Business Journal **1**(3): 45-55.

Cavusgil, S. T. (1980). "On the internationalization process of firms." European Research **8**(6): 273-281.

Cavusgil, S. T. and J. Naor (1987). "Firm and management characteristics as discriminators of export marketing activity." Journal of Business Research **15**: 221-235.

Chandra, Y., Styles, C. and Wilkinson, I. (2009). "The recognition of first time international entrepreneurial opportunities: Evidence from firms in knowledge-based industries." International Marketing Review **26**: 30-61.

Chiles, T. H., Bluedorn, A.C. and Gupta, V.K. (2007). "Beyond creative destruction and entrepreneurial discovery: A radical Austrian approach to entrepreneurship." Organization Studies **28**(4): 467-493.

Coviello, N. E. and H. J. Munro (1995). "Growing the entrepreneurial firm: Networking for international market development." European Journal of Marketing **29**(7): 49-61.

Dickson, P. R. and J. J. Giglierano (1986). "Missing the boat and sinking the boat: A conceptual model of entrepreneurial risk." Journal of Marketing **50**(3): 58-71.

Drucker, P. D. (1985). Innovation and entrepreneurship. New York, HarperCollins.

Endres, A. M. and C. R. Woods (2007). "The case for more "subjectivist" research on how entrepreneurs create opportunities." International Journal of Entrepreneurial Behaviour & Research **13**(4): 223-234.

Engell, J. (1981). The creative imagination: Enlightenment to romanticism. Cambridge, Massachusetts, Harvard University Press.

Gaglio, C. M. and J. A. Katz (2001). "The pyschological basis of opportunity identification: Entrepreneurial alertness." Small Business Economics **16**(2): 95-111.

Gartner, W. B. (1985). "A framework for describing the phenomenon of new venture creation." Academy of Management Review **10**: 696-706.

Grant, R. M. (2002). "The resource-based theory of competitive advantage: Implications for strategy formulation." California Management Review **33**(3): 114-134.

Gruber, M., I. C. MacMillan, and J.D. Thompson (2008). "Look before you leap: Market opportunity identification in emerging technology firms." Management Science **54**(9): 1652-1665.

Hayek, F. A. (1945). "The use of knowledge in society." The American Economic Review **35**(4): 519-530.

Holcombe, R. (2003). "The origins of entrepreneurial opportunities." Review of Austrian economics **16**(1): 25-43.

Johanson, J. and L. G. Mattson (1988). Internationalization in industrial systems -- A network approach. Industrial networks: A new view of reality. B. Axellson and G. Easton (Eds.). London, Routledge**:** 205-217.

Johanson, J. and J. Vahlne (1977). "The internationalization process of the firm--- A model of knowledge development and increasing foreign market commitment." Journal of International Business Studies **8**: 23-32.

Johanson, J. and J. E. Vahlne (2006). "Commitment and opportunity development in the internationalization process: A note on the Uppsala internationalization process model." Management International Review **46**(2): 165-178.

Jones, M. V. and N. E. Coviello (2005). "Internationalisation: Conceptualizing and entrepreneurial process of behaviour in time." Journal of International Business Studies **36**(3).

Katz, J. A. and R. P. Green (2009). Entrepreneurial small business. New York, NY, McGraw-Hill Irwin.

Katz, J. A. and D.A. Shepherd (2003). "Cognitive approaches to entrepreneurship research." Advances in Entrepreneurship, Firm Emergence, and Growth **6**: 1-10.

Kirzner, I. M. (1979). Perception, opportunity, and profit. Chicago, University of Chicago Press.
Kirzner, I. M. (1985). Discovery and the capitalist process. Chicago, The University of Chicago Press.
Kirzner, I. M. (1992). The meaning of market process: Essays in the development of modern Austrian economics. New York, Routledge.
Kirzner, I. (1997). "Entrepreneurial discovery and the competitive market processes: An Austrian approach." Journal of Economic Literature **35**: 60-85.
Kor, Y. Y., J. T. Mahoney, et al. (2007). "Resources, capabilities and entrepreneurial perceptions." Journal of Management Studies **44**(7): 1187-1212.
Kotler, P., S. H. Ang, S.M. Leong, and C.T. Tan (1999). Marketing management: An Asian perspective (2nd Ed.). Singapore, Prentice Hall.
Kundu, S. K. and J. A. Katz (2003). "Born-international SMEs: Bi-level impacts of resources and intentions." Small Business Economics **20**: 25-47.
Lachmann, L. M. (1976). "From Mises to Shackle: An essay on Austrian economics and the kaleidic society." Journal of Economic Literature **14**(1): 54-62.
Lachmann, L. M. (1986). The market as an economic process. Oxford, Blackwell.
Lachmann, L. M. (1990). G.L.S. Shackle's place in the history of subjectivist thought. Expectations and the meaning of institutions: Essays in economics by Ludwin Lachmann. D. Lavoie (Ed.). London, Routledge**:** 241-248.
Longnecker, J. G., Petty, W.J., Palich, L.E. and Moore, C.W. (2010). Small business management: Launching & growing entrepreneurial ventures. Mason, OH, South-Western Cengage Learning.
Lumpkin, G. T. and G. G. Dess (1996). "Clarifying the entrepreneurial orientation construct and linking it to performance." Academy of Management Review **21**: 135-172.
Madsen, T. K. and P. Servais (1997). "The internationalization of born globals: An evolutionary process?" International Business Review **6**: 561-583.
McDougall, P. P. and B. M. Oviatt (2000). "International entrepreneurship: The intersection of two research paths." Academy of Management Journal **43**(5): 902-906.
McDougall, P. P., Shane, S. and Oviatt, B.M. (1994). "Explaining the formation of international new ventures: The limits of theories from international business research." Journal of Business Venturing **9**(6): 469-487.
Oviatt, B. M. and P. P. McDougall (2005). "Defining international entrepreneurship and modeling the speed of internationalization." Entrepreneurship Theory and Practice **29**(5): 537-553.
Plummer, L. A., Haynie, J.M. and Godesiabois, J. (2007). "An essay on the origins of entrepreneurial opportunity." Small Business Economics **28**: 363-379.
Reid, S. D. (1984). Market expansion and firm internationalization. International marketing management. E. Kaynak (Ed.). New York, Praeger**:** 197-206.
Sarasvathy, D., N. Dew, S.R. Velamuri, and S. Venkataraman (2003). Three views of entrepreneurial opportunity. Handbook of entrepreneurship research: An interdisciplinary survey and introduction. Z. J. Acs and D. B. Audretsch (eds.). New York, Springer.
Sarasvathy, S. D. (2001). Effectual reasoning in entrepreneurial decision making: Existence and bounds. Academy of Management Proceedings 2001.
Sarasvathy, S. D. (2008). Effectuation: Elements of entrepreneurial expertise. Cheltenham, UK, Edward Elgar.
Schumpeter, J. A. (1934). The theory of economic development. Cambridge, MA, MIT Press.
Shane, S. (2000). "Prior knowledge and the discovery of entrepreneurial opportunities." Organization Science **11**(4): 448-469.
Shane, S. and J. Eckhardt (2003). The individual-opportunity nexus. Handbook of entrepreneurship research: An interdisciplinary survey and introduction. Z. J. Acs and D. B. Audretsch (Eds.). Boston, Kluwer Academic Publishers.
Shane, S. and S. Venkataraman (2000). "The promise of entrepreneurship as a field of research." Academy of Management Review **25**(1): 217-226.

Stevenson, H. H. and J. C. Jarillo (1990). "A paradigm of entrepreneurship: Entrepreneurial management." Strategic Management Journal (Special issue) **11**: 17-27.

Teece, D. J., Pisano, G. and Shuen, A. (1997). "Dynamic capabilities and strategic management." Strategic Management Journal **18**(7): 509-533.

Timmons, J. A. (1994). New venture creation (4th ed.). Burr Ridge, IL, Irwin.

Timmons, J. A. (1999). New venture creation. Entrepreneurship for the 21st century (5th ed.). New York, IrwinMcGraw-Hill.

Venkataraman, S. (2003). Foreword to a general theory of entrepreneurship: The individual-opportunity nexus. A general theory of entreprneneurship: The individual-opportunity nexus. Cheltenham, U.K., Edward Elgar.

Venkataraman, S. and S. D. Sarasvathy (2001). Strategy and entrepreneurship: Outlines of an untold story. Virginia, Social Science Research Network Electronic Paper Collection**:** 34.

Webster's New World Dictionary (1990). New York, NY, Simon & Schuster.

Weick, K. E. (1995). Sensemaking in organizations. Thousand Oaks, CA, Sage.

Westhead, P., Wright, M. and Ucbasaran, D. (2001). "The internationalisation of new and small firms: A resource-based view." Journal of Business Venturing **16**: 333-358.

Whittaker, D. H., P. Byosiere, Momose, S., Morishita, T., Quince, T., and Higuchi, J. (2009). Comparative entrepreneurship: The UK, Japan and the shadow of Silicon Valley. Oxford, Oxford University Press.

Zahra, S. A., J. S. Korri, and J.F. Yu (2005). "Cognition and international entrepreneurship: Implications for research on international opportunity recognition and exploitation." International Business Review **14**: 129-146.

Zucchella, A., G. Palamara, and S. Denicolai (2007). "The drivers of the early internationalization of the firm." Journal of World Business **42**: 262-280.

CRITICAL REALISM BASED ENTREPRENEURIAL ACTION THEORY: ENTREPRENEURIAL VALUE CREATION FRAMEWORK

Marko Forsell and **Kaarlo Paloniemi**

Oulu Business School, Oulu, Finland

marko.forsell@oulu.fi, kaarlo.paloniemi@oulu.fi

ABSTRACT

We propose to use critical realism as the basis for ontology and epistemology in entrepreneurship research. Further, we argue that the teleology of entrepreneurship is value creation. Based on these assumptions we propose that an essential part of the entrepreneurial process is the creation of a business model that shows conceptually how the value will be created. This model can be categorized in three different categories along with the value system continuum: stable value system, redefined value system and emerging value system. We propose an entrepreneurial value creation framework that describes elements that are essential to the value creation.

Keywords: entrepreneurship, critical realism, business opportunity, role of entrepreneur, business model, value continuum, value creation system.

INTRODUCTION

From the ontological point of view it is clear that the objectivist approach located in realism (Burrell and Morgan, 1979; Gioia and Pitre, 1990; Guba and Lincoln, 1989) forms the scientific basis for the dominant approach in entrepreneurship literature. The dominant view sees the environment as external to the actor involved in the entrepreneurial process (e.g. Alvarez, 2005a). This is the case regardless of whether or not the concept of entrepreneur is defined as a role played by an individual or a team of individuals.

It seems to be widely accepted in the recent literature on entrepreneurial process and opportunity creation that actors involved in the process, i.e., the entrepreneurs, are not treated as 'lonely riders' (Øyhus, 2003), but rather as laymen playing the role of the entrepreneur who are embedded deeply in the natural and social environment. The existing reality, however, can be understood only imperfectly by these actors. It is also widely accepted in the field that there is a close relation between the actor involved in the process, the environment and the process. This relationship is so evident that it will actually characterize the whole entrepreneurial process. It will be argued here that the nature of the entrepreneurial process is teleological because the core purpose of the process is to generate value for all of the stakeholders included within it. This kind of statement is parallel with the definition of *'business'* as a social structure (or mechanism) for generating value for whoever or whatever is related to it.

One other issue concerning the relationship between the key actors in the process has been presented quite ambiguously in the previous literature. This issue is about the origin and nature of the idea on which the intended business venture will be built or created. It has been – and it may still be – a common way to think like Sarasvathy *et al.* (2003) that since there are opportunities endlessly in the environment, we need just to grab onto at least one of them at the time. However, it is made clear in this paper that this is not the whole case: it is **not only** about the existing ideas, i.e., those commonly treated as 'opportunities' in the established definitions in the literature, on which a new business venture could be started. But, it is **also** about the ideas treated as sources available for the creation process of the business opportunity (the BOC process). The BOC process means the other part of a double-barreled entrepreneurial process, namely the discovery process, according to the vocabulary of Shane and Venkataraman (2000). In this latter situation the ideas existing are indeed as *'ready–to–be used as such'* but only as sources for the BOC process rather than as final solutions to be exploited in the market.

One well known example of the 'ideas as sources' approach is given by Shane (2000) who describes how one particular invention, the three-dimensional printing invented at the Massachusetts Institute of Technology (MIT), was transformed into several different kinds of business ventures depending on the process conducted by the entrepreneurs in question. According to Shane, *"technological change does not generate obvious entrepreneurial opportunities, which allows anyone to discover any given entrepreneurial opportunity which results from that change"* (ibid: 465). In other words, the business opportunity – interpreted here as the 'outcome of the creation process of the business opportunity' – needs to be made, i.e., built, or created, by the people who will intentionally start to play the role of entrepreneur in order to continue in the BOC process.

It is recognized in the literature that people who operate in the process (whether or not it is called the discovery process by Shane and Venkataraman (2000) or the BOC by the present researchers) keep firmly interacting with the environment. Thus, it is clear that the environment, i.e., both the natural and social reality (Perry, Riege, and Brown, 1998) influences the entrepreneur. On the other hand, the effect of the entrepreneurial process on the people is also important. That is, the outcomes of the process will directly generate the sources for the new business ideas, and, more indirectly, the ways the entrepreneur perceives all the numerous alternative solutions to put ideas to work in the real-life context, namely the market.

The recursive nature of the interaction between the entrepreneur, the BOC process, and the environment opens up a question about whether the strict objectivist approach (Burrell and Morgan, 1979) is too restrictive in understanding the creation process of the business opportunity. The fact is that the kind of approach based on pure objectivism neglects the effects of human activities in the creation of inventions or other various sources upon which business opportunities could be created. That is, from the dominant perspective of entrepreneurship, people who will play the role of the entrepreneur are seen merely as discoverers of what already exists in the environment.

The problems connected to a strictly objectivist line of thinking argue for alternative approaches. The challenge is presented in the literature (e.g. Alvarez and Barney, 2006a;

2006b; Hjorth, Jones and Gartner, 2008) by including the concept of creativity into the theory of entrepreneurship in order to limit the influence of the dominant approach that, in fact, *"appears to actively discourage creativity"* (Hjorth, Jones and Gartner, 2008: 81; also Gilad, 1987). The critique presented above is in line with the basic theoretical assumptions of the present study, i.e., the critical realist ontology. According to Eriksson and Kovalainen (2008, 15), critical realism *"takes reality as material, but acknowledges that people interpret it differently in different times and contexts"*. This means that both the natural and social reality are treated as existing as given because the social reality, particularly, has been created by people of the past. However, people of the present are still able to interpret and change that reality. In the same vein, Fleetwood (2005) opens up further the question around what is meant by entities exist independently of their identification in the approach of critical realism:

> *"Critical realists claim that an entity can (which does not mean it does) exist independently of our knowledge of it." … "Saying an entity can exist independently of its identification implies that it can exist without someone observing, knowing and constructing it." (Fleetwood, 2005: 198–199, underlined words added to imply italics in original)*

According to Fleetwood (ibid.), this also implies that in some cases the entity is knowledgeable but only as tacit knowledge. This means that an actor actually knows how to perform a work task but cannot explain how he or she actually does it. In Fleetwood's own words: *"they know 'how' but they don't know 'that' (see Fleetwood, 1995, Ch. 7)."*(199). By following this line of thought it is easy to agree with Weick (1995) who argues that *"people can know what they are doing only after they have done it"* (24).

One other point that is extremely interesting in Fleetwood's ideas is that, according to him, critical realists accept that *"there is no (defensible) theory-neutral observation, description, interpretation, theorizing, explanation or whatever. There is, in other words, no unmediated access to the world: access is always mediated."* (Fleetwood, 2005: 199, parentheses and italics in original). This is in line with Davidsen (2005) who claims that structures in social reality have real existence as emergent properties irreducible to individuals or individual actions.

In practice, to apply the logic of critical realist perspective presented by Fleetwood (2005), this means that in the role of the entrepreneur individuals and teams, as well as all other people operating in some specific context, interpret, make sense of, understand, and act based on both their individual beliefs and opinions and social or inter-subjective theories, perceptions or social norms (through one's pre-understanding or 'double hermeneutics' in Nörreklit, 2006). Furthermore, according to critical realism, it is necessary to accept that the reason why people (in the role of the entrepreneur, or whatever) interact more or less with the environment is to become more thoroughly informed of the yet unknown factors that may enhance his or her individual activities or activities together with other people – for example, to create new business opportunities for the benefit of oneself or of anybody related in that process.

The article is organized as follows. We start by discussing the scientific assumptions of the study, the critical realism. Then we describe value system continuum and discuss value creation systems as business models. In the third chapter we describe our entrepreneurial value creation framework and scrutinize it with two examples. Discussion on the theoretical and managerial conclusions ends the article.

BACKGROUND

Critical Realist perspective to social reality

> *"Critical realism is a philosophical approach to sciences (Bhaskar, 1978, 1979, 1986) that criticises the study of the social domain as a 'closed' system, typical of positivist approaches in the social sciences. At the same time, it opposes the idea that reality can simply be reduced to our interpretation of it, as has been argued in different forms in the past by idealist and conventionalist scholars."* (Castellacci, 2006: 861)

Critical realism (or critical realist perspective) is becoming an increasingly important approach to study phenomena in the domain of management in general. As Fleetwood and Ackroyd (2004: 1) say *"there is, in fact, a significant intellectual movement now going on in the field of organisation and management studies (O&MS), in which the philosophy of critical realism is being more and more widely appreciated and put to use"*. Parrish (2007), influenced by Easterby-Smith, Thorpe, and Lowe (1991), prefers critical realism to constructivism since several researchers in management *"are making increasingly explicit reference to the critical realist basis of their research (e.g., Baum and Rowley, 2002; Fleetwood and Ackroyd, 2004; Mutch et al., 2006; Van de Ven and Poole, 2005)"* (82, brackets in original). To provide a middle ground between the established paradigms of positivism and interpretivism (McEvoy and Richards, 2006) Easterby-Smith et al. treat critical realism as *"bridging between the two extreme viewpoints"* (1991: 26).

The ontology of critical realism refers to the reality that is divided into two parts: the natural and social reality (Collin, 1997). To focus on the social reality then makes it possible to claim that underlying structures and mechanisms of the socially constructed reality determine social arrangements and our understandings of it. In fact, Bhaskar (1978) states clearly that *"the relationship between science and reality seems problematic only if one either accepts the social character of science, but denies that its object of study is independent of all social activity (the epistemic fallacy), or if one accepts the independence of reality, but denies the social character of science (ontic fallacy)"* (Zembylas, 2006: 668).

The key to the critical realist approach is that society has existed prior to human action, and it thus defends *"the separability of 'agency' and 'structure' on the grounds that it makes it possible to expose restrictions upon agency that would otherwise go undetected; and, relatedly, it enables human beings to make more informed, strategic calculations about how to transform the social world in ways that will eliminate such restrictions"* (Willmott, 2005: 758, single quotes in original). The world perceived through critical realism is not only about *"events, states of affairs, experiences, impressions, and discourses, but also of underlying*

structures, powers, and tendencies that exist, whether or not detected or known through experience and/or discourse" (Patomäki and Wight, 2000: 223).

While critical realists state that an entity in its context "*can exist independently of our knowledge of it"* (Fleetwood, 2004: 29, underlined word as italic in original), however, it is important to note the actual interaction between human agents (or the entrepreneur from the perspective of the present study) and the overall structures of the particular context. This is especially evident with artefactual, social, and ideal type of entities which are dependent for their existence on human activities, but not with material entities which exist even if human beings are omitted (ibid; Sousa, 2008). Furthermore, Fleetwood (2005: 203–204) emphasizes that the interaction between 'some but not all' human activities of 'some but not all' human beings, for example, the becoming or acting entrepreneurs, and the structures in which these agents are embedded is a continuous and cyclical flow over time: "*here are no empty spaces where nothing happens, and things do not just begin and end"* (Fleetwood, 2005: 203).

Bhaskar (1998) argues for the relations between society and individuals as follows: *"people do not create society"* (39), since it both pre-exists them and is a necessary condition for their activity. However, society does not exist independently of human activity. It is to be regarded as "*an ensemble of structures, practices and conventions which individuals reproduce or transforms, but which would not exist unless they did so"* (ibid.). *'Socialization'* is referred to as the process in which for example, various skills, competences and habits feasible in a given context are either reproduced or transformed by the individuals. According to Bhaskar (1998) the given society, on the one hand, is a necessary condition for intentional human action, and, on the other hand, these intentional human actions are also the necessary conditions for it.

By acknowledging what is stated above, it is possible to describe the overall process of these continuous actions of human beings in either reproducing or transforming the existing reality. According to Archer's model, called 'The Transformational Model of Social Action' (Archer, 1998: 376, quoted in Fleetwood, 2004: 41; 2005: 204), the starting point here is some prior cycle (T^1 on upper-left in Fig. 1). Based on these pre-existing structures and mechanisms, that is, the elements of the social reality with *"powers and liabilities capable of generating events"* (e.g. Easton, 2002: 104), and the structural conditions prevailing the social interaction will start at T^2 where *"these agents do whatever it is they can do given the nature of these pre-existing structures – i.e. they are constrained and enabled by them"* (Fleetwood, 2004: 41).

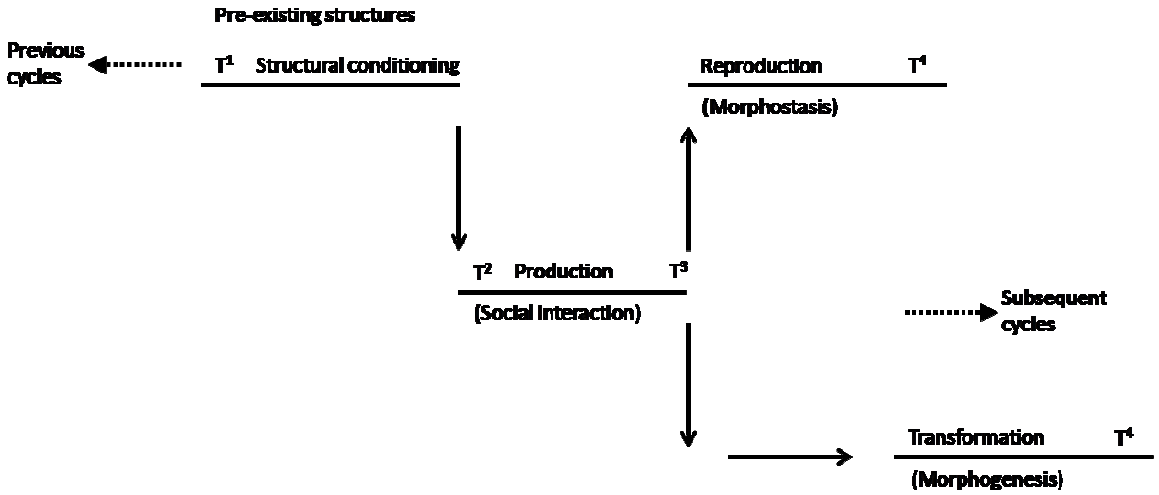


Fig. 1. The Transformational Model of Social Action (Source: Archer, 1998: 376, quoted in Fleetwood, 2005: 204)

According to Fleetwood (2004; 2005) the results of the interaction between T^2 and T^3 will present themselves as changes of the pre-existing structures. These changes will be completed by T^4 where the pre-existing structures will be either *"reproduced (i.e. morphostasis occurs) or transformed (i.e. morphogenesis occurs)"* (Fleetwood, 2004: 41; 2005: 204). The former type of change refers to the process in complex system-environment exchanges that tend to serve or maintain a system's given form, organization, or state (Heylighen, Joslyn, and Turchin, 2000a), whereas the latter is more about creating new organizational forms (Heylighen, Joslyn, and Turchin, 2000b). After T^4 the pre-existing structures and conditions are either confirmed as feasible enough or changed into something totally different. In both of these cases a new cycle may start.

Fleetwood (2005) concludes clearly that both the reproduction and transformation are activity dependent, and the process is about *'who does and who does not do what, when and how'*. However, as Leca and Naccache (2006) emphasize, based on critical realism the social structures and actions of entrepreneurs (as well as actions of all other actors) are at the same time both separate and related entities. This means that they can neither collapse into nor conflate onto each other (Sayer, 2000). Thus, it can be concluded with Castellacci (2006) that there is a strict link between the agents and the structure of society in a way that society pre-dates individual existence. At the same time, however, the social reality, the human society, will be either reproduced or transformed (Fig. 1) by the people of that very same society. Thus, while '*individuals do not create societies'* (Castellacci, 2006), the active agents in every society are the only ones who are able to reproduce and transform it repeatedly. It is the critical realist perspective that gives primacy to the ontology due to the form of the transcendental framework (Boylan and O'Gorman, 2006).

Value System Continuum

Möller and Svanh (2003) introduced the idea of using a value system continuum to describe a value creating system (VCS) based on Parolini's work (Parolini, 1999), and they based this on three ideal value creating systems: stable value system, redefined value system and emerging value system (See also, Möller and Rajala, 2007; Möller and Törrönen, 2003). This value system continuum (Fig. 2) can be used to categorize different value creating systems and be applied to entrepreneurship.

Fig. 2. Value system continuum

Stable value creating system. The activities are well known and specified. We know the actors in the value creation and each of them has a pre-defined role to play in the VCS. The business processes and used technologies are well known by the key players. We know what capabilities and resources are needed for turning inputs into value-added outputs. IKEA might have once been very innovative and it redefined the furniture business value creating system. However, nowadays the value creating system is treated as very stable since other players in the field have copied more or less thoroughly its VCS. Other examples of very stable value creating systems are e.g. Volvo's or Nokia Mobile Phones'.

Redefined value creating system. Here the target value system is fairly well known, but the entrepreneur will make some improvements on the existing value creating system. These improvements may consider the whole set of components of the VCS, or just one or two of its specific factors. Quite often these changes will influence the final products (or services) so that customers will get improved value (or same value for less). It is possible for the entrepreneur to get a good idea of who is the customer and so to perform pre-marketing to create understanding about how the new redefined VCS is evaluated in the market place.

One feasible way to describe redefinition of the VCS is to look at it as a stepwise improvement of the product or production process. An example of this kind of work is iTunes. Although iTunes did not know beforehand how it would succeed, all the needed components were already present: mp3 players, e-stores for music, DRM system. But it was iTunes web-shop and software that successfully implemented this. That is, together with Apple's credibility, the very innovative and 'sleek' mp3-player design, and the growing need for new feasible products that were able to merge technology with real-life activities, it managed to break through.

Emerging value creating system. These are VCSs that are still emerging and it is not clear how the value is created. Here it is aimed at creating totally new way of providing value to customers, and, of course, also to all people relating in some way to the business venture. Quite often the emerging value creating system needs the capability of utilizing new technology. The innovations that are used are not incremental innovations as they were in the case of redefined value system above, but radical innovations. More often it is the ways in

which business processes or technologies are combined or created that are unheard of among the other players in the field. One would suspect that Google was like this when it started. Though its emerging value creating system included the basic idea of the born net company, however, it was quite ambiguous about how the money would come into the business venture. Perhaps it only had high expectations that the money would somehow come along with a big customer base. Now also its EVCS has become quite well known and it can be characterized as a more or less stable VCS.

Examples of sources for emerging VCS could be new technological innovations such as printable electronics or flexible displays. Flexible display, for example, has both some old and some new ways of using this technology. While they are not yet as good quality as existing LCD displays there seems, however, to be various new applications to utilize flexible display technology, e.g. it can be integrated in clothes and used as wearable displays. Printable electronics is yet another area which will be even further developed in the future, although where it will be utilized is yet to be seen. The common thing is to come up with some kind of new and exciting application of new technology. The same kind of thing is happening with Amazon's Kindle and Apple's iPad, which are expected to change the way books and other printed materials are read and bought if successful.

Value Creation Systems as Business Models

Normann and Ramirez (1993) introduced the concept that firms are moving from traditional value chains to value constellations and called them value-creating systems. According to Norman and Ramirez, every product and service is created through many activities among suppliers, customers, employees and managers, and that all economic revolutions redefine value-creating systems. It seems that ever-tightening competition drives firms to reconfigure their business opportunities, in general, and their VCSs, in particular. According to Sanz-Velasco and Magnusson (2004: 288), it is quite clear that the *"business opportunity development does not only take place before or in the very beginning of the venture, but continues throughout the lifetime of the venture"*. This is in line with Johnson, Christensen and Kagermann (2008) who express this as follows: You should reinvent your Business Model! In all, if a firm fails in re-creating their business they will be outperformed by other firms.

Above, it is shown that the business model (BM) is one key element of the business opportunity. While the BM is commonly used in the context of business ventures, Morris et al. (2005) conclude in their study that considerable work still remains to properly understand the business model and its components. We believe that BM and VCS are tightly intertwined, and we always have to remember that when we speak of BM it is always in the light of VCS (see Parolini, 1999: 62-63). We suggest a rudimentary approach here, which we hope to be a first stepping stone for further understanding of the business model.

The definition of the business model of Amit and Zott (2001) *"depicts the content, structure, and governance of transactions designed so as to create value through the exploitation of business opportunities"* (511). Amit and Zott based their construction of this definition on

some of the main theoretical frameworks of strategic management and entrepreneurship, namely Schumpeter (1942), Porter's value chain framework (1985), the resource-based view (Barney, 1991), strategic network theory, and transaction cost theory (Williamson, 1975). A business model view of value creation answers two questions: (1) How do the participants in a transaction enable it, and (2) How is value created in enabling transactions? It is also important to make a clear distinction between business model and revenue model, something which is defined as *"a revenue model refer[ing] to the specific modes in which a business model enables revenue generation"* (Amit and Zott, 2001: 515).

Whereas Amit and Zott focus on transactions, Morris et al. (2006) define their business model concept as a model that *"is used to describe a company's unique value proposition (the business concept), how the firm uses its sustainable competitive advantage to perform better than its rivals over time (strategy), and whether, as well as how, the firm can make money now and in the future (revenue model)"* (28).

Hence, by drawing on both Amit and Zott and Morris et al., we consider in the present study that the business model describes the conceptual description of the value creating system of the expected new business venture. Accordingly, it is treated as one of the key components of the creation process of the business opportunity. Matthyssens et al. (2006) argue that *"value innovation is more important than ever"* (752) since recently the already established and successful *"business models will be challenged (Stabell & Feldstad, 1998), imitated, diluted and commoditized due to intense rivalry"* (ibid). But of course, some business models, such as IKEAs, are very hard to copy though they are fairly well known.

ENTREPRENEURIAL VALUE CREATION FRAMEWORK

Value Creation Systems

To consider the teleology of entrepreneurship as value creation means that the two sub-processes, i.e. opportunity creation and exploitation, are also related to value creation. In the case of opportunity creation process there are several definitions of what kind of process it is. One of the most widely shared definitions is based on Sarasvathy, Dew, Velamuri and Venkataraman (2003) who categorize the process in three categories: recognition, discovery and creation. Their definitions parallel well the definition of Alvarez and Barney (2007): While the recognition and discovery can be related to the Discovery Theory in Alvarez and Baron, the creation refers to the Creation Theory, respectively.

From the point of entrepreneurship literature the value system continuum of Möller and Svanh (2003) shares the idea of the tripartite category with Sarasvathy et al. and Alvarez and Barney: stable VCS – opportunity recognition; redefined VCS – opportunity discovery; emerging VCS – opportunity creation. This means that the phenomena under scrutiny here, the VCS – the opportunity recognition, discovery, or creation - are actually about all these issues. However, the problem is that at the moment there is a lack of an ontological and epistemological basis to understand them all from the one theoretical perspective. The

answer that is proposed in the present study is the critical realist perspective, in general, and the transformational model of social action of Archer (1998; Fig. 1), in particular.

It has been shown in the literature on entrepreneurial process that the relation between the two processes, the creation and the exploitation, should be seen as continuous, cyclical and parallel processes (e.g. Davidsson, 2005; 2006). Based on the nature of cyclicality it is possible to start the observation of the actions of the entrepreneur in the value creation process from some arbitrary point, while bearing in mind that actions do not just start and end (see Archer, 1998; **Fout! Verwijzingsbron niet gevonden.**). Starting with opportunity creation, we begin from some point on the value system continuum: with a radical non-existent idea on which the VCS is expected to be built, or with more conventional improvement to existing business logic perhaps copied from another business field. The VCS may move between the ends of continuum during the process of business opportunity creation, incorporating well-defined business solutions and inventing new ones if needed. At the end of opportunity creation this oscillation of movement will eventually diminish before the well-defined and stable proposal for value system is ready to be exploited as an input of the next sub-process of the BOC process, the Business Planning[i]. With this we then propose that all opportunity creation must obey certain well-defined business practices and it cannot escape the key business-like (or economic) restrictions. At the end of the process of the business opportunity creation there must be a feasible and identifiable logic for value creation and a definite plan for implementation so that we can move on to opportunity exploitation.

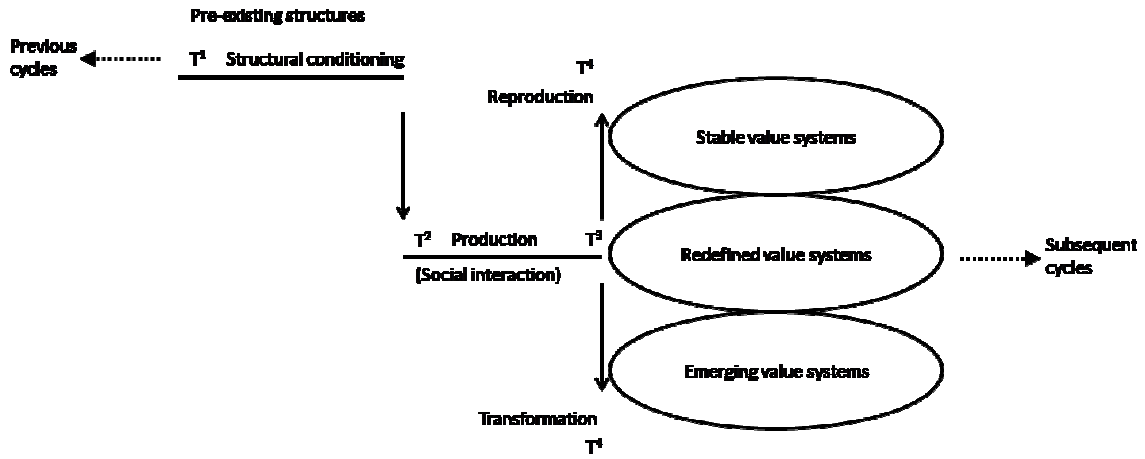


Fig. 3. Framework of entrepreneurial value creation

We propose that much of the more or less radical VCS (or the business opportunity) must also contain enough familiar ingredients so that people will accept the value it creates. Thus, although our initial idea would be radical and includes novel ways to create value for the customer there must be enough familiar points so that people can firmly anchor their value perception. So, in the case of Amazon.com and Kindle books are technological equipment and writing is bits in its memory and the new radical value is that you can carry your library

with you. Thus, the VCS improvement will also include some existing stable components (or ideas), some must be adapted and some are totally new.

Process of creating business model

In this section we present a process model that describes how business model (or the VCS) develops over time and ends up being ready. The process is teleological in a sense that it aims at producing a business model that can be exploited later to create value in the real-life context. Hence, it could be seen that the business model is a vehicle to create value. Also, the process is based on the assumption that it is created purposefully and adaptively (see Van de Ven, 1992). We propose a process model based on the six business model components identified by Morris et al. (2006) (see Table 1). Each component includes a number of factors.

The creation process of a new business model starts when a person believes that he or she has an idea on which one could to create a business opportunity, i.e. to create value. One key part of the process is the creation of the business model. This initial idea for a new business model may include one or many components and factors from the business model (Table 1). After this the process continues by incorporating a component and factor at a time into the business model. This continues as long as there are components and factors left. If the new component or factor to-be-included does not fit into the existing set of components and factors in the new business model, one must change either the incorporated components and factors or the component or factor-to-be-included.

The initiating idea of the business opportunity creation may lead to a business model that can reside in any value system category (**Fout! Verwijzingsbron niet gevonden.**). This means that the 'me too' type of business model works at times when there is lots of demand in the markets. For example, in the middle of the 90s any company creating web pages could create value even if it had nothing new to offer but free resources. However, there is often some differentiating twist in business models that is accepted by customers as value creating. Here, the fitting of the components and factors into the current market situations becomes important.

When we are fitting new components or factors to the business model we may have to move along the value system continuum. Some components must be from the stable VCS. At other times, however, we may have to consider a totally new approach. So, while we take a component or factor at a time we may have to do some work with it and maybe create something new or even rely on the emerging VCS. There should be some components from the stable VCS since customers must be able to understand the benefits of the offer. If everything is brand new and unrelated to existing value systems there may be a danger that the whole business opportunity, as an entity, is too far ahead of its time.

Two Examples

An example of a very simple business model creation which is firmly based on the stable VCS is to make an agreement to start as franchisee, e.g. a Koti-Pizza[ii] license. Here the main

difference between each pizzeria, i.e. franchises, is location. To be a little bit over simplistic the key component of the business model is created by drawing a circle with a pair of compasses. The rules are that the area should include more than 10 000 inhabitants and should not include another Koti-Pizza. So the appropriate point is to find a suitable location. The part that differentiates different Koti-Pizzas is location, thus belonging to the Morris et al.'s framework called "Market Factors". The main separating factor is location. The resulting business model belongs to stable value system. One could argue that location brings a little bit uncertainty to the equation and thus even these kinds of concepts are not fool-proof, because their value creation capabilities need to be tested in the actual market context. Thus, we could argue that when creating new 'koti-pizza' based on market factors belonging to established value system its value creation capability must be validated by markets.

Another example is Amazon.com's Kindle concept. The underlying vision is: *"every book, ever printed, in any language, all available in less than 60 seconds"* (Amazon, 2009). This idea has required lots of different kinds of solutions for business model components and they have all belonged to different value systems. Of course, it is impossible to reconstruct the actual process of creating the business model but we can identify in hindsight to which value system each component belongs. To start with, the first component the offering factors (Table 1) we can identify that there are some factors which have changed quite substantially. Although the primary product is a book and it has well-identified ways of creating value to the customers, the total offering includes innovative parts. The book that is sold is bits, i.e. it is in electronic form. The standard is proprietary AZW-standard and owned by Amazon.com. However, Kindle does support other formats too. Further, to be able to download the book in less than 60 seconds Amazon.com has had to develop a device, Kindle, to support this vision. Kindle allows Amazon.com to move content wirelessly into it. In addition, to support the electronic book format, Amazon.com has created Kindle-readers for PC, Mac and iPhone.

The second component market factors are almost the same as earlier. However, there is the possibility to gain new customers from e.g. newspaper readers, since Kindle allows you to download content and newspapers quickly and wirelessly into your device. At the moment, the business model is still emerging and we will see how this turns out.

The third component is internal capability factors. Here we can identify that Amazon.com has improved substantially its supply chain management by excluding a few steps from the chain. Amazon.com is skipping printing houses and logistics firms since it has turned the physical book into a bit format. This is not a brand new idea but packaged with the Kindle-reader this logistic chain works seamlessly and the end user can easily carry the electronic books around inside the Kindle and can download them everywhere via GSM network.

The fourth component of competitive strategy factors indicate to the user that Amazon.com is bringing some new value to them with the Kindle concept and the overall idea belongs to the emerging value system. The users and customer identify that Amazon.com has innovation leadership and that this whole idea finely supports their overall vision of being at the forefront of cost leadership. The product and service availability and efficiency are something unheard of and thus belong firmly to the emerging value system area.

The fifth component, economic factors, has certainly included some new ways of distributing profits among the partners. Undoubtedly, there are new ways of paying for digital rights to the publishing houses and both Amazon.com and publishing houses have to reconsider what kind of margins and volumes might be in question.

The sixth component of personal and investor factors remains the same as for the whole company. The Kindle concept supports Amazon.com's long-term aim of giving customers the ability to buy 'anything with a capital A'.

Amazon.com's Kindle concept business model's components belong to different value creation systems. Some are stable ones, some are established and quite a few are emerging ones. The components fit well together and it should not come as a surprise if this is the prevalent way of doing book business in the future.

Table 1. **The core components of the business model (Morris et al., 2006: 36)**

How do we create value? (select one from each set) **(factors related to the offering)** • Offering: primarily products / primarily services / heavy mix • Offering: standardized / some customization / high customization • Offering: broad line / medium breadth / narrow line • Offering: access to product / product itself / product bundled with other firm's product / service • Offering : internal manufacturing or service delivery / outsourcing / licensing / reselling / value added reselling • Offering: direct distribution / indirect distribution (if indirect: single or multi-channel)
Who do we create value for? (select one from each set) **(market factors)** • Type of organization: B2B / B2C / both / other • Local / regional / national / international • Where customer is in value chain: upstream supplier / downstream supplier / government / institutional / wholesaler / retailer / service provider • Broad or general market / niche market • Transactional / relational
What is our source of competence / advantage? (select those that apply) **(internal capability factors)** • Production / operating systems • Selling / marketing • Information management / mining / info, packaging • Technology / R&D / creative or innovative capability / intellectual • Financial transactions / arbitrage • Supply chain management • Networking / resource leveraging
How do we differentiate ourselves? (select those that apply) **(competitive strategy factors)** • Image of operational excellence / consistency / dependability • Product or service quality / selection / features / availability • Innovation leadership • Low cost / efficiency • Intimate customer relationship / experience
How do we make money? (select one from each set) **(economic factors)** • Pricing & revenue sources: fixed / mixed / flexible • Operating leverage: high / med / low • Volumes: High / med / low • Margins: High / med / low
What are our time, scope and size ambitions (select one) **(personal / investor factors)** • Subsistence model • Income model • Growth model • Speculative model

CONCLUSIONS

It is argued that the entrepreneurial process is teleological and it aims at creating value which can be captured in a conceptual level by the value creating system, i.e. business models. This paper presents a critical realism based entrepreneurial value creation framework to describe how entrepreneurs create value. In addition, the process of creating a business model is described. The resulting business models can be categorized into three different categories along a value system continuum, namely, stable value systems, redefined value systems and emerging value systems (see Fig. 3). While the business model is under construction the components and factors (see Table 1) may belong to different value system categories, so the resulting business model can have components belonging to different locations along the value systems continuum. The value system continuum is not a stage model that describes the evolution or revolution of business models. Rather it describes at a certain point of time how well a business model's capability to create value is known. Even the most innovative and radical business models will become industry recipes if their capability of creating value is superior to existing ones. We used two examples to scrutinize our entrepreneurial value creation model.

The entrepreneurial implications are that entrepreneurs should pay close attention to all components of the business model and see that they fit well together. All of the components must be thought through. The value continuum view gives managers an extra dimension so that they can evaluate the newness of the concept and thus articulate it forward, for example to the investors. Also, the newness of a given business model should advise entrepreneurs to decide how much and what sort of education and marketing material the markets need. A very new business model must show very convincingly how it creates value for the customer. Also, new value creation models may be needed for the education of customers.

The research implications lie in the use of critical realism as a basis of entrepreneurial research. Lindgren and Packendorff (2008) argue that there is a 'lack of research literature discussing underlying scientific assumptions within entrepreneurship' and this paper aims to fill, at least a little bit, that gap. Further, we hope that we have demonstrated that critical realism may have an opportunity to work as unifying epistemology and ontology in entrepreneurial research so that we can see that creation and discovery theories may indeed belong to the same phenomena. This study is only a first theoretical step towards a more comprehensive model of the entrepreneurial model. Here we have only considered the phase of creating a business model, but not the exploitation of the model and the actual value creation. This needs to be done in the future. Also, the model of entrepreneurial value creation that is presented here should be scrutinized with empirical results. In conclusion, it would be interesting to see if it is possible to evaluate business models based on their components and factors to see in which value system category they belong. This kind of tool might be of great value for venture capitalists and business angels.

REFERENCES

Alvarez S. A., 2005a. Two Theories of Entrepreneurship: Alternative Assumptions and the Study of Entrepreneurial Action. Prepared for Max Planck Summer Entrepreneurship Intensive. No: 1905, 43.

Alvarez S. A. and Barney J., 2007 Guest editors' introduction: The Entrepreneurial Theory of the Firm. Journal of Management Studies (44)7, pp. 1057-1063.

Alvarez S. and Barney J. B., 2006a. [WWW] A Creation Theory of Entrepreneurial Opportunity Formation. Seminar Series Spring, 2007: May 25, 2007 at University of Kentucky, The Agricultural Economics Department. [On line] http://www.uky.edu/Ag/AgEcon///seminars/alvarez-may07-txt.pdf

Alvarez S. and Barney J. B., 2006b. Discovery and Creation: Alternative Theories of Entrepreneurial Action. Working Paper Series of Fisher College of Business. WP 2006-01-005.

Amazon, 2009. [WWW] Annual Report 2008.[On line] www.amazon.com

Amit R. and Zott C., 2001. Value creation in e-business. Strategic Management Journal. Vol 22, Iss. 6–7, 493–520.

Archer M., 1998. Realism and morphogenesis. In Archer M., Bhaskar R., Collier A., Lawson T., and Norrie A. (eds.), 1998. Critical Realism: Essential Readings. Routledge. 356–382.

Barney J. B., 1991. Firm resources and sustained competitive advantage. *Journal of Management*. Vol. 17, Iss. 1, 99–120.

Bhaskar R., 1998. *The Possibility of Naturalism: A Philosophical Critique of the Contemporary Human Sciences*. 3rd edn., New York, London: Routledge.

Boylan T. A. and O'Gorman P. F., 2006. Notes and Comments: Fleetwood on causal holism: clarification and critique. Cambridge Journal of Economics. Vol. 30, Iss. 1, 123–135.

Burrell G. and Morgan G. 1979. *Sociological paradigms and organizational analysis*. Heinemann, London.

Buzenis L., G.P. III West, D. Shepherd, T. Nelson, G.N. Chandler, and A.L. Zacharachis (2003). Entrepreneurship research in emergence: 15 years of entreprenurship research in management journals. Journal of Management, 29(3), pp. 285-308.

Castellacci F., 2006. A critical realist interpretation of evolutionary growth theorizing. *Cambridge Journal of Economics*. Vol. 30, Iss. 6, 861–880.

Davidsen B-J., 2005. [WWW] Critical Realism in Economics – a different view. *post-autistic economics review (PAER)*. Iss. 33, article 414. [On line] http://www.paecon.net/PAEReview/issue33/Davidsen33.htm

Davidsson P., 2003a. The Domain of Entrepreneurship Research: Some Suggestions. In: Katz, J.A. and Shepherd, D., 2003. *Cognitive approaches to entrepreneurship research*. Advances in Entrepreneurship, Firm Emergence and Growth, Vol. 6. Elsevier Science Ltd. 315-372.

Davidsson P., 2005. *Researching Entrepreneurship*. USA: Springer.

Davidsson P., 2006. The entrepreneurial process. In Carter S. and Jones-Evans D. (Eds.) *Enterprise and Small Business. Principles, Practice and Policy*. 127–151. (2.Ed.). Prentice Hall.

Dunham L. and Venkataraman S., 2002. [WWW] From Rational to Creativity Action: Recasting Our Theories of Entrepreneurship. Working Paper 02-06 of Darden

Graduate School of Business Administration, University of Virginia. [Online: http://ssrn.com/abstract=392421]

Easterby-Smith M, Thorpe R, Lowe A., 1991. Management Research: An Introduction. London: SAGE.

Eriksson P. and Kovalainen A., 2008. Qualitative Methods in Business Research. Sage.

Fleetwood S., 2004. An ontology for organization and management studies. In Fleetwood S. and Ackroyd S. (Ed.) *Critical Realist Applications in Organisation and Management Studies.* Routledge. 27–53.

Fleetwood S., 2005. Ontology in Organization and Management Studies: A Critical Realist Perspective. *Organization.* Vol. 12, Iss. 2, 197–222.

Fleetwood S., 2005. Ontology in Organization and Management Studies: A Critical Realist Perspective. *Organization.* Vol. 12, Iss. 2, 197–222.

Fleetwood S. and Ackroyd S., 2004. (Ed.) *Critical Realist Applications in Organisation and Management Studies.* Routledge. 366.

Gilad B., 1984. Entrepreneurship: the issue of creativity in the market place. The Journal of creative behavior. Vol. 18, Iss. 3, 151–161.

Gioia D. A. and Pitre E. 1990. Multiparadigm Perspectives on Theory Building. *The Academy of Management Review. The Academy of Management Review.* Vol. 15, Iss. 4, 584–602.

Guba E. and Lincoln Y., 1989. J, *Fourth generation evaluation*. Thousand Oaks, CA: Sage. 294.

Heylighen F., Joslyn C., and Turchin V. (ed.), 2000b. [WWW] *Principia Cybernetica Web* (Principia Cybernetica, Brussels), [On line] http://pespmc1.vub.ac.be/ASC/MORPHOGENES.html

Hjorth D., Jones C., and Gartner W. B., 2008. Introduction for 'Recreating/ Recontextualising Entrepreneurship'. *Scandinavian Journal of Management*. Vol. 24, Iss. 2, 81–84.

Johnson M. W., Christensen C. M., and Kagermann H., 2008. Reinventing your business model. *Harvard Business Review*. Vol. 86, Iss. 12, 50–59.

Katsikis I.N. and Kyrdidou L.P., 2008. Entrepreneurship in teleology: the variety of the forms. International Journal of Entrepreneurial Behaviour & Research. Vol. 15, Iss. 2, 209-231.

Leca B. and Naccache P., 2006. A Critical Realist Approach To Institutional Entrepreneurship. *Organization*. Vol. 13, No. 5, 627–651.

Lingren M. and Packendorff J., 2008. Social Constructionism and Entrepreneurship: Basic Assumptions and Consequences for Theory and Research. *International Journal of Entrepreneurial Behaviour & Research*. Vol. 15, No. 1, 25-47.

Matthyssens P., Vandenbempt K., and Berghman L., 2006. Value innovation in business markets: Breaking the industry recipe. *Industrial Marketing Management*. Vol. 35, 751–761.

McEvoy P. and Richards D., 2006. A critical realist rationale for using a combination of quantitative and qualitative methods. *Journal of Research in Nursing*. Vol. 11, Iss. 1, 66–78.

Möller K. and Svanh S., 2003. Managing Strategic Nets: A Capability Perspective. *Marketing Theory*. Vol. 3, Iss. 2, 209-234.

Möller K. and Rajala A., 2007. Rise of Strategic Nets: A New Modes of Value Creation. *Industrial Marketing Management*. Vol. 36, 895-908.

Möller K. and Törrönen P., 2003. Business suppliers' value creation potential: A Capability-based Analysis. *Industrial Marketing Management*. Vol. 32, 109-118.

Morris M., Schindehutte M., and Allen J., 2005. The entrepreneur's business model: toward a unified perspective. *Journal of Business Research*. Vol. 58, 726–735.

Morris M., Schindehutte M., Richardson J., and Allen J., 2006. Is the Business Model a Useful Strategic Concept? Conceptual, Theoretical, and Empirical Insights. *Journal of Small Business Strategy*. Vol. 17, Iss. 1; 27–50.

Morris M., Schindehutte M., Richardson J., and Allen J., 2006. Is the Business Model a Useful Strategic Concept? Conceptual, Theoretical, and Empirical Insights. *Journal of Small Business Strategy*. Vol. 17, Iss. 1; 27–50.

Normann R. and Ramírez R., 1993. From Value to Value Constellation: Designing Interactive Strategy. *Harvard Business Review*. July-August 1993, 65-77

Nörreklit L., 2006. [WWW] The double hermeneutics of life world. Workin Paper of Danish Centre for Philosophy and Science Studies. Iss. 5, 13. [On line] http://www.think.aau.dk/Publications/philosophy-science/2006/5-Double%20hermeneutics.pdf

Parolini C., 1999. *The Value Net: A tool for Competitive Strategy*. Chichester: Wiley.

Parrish B. D., 2007. [WWW] Sustainability Entrepreneurship: Design principles, Processes, and Paradigms. Submitted in accordance with the requirements for the degree of Doctor of Philosophy. At the School of Earth and Environment of the University of Leeds. [On line] http://homepages.see.leeds.ac.uk/~earbdp/Parrish-Sustainability_Entrepreneurship-Full_Text-2007.pdf

Patomäki H. and Wight C., 2000. After Postpositivism? The Promises of Critical Realism. *International Studies Quarterly*, Vol. 44, Iss. 2, 213-237.

Perry C., Riege A., and Brown L. 1998. [WWW] Realism Rules OK: Scientific Paradigms in Marketing Research about Networks. Working Paper. Theme: Firms & Networks. [On line] http://smib.vuw.ac.nz:8081/www/ANZMAC1998/Cd_rom/Perry73.pdf

Porter M., 1985. *Competitive Advantage: Creating and Sustaining Superior Performance*. New York: Free Press.

Rindova B. and Ketchen D.J., 2009. Entrepreneuring as emancipation. *The Academy of Management Review*. Vol. 34, Iss. 4, 757–760.

Sanz-Velasco S. and Magnusson M. G., 2004. Opportunity Development in a Knowledge-Intensive Venture: A Case Study. Journal of Small Business and Entrepreneurship. Vol. 17, Iss. 4, 277–292.

Sarasvathy S. D., Dew N., Velamuri R., and Venkataraman S., 2003. Three views of entrepreneurial opportunity. In Acs Z. (Ed.) *Handbook of Entrepreneurship*. Boston, MA: Kluwer Academic Press, 141-160.

Schumpeter J.A., 1942. *Capitalism, Socialism and Democracy*. New York: Harper.

Shane S., 2000. Prior Knowledge and the Discovery of Entrepreneurial Opportunities. *Organization Science.* Vol. 11, Iss 4, 448–469.

Shane S. and Venkataraman S., 2000. The promise of entrepreneurship as a field of research. *Academy of Management Review*. Vol 25, 217-226.

Sousa F. J., 2008. [WWW] The anatomy of relationship significance: a critical realist exploration. Tese de Doutoramento em Ciências Empresariais. Faculdade de Economia, Universidade do Porto [On line] http://www.impgroup.org/uploads/dissertations/dissertion_33.pdf

Van de Ven A. H., 1992. Suggestion for studying strategy process: a research note. *Strategic Management Journal*. Vol. 13, 169–188.

Weick K. E., 1995. *Sensemaking in Organizations*. A Sage Series: Foundations for Organizational Science. Sage.

Williamson O.E., 1975. *Markets and Hierarchies: Analysis and Antitrust Implications*. New York: Free Press.

Willmott H., 2005. Theorizing Contemporary Control: Some Post-structuralist Responses to Some Critical Realist Questions. Organization. Vol. 12, Iss. 5, 747–780.

Zembylas M., 2006. Science Education as Emancipatory: The case of Roy Bhaskar's philosophy of meta-Reality. *Educational Philosophy and Theory*. Vol. 38, Iss. 5, 665–676.

ENDNOTES

[i] Since the focus of the study is on the business model only, the other elements of the BOC process are excluded from the article.

[ii] Koti-Pizza (www.kotipizza.fi) is a Finnish pizza franchise with more than 250 firms in 130 cities around Finland. More than 95% of firms are run by independent entrepreneurs.

ORGANIZING NPD NETWORKS FOR HIGH INNOVATION PERFORMANCE: THE CASE OF DUTCH MEDICAL DEVICES SMES

Annemien J.J. Pullen
Corresponding author
University of Twente
Institute for Governance Studies, SRO Innovation and Entrepreneurship, NIKOS Institute,
P.O. Box 217, 7500 AE Enschede, The Netherlands,
a.j.j.pullen@utwente.nl

Aard J. Groen
University of Twente, The Netherlands
Institute for Governance Studies, SRO Innovation and Entrepreneurship, NIKOS
a.j.groen@utwente.nl

Petra C. de Weerd-Nederhof
University of Twente, The Netherlands
Institute for Governance Studies, SRO Innovation and Entrepreneurship
p.c.deweerd-nederhof@utwente.nl

Olaf A.M. Fisscher
University of Twente, The Netherlands
Institute for Governance Studies, SRO Innovation and Entrepreneurship
o.a.m.fisscher@utwente.nl

This research examines which combination of network characteristics (the network configuration) leads to high innovation performance for small and medium sized companies (SMEs). Even though research has paid significant attention to the relation between the external network and the innovation performance of SMEs, research has not yet clearly demonstrated which configurations most affect innovation in particular contexts. The context of the research is the Dutch medical devices sector. This sector is selected because collaboration with external partners for new product development means becomes increasingly important due to the complexity of the products and the fragmentation of the market. In addition the sector is characterized by very strict regulations. These regulations are the cause of the time and cost consuming product development process.
In triangulation with quantitative survey data (N=60), qualitative data was gathered through semi-structured interviews in these same companies (N=50), which resulted in a response rate of 61,9%. The systems approach was used to construct the successful network configuration that is related to high innovation performance. By using this approach we are able to simultaneously address multiple network characteristics. Correlation statistics between the Innovation Performance and the Euclidean Distance showed that the more a companies' network configuration differed from the successful network configuration, the lower the Innovation Performance of that company. Contrary to what we hypothesized from literature, the results of the social systems approach indicate that the network configuration that is related to high innovation performance includes high levels of resource complementarity and goal alignment, and low levels of trust and network position strength. Instead of the social way of networking, both our quantitative and qualitative findings show that a "businesslike" approach which is focused and consistent is related to high innovation performance.

INTRODUCTION

For successful New Product Development (NPD) SMEs[1] see themselves confronted with the need to collaborate (Karlsson and Olsson 1998, Rogers 2004). This need is caused by the fact that on the one hand, SMEs need to innovate to compete (Hanna and Walsh 2002, O'Regan et al. 2006) but on the other hand they also need to focus on their core competences for efficiency matters. This focus on core competences (Penrose 1959) inherently means that SMEs cannot do everything themselves. The question that remains unanswered is "how to organize, from the perspective of the SME, the interaction pattern between the SME and its external partners in the egocentric network[2], in order to achieve high innovation performance?"

What we know from previous research is that collaboration positively influences NPD and the innovation performance which is the result of NPD. For example Branzei and Thronhill (2006) conclude that diverse networks increase the positive payoffs of internal innovation capabilities (Branzei and Thornhill 2006). Furthermore, Teece (1989) states that the successful commercialization of technology often requires collaboration among horizontal competitors that have different capabilities (Teece 1989). Especially in the field of new product development networking activity becomes more and more popular as cooperation with other organizations increases the innovation performance of organizations (Ritter and Gemünden 2003, Ritter and Gemünden 2004, Hanna and Walsh 2002, Rothwell 1991, Chang 2003, Salman and Saives 2005). However, practice shows that numerous alliances fail in practice (Duysters et al. 1999, Spekman et al. 1996, Sadowski and Duysters 2008, Faems et al. 2005), mainly due to negative prospects and negative perceptions (Sadowski and Duysters 2008), differences in cognition, conflicting interests, differences in timing of contributions

(Mahnke and Overby 2008), opportunistic hazards, and managerial complexity and uncertainty (Park and Ungson 2001). However, up to this moment, research has not yet clearly demonstrated which combination of network variables (i.e. the network configuration) most affect innovation in particular contexts (Pittaway et al. 2004). Therefore, the objective of this research is to examine which combination of network characteristics (the network configuration) leads to high innovation performance.
The setting of this research is the Dutch medical devices sector. This sector was selected for data gathering because collaboration with external partners for new product development means becomes increasingly important due to the complexity of the products and the fragmentation of the market (Atun et al. 2002, MacPherson 2002, Prabhakar 2006). In addition the sector is characterized by very strict regulations. These regulations are the cause of the time and cost consuming product development process (Kaplan et al. 2004, Atun et al. 2002, MacPherson 2002). As Langerak and Hultink (2006) we focus on a single industry to rule out possible confounding effects due to unmeasured industry level factors.
This research contributes to theory as it addresses multiple network characteristics simultaneously in relation to innovation performance instead of focusing on individual network characteristics as past research did. In addition we use the systems approach (Drazin and Van de Ven 1985) instead of cluster analysis to examine the successful combination of network characteristics. Focusing on multiple network characteristics in combination and applying the systems approach leads to new insights in the external organization of new product development (NPD). In addition, the research contributes to practice by offering SMEs a guideline in organizing their NPD network,. This not only improves the innovation performance of the SME, but it also improves the innovativeness of the medical devices sector as a whole.

To answer our research question “how to organize, from the perspective of the SME the interaction pattern between the SME and its external partners in the egocentric network, in order to achieve high innovation performance?” we constructed hypotheses based on theory in section 1 of this paper. Section 2 describes the methodology which includes the research context (§2.1) and sample (§2.2), the research method of the social systems approach (§2.3) and the operationalization of variables (§2.4). The results of the quantitative data analysis (§3.1) which are complemented by a qualitative data analysis (§3.2) are described in section 3. In addition, section 4 discusses the research results. Section 5 presents the research limitations and suggestions for further research. Finally, the concluding remarks can be found in section 6.

1. THEORETICAL FRAMEWORK AND HYPOTHESES

The theoretical framework covers literature on the relation of several network characteristics in relation to innovation performance. We start by briefly introducing and defining the concept of Innovation Performance (§1.1) after which we elaborate on the relation between Innovation Performance and network characteristics and construct the research hypothesis. Prior research has frequently considered the effect of firm network characteristics on innovation performance. A literature study on the network characteristics that are most often used in research in relation to innovation performance indicated that the network characteristics “resource complementarity” (§1.2), “trust” (§1.3), “network position strength” (§1.4), “distrust” (§1.3), and “goal alignment” (§1.5) are most often used (Pullen et al. forthcoming 2010b). Therefore we use these characteristics in this research.

1.1. Innovation Performance

In this research the definition of innovation proposed by Afuah (1998) is used, which states that in the field of high technology innovation is invention + commercialization (Afuah 1998). Garcia and Calantone (2002) align with this definition as they state that innovation is ‘‘an iterative process initiated by the perception of a new market and/or new service opportunity for a technology-based invention which leads to development, production, and marketing tasks striving for the commercial success of the invention’’ (Garcia and Calantone 2002).
The performance that is achieved as a result of new product development is the innovation performance (Salomo et al. 2007). For this research a measure of innovation performance which is not bound to a certain time span and which is also applicable at the project level is needed. Such a measure is developed by Atuahene-Gima, Slater, and Olsen (2005; 2007) who present a measure for product innovation performance which focuses on whether the product development objectives were achieved. (Atuahene-Gima et al. 2005). Therefore we use the innovation performance measure of Atuahene-Gima et al. (2005)

1.2. Resource Complementarity

In relationships between companies the physical and organizational resources of the company are exchanged and combined with those of its counterparts in order to achieve the set goals (Haythornthwaite 1996, Tichy et al. 1979). Firms are encouraged to innovate by searching out new resources, or new ways of using existing resources, as the basis for future organizational rents (Galunic and Rodan 1998, Håkansson 1989, Oerlemans et al. 1998). Such resources will fuel the firm’s innovative activities by providing the external information necessary to generate new ideas. Equally, the innovative work of the firm will benefit from access to new knowledge necessary to resolve design and manufacturing problems (Tsai 2001). Simply having resources is not enough to produce innovative output. It is also the way these resources are utilized in the innovation process, which determines whether innovative outputs are produced in an effective and efficient way (Oerlemans et al. 2001). In fact, the innovation effects of resource exchange in NPD collaborations can be located at two levels. First, the adaptation of external resources leads to an extension of firms’ technological capabilities of developing new products. Second, the implementation of additional capacities from outside raises the probability of realizing innovations (Becker and Dietz 2004).

The resources of the companies are affected, both in terms of how they are used and how they develop (Gadde et al. 2003).
Lambe et al (2002) distinguish between resources that are developed and resources that are used in external collaboration: idiosyncratic and complementary resources. Idiosyncratic resources are developed during the life of the collaboration, are unique, and facilitate the combining of resources contributed by the partner firms. Complementary resources are defined as the degree to which firms in an alliance are able to eliminate deficiencies in each other’s portfolio of resources by supplying distinct capabilities, knowledge, and other entities (Lambe et al. 2002). Since both resource types should be present as they affect the success of the external collaboration (Lambe et al. 2002), we use the measure for complementary and idiosyncratic resources of Lambe et al. (2002)

1.3. Trust

Trust is defined as the belief that the results of somebody’s intended action will be appropriate from our point of view (Nahapiet and Ghoshal 1998). Trust is necessary for people to work together on common projects, even if only to the extent that all parties believe they will be compensated in full and on time (Leana and Van Buren III 1999). Faems et al (2008) distinguish between competence trust, which is defined as encompassing positive expectations about a partner’s ability to perform according to an agreement, and goodwill trust, which is

defined as the partner's intention to perform according to an agreement. They find that competence trust is a crucial condition for subsequent transactions and goodwill trust is found to be a condition that determines how contracts are applied (Faems et al. 2008). Trust that builds up over time may in itself lead to unforeseen benefits, even when the expected gains are not fully realized over a given time period. Trust is an important factor in determining commitment, over and above any strict cost-benefit accounting, particularly among small and medium sized producers (Suarez-Villa 1998). Some element of trust will be required for any transaction in which simultaneous exchange is unavailable to the parties (Ring and Van de Ven 1992) as in new product development. We are interested in the level of trust between the focal SME and its external partners. Gulati & Sytch (2008) investigate the formation of trust between firms. To measure interorganizational trust we use the measure of Gulati & Sytch (2008).

1.4. Network Position Strength

Even though the extensive body of literature concerning network characteristics repeatedly indicates the importance of the structure of the network in terms of the presence of structural holes (Burt 1992b), the density of the network (Burt 1992b, Gilsing and Nooteboom 2005) and the size of the network (Borgatti et al. 1998) in relation to innovation performance it lacks a solid measure to measure the structure of the ego network. Therefore, based on literature, a measure for "network position strength" was developed (Pullen et al. forthcoming 2010b). "Network position strength" includes the items "density", "size", and "structural holes" (Pullen et al. forthcoming 2010b).

Density is the number of actual links in the network as a ratio of the number of possible links in the network (Kerssens-VanDrongelen and Groen 2004, Haythornthwaite 1996, Burt 1992a, Borgatti et al. 1998, Inkpen and Tsang 2005, Liao and Welsch 2005, Nahapiet and Ghoshal 1998, Tichy et al. 1979, Rowley 1997). As density increases, communication across the network becomes more efficient. Furthermore as interorganizational linkages become more dense, behaviors become more similar across the network, and the likelihood that shared behavioral expectations will be established increases (Rowley 1997). Irrespective of one's position, high density inhibits the existence and utilization of diversity, and hence of novelty value, while at low levels it does not support absorption sufficiently (Gilsing et al. 2008).

When ego occupies a structural holes position in the network, ego is able to broker connections between alters in his network (Burt 1992a, Haythornthwaite 1996). In an ego network, ego is connected to every other actor (by definition). If these others are not connected directly to one another, ego may be a "broker" if ego falls on the paths between the others (Hanneman and Riddle 2005). Firms occupying the favored network position of bridging structural holes are likely to perform better because of the their superior access to information (Burt 1992b, Zaheer and Bell 2005). Actors in a network rich in structural holes will be able to access novel information from remote parts of the network, and exploit that information to their advantage (Burt 1992b, Burt 2001, Burt 2004). Consequently, networks rich of structural holes are more likely to yield new information, which can lead then to the discovery of entrepreneurial opportunities (Arenius and De Clerq 2005).

The size of the network is determined by the number of alters that an ego is directly related to (Koka and Prescott 2002, Kerssens-VanDrongelen and Groen 2004, Borgatti et al. 1998, Tichy et al. 1979).

1.5. Goal Alignment

Value, in terms of innovation performance, can be created through cooperation and knowledge sharing (Inkpen and Tsang 2005). When the objectives and strategies of an alliance are clearly stated, a foundation of common understanding and the means to achieve

the collaborative purpose is established among the partners. Subordinating cooperation to strategic goals can provide longer-term horizons for the alliances, compared with circumstantial cooperative outsourcing, even when an alliance is structured to deal with specific projects of a pre-determined duration (Suarez-Villa 1998).
Goal alignment is the degree to which every pair of individuals has clearly defined expectations about each other's behavior in the relation (Tichy et al. 1979), or the degree to which network members share a common understanding and approach to the achievement of network tasks and outcomes (Inkpen and Tsang 2005). When partners have contradicting or inconsistent goals, inter-partner conflicts may arise. This is not conducive to the flow of knowledge between the partners and the alliance. For goal alignment Bourgeois III (1980) uses the term goal consensus. In his research on goal consensus Bourgeois III (1980) concludes that a coalition of strategy makers cannot focus on alternative means without a clearly conceived set of goals in mind. Therefore goals agreement is paramount/ predominant. Dess (1987) builds on the research and questionnaire of Bourgeois (1980). He finds that consensus on competitive methods has an important relationship to performance. We adopt the measure of Dess (1987) to measure goal alignment.

The literature on network characteristics as described above, states that all these network variables when considered separately are related to innovation performance. The focus on one or more network characteristics in solitude in relation to innovation performance leads to a form of reductionism (Drazin and Van de Ven 1985), as 1) real-life organizations and networks consist of multiple characteristics in combination, and 2) the interaction between the variables is ignored which might lead to different research results. This form of reductionism can be overcome by addressing the characteristics of organizations in combination (Miller and Friesen 1982). The network characteristics in combination, or in other words the network configuration, must be taken into account when analyzing technological networks. In their research on the underlying structure of network characteristics and innovation performance, Pullen et al. (forthcoming 2010a) find that the network characteristics in solitude do not have a direct main effect on innovation performance. However the interaction effect of the network characteristics has a direct significant effect on innovation performance (Pullen et al. forthcoming 2010a). However research has not yet clearly demonstrated which configurations most affect innovation in particular contexts (Pittaway et al. 2004). In the context of SMEs in the medical devices sector we hypothesize that:

H1: The network configuration of SMEs that is related to high innovation performance in the medical devices sector includes high levels of resource complementarity and trust, a strong network position, and a high level of goal alignment.

The variables that are included in the hypothesis and their hypothesized relations are visualized in the research model below.

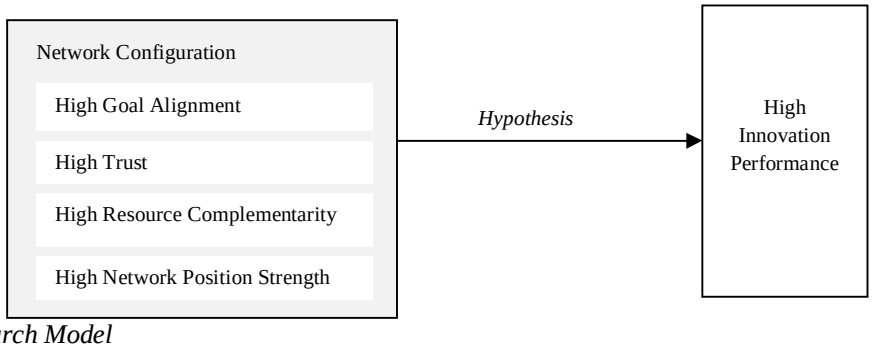


Figure 1: Research Model

2. METHODOLOGY

This methodology section first explains more in-depth why the medical devices sector was selected as research context (§2.1). Second, it describes the sampling and datagathering process (§2.2). §2.3 describes the operationalization of variables we conducted to test the validity of the self-administered questionnaire. The research method of the systems approach is described in §2.4.

2.1. Research Context

The context of the research is the Dutch medical devices sector[3]. This sector was selected, because collaboration with external partners for new product development becomes increasingly important due to the complexity of the products and the fragmentation of the market. 80% of the companies in this sector are SMEs and based on theory and in line with earlier research we assume that they need to cooperate with external partners to share resources for the development of new products (Prabhakar 2006, Biemans 1989, Millson and Wilemon 2000). In addition the sector is characterized by very strict regulations (Kaplan et al. 2004). Mainly due to these regulations which cause a very time- and cost consuming new product development process (Kaplan et al. 2004, Nieto and Santamaría 2010) SMEs in the medical devices sector face the problem of a lack of financial resources and a lack of qualified personnel in their NPD process. This makes it necessary for them to cooperate (Kaufmann and Tödtling 2002, Rogers 2004). In addition, the intense competition, high rate of growth, continuing technological innovation, and customer sophistication suggest a significantly above average level of new product development activity (Rochford and Rudelius 1997).

2.2. Data gathering and Sample

The data gathering has taken place during the autumn and winter of 2009. Through a telephone pre-survey among 751 Dutch medical devices companies, companies that actively participate in the development of new medical devices and that have less than or equal to 250 Full Time Equivalents were identified as suitable companies to participate in the research. In this telephone pre-survey also key respondents were identified, the purpose of the research was explained and the potential respondents were asked to participate in the research. A total of 105 suitable companies were identified. A total of 97 potential respondents indicated that they were willing to cooperate with the research. They received a personalized letter explaining the purpose of the study, along with a questionnaire by e-mail. The questionnaire could be filled-in electronically and returned by e-mail. Non-respondents received reminder telephone calls and a second questionnaire. Respondents were new product development managers, R&D Managers, CTO's and CEO's. These efforts yielded 60 usable responses, giving a response rate of 61,9% percent (see Table 1).

In triangulation with quantitative survey data, also qualitative data was gathered through semi-structured interviews in 50 of these same companies. Gathering both quantitative and qualitative data enriches the data to a large extent

		Frequency	Percent	**Cumulative Percent**
Valid	filled-in questionnaire	13	13,4	13,4
	filled-in questionnaire + interview	47	48,5	**61,9**
	withdrawn participation	37	38,1	100,0
	Total	97	100,0	

Table 1: Response rate of the sample

2.3. Research method

To examine which combination of network characteristics leads to high innovation performance we use the systems approach of Drazin and Van de Ven (1985). The systems approach examines the impact of the network characteristics taken as a set on innovation performance by calculating the distance from an ideal profile (Govindarajan 1988). This ideal profile is in the context of this research the combination of network characteristics that is related to high innovation performance (i.e. the successful network configuration). The successful network configuration of design variables can be generated either theoretically or empirically. As Drazin and Van de Ven (1985), we chose to use the empirical-based successful network configuration.

Next to this quantitative data analysis we use qualitative interview data in triangulation to verify and complement the quantitative data results.

2.4. Operationalization of Variables

This section describes the operationalization and validity of the variables "innovation performance", "goal alignment", "trust", "resource complementarity" and "network position strength". In addition, the research method is of the social systems approach is described.

Innovation Performance

The measure of Atuahene-Gima, Slater and Olsen (2005) to measure innovation performance was used. Innovation performance was measured through 5 items on a 7-point Likert scale . After factor analysis (see "Questionnaire Validity" in this section) the factor scores of innovation performance were used in the analyses. The 15% of companies with the highest factor scores for innovation performance together formed the "successful configuration sample (top 15%)" (N=7). The other 85% of companies together formed the "calibration sample (bottom 85%)".

Network Characteristics

From literature we extracted 4 network characteristics (a total of 19 items) that are suggested to have a relation to the companies' innovation performance (Pullen et al. forthcoming 2010b). We used the measures of Lambe et al (2002) to measure the level of idiosyncratic and complementary resources. The items were measured on a 7-point Liker scale ranging from "Not true at all" to "Very True". To measure "trust", Gulati and Sytch's (2008) measure of "trust" was used. The measurement consists of 6 items that are all measured on a 7-point Likert scale ranging from "Disagree strongly" to "Agree Strongly" (Gulati and Sytch 2008). The measurement of "goal alignment" of Dess (1987) was used, which uses the sum of the standard deviations between ego's goals and the goals of its external partners (Dess 1987).

To measure "network position strength" a measure was developed by Pullen et al. (forthcoming 2010b) in which respondents are asked to indicate the direct relations between the partners in the network in a matrix. Based on this matrix UCINET (Borgatti et al. 2002) iss able to compute the values of density, structural holes position, and network size, which together build the measurement for the "network position strength".

After factor analyses (see "Questionnaire Validity" below) the mean scores of the full sample (N=59) on the network characteristics are 0, since the scores of the network characteristics are factor scores. As a consequence the standard deviations of each network characteristic for the full sample are all 1. Mean scores of network characteristics above 0 are considered "high" and scores below 0 are considered "low".

	Component					
	1 Resource Complementarity	**2 Innovation Performance**	**3 Trust**	**4 Network Position Strength**	**5 Distrust**	**6 Goal Alignment**
Q19.6_IfPartnerSwitchInvestmentsWasted	,836					
Q19.1_CreatedUniqueCapabilities	,807					
Q19.3_TogetherInvestedInBuildingBusiness	,806					
Q19.4_TogetherInvestedInRelationship	,798					
Q19.2_TogetherDevelopedKnowledge	,794					
Q19.5_IfEndedKnowledgeWasted	,734					
Q20.1_ContributeDifferentResources	,708					,472
Q20.3_SeparateAbilitiesCombined	,708		,438			
Q20.2_ComplementaryStrengths	,619					
Q8.3_ReturnAssets_Objective		,891				
Q8.4_ReturnInvestment_Objective		,874				
Q8.5_Profitability_Objective		,868				
Q8.2_Sales_Objective		,864				
Q8.1_MarketShare_Objective		,811				
Q25.2_ConfidentialityOfInformation			,879			
Q25.1_TreatYouFairly			,852			
Q25.3_PartnersAlwaysEvenHanded			,746			
Ties_Brokered_normalized				,911		
Density				-,828		
Network_Size				,721		
Q25.5_Inv_CannotCompletelyRelyOnPromises					,847	
Q25.4_Inv_ProfitAtYourExpense					,796	
Q25.6_Inv_HesitantVagueSpecifications					,767	
Goal_Alignment						-,830
Eigenvalue	**6,97**	**3,96**	**2,47**	**2,09**	**1,66**	**1,12**
% Variance explained	**29,04**	**16,51**	**10,31**	**8,72**	**6,93**	**4,68**
Cronbach's α	**0,925**	**0,923**	**0,886**	**0,815**	**0,750**	**x**
# items	**9**	**5**	**3**	**3**	**3**	**1**

Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.

a. Rotation converged in 6 iterations.

Table 2: Factor analysis results

Questionnaire Validity

Since not all measures were directly extracted from literature, nor previously tested in combination, an exploratory factor analysis was conducted. Factor analysis on the 4 network characteristics and innovation performance (excluding innovativeness since this is a categorical variable) indicated that the 24 items in the questionnaire together build six constructs (Innovation Performance and five network characteristics) (see Table 2) that together explain 76,19% of the variance (Pullen et al. forthcoming 2010b). Items with loadings greater than 0,40 on a factor are considered significant. As can be seen in Table 3 there are two items (Q20.1 and Q20.3) that load on more than one factor. There is some disagreement in literature about what to do when items load on multiple factors. Kline (2000) suggests to drop the items that load on multiple factors, because they are difficult to interpret (Kline 2000). However Hair et al. (1995) argues that the meaning of an item must be taken into account when assigning labels to a factor (Hair et al. 1995). In line with Hair et al. (1995) Pett et al. (2003) suggest placing the item with the factor it is most closely related to conceptually instead of dropping the item. They argue that reliability tests of the factors will show the internal consistency of a factor and will also indicate whether or not reliability of a factor will increase by dropping an item (Pett et al. 2003). As Hair et al. (1995) and Pett et al.

(2003) we do not drop the items with multiple (significant) factor loadings, rather we assign the item to the factor it is most closely related to and use reliability test for internal consistency. All six constructs had high reliabilities, and high Eigenvalues. In some cases the grouping of the items differs from literature. This might be explained by the fact that literature focuses on each of these network characteristics individually, whereas we focus on these network characteristics in combination.

3. RESULTS

This section describes the research results of both the quantitative data analysis (social systems approach) which tests our hypothesis (§3.1), and the qualitative data analysis (§3.2) which is used to complement and clarify the quantitative data results.

3.1. Quantitative data analysis

The empirical-based successful network configuration consists of the best performing 15% of companies (top 15%) in terms of Innovation Performance[4]. The other 85% of companies in the sample is the calibration sample. Table 3 below shows the mean scores[5] of the five network characteristics for both the successful network configuration sample and the calibration sample. The mean scores of the top 15% best performing companies is considered as the empirical-based successful network configuration.

	SampleInnovationPerformance	Mean	Std. Deviation	N
FAC1_2ResourceComplementarity	Calibration Sample (bottom 85%)	-,0374675	1,02977594	51
	Successful network configuration Sample (top 15%)	,2729774	,75109526	7
	Total	,0000000	1,00000000	58
FAC3_2Trust	Calibration Sample (bottom 85%)	,0438780	1,04397646	51
	Successful network configuration Sample (top 15%)	-,3196824	,53105098	7
	Total	,0000000	1,00000000	58
FAC4_2NetworkPositionStrength	Calibration Sample (bottom 85%)	,0018533	1,01170593	51
	Successful network configuration Sample (top 15%)	-,0135023	,98497919	7
	Total	,0000000	1,00000000	58
FAC5_2Distrust	Calibration Sample (bottom 85%)	-,0340582	,99872564	51
	Successful network configuration Sample (top 15%)	,2481384	1,05175950	7
	Total	,0000000	1,00000000	58
FAC6_2GoalAlignment	Calibration Sample (bottom 85%)	-,0489618	1,02477099	51
	Successful network configuration Sample (top 15%)	,3567219	,76149048	7
	Total	,0000000	1,00000000	58

Table 3: Descriptive statistics for the Ideal Profile (top 15%) and the Calibration Sample (bottom 85%)

The next step was to calculate the Euclidean Distance for each case which is the difference between the successful network configuration and the network configuration of an individual case company. The Euclidean distance was calculated as follows: Euclidean Distance = $\sqrt{\Sigma(X_{is} - X_{js})^2}$, where X_{is} is the score of the successful network configuration on the s^{th} network characteristic and where X_{js} is the score of the j^{th} case company on s^{th} network characteristic (Drazin and Van de Ven 1985).

After calculating the Euclidean Distance for all cases in the sample this distance measure was correlated with the innovation performance measure to test the pattern approach to contingency theory. Table 4 shows the correlation between the Euclidean Distance and the Innovation Performance.

		FAC2_2Innovation Performance	EuclideanDistance
FAC2_2InnovationPerformance	Pearson Correlation	1,000	-,305*
	Sig. (2-tailed)		,020
	N	58,000	58
EuclideanDistance	Pearson Correlation	-,305*	1,000
	Sig. (2-tailed)	,020	
	N	58	58,000

*. Correlation is significant at the 0.05 level (2-tailed).

Table 4: Correlations

Euclidean Distance correlates -0,305 ($p<0,05$) with Innovation Performance. The results indicate that as the network configuration (i.e. the combination of network characteristics) of a company differs more from the successful network configuration (i.e. the Euclidean distance increases), the Innovation Performance will decrease. In other words, the more the combination of network characteristics is similar to the successful network configuration of the top 15% best performing companies, the higher the Innovation Performance of the company will be. In addition these results show significant support for the systems approach in the context of networks in new product development.

Table 5 shows the mean scores of the top 15% performing companies on the network characteristics. As described in §2.4 (operationalization) are scores above 0 considered "high" and scores below 0 considered "low". As the last column in table 5 shows can the successful network configuration be described as one having high levels of "resource complementarity", "distrust" and "goal alignment", and low levels of "trust" and "network position strength".

	N	Minimum	Maximum	Mean	Std. Deviation	**Level**
FAC1_2ResourceComplementarity	7	-,65443	1,39224	,2729774	,75109526	**High**
FAC3_2Trust	7	-1,27900	,24147	-,3196824	,53105098	**Low**
FAC4_2NetworkPositionStrength	7	-1,63854	,93432	-,0135023	,98497919	**Low**
FAC5_2Distrust	7	-1,02712	1,59827	,2481384	1,05175950	**High**
FAC6_2GoalAlignment	7	-1,16537	1,13650	,3567219	,76149048	**High**
Valid N (listwise)	7					

Table 5: Successful Network Configuration

The network configuration of the calibration sample (the bottom 85%) is the inverse of the successful network configuration (see table 6). This network configuration, that is related to a lower level of Innovation Performance, has low levels of "resource complementarity", "distrust" and "goal alignment", and high levels of "trust" and "network position strength".

	N	Minimum	Maximum	Mean	Std. Deviation	**Level**
FAC1_2ResourceComplementarity	51	-2,67224	1,31463	-,0374675	1,02977594	**Low**
FAC3_2Trust	51	-3,33155	1,90883	,0438780	1,04397646	**High**
FAC4_2NetworkPositionStrength	51	-2,00956	1,88500	,0018533	1,01170593	**High**
FAC5_2Distrust	51	-2,50056	2,71374	-,0340582	,99872564	**Low**
FAC6_2GoalAlignment	51	-2,14984	2,46205	-,0489618	1,02477099	**Low**
Valid N (listwise)	51					

Table 6: Network configuration of the Calibration Sample

The contents of the successful network configuration (table 5) show that the top 15% best performing companies have a clear focus and are functional when it comes to collaboration with other companies. They collaborate only when their goals and the goals of the partner firm are aligned and if the partner firm is able to offer the resources that the company initially lacks. Instead of trusting the partner firm blindfolded, the company has a certain level of distrust towards the partner firm. The network of the company consists of a limited number of partners (small size) and, in addition, these partners are not directly connected to each other (low density). Even though the company occupies the structural holes position, its network position strength is low due to the small size and the low density. These companies are very focused, functional and consistent in collaborating for new product development.
In contrast, the lower performing companies express high levels of trust towards their partners. Also, partners in the network know each other. It seems that they rather select partners based on trust, than on more objective selection criteria like the complementarity of resources. These lower performing companies are far more shifty and devious than the straight and focused high performing companies.
These findings do not support our hypothesis in which we stated that the successful network configuration included high levels of resource complementarity and trust, a strong network position and a high level of goal alignment. Rather we find a low level of trust and a low level of network position strength included in the successful network configuration.

3.2. Qualitative data analysis

To complement and clarify these quantitative results and, we conducted semi-structured interviews with companies in both the top 15% sample and the bottom 85% sample. In general, the top 15% best performing companies do not deliver their products to the end-market (see table 7). In case of the medical devices industry this end-market most of the time consists of hospitals and other health care institutions. Rather they deliver their products to distributors. Instead of the company having to deal with the difficult commercialization of medical devices to the end-market, the distributor deals with these difficulties like negotiations with health care insurance companies. For the company this a more efficient sales strategy than direct sales to health care institutions.

			DeliveryToEndMarket			
			Yes	No	Mixed	Total
Sample	Calibration sample (Bottom 15%)	Count	12	19	7	38
		% within Sample	31,6%	50,0%	18,4%	100,0%
	Successful network configuration (Top 15%)	Count	1	5	0	6
		% within Sample	16,7%	83,3%	,0%	100,0%
	Total	Count	13	24	7	44
		% within Sample	29,5%	54,5%	15,9%	100,0%

Table 7: Position of companies from both samples in the supply chain with regard to end market delivery

Table 8 shows that for the majority of companies in the calibration sample (59,5%) the NPD project is initiated by the company itself. In contrast, in only 33,3% of the top 15% best performing companies the project is initiated internally. In the majority of the top 15% best performing companies the company is approached by an external company who is not able or not willing to execute the NPD process itself. By not internally initiating the NPD project, but by executing the NPD project "on demand", the top 15% best performing companies guarantee their external revenues from the NPD project.

			SourceNPDProject				
			Client Order (external)	Development Order (external)	Physician (external)	Company (internal)	Total
Sample	Calibration sample (Bottom 85%)	Count	10	1	4	22	37
		% within Sample	27,0%	2,7%	10,8%	59,5%	100,0%
	Successful netwok configuration (Top 15%)	Count	3	1	0	2	6
		% within Sample	50,0%	16,7%	,0%	33,3%	100,0%
	Total	Count	13	2	4	24	43
		% within Sample	30,2%	4,7%	9,3%	55,8%	100,0%

Table 7: Initiation sources of the NPD project

As table 8 shows, the attitude that these companies have towards their partners in the NPD project is far more business-like than the attitude that the lower performing companies have. The top 15% best performers use a focused strategy in contacting their partners with specific resource requests. It is rather a customer-supplier relationship than a collaborative relationship. The lower performing companies are far more collaborative towards their NPD partners. Not only are partners consulted, they also share ideas in NPD and are developing the new product together. Often IP is shared.

			AttitudeTowardsPartners		
			Business-like	Collaborative	Total
Sample	Calibration sample (Bottom 85%)	Count	17	22	39
		% within Sample	43,6%	56,4%	100,0%
	Successful network configuration (Top 15%)	Count	3	2	5
		% within Sample	60,0%	40,0%	100,0%
	Total	Count	20	24	44
		% within Sample	45,5%	54,5%	100,0%

Table 8: Attitude towards partners

4. DISCUSSION

We began by observing that cooperation with other organizations increases the innovation performance of organizations (Ritter and Gemünden 2003, Ritter and Gemünden 2004, Hanna and Walsh 2002, Rothwell 1991, Chang 2003, Salman and Saives 2005). Especially for SMEs, as they are bounded by a lack of financial resources, manpower and substitutes for lack of sales (Kaufmann and Tödtling 2002, Hanna and Walsh 2002). We examined which combination of network characteristics (the network configuration) is related to high innovation performance and we thereby address the issue raised by Pittaway et al. (2004) who state that research has not yet clearly demonstrated which configurations most affect innovation in particular contexts.

We used the systems approach to examine which network configuration is related to high innovation performance. Using the systems approach we were able to address multiple network characteristics simultaneously which led to new insights in the successful external organization of new product development.

Contrary to what we predicted we found that the successful network configuration includes high levels of resource complementarity and goal alignment and low levels of trust and network position strength, instead of high levels of all these network characteristics. The high performing companies have a businesslike mentality and are very focused and consistent in how they collaborate in NPD. The relation with their partners is almost like a customer-supplier relationship as the company contacts their partners with specific resource requests for which the partner is paid. Instead of trusting the partner firm blindfolded, the company has a certain level of distrust towards the partner firm. The network of the company consists of a limited number of partners (small size) and, in addition, these partners are not directly connected to each other (low density). In contrast, the lower performing companies are searching for partners with whom they can collaborate and build resources. Trust is considered crucial for these companies. Their approach to collaboration in new product development is more soft and subjective in comparison to the approach of the high performing companies. These results are in line with the findings of Lindman (2002) who finds that NPD can be highly successful regardless of the degree of cooperation (Lindman 2002). Even though past research argues that a social way of networking is related to high innovation performance, both our quantitative and qualitative findings indicate that a businesslike way of networking is related to high innovation performance.

An explanation for the fact that the businesslike, objective network configuration of the high performers is related to high innovation performance can be explained by the fact that the high performers face less risk in the NPD process. The NPD projects are most of the time initiated outside the company: the high performers develop new products on request which secures their NPD revenues. In addition by not trusting their partners blindfolded and by maintaining a businesslike relationship towards partners the risk of being deceived is minimized. As Duysters et al. (1999) concluded, effective technology partnering selection should involve an evaluation of the potential partner on the basis of that partner's competitive and technological position and access to business networks but also on its track record of successful partnerships and the transferability of desired resources (licenses, patents etc.) (Duysters et al. 1999).

An explanation for the fact that the successful network configuration is a businesslike configuration might be caused by the fact that companies in our dataset mainly focus on low (incremental) and moderately innovative new products. We assume that this is caused by the strict sector regulations. The average development time for medical devices ranges from 1-2 years for incremental devices and 5-7 years for radical devices, dependent on the product type, complexity, and degree of risk to the patient that dictates their regulatory defined conformance and approval route (Hourd and Williams 2008). Since the developed products

are not highly innovative the SME can focus more on efficiency and routines instead of focusing on the early research and development stages. There is less need for the company to involve the partner in the development project. Rather, the company is able to pose a specific resource request. Also, because the company and the partner do not develop brand new products of which the market and competitors are unaware of, trust is not a prerequisite for collaboration. Resource complementarity and goal alignment are more important, which is in line with research of Oerlemans et al. (2001), Becker and Dietz (2004), Inkpen and Tsang (2005) and Suarez-Villa (1998).

5. LIMITATIONS AND FURTHER RESEARCH

Our study has some limitations that suggest a number of directions for further research. The companies in our dataset mainly focus on low to moderately innovative development projects. Even though we expect that companies that focus on highly innovative development projects do not achieve high innovation performance due to sector specific regulations, a direction for further research might be to gather additional data on these companies in order to examine their innovation performance and related network configuration.

We showed how the network configuration that is related to high innovation performance for SMEs in the medical devices sector is organized. A suggestion for further research is to conduct a cross-industry study in multiple highly regulated sectors for generalizability of the research findings.
A final suggestion for further research is to examine the interaction between the network characteristics in relation to the innovation performance. Earlier research showed that the interaction between network characteristics (the network configuration) is directly related to innovation performance (Pullen et al. forthcoming 2010a). In this research we demonstrated which configuration of network characteristics is related to high innovation performance for SMEs in the medical devices and thereby addressed the issue of Pittaway et al (2004). It was out of the scope of this research to also examine how the different network characteristics are related to each other and how they interact. Further research might address this issue.

6. CONCLUDING REMARKS

We argued that the successful network configuration of SMEs in the medical devices sector consists of high levels of resource complementarity, trust, network position strength, and goal alignment. Using the context of SMEs in the Dutch medical devices sector, we show that the a network configuration that includes high levels of resource complementarity and goal alignment, but low levels of trust and network position strength is related to high innovation performance.

In line with both our quantitative and qualitative research findings, we argue that a “soft and friendly” approach towards external NPD collaboration in which trust is an important prerequisite is not related to high innovation performance. Rather a more “businesslike” approach which is focused and consistent is related to high innovation performance.
Managers of SMEs in the medical devices sector that aim to achieve high innovation performance, should use objective criteria to select partners. Partner selection should not be mainly determined by trusting a partner. Developing new products “on demand” is a more effective way to achieve high innovation performance than by initiating NPD projects internally. Even though the latter is often associated with high firm innovativeness in a highly

regulated sector like the medical devices sector it is not related to high innovation performance.
In conclusion, SMEs in the medical devices sector should aim for a businesslike organized network configuration that includes high levels of resource complementarity and goal alignment with development partners, a low network position strength and in which partners are not trusted blindfolded in order to achieve high innovation performance.

NOTES

[1] According to European standards, SMEs are defined as companies that have 250 or fewer fulltime employees (Commission of the European Communities 2003. 'Commission Recommendation of 6 May 2003 Concerning the Definition of Micro, Small and Medium-Sized Enterprises *(notified under document number C (2003) 1422)* 2003/362/EC.' 36–42. Official Journal of the European Union.)

[2] There are many different types of social networks that can be studied. One can distinguish between one-mode networks which study just a single set of actors, two-mode networks which focus on two sets of actors, or higher mode networks Wasserman, S. & Faust, K. 1994. *Social network analysis: methods and applications.* New York: Cambridge University Press.. Another design is and ego-centered network which consists of a focal actor, termed ego, a set of alters who have ties to ego, and measurements on the ties among these alters Wasserman, S. & Faust, K. 1994. *Social network analysis: methods and applications.* New York: Cambridge University Press.. Since we take the perspective of the SME to analyze its network, we adopt the *ego-centered network perspective* in our research.

[3] According to medical device directive 93/42/EEC , a medical device is:*…any instrument, apparatus, appliance, material, or other article, whether used alone or in combination, including the software necessary for its proper application, intended by the manufacturer to be used for human beings for the purpose of a) Diagnosis, prevention, monitoring, treatment or alleviation of a disease, b)Diagnosis, monitoring, treatment or alleviation of or compensation for an injury or handicap, c)Investigation or modification of the anatomy or of a physiological process, or, d)Control of conception. And which does not achieve its principal intended action in or on the human body by a) Pharmacological, b)Immunological or c) Metabolic means, but which may be assisted in its function by such means.*

[4] The scores for Innovation Performance were factor scores

[5] The scores for network characteristics were factor scores

REFERENCES

Afuah, A. 1998. *Innovation Management.* New York: Oxford University Press.

Arenius, P. & De Clerq, D. 2005. 'A network-based approach on opportunity recognition.' *Small Business Economics,* 24, 249-65.

Atuahene-Gima, K., Slater, S. & Oslon, E. 2005. 'The contingent value of responsive and proactive market orietation on new product program performance.' *Journal of product innovation management,* 22, 464-82.

Atun, R., Shah, S. & Bosanquet, N. 2002. 'The medical devices sector: coming out of the shadow.' *European Business Journal,* 14, 63-72.

Becker, W. & Dietz, J. 2004. 'R&D cooperation and innovation activities of firms - evidence for the German manufacturing industry.' *Research Policy,* 33, 209-23.

Biemans, W. G. 1989. 'Developing innovations within networks: with an application to the Dutch medical equipment industry.' Eindhoven: University of Eindhoven.

Borgatti, S. P., Everett, M. G. & Freeman, L. C. 2002. 'UCINET for Windows: Software for Social Network Analysis.' Harvard, MA: Analytic Technologies.

Borgatti, S. P., Jones, C. & Everett, M. G. 1998. 'Network measures of social capital.' *Connections,* 21:2, 27-36.

Branzei, O. & Thornhill, S. 2006. 'R&D networks and innovation capabilities: a context-contingency perspective.' Paper presented at In CDRom proceedings of the Academy of Management Conference 2006.

Burt, R. S. 1992a. 'The social structure of competition.' In N. Nohria & R. G. Eccles (Eds.) *Networks and Organizations: structure, form, and action:* 57-91. Boston, MA: Harvard business school press.

Burt, R. S. 1992b. *Structural holes: the social structure of competition.* Cambridge, MA: Harvard University Press.

Burt, R. S. 2001. 'Structural holes versus network closure as social capital.' In N. Lin, Cook, K.S., and R.S. Burt. (Ed.) *Social Capital: Theory and Research.:* 31-56. Aldine de Gruyter: Chicago Il.

Burt, R. S. 2004. 'Structural holes and good ideas.' *American journal of sociology,* 110, 349-99.

Chang, Y. C. 2003. 'Benefits of co-operation on innovative performance: evidence from integrated circuits and biotechnology firms in the UK and Taiwan.' *R&D Management,* 33:4, 425-37.

Commission of the European Communities 2003. 'Commission Recommendation of 6 May 2003 Concerning the Definition of Micro, Small and Medium-Sized Enterprises *(notified under document number C (2003) 1422)* 2003/362/EC.' 36–42. Official Journal of the European Union.

Dess, G. G. 1987. 'Consensus on strategy formulation and organizational performance: competitors in a fragmented industry.' *Strategic management journal,* 8:3, 259-77.

Drazin, R. & Van de Ven, A. H. 1985. 'The concept of fit in contingency theory.' In L. L. Cummings & B. M. Staw (Eds.) *Research in organizational behavior:* 333-65. Greenwich, CT: JAI Press.

Duysters, G., Kok, G. & Vaandrager, M. 1999. 'Crafting successful strategic technology partnerships.' *R&D Management,* 29:4, 343-51.

Faems, D., Janssens, M., Madhok, A. & Van Looy, B. 2008. 'Toward an integrative perspective on alliance governance: connecting contract design, trust dynamics, and contract application.' *Academy of management journal,* 31:6, 1053-78.

Faems, D., VanLooy, B. & Debackere, K. 2005. 'Interorganizational collaboration and innovation: toward a portfolio approach.' *Journal of product innovation management,* 22, 238-50.

Gadde, L. E., Huemer, L. & Håkansson, H. 2003. 'Strategizing in industrial networks.' *Industrial Marketing Management,* 32, 357-64.

Galunic, D. C. & Rodan, S. 1998. 'Resource recombinations in the firm: knowledge structures and the potential for Schumpeterian innovation.' *Strategic management journal,* 19, 1193-201.

Garcia, R. & Calantone, R. 2002. 'A critical look at technological innovation typology and innovativeness terminology: a literature review.' *Journal of product innovation management,* 19, 110-32.

Gilsing, V. A. & Nooteboom, B. 2005. 'Density and strength of ties in innovation networks: an analysis of multimedia and biotechnology.' *European Management Review,* 2, 179-97.

Gilsing, V. A., Nooteboom, B., Vanhaverbeke, W., Duysters, G. & Van den Oord, A. 2008. 'Network embeddedness and the exploration of novel technologies: technological distance, betweenness centrality and density.' *Research Policy,* 37, 1717-31.

Govindarajan, V. 1988. 'A contingency approach to strategy implementation at the Business-Unit level: Integrating administrative mechanisms with strategy.' *The academy of management journal,* 31:4, 828-53.

Gulati, R. & Sytch, M. 2008. 'Does familiarity breed trust? Revisiting the antecedents of trust.' *Managerial and Decision Economics,* 29:2-3, 165-90.

Hair, J. F., Anderson, R. E., Tatham, R. L. & Black, W. C. 1995. *Multivariate data analysis: with readings.* Upper Saddle River, NJ, USA: Prentice-Hall, Inc.

Håkansson, H. 1989. *Corporate technological behavior: co-operatoin and networks.* London: Routledge.

Hanna, V. & Walsh, K. 2002. 'Small firm networks: a successful approach to innovation?' *R&D Management,* 32:3, 201-07.

Hanneman, R. A. & Riddle, M. 2005. *Introduction to social network methods.* Riverside, CA: University of California, Riverside.

Haythornthwaite, C. 1996. 'Social network analysis: an approach and technique for the study of information exchange.' *Library and information science research,* 18:4, 323-42.

Hourd, P. C. & Williams, D. J. 2008. 'Results from an exploratory study to identify the factors that contribute to success for UK medical device small-and mediumsized enterprises.' *Journal of Engineering in Medicine,* Part H: 222, 717-35.

Inkpen, A. C. & Tsang, E. W. K. 2005. 'Social capital, networks, and knowledge transfer.' *Academy of management review,* 30:1, 148-65.

Kaplan, A. V., Baim, D. S., Smith, J. J., Feigal, D. A., Simons, M., Jefferys, D., Fogarty, T. J., Kuntz, R. E. & Leon, M. B. 2004. 'Medical device development: from prototype to regulatory approval.' *Circulation,* 109, 3068-72.

Karlsson, C. & Olsson, O. 1998. 'Product innovation in small and large enterprises.' *Small Business Economics,* 10, 31-46.

Kaufmann, A. & Tödtling, F. 2002. 'How effective is innovation support for SMEs? An analysis of the region of upper Austria.' *Technovation,* 22:3, 147-59.

Kerssens-VanDrongelen, I. C. & Groen, A. J. 2004. 'What is the added value of R&D.' Paper presented at High Technology Small Firm Conference.

Kline, P. 2000. *A psychometrics primer.* Free Association Books

Koka, B. R. & Prescott, J. E. 2002. 'Strategic alliances as social capital: a multidimensional view.' *Strategic management journal,* 23:9, 795-816.

Lambe, C. J., Spekman, R. & Hunt, S. D. 2002. 'Alliance competence, resources and alliance success: conceptualization, measurement, and initial test.' *Journal of the Academy of Marketing Science,* 30:2, 141-58.

Leana, C. R. & Van Buren III, H. J. 1999. 'Organizational social capital and employment practices.' *Academy of management review,* 24:3, 538-55.

Liao, J. & Welsch, H. 2005. 'Roles of social capital in venture creation: key dimensions and research implications.' *journal of small business management,* 43:4, 345-62.

Lindman, M. T. 2002. 'Open or closed strategy in developing new products? A case study of industrial NPD in SMEs.' *European Journal of Innovation Management,* 5:4, 224-36.

MacPherson, A. 2002. 'The contribution of academic-industry interaction to product innovation: The case of New York State's medical devices sector.' *Papers in Regional Science,* 81, 121-29.

Mahnke, V. & Overby, M. L. 2008. 'Failure sources in R&D consortia: the case of mobile service development.' *International Journal of Technology Management,* 44:1/2, 160-78.

Miller, D. & Friesen, P. H. 1982. 'Innovation in conservative and entrepreneurial firms: two models of strategic momentum.' *Strategic management journal,* 3:1, 1-25.

Millson, M. R. & Wilemon, D. 2000. 'Managing Innovation in medical devices.' *International journal of healthcare technology and management,* 2:5/6, 425-55.

Nahapiet, J. & Ghoshal, S. 1998. 'Social capital, intellectual capital, and the organizational advantage.' *Academy of management review,* 23:2, 242-66.

Nieto, M. J. & Santamaría, L. 2010. 'Technological collaboration: Bridging the innovation gap between small and large firms.' *journal of small business management,* 48:1, 44-69.

O'Regan, N., Ghobadian, A. & Sims, M. 2006. 'Fast tracking innovation in manufacturing SMEs.' *Technovation,* 26, 251-61.

Oerlemans, L. A. G., Meeus, M. T. H. & Boekema, F. W. M. 1998. 'Do networks matter for innovation? The usefulness of the economic network approach in analysing innovation.' *Tijdschrift voor economische en sociale geografie,* 89:3, 298-309.

Oerlemans, L. A. G., Meeus, M. T. H. & Boekema, F. W. M. 2001. 'Firm clustering and innovation: determinants and effects.' *Papers in Regional Science,* 80:3, 337-56.

Park, S. H. & Ungson, G. R. 2001. 'Interfirm rivalry and managerial complexity: a conceptual framework of alliance failure.' *Organization science,* 12:1, 37-53.

Penrose, E. T. 1959. *The theory of the growth of the firm.* New York: John Wiley.

Pett, M. A., Lackey, N. R. & Sullivan, J. J. 2003. *Making sense of factor analysis: The use of factor analysis for instrument development in health care research.* Thousand Oaks, USA: Sage Publications, Inc.

Pittaway, L., Robertson, M., Munir, K., Denyer, D. & Neely, A. 2004. 'Networking and innovation: a systematic review of the evidence.' *International Journal of Management Review,* 5/6:3&4, 137-68.

Prabhakar, S. 2006. 'Medical devices + collaboration = innovation.' *Advanced Materials & Processes,* 164:10, 46.

Pullen, A. J. J., Groen, A. J., DeWeerd-Nederhof, P. C. & Fisscher, O. A. M. forthcoming 2010a. 'SME product innovativeness and network characteristics for high innovation performance: What really counts in the medical devices sector.' Paper presented at 17th International Product Development Management Conference.

Pullen, A. J. J., Groen, A. J., Fisscher, O. A. M. & DeWeerd-Nederhof, P. C. forthcoming 2010b. 'Measuring the network-innovation performance in SMEs: The development of a questionnaire.' *Working paper*. University of Twente.

Ring, P. S. & Van de Ven, A. H. 1992. 'Structuring cooperative relationships between organizations.' *Strategic management journal,* 13, 483-98.

Ritter, T. & Gemünden, H. G. 2003. 'Network competence: its impact on innovation success and its antecedents.' *Journal of Business Research,* 56, 745-55.

Ritter, T. & Gemünden, H. G. 2004. 'The impact of a company's business strategy on its technological competence, network competence and innovation success.' *Journal of Business Research,* 57, 548-56.

Rochford, L. & Rudelius, W. 1997. 'New product development process: stages and successes in the medical products industry.' *Industrial marketing management,* 26, 67-84.

Rogers, M. 2004. 'Networks, firm size and innovation.' *Small Business Economics,* 22, 141-53.

Rothwell, R. 1991. 'External networking and innovation in small and medium-sized manufacturing firms in Europe.' *Technovation,* 11:2, 93-112.

Rowley, T. J. 1997. 'Moving beyond dyadic ties: a network theory of stakeholder influences.' *Academy of management review,* 22:4, 887-910.

Sadowski, B. & Duysters, G. 2008. 'Strategic technology alliance terminatioj: An empirical investigation.' *Journal of Engineering Technology Management,* 25, 305-20.

Salman, N. & Saives, A. L. 2005. 'Indirect networks: an intangible resource for biotechnology innovation.' *R&D Management,* 35:2, 203-15.

Salomo, S., Strecker, N. & Talke, K. 2007. 'Innovation strategy - investigating the performance effects of innovativeness, familiarity, driver of innovation, andinnovation field orientation.' Paper presented at 14th International Product Development Management Conference. 11-12 June 2007.

Spekman, R. E., Lynn, A. I., MacAvoy, T. C. & Forbes III, T. 1996. 'Creating strategic alliance which endure.' *Long Range Planning,* 29:3, 346-57.

Suarez-Villa, L. 1998. 'The structures of cooperation: downscaling, outsourcing and the networked alliance.' *Small Business Economics,* 10, 5-16.

Teece, D. J. 1989. 'Inter-organizational requirements of the innovation process.' *Managerial and Decision Economics,* 10:Special Issue: Competitiveness, Technology and Productivity, 35-42.

Tichy, N. M., Tushman, M. L. & Fombrun, C. 1979. 'Social network analysis for organizations.' *Academy of management review,* 4:4, 507-19.

Tsai, W. 2001. 'Knowledge Transfer in Intraorganizational Networks: Effects of Network Position and Absorptive Capacity on Business Unit Innovation and Performance.' *The academy of management journal,* 44:5, 996-1004.

Wasserman, S. & Faust, K. 1994. *Social network analysis: methods and applications.* New York: Cambridge University Press.

Zaheer, A. & Bell, G. G. 2005. 'Benefiting from network position: firm capabilities, structural holes, and performance.' *Strategic management journal,* 26, 809-25.

Psychology in Entrepreneurship and Economic Evolution

Paper for HTSF 2010, Nikos, Twente

Entrepreneurial Heuristics and Decision Making.

Abstract

In this paper I describe the processes of internal and external selection of a business project before official founding. I put particular emphasis on the psychological processes of `internal' selection in an aspiring entrepreneur. The project deals with development and commercialisation of innovative DNA-Biochips. These can be used to detect gene-based health conditions and in drug discovery. The case study is used to test some conjectures on the operation of evolutionary principles in economics and to identify similar and differing characteristics in visionary technologists and entrepreneurs.

Psychology in Entrepreneurship and Economic Evolution

1. Introduction

According to Schumpeter, the entrepreneur is characterized by a vision of how the future will unfold. His role lies in the combination of some or all of the following elements: ideas, technologies, services, people, knowledge, to form a workable product and organization selling it. In the 'Theory of Economic Development' (1911/1934), written before WW I and translated to English afterwards, Schumpeter analyzes the function of the entrepreneur in economic change. Entrepreneurs further innovation as new combinations of (sometimes new) elements that lead to the "competitive elimination of the old" (Schumpeter 1934, 66-7). Entrepreneurs perceive opportunities, combine ideas, resources, and production factors into new products and entrepreneurial ventures that, if successful, lead to innovations and the creative destruction of established enterprises and industries. Schumpeter distinguishes between 5 cases of innovation:

"(1) The introduction of a new good … (2) The introduction of a new method of production … (3) The opening of a new market … (4) The opening of a new source of supply … the organization of a new organization of any industry, …" (Schumpeter 1934, 66).

The paper describes in a case study of an entrepreneur indicates how industry evolution can be influenced by 'internal' selection decisions of potential entrepreneurs and 'external' selection decisions of financiers / investors. It describes the process of planning a particular venture at the intersection of biotechnological, electronics and diagnostics industries. Although the project presently is proceeding slowly due to technological development issues, it can illustrate the operation of mental representations in response to expected market `reactions' respectively selection decisions by potential investors, managers of competing and alliance firms and potential product buyers. In both cases of internal and external selection the mental

representations of the economic actors have a major impact. This links into Schumpeter's interest in the psychological characteristics of entrepreneurial actors (cp. Becker and Knudsen 2004), and an evolutionary interpretation of economic processes.

Alchian (1950) had argued that processes in industrial evolution can be linked to an evolutionary interpretation of economic phenomena. In contrast, Penrose (1952) in a critique had focussed on the individual actors' profit motivation as main explanatory element of economic actions. From an Austrian perspective, Kirzner (1973) perceived the competitive process as one of discovery and learning. Nelson and Winter (1982) have linked Schumpeterian creative destruction into evolutionary accounts and simulations of development. Grebel (2002) has linked entrepreneurship, industry evolution and their simulation. These arguments require a micro-perspective on the entrepreneurial process and its connection to evolutionary principles. Schlicht (1997), based on a systemic school of evolutionary thought, has argued that certain principles from Gestalt theory should influence economic actors and lead to the operation of evolutionary principles in social systems. Here, I link Schlicht's argument and personal construct theory (Kelly 1955) to economic evolutionary processes and the construction of an operationizable theory of economic evolution.

In this paper, I show on the basis of the case study how personal construct theory can be used to analyze processes of internal selection and how external selection can be traced to actors decision's on the basis of mental representations (certain worldviews) which leads to "external" selection by investors and in markets.

2. The Theory

2.1 A Learning Perspective Economic Evolution

One of the problems of evolutionary approaches to economic is the transfer of the genotype-phenotype-concept to social systems. There have been several propositions, the most important being the concept of routines by Nelson and Winter, which nevertheless does not meet a number of criticisms. Elsewhere, it has been proposed to use mental representations from personal construct theory as equivalent to the role of the genotype and routines as translation apparatus between mental and real world. Mental representations are concepts, which actors use to structure their environment in cognitive maps. These can be measured and compared to the structure of reality and action of actors. This is the basis for an evolutionary concept of selecting and characteristics-changing feedback between the perception of actors on the one hand and reality on the other:

$$MR\ //\ CM^{t} \rightarrow p_x^{t} \rightarrow D/A \rightarrow p_x^{t+1} \rightarrow MR\ //\ CM^{t+1}$$

MR: mental representation,
CM: cognitive map,
p: perception,
D / A: decision or action.
MR // CM: mental representation given cognitive map

Figure 1: Structure of evolutionary process over time

For instance, the process of business entrepreneurial strategy formulation and implementation of plans can be seen as a learning process on the individual and group level, and thus as an evolutionary process on a more abstract and aggregated level.[1] In an evolutionary context that links mental representations and actions, the perspective profits from a complementary perspective on the actions of economic actors. A potential perspective filling this need has been proposed by `strategy-as-practice' researchers (Whittington 1996, Hendry 2000). The strategy-

[1] While a learning perspective has already been developed for market processes (cp. Kirzner 1973), this is missing for 'pre-market' processes.

as-practice approach to strategy aims to develop a micro-perspective on strategy-making. Thus it operates on the micro-level of day-to-day managerial actions and routines. This approach can be transferred to the entrepreneurial realm in order to better understand how entrepreneurs think and act, how they succeed, what they need to succeed and what hinders success.

2.2 Psychology

Veblen

According to Veblen (1898), the psychological characterization of the economic agent as mechanic calculator of hedonistic utilities is outdated. The advantage of the evolutionary paradigm - combination of causal explanation and observations - is neglected. Classical economics and the historic school are focussed on taxonomy and description of development processes - partly oriented towards the pre-scientific goal of discovering a `natural order' – without accounting for the genetic (causal) mechanisms of such developments. Modern anthropology shows that human behavior in groups, even in the economic sphere, is guided by tradition. Ever since Thorstein Veblen's critique of economics' dealings with psychology, evolutionary / institutional economists need tools to operationalize and formalize them necessary psychological toolchest. Here is one possible way to get it.

Schlicht

Schlicht (1997) and Kubon-Gilke and Schlicht (1998) argue that social evolution is patterned and essential changes are created by what they define as directed evolution. Directed evolution - to be understood without teleological connotations - refers to structured (or patterned) variation in the sense that regularities in the emergence of variation exist. These regularities are an important part of the process of evolution in creating novel features. In contrast, blind evolution (based on random variation) leads to stabilization of existing characteristics in entities, since variation is often too far off a viable ‘hit’. Existing characteristics are seen as residing at or near

local optima in the fitness landscape, so that too large variations tend to lead away from a 'good' working organization of elements, while small variations may increase fitness values (until the peak is reached).

The argument runs as follows: variations are coupled in social evolution (as in biological evolution), since psychological regularities (gestalts) generate patterns in innovations, and complex organizations (and artefacts, I would like to add) are characterized by functionally correlated traits. Therefore variation must be kept within certain limits and is correlated, but not purely random. Since the structure and elements of an organism determine what variations are possible at all, the structure and elements of technical and social systems influence the type of variations that can occur in social evolution.

Personal Construct Theory

An evolutionary account of social phenomena requires the researcher to juxtapose the perception of actors with its effects in the real world over longer periods. Perception could play an analogous role to the biological genotype while the role of the phenotype is taken by artefacts, designs and documents. The cognitive landscape concerning a field of concepts of an actor could be seen the analogue to a chromosome. Such a conceptualization allows to capture the perception of an actor in a cognitive architecture, based on dichotomous separation between the defining characteristics of concept.

One perspective from psychology that seems useful in an evolutionary characterization of social processes is personal construct theory (Kelly 1955, Addams-Webber 1979, Bannister 1985). It posits that humans perceive and structure their world mentally along dichotomous conceptual poles. These concepts can be seen as elements in cognitive maps describing the structure and content of actors' worldviews. This perspective manages to show the existence of a binary, hierarchical ordering of human concepts. It focuses largely on changes in this ordering and self-perception.

Researchers can construct binary orderings of finite constructs by applying Boolean set theory to cognitive maps. This method, called repertory grid, is based on the analysis of correlations between the elements of cognitive maps. It is also possible to relate the binary orderings of human concepts to observable attributes of real world phenomena such as artefacts and to actions as well as conceptual structures. This approach runs also under the heading of cognitive architecture. The cognitive architecture of a concept is a similar dichtomous splitting of the attributes perceived relevant by actors leading to a hierarchical tree structure of attributes. This approach allows to operationalize the concept of routines (Nelson and Winter 1982). Routines have been theorized about a lot and used in a black box fashion, but progress in identification and observation has been slow (see Becker 1999). A micro-foundation for routines in mental representations is one way to alleviate this situation.

The correlation between the mental structure of perceived attributes and the structure of real world phenomena can be measured over time - showing the process of individual and group learning. If the concept is transferred to groups of people one may be able to identify different systems of belief between different groups of actors. By assigning numerical values to the degree of difference between these belief systems empirical measures can be easily constructed. Likewise the evolution of such cognitive architectures - if sufficiently identifiable from historical documents - should allow the tracking of mental representations. Thus researchers should be able to relate changes in mental representations with effects in the real world over long periods. This theoretical structure would allow for the transfer of the structure of biological evolutionary theory to the social sciences as well as providing the necessary differentiation for social systems.

3. The Case Study

3.1 Introduction

Methodolgy

The case study focuses on the first part of the methodology of personal construct theory – identifying the changes in the mental representation of an individual entrepreneur. Thus I use mainly document analysis and “field” observations. No standardized design or procedure has been used, but research was led by the goal to understand what is going on and why, in order to test developing hypotheses that formed in the process of interacting and observing.

Background

Pharma companies are reluctant to invest in new and unproven technologies since they are doubtful about the consequences of genetic separability of patient population which would enable individualized medicine or at least the identification of patient sub-populations. This might endanger the blockbuster model of big pharma, and certainly creates uncertainty about market size and cost for new pharmaceutical products. Therefore investors are reluctant to invest in the uncertain future of such ventures. In this context, I describe the psychology of entrepreneurial `marketing' decisions taken from versions of the business plans, discussions with the entrepreneur and (internal) background material. From the observations in the case study and comparison with some notable technology visionaries and entrepreneurs, I develop a classification scheme for (un)successful (technology) entrepreneurs and visionaries.

I have come across Dr. K and the project described here in the spring of 2003, when a friend of mine introduced each other in a Cologne soccer pub. At the time the friend was working on a master's thesis on industrial relations and got to read the businessplan of BT AG, a German biotech start-up co-founded by Dr. K. I had a look at the plan, made an offhand remark based on my interest in start-up issues and later contacted Christian K. to discuss strategies in the bio-pharmaceutical industry. The meeting turned into a discussion of his technical ideas and has resulted in me discussing ideas relating to the plan and commenting on various ensuing versions.

The entrepreneurial challenge of the project consists in organizing the project such that it becomes a success, and its acceptance by a diverse set of actors, that act as selecting instance at various stages of the project. These actors include investors, which might involve business angels, venture capitalists, banks, institutions such as regulatory authorities, and customers which might be pharma and / or diagnostics companies and end-customers such as researchers, diagnostics laboratories or physicians.

I will focus here on internal selection by the entrepreneur and external selection by investors, add a little about pharma companies as potential partners and the focus on issues of the possible retention of this technology through institutional arrangements. These are the issues that have an immediate relation on which something can be said with certainty at the present state of affairs. It must be considered though that the adoption of the product is the ultimate selection event from which the necessary requirements and outcomes of other selection events can be (or are tried to be) deduced – rather similar to the process of backward induction in game theory.

3.2 Inner Selection Processes

What we can illustrate with the different versions of the Business plans (in as little time as they were conceived), is the working of the inner and outer selection and the associated shifts in mental representations in an entrepreneur. We observe the mental turning around and recombining of technological elements and their associated economic implications in response to feedback, respectively anticipating the perceived counter argument of
investors and (potential) partners.

The project was already two years old when I hit upon it. An earlier lengthy business plan was written by an involved physician on the basis of the advice of a controller, coming from large retail business. This version was not up to the standards business plans are usually. Dr. K had come into the project, since the original participants were looking for a CEO with management experience in the biotech sector. This lead to negotiations with potential investors, which

subsequently derailed as the advisor demanded a high portion of about 44% of shares for himself. The project came to almost a halt then. It seemed to take up speed again in the spring of 2003. The early argumentation as documented in the version I received in the beginning of May (around May 6th) was based on the property of the technology being label free, which eliminates errors due to (optical) mis-registration of fluorescent labels, and being amplification free, which eliminates errors due to chemical reactions necessary to increase the amount of the original probe in order to be able detect the elements in it. Diagnostics company Roche holds a patent on a reaction to achieve this, called polymerase chain reaction (PCR). This was developed by Kary Mullis in the 1980s, for which he received a nobel-price in 1987.

"At the forefront of technological advance today are attempts to eliminate amplification by increasing the sensitivity of DNA detection on the one hand, while on the other hand technology concepts are being proposed which seek to allow for label-free detection.

No technological approach at the present time envisions a process which can combine the advantages of both routes by integrating both label-free and amplification-free detection. A new process with this capability would confer such a strong economical advantage that it could compete successfully against market giants as well as technology driven start-up companies. We have developed a technology which makes possible label-free detection of DNA with a sensitivity which makes amplification unnecessary in most practical applications. Our detection technology is based on an ion-selective field-effect transistor. Field-effect transistors are used in all computer microchips and can therefore be easily and cheaply mass produced.

Whereas, however, transistors for data processing are switched by applying a voltage to the transistor surface, our DNA-sensing transistor measures the changes in surface charge density caused by the binding of a sought-for DNA molecule itself, utilizing the high intrinsic negative charge of all DNA molecules. This eliminates the need for labelling." (Businessplan dated May 2003, p.2-3.)

The technology combines two approaches to eliminate sources of error in measuring DNA fragments. The competitive advantage of the technology itself lies in that it involves less error prone steps and offers a higher sensitivity. The question that arises is how to sell the technology development platform to investors funding further development. An added difficulty is that this actually involves two financing steps if one goes by the (US-American) book, namely a seed-financing round by business angels until a workable prototype or `proof-of-principle' is achieved and a further financing round to cover market introduction and expansion.[2]

Competitive advantage to sell the project to investors is seen in the elimination of the amplification step, i.e. PCR free Chips, which leads to cost savings on the license fee paid to Roche. The argumentation line in favor of the project taken here is based strongly on cost advantages. Chip cost/price estimates by Dr. K at the time were around US$ 200-400. Price is seen as major competitive weapon since entry in the market will be difficult, given high entry barriers:

"One market player is dominant in nucleic acid based diagnostics, namely Roche. Roche's market dominance is based on its proprietary technology for DNA-amplification, the polymerase chain reaction (PCR). Although alternative technologies for DNA amplification exist, PCR is still the most reliable. Roche is moving aggressively into the field of chip-based molecular diagnostics and plans to more than double its diagnostics revenues within the next ten years. Roche will presumably try to retain the advantage of its ownership of the PCR-based amplification technology. Already, the company is demanding high royalties for the use of the PCR-reaction of around $ 50 per diagnostic test. Our technology allows molecular diagnostic tests to be performed in many cases without amplifying the DNA. For our own portfolio of products we will focus on diagnostic tests which we can perform without using Roche's PCR-technology and will team up with major market players for marketing and

[2] A second (and maybe a third) financing round would be negotiated with venture capitalists on successful completion of this step, funding further development and market penetration. If this step is successful often a further financing round, called 'mezzanine' round to brush the company up and prepare for a public offering may be necessary (see Southwick 2001).

distribution. The independence of our products from Roche will make us an attractive partner." (Businessplan dated 21.05.2003, p. 34.)

For our entrepreneur, the problem with Roche and other market players in the diagnostics market is that entry barriers are high. Eight companies serve 80% of the market. Therefore building an independent company and steering it successfully through market expansion seems difficult. The obvious solution to this is a trade sale in which the company is sold to an industry participant interested in the technology and/or an outsider, e.g. from the pharmaceutical market is interested in entering the market. But this possibility is not explicitly written in the business plan until the very last versions, since it reduces the returns for investors (relative to an IPO) and thus is seen hampering chances of finding investors.

Some weeks later the additional advantages in the technology itself are emphasized more. Since the measurement process does not seem to require amplification it is less error-prone than PCR-based measurement methods. Therefore data accuracy should be higher. This argumentation comes into play since the argument on being able to compete on a cost basis by saving PCR-fees is limited to a small window of time until patents on PCR run out in (presumably) 2007. A pure cost advantage therefore would therefore be of limited duration. The time frame of advantage amounts to roughly 2-3 years assuming a development time until 2005 which is not necessarily interesting as sole basis for competitive advantage.

"From an outside viewpoint it might appear to many analysing the state-of-the-art in microarray technology that existing procedures, i.e. the PCR-amplification and fluorescent labelling protocol described above, are readily amenable to routine applications in diagnostic laboratories. Indeed, the technology is highly sensitive and error-free results can be obtained if the tests are executed by skilled labour and if the necessary laboratory infrastructure is in place.

Deeper analysis of the actual laboratory reality, however, reveals that these prerequisites are rarely in place, especially in the largest regional market, the US. For a routine laboratory the state-of-the-art

procedure is regarded as costly (infrastructure, instrumentation, reagents), highly complex (demanding intense training of users), error-prone (due to the sensitivity of PCR-amplification to contamination), and difficult, if not impossible, to automate for high-throughput and essentially push-button operation." (Businessplan dated 21.05.03, p. 5.)

Later, in the fall of 2003, the only comment in the business plan on the technology being PCR free is the following, putting even stronger emphasis on data sensitivity due to the nano-transducer which should enable high sensitivity.

"We have already embarked on a project which uses nano-scaled electronic transducers, with the aim of increasing the sensitivity of our system to a level of several hundred DNA-molecules. This will enable the detection of nucleic acids from biological specimens without prior amplification by PCR or other biochemical methods." (Businessplan dated 28.11.2003, p.6.)

Rather the focus has shifted to a number of technological key advantages:

"Low cost: the electronic read-out device is no more than a conventional electronic chip-card reader; its production will cost less than 1000.

Label-free: DNA is detected solely by virtue of its intrinsic high negative charge, completely eliminating the labelling step;

Time-resolved measurement: Our technology uniquely enables us to measure the kinetics of DNA-binding. We can thereby determine the absolute concentration of individual genes in a biological sample, achieving an entirely new level of precision.

Highest specificity and speed: The special DNA-analogous structures used as probes lead to higher discriminative specificity and faster measurement.

Potentially reusable chips: Our microarrays are more stable than those currently in use and can be reused more than 50 times.

1.4. Our Technology Addresses Key Drivers of Customer's

Purchasing Decision

Set-up cost: Our read-out system, costing a fraction of those currently available, allows us greater flexibility of marketing strategy. This will help to overcome market entry

barriers for new technologies. Low-cost instrumentation will also open up new markets such as point-of-care diagnostics.

Cost per test (chips and reagents): Our system, dispensing with labelling reagents will lower the cost per test. The reusability of our chips could, if desired, lead to additional

savings.

Ease-of-use: Our technology avoids complex instrumentation and directly delivers unambiguous, digital data, reducing the need for technically trained personnel.

Reliability: Our system is geared to fulfil the highest customer demands in respect to specificty, reliability and robustness.

Enabling technology: Our label-free, time resolved DNA-chip technology will provide quantitative measurement capabilities that researchers have long sought for." (Businessplan dated 28.11.2003, p. 5.)

3.3 External Selection

'External' selection takes place by by investors, cooperation partners and finally stock-market investors / analysts to which all actions must be geared to ensure a successful IPO.

One problem of the project that involves external selection is a bad reputation of DNA-Chips among investors. Therefore attention is drawn to the issue of gold electrodes (which are not used but that have been used by competitors such as Siemens). Companies using gold electrodes have run into trouble stabilizing them, which seemingly discredits the whole idea of bio-chips. The problem is that investors are often not able to differentiate enough between different versions of technologies, but act on category-labels such as `electronic DNA-detection'. The task of putting straight such matters falls on the entrepreneur / technologist

developing the business-plan, who often has the problem that he takes such differentiating issues for granted, based on his specialized and more differentiated mental representations.

"We do not employ gold electrodes. In contrast, the surface of the transistors use in our chips consist of silicon dioxide, the same material as the glass slides commonly used for DNA-microarrays. Our system therefore relies on the same surface preparation and DNA-immobilization technologies as the conventional fluorescence-based systems currently in use around the world. Our special DNA-chemistry renders our chips even significantly more stable than today's commercial standard." (Businessplan dated 24.11.2003, 8-9.)

Similarly investors are cautious due to general problems with the state of the DNA-Chip market and process of approval of DNA-Biochips. There are estimates that more than 400 companies try to develop and sell such products. Thus one US American investor responds to the business-plan proposal as follows:

„Dear Dr. K,

Thanks much for the opportunity to review your proposal. This certainly represents a novel approach that may enable label-free detection in nucleic acid arrays. For strategic reasons however, we have decided not to pursue new DNA array technologies at this time due to the crowded market and the low valuations placed on new entrants to this space as well as the exiting of some larger players such as Corning from this area due to the presence of large established platforms in the research area such as Affy's. I could certainly imagine this having interesting applications in the diagnostics field, however, it is still too early, in our opinion, to introduce such a platform in the diagnostics area due to the lack of clear FDA guidance on this type of use. …" (email to C. K., underlining added by the author).

In this case the lack of established `rules of conduct' by a public authority, the FDA, is quoted among the main reasons for not pursuing the investment opportunity further. (Actually, the

FDA developed a guideline at that time and published it shortly thereafter.) The FDA approves and oversees products on medical and health care markets to prevent harm to patients. Additionally, in the summer / fall of 2003 Roche had tried to market such Chips as application specific reagent (ASR) which does not require official approval by the FDA. This approach was not accepted by the FDA. An alternative would be to claim the status of an experimental device, which requires less deep scrutiny by the FDA.

Uncertainty about viable technologies and market prospects hinders the funding of the project. This links into Alchian's (1950) story about evolutionary selection of those choosing the right approach to an economic goal and Knight's (1921) argument that uncertainty breeds heterogeneity in economic actors responses. Here, the absence of formal institutional rules prevents positive selection of the proposal at the given time. These rules would direct actions of market actors as well as differentiate (select) between acceptable and unacceptable technological approaches (respectively products). These rules allow evaluation of the possibility to make profits from such projects. The existence of rules which require testing would likely hurt some projects or products that either cannot meet the requirements or garner the necessary resources to do the testing, but not all and would actually have a positive impact on the the development of the field as a whole. Whether the particular project described here is among them is another question, but given the potential characteristics of the technology and the implicitly positive evaluation of the just cited investor, by wanting to stay in touch, the prospects cannot be judged to be entirely dim.

3.4 The Personality of the Entrepreneur

The background of Dr. K is an education as chemist, with a specialization in biochemistry, working on the synthesis of artificial oligo-nucleotides at Harvard and the ETH Zurich. This was later, after a spell as post-doc, followed by the founding of one of the first German biotech companies, which went public as BT AG and survives until today. The motivation for this was

an interest in evolution and origin of life, combined with the idea to do research, but not in a "slow" academic environment. The solution to what could be done in this area that also had a commercial application, to fund the project, was the human immune system. The approach chosen was that of applying artificial evolution to the development of artificial antibody libraries. This techniques is based on combinatory chemistry where relatively well performing candidates are selected from a number of randomly generated compounds and used for further refinement.

From what I observed and concluded from questions there is a recurring pattern of novelty search, of 'research activities': sifting through masses of information, combining and linking information concepts, as well as a search for partners, activities to connect (with) them and build a network.

On Technology

The monoclonal antibody technology (Mab) developed by BT AG with Dr. K's involvement is a combination of several elements:

1. High Throughput Screening (HTS)
2. Combinatory chemistry
3. Robotics to automatically produce antibody compounds
4. protein-coding nucleotides which are recombined

(Presentation Dr. K at btS seminar, Cologne, November 25, 2003)

Likewise the project aiming at the development of Bio-chips for the identification of marker genes for health conditions is a similar combination of a set of technologies:

1. a nano-technology transducer element
2. a silicon carrier basis for capture probes

3. particular type of synthetic capture probes emulating DNA structure, but having better chemical properties in terms of stability than DNA

While he was actively involved in the development of monoclonal antibody technology at BT AG, his role in the diagnostic chip venture is purely on the commercialisation side of activities.

On Management

"Well, well management. One should not be too much in awe. … Jobs and Gates did not have management in the beginning. Important is that the technology works just really well." (email C. K., 15.11.2003, translation by author.)

Here we can discern a strong focus on technology. This trait hampers many technological entrepreneurs in that they do not start to worry about the market or even in some cases on managing the project organization when the need arises. This is possibly related with personal traits, abilities and interests of the entrepreneur. Therefore it is important to have a team with complementary capabilities that serve all needs.

Motivation

The personality, based on my own personal and subjective impression, is that of a winning, people-oriented, very marketing-capable, (an activity he stated he actually dislikes), social and intellectually-analytical person, who is also characterized by a hidden insecurity and the feeling of a pressure to have to achieve something, to prove his worth. The family may matter in an entrepreneurial socialization in as much as the father was a successful lawyer who co-founded one of the larger law-practices in Germany. Already during studying in the 1980s in Berlin, he participated in a removal operation renting out a little bus and himself with friends.

The motivation of our entrepreneur seems to rest largely on the possibility to bring about a technically excellent solution, which offers an "ultimate" solution to the problem at hand. This certainly also helps, if successful, the financial wealth and social status of the entrepreneur. Altshuller in a large scale analysis of Soviet-russian patent applications has shown that seminal discoveries and technological advantages are based on a logical reasoning as to which would be the best possible solution (cp. particularly Altshuller 1977). [3]

"I lay awake last night and thought about all. Why am I doing this? Because I believe that transistors and semiconductor technology, which we control like nothing else in the world (with respect to sensitivity and miniaturization[)], is the best basis for biological measurements. Full stop.

Basically, it is just a visionary belief. They might be miles ahead of us, [but] what we have is the final and best version. Sustainable to eternity. But who believes this[?] Proteins will be measured at some point like this, too. The system can become sensitive in the future. One-electron-transistor, they work on it already. Nevertheless it is despairing. […]" (email C. K. 11.12.2003, translation by author.)

Particularly interesting is the remark on proteins. In the first meeting at the beginning of our acquaintance, I had asked about the possibility to measure proteins (as opposed to DNA) with the technology. The answer of Dr. K was he could hardly imagine how that should be possible, given the instability of proteins. So part of the motivating factors seems also to be the potential to develop a general approach that has a wide impact on society or the relevant community. The economic importance of protein identification is debateable, since a lot of the practically relevant information can be inferred from other sources such as the DNA and messenger RNA from which proteins are derived in the cell, according to industry participants' perception

[3] The wealth motive should have been less important in an absolute sense but may still matter in a relative sense in the Soviet-russian society, and can well be compensated for by a motivation aiming at status improvement.

(Pfenning and Luithle 2003). If one wants to know what is going on in cell it might nevertheless be necessary and helpful to detect proteins, particularly in a time-resolved fashion.

The focus of thinking of our entrepreneur is the competition that has a lot more resources at its disposal and better market access. Advantages of technology that potentially solve the problems that others have in applying their technologies (knowing well that there lie many problems and pitfalls ahead) and economic advantages. Only later, in the spring of 2004 (in the context of a debate on rewriting and promoting the business plan), I realized that the lack of a marketing person posed a certain problem for Dr. K, who seemingly is feeling well in the realms of technological development. But it is already contained in the following from December 2003, particularly the quote at the end which implies that investors (and customers) will come on their own. Here we find the motive of technical excellence again:

"Well, researched the whole day. Printed hundreds of pages. Especially [on] FDA approval but also normalization of micro-arrays. On competition. Motorola's chip is around since ages. Based on gold. Gold chemically not stable. far too complicated. There is no comparable technology to ours, if it works. Chips went out to […] for functionalization. Results before Christmas if everything works fine. […]

I have the strong feeling that nobody has thought about time-resolved measurement of absolute concentration on 10.000 spots. But I am sure that such a chip would be a breakthrough. People are laboring very hard to get good data. Problems are non-uniform spot size, background and unspecific fluorescence, normalization and the execution of statistically significant of multiple measurements. […] reusable chips are important. SNPs cannot be differentiated, especially not if they are heterozygotic. And then [there is] the design of Oligos with respect to equal melting points. The whole microarray business is a mess. Groping in the dark and hoping for software solutions. Only, since nobody thinks that measurement of concentration might be possible, no one has thought about the benefits of this. I am solving a problem that nobody has recognized yet. Very difficult to sell. We just have to do […] the measurements with PNA. The experiments must be designed in such a away that the potential is visible.

Then publishing it, and letting the scientific community fire back. One could build on that in the sense of preaching to the converted. On marketing. The best market are newborns. […]and whatever there is in terms of hereditary diseases. All of it on a chip and offer for 50-100 Euro inclusive PCR. Just opening our own laboratory. Good PR and all mothers will want to know whether the child is healthy. […]

After today's research I think that such a test can be marketed as `experimental'. Another question: Is our RT and self-calibrating reusable platform not much better suited to be approved for quality control by the FDA than inhomogenous Affymetrix chips? Beadbased systems (Illumina and Luminex) already are perceived to be better suited for approval (you take a sample and check, then you know how the rest is). Affymetrix chips are destroyed once tested.

In my opinion we still have the `stone of the wise people'. Just missing the PNA-measurements and the development of the whole thing.

…

`If you have a better mousetrap, the world will beat a path to your door'

so long,

the Biotech Cowboy (Email dated dec 5, 2003, translation by author.)

4. Characteristics of Visionary Entrepreneurs

We can discern the following psychological characteristics, motivations and behaviors of a entrepreneur from the evidence presented above:

1. a vision, which amounts to having a strong opinion on how things should be or will develop which amounts to normative thinking
2. perception of opportunity, i.e. the ability realize when positive circumstances and necessary conditions overlap and when not
3. combination of new (technological) elements, and/or recombination of existing elements, attempted on a massive scale

4. a set of differentiated priorities and conditions for certain actions, i.e. a mental representation of the world containing a differentiated hierarchical ordering of necessary steps and conditions as well as (momentarily) irrelevant issues
5. sampling, evaluation and selecting of masses of data
6. motivation: driven by desire to do science, but in better condition than at university

The problem solution approach of such a personality, at one extreme characterized by the aim of solving an issue of major importance, can also be compared to Schiller's `philosophischem Geist' (versus his `Brotgelehrtem', see Schiller 1789), that tries to connect issues across disciplinary boundaries. It is certainly characterized by a a certain perfectionist stance which makes it hard to put constraints on the ideas and activities of (some of) such persons.

According to Becker and Knudsen the characteristics of our entrepreneur match into a seldomly acknowledged category of the entrepreneurs:

"The 'founder' (promoter), is not commonly considered entrepreneur either, if for completely different reason. The most striking characteristic of the founder is his almost exclusive focus on seeking and carrying out new possibilities. That does not entail any power over means of production, though, which often is a defining characteristic entrepreneurship. From Schumpeter's point of view, however, the founder is the purest expression of the entrepreneur." (Becker and Knudsen 2004 p. 14).

The lack of (the necessary) resources and discretion over resources is certainly correct in our case, but to criticize the lack of consideration of such persons goes too far in my view. It may be hard to easily observe such a category of entrepreneurs until they are reasonably successful, and an exclusive focus on new possibilities may stand in the way of commercialisation, success and recognition (e.g. take the case of Ted Nelson, the hypertext–pioneer). Even if one argues that these are the characteristics of pioneers, if found in the economic realm they are likely to be considered entrepreneurial.

This point hints to a differentiation of entrepreneurial activities according to risk(-aversity) on the one hand and social and/or economic "reach". In terms of risk and economic success, it matters whether entrepreneurs tend to pick low-hanging fruits that present themselves, or whether they aim to build 'systems' (in the sense of Thomas Hughes), such as Edison managed to do. As it seems, successful entrepreneurs are characterized either by focussing on the low-hanging fruits they happen to come across and follow their lead wherever that may be, or by a combination of system-building traits with the ability to focus on / select economically successful plans. Less successful entrepreneurs in contrast choose fruits hanging (too) high (for them), which do not yield sufficient (economic) returns and/or are focussed on specific technological or social questions, which make them possibly persistent pioneers changing the

5. Conclusion

The case study shows how the founding process of a new venture is characterized by many selection decisions prior to the operation of market selection and how these interact in the mind of an entrepreneur. These include and are related to technological approaches, choice of partners, choice of investors by entrepreneurs and investment decisions of investors. Overall decisions about how to present and market the venture are controlled by the expectations about market (selection) decisions. The environment for DNA-Biochips is presently a difficult one since a large number of approaches competes for attention and resources. This is reflected in the shifting argumentation for the technological approach championed by our entrepreneur.

In social systems the generation of change can be conceptualised as follows: Mental representations respectively elements in cognitive maps are moved around, realigned and translated into real-world tests of (hypotheses about) artefacts. In an evolutionary perspective: Variety generation is closely related to hypothesis generation and testing. In terms of the generation of novelty and application of novel approaches to problems, two extreme types of 'archetypical' actors respectively approaches can be discerned:

- The first one is asking: What do we have in terms of resources? What can we do with them? This means, an actor is looking for a problem to solve with his available tools.
- The second one starts out from a problem and asks: Given a problem, what is a good (if not ideal) solution? What do we need (to do) to solve it?

Real, observed behavior will of course lie on a continuum between these cases with differing expectations as to the quality of the outcome.

The example also shows that an evolutionary learning perspective can integrate perspectives from evolutionary biology, psychology, sociology, institutional and evolutionary economics and thus can complement 'standard' economic approaches to economic behavior in the case of entrepreneurship on the micro-level (and in the aggregation of many such actors to economic development on the macro-level). Individual profit motivation a la Penrose, complemented by a motivation to build something and an evolutionary account of economic behavior do not contradict each other neither at the micro-level nor at the aggregate level.

6. References

Addams-Webber, J.R. (1979). *Personal Construct Theory. Concepts and Applications*. Cichester: John Wiley.

Alchian, Armen (1950). Uncertainty, Evolution, and Economic Theory. *Journal of Political Economy*, 58, 211-221.

Bannister, D. (1985). *Issues and Approaches in Personal Construct Theory.* London: Academic Press.

Becker, M. C. (1999). *The Role of Routines in Organizations. An Empirical and Taxonomic Investigation*. Unpublished PhD thesis, Judge Institute of Management, University of Cambridge, England.

Becker, M.C. and Knudsen T. (2004). *The Role of Entrepreneurship in Economic and Technological Development: The Contribution of Schumpeter to Understanding*

Entrepreneurship. Paper to be presented at the DRUID Summer Conference, Industrial Dynamics, Innovation and Development, Elsinore, Denmark, June 14-16, 2004

Businessplan Dr. Christian K., various versions, on file with author.

Fagerberg, J. (2003). Schumpeter and the Revival of Evolutionary Economics: An Appraisal of the Literature, *Journal of Evolutionary Economics*, 13, 125-159; longer version available at: http://folk.uio.no/janf/downloadp/02fagerberg_evolution.pdf

Gates, W. H. (1995). *The Road Ahead.* New York: Penguin.

Grebel, T. (2002). *Entreprenuership. A New Perspective*. Doctoral Dissertation, University of Augsburg.

Kelly, G.A. (1955). *The Psychology of Personal Constructs*. 2 vols., New York: Norton.

Kubon-Gilke, G. and Schlicht, E. (1998). Gerichtete Variationen in der biologischen und sozialen Evolution, *Gestalt Theory*, 20, 48-77.

Kirzner, I. M. (1973). *Competition and Entrepreneurship*. Chicago: University of Chicago Press.

Knight, F. H. (1921): *Risk, Uncertainty and Profit*. New York: Houghton Mifflin.

Millard, A. (1990). Edison and the Business of Innovation. Baltimore: The John Hopkins University Press.

Nelson, R.R. and Winter, S.G. (1982). *An Evolutionary Theory of Economic Change*. Cambridge: Harvard University Press.

Pfenning, D.-M. and Luithle, J. (2003): Lecture on Bayer AG and its View of the Pharmaceutical Industry. Arbeitsamt Köln, December, 2, 2003.

Schiller, F. (1789). *Was heißt und zu welchem Ende studiert man Universalgeschichte*? Akademische Antrittsrede am 25. Mai 1789 in Jena, appeared in: *Deutscher Mercur* November 1789.

Schlicht, E. (1997): Patterned Variation: The Role of Psychological Dispositions in Social and Institutional Evolution, *Journal of Institutional and Theoretical Economics*, 153, 722-736.

Schumpeter, J. A. (1993 [1934]). *The Theory of Economic Development*. New Brunswick, London: Transaction Publishers.

Southwick, K. (2001). *The Kingmakers. Venture Capital and the Money behind the Net*. New York: Wiley.

Veblen, T. (1898). Why is Economics not an Evolutionary Science, *Quarterly Journal of Economics*, 12, 373-397.

Wallace, J. and Erickson, J. (1992). *Hard Drive. Bill Gates and the Making of the Microsoft Empire.* New York: Wiley.

PAPER FOR THE High Technology Small Firms conference 2010

Online revenue model adoption in the media sector: in-depth results from an exploratory study in the Netherlands

Martin R. Stienstra
University of Twente
The Netherlands
m.r.stienstra@utwente.nl

Huub J.M. Ruël
University of Twente
The Netherlands
h.j.m.ruel@utwente.nl

Thomas Boerrigter
Technocentrum – The Netherlands
thomasboerrigter@hotmail.com

Abstract

Especially for companies in the media sector such as publishers, the Internet has created new strategic and commercial opportunities. However, many companies in the media sector are struggling with how to adapt their business and revenue model for doing profitable business online. This exploratory study goes into the success factors and the level of adoption of online revenue models by media sector companies. We use Chaffey (2002) in determining online revenue models in which we included Osterwalder's (2001) four 'pillars' of business models. These four pillars cover the twelve critical success factors for e-businesses as identified by Sung (2004). This theoretical framework was used for in-depth interviews with 20 senior managers within the media sector in the Netherlands. From this, it appeared that advertising is the most used online revenue model, with targeting advertising, lead generation and a combination of content and customer profiles as most promising. Ease of use is distinguished by all senior managers as success factor. Still, in order to be successful, all factors should be applied, and this appears not to be the case. Organizations in the media sector need to invest in technical and organizational expertise by hiring the right employees with the right knowledge. Emphasis on target advertising and lead generation are most promising. A combination of content and customer profiles is a focus-point for the near future.

1. INTRODUCTION

The Internet has influenced the way of doing business in most industries over the past two decades. Especially for companies in the media sector such as publishers, the Internet has created new strategic and commercial opportunities. Democratization of the production of content and free availability of information are key words. However, for the media sector, questions emerged such as: how to react to these developments? How to embrace the business opportunities the Internet is offering? And perhaps most importantly, how to keep on making money? What are feasible and sustainable business and revenue models for doing profitable business online?
Many companies in the media sector, old and new ones, are still struggling with these questions, for example traditional newspaper companies and publishers. This calls for a study on the success factors and the level of adoption of online revenue models by media sector companies. In this paper we present the results of an exploratory study on this topic. The overall research question was the following:

> ***What are the most promising innovative online revenue models, their critical success factors, and how are they being used by organizations in the internet and media sector?***

2. LITERATURE REVIEW

The popularity of online news provision has increased rapidly because of the rise of internet. A consequence of this trend is that the existing traditional publishers are losing subscribers, as online content is (still) in most cases for free (see e.g. Krueger 2006). News sites, blogs, and social media have become dominant sources of news. Traditional paper-based publishers are fighting their way back. Major newspapers all have their own websites with free content though based on online business models and online revenue models of which it is unclear whether these can be sustained in the long run.
Let us first define the concepts of online business model and online revenue model. Several researchers have proposed definitions of business models for content and news. Krueger & Swatman (2006) give an overview of these definitions in which they describe the work of (among others) Rayport, Niewiarra, Weill & Vitale, Wirtz,

Farhoomand & Lovelock and Bartussek. Rayport (1999) and Niewiarra (2001) stress the aspect of a network as a central element of a content provider's business model. For Weill and Vitale (2001), by contrast, the business model of a content provider concentrates on the production of content; whereas for authors like Wirtz (2001) or Farhoomand & Lovelock (2001) content providers act more as intermediaries in the value chain. Bartussek (2001) takes both of these aspects into account. Considering all of the literature on business models it is remarkable that there is not one, broadly accepted definition of an *online* business model for content and news. Shafer, Smith and Linder (2005) describe that this also goes for business models in general. They came up with a definition of a business model on the basis of a literature review in which they enclosed 12 definitions of business models. We will use this definition in a slightly adapted way; *An online business model is a representation of a firm's underlying core logic and strategic choices for creating and capturing value within an online value network.*

Krueger, Swatman and Van der Beek (2003) state that there are two groups of promising online business models: 1. those models which integrate the creation, acquisition, value adding and digital distribution of content with the help of a software platform and therefore profit from the network effects. 2. those models which concentrate on what they know best, their core competence, and which find the right partners to support this strategy.

According to Krueger & Swatman (2003), media companies evolved quickly to make use of the Internet as an alternative distribution channel, but online news is an entirely different business from offline news, with different needs. Not only does it require a relatively sophisticated technology infrastructure, but also a new way of reporting information. Both these requirements lead to increased costs for the online news provider. Since the internet consumer is accustomed to free information, the question of how to generate revenue is both difficult and pressing. Two additional factors have further complicated this issue: the global recession has limited many organizations' capacity to invest in the development of sophisticated new business models, and the classic news revenue source (advertising) is not very successful in this new environment.

Towards a research model

Chaffey (2002) identifies five online revenue models: direct sales of product or service; subscription or rental of service; commission-based sales (affiliate, auction, marketplace); advertising (banner ads, sponsorship); and sales of syndicated content or services.

Sung (2004) identifies 16 critical success factors that are influencing the success of online revenue models:

- Customer relationship
- Privacy of information
- Low-cost
- Ease of use
- EC strategy
- Technical EC expertise
- Stability of systems
- Security of systems
- Plenty of information
- Variety of goods/services
- Speed of systems
- Payment process
- Services
- Delivery of goods/services
- Low price of goods/services
- Evaluation of EC operations

We added Osterwalder's (2001) four 'pillars' of business models, being product innovation, infrastructure management, customer relationship, and financials to the online revenue models by Chaffey (2002). This combined framework covers twelve out of 16 critical success factors for e-businesses as identified by Sung (2004), which we consider a support for the relevance of the factors.

The 4 factors which are not covered will not be included. This is because of the following reasons: 'Customer relationship' is already one of the 4 pillars of the business model of Osterwalder (2001), which is used in the theoretical framework, and in the criteria of this research it is a very broad concept. Therefore it is not mentioned as an individual success factor. 'Payment process' used to be a difficult and therefore very important process. In this research it is not regarded as a critical success factor because nowadays in every organization it is automated and it does not influence the implementation of an online revenue model. 'Delivery of goods/services' can be compared with 'services' because in this research it is the same and therefore it will be asked only once to a respondent. And 'speed of systems' has an overlap with 'stability of systems', according to this research it is a small part of the stability and therefore it will not be mentioned in the questionnaire.

The combined framework is presented in figure 1;

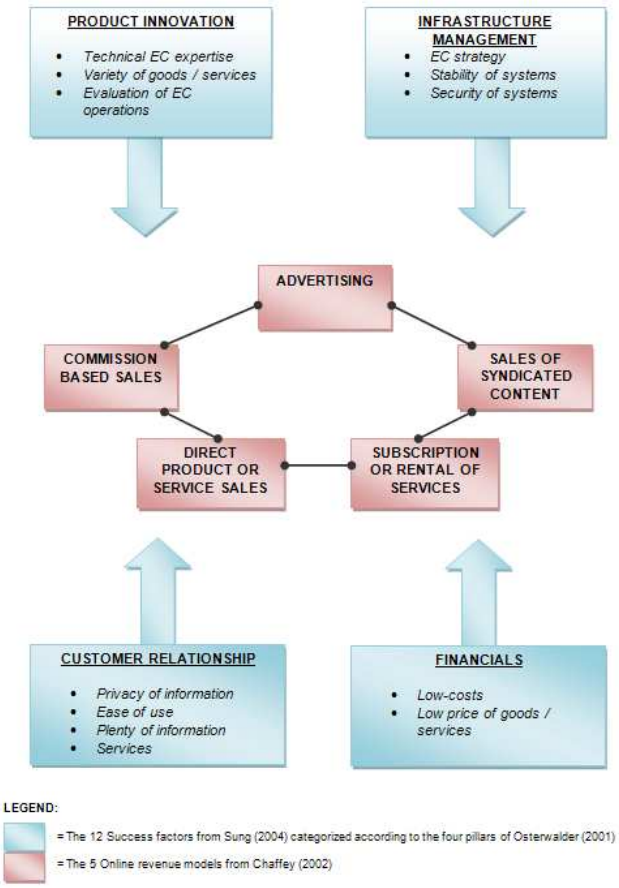


Figure 1 The research model

The following 12 success factors which could be relevant for working in an Electronic Commerce environment remain for this research;

1 *Privacy of information*

2 *Low-cost*

3 *Ease of use*

4 *EC strategy*

5 *Technical EC expertise*

6 *Stability of systems*

7 *Security of systems*

8 *Plenty of information*

9 *Variety of goods/services*

10 *Services*

11 *Low price of goods/services*

12 *Evaluation of EC operations*

This study explores whether these 12 success factors are really that important for organizations in the internet and media sector when implementing and using online revenue models.

Categorizing the success factors according to the business model of Osterwalder

The 12 critical success factors are independent and they have different meanings, but some factors are more interrelated with each other than other factors. Other factors do not have any overlap and they are very different. Overall, there is a lack of overview in these 12 factors. For this reason they are categorized into the 4 pillars of the business model of Osterwalder (2001). These 4 pillars are mentioned below:

1. *Product innovation*
2. *Customer relationship*
3. *Infrastructure management*
4. *Financials*

The 12 success factors are categorized into the 4 pillars of Osterwalder (2001):

Customer relationship:
- *Privacy of information*
- *Ease of use*
- *Plenty of information*
- *Services*

Infrastructure management:
- *EC strategy*
- *Stability of systems*
- *Security of systems*

Product innovation:
- *Technical EC expertise*
- *Variety of goods / services*
- *Evaluation of EC operations*

Financials:
- *Low-costs*
- *Low price of goods / services*

By categorizing the success factors there is a better overview of the success factors and therefore clearer conclusions can be drawn. Next to this, the business model of Osterwalder (2001) is also an often used and respected model, and therefore it gives reliability to this research.

3. METHOD

Our overall aim was to deepen our understanding of which online revenue models are considered profitable and sustainable by media sector companies and why. Thus, we opted for a qualitative research design. We chose for in-depth interviews with senior managers of a sample of media sector companies. The research model derived from the literature was used as a guide for the development of an interview protocol. It consisted of 30 questions which were pre-tested by an expert panel of a large international consulting firm.

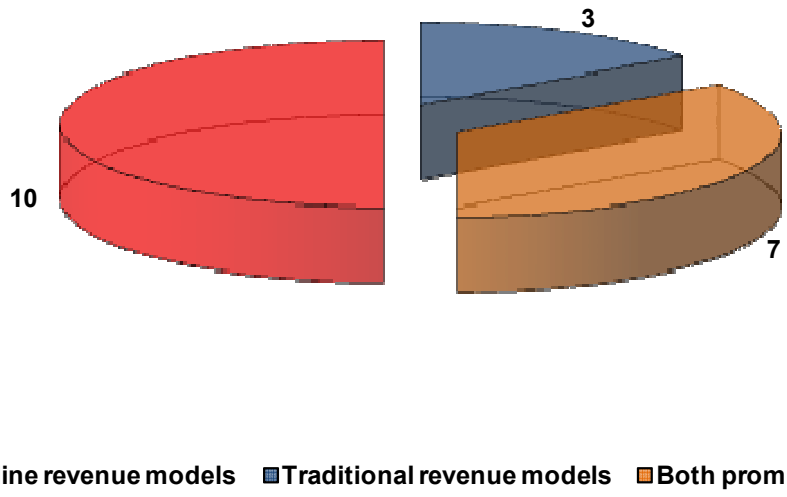
Data for this study were collected in the media sector in the Netherlands. We consider the Netherlands a good sample country for our study as it is the country with the second highest internet penetration rate in the world after Greenland (www.internetworldstats.com/top25.htm), the third highest level of broadband penetration in the world (www.websiteoptimization.com/bw/0809/) after Monaco (1^{st}) and Denmark (2^{nd})], the second best connectivity and technological infrastructure in the world (after Switzerland) (Economist intelligence unit e-readiness rankings 2008), and seventh in the world in overall e-readiness (Economist intelligence unit e-readiness rankings 2008).

The data were collected by interviewing 20 senior managers of organizations in the media sector. They were selected by means of snowball sampling. This was done with the help of the enormous network of a group of consultants. The potential respondents were contacted through e-mail or telephone, and every interviewed respondent had more than 5 years of experience. Every interview took 1 hour to conduct and was held at the interviewee's organization. We thereby created the ideal circumstances and environment in order to minimize biases in the answers.

4. FINDINGS

From the interview it becomes clear that the organizations involved think that online revenue models are very promising for the future. From the responses to the question, what do you find the more promising for the future, online revenue models or traditional revenue models the following picture emerged:

FIGURE 2: The most promising revenue models according to the respondents (N=20)



Only 3 respondents find traditional revenue models like advertising in print papers and magazines most promising for the future. The other 17 respondents find either online revenue models the most promising or a combination of online and traditional revenue models. In general, during the interviews it becomes explicitly clear that the respondents are finding online revenue models the most promising revenue model for the future. Every organization is working with online revenue models, either exclusive or in combination with traditional revenue models.

When asked for the reasons why online revenue models are considered as promising respondents came up with a different number of reasons.

- *"Traditional revenue models are being transformed into online revenue models"*
- *"In the long run money can be made with online revenue models"*
- *"Traditional revenue models will stay for a long period to come, although they are diminishing"*
- *"Nobody really knows what the most promising is. There is hope that the online revenue models will be as big as traditional revenue models, but at the moment it is not even close"*
- *"We keep investing in traditional revenue models because they are at the moment the most profitable. But online does need more attention for sure, because it is growing very rapidly"*
- *"It is a combination of different types online and traditional what is most promising for the future, customers are sensitive for combinations"*

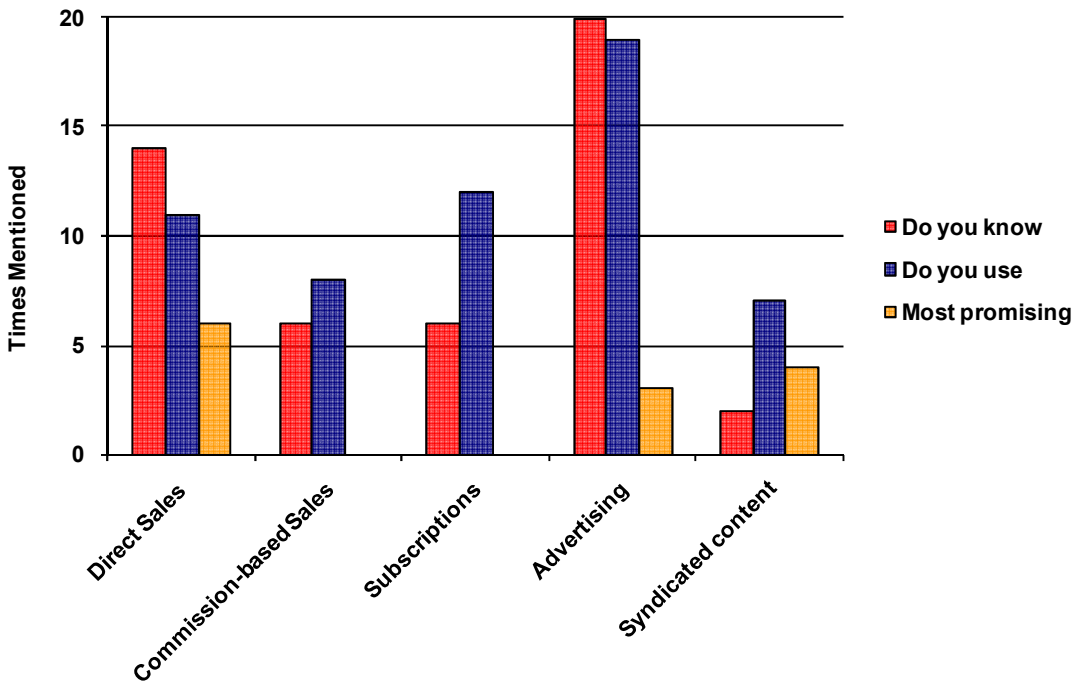
Organizations that started with 'print' as their core business (12 out of 20 organizations) expressed that their 'print' will stay for the upcoming years and they

will still earn a lot of money with it. At the moment these organizations earn a lot more money trough traditional revenue models than trough online revenue models. An obvious tendency is that the turnover from traditional revenue models is diminishing and that the turnover from online revenue models is growing. All these respondents also expressed that their organizations are busy with the development of online revenue models. All the organizations spend a great amount of time on developing online revenue models.

Online revenue models

What kind of online revenue models do companies in the media sector know and what kind of online revenue models are they using? Which online revenue models do these companies find most promising for the future? Figure 3 presents the responses to these questions:

FIGURE 3: Online revenue models in the internet and media sector (N=20)



The first question regarding which models do you know, was first asked without mentioning examples or showing lists of existing models. When a list with models based on the literature is shown to respondents, almost every online revenue model is familiar to the respondents. It is remarkable though that in general online revenue

models are associated with ‘advertising’ and to a lesser extent with ‘direct sales’ when asked spontaneously.

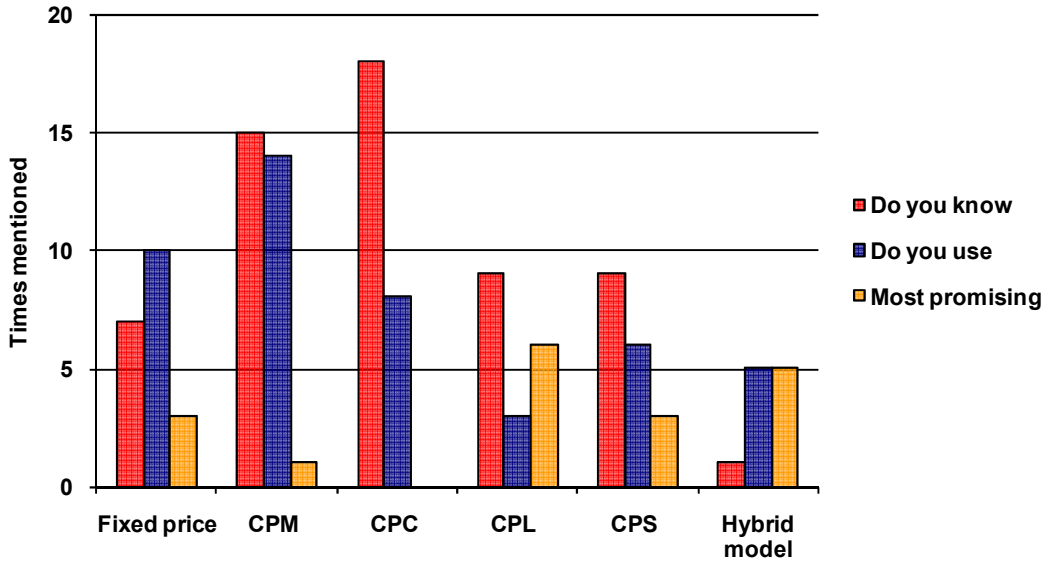
The answers to the question which models do you use, gives a different view on online revenue models. Although ‘advertising’ is almost used by every organization, ‘subscriptions’ are second in ranking. Another obvious outcome is that with ‘commission-based sales’, ‘subscriptions’, and with ‘syndicated content’, these online revenue models are more used than known. They are being used in organizations, but fewer respondents mention them as online revenue model. Initially they are not associated as online revenue models.

Remarkable responses were provided to the question what is the most promising online revenue model? Figure 5 shows that overall online revenue models as not considered as the most promising. Only ‘direct sales’, ‘advertising’, and ‘syndicated content’ are mentioned respectively ‘6’, ‘3’, and ‘4’ times asmost promising out of 20 respondents. If these online revenue models are being used a lot, but they are not very promising, then why are online revenue models being regarded as growing and profitable? The answer to this is a bit more complicated and will be given later on in this section.

Figure 3 shows that advertising is the most used online revenue model at the moment. In order to earn money with this model there are different methods of calculating the charge for pages (advertisements) being offered to online users. Therefore also a few questions were asked to the respondents about calculating methods: What kind of online calculating methods do you know? What kind of online calculating methods do you use? What kind of online calculating methods do you find promising?

Figure 4 shows the responses to these questions..

FIGURE 4: Calculating methods known, used, and most promising according to the respondents (N=20)



In the figure above a few things are remarkable:

- CPC and CPM are best known with the respondents in the internet and media sector
- CPC is best known with the respondents, but it is not most used in comparison with the other calculating methods
- Only one respondent mentioned the hybrid model as a calculating method. It is remarkable though that more than one organization used the method and found it very promising

Throughout the interviews there is one striking resemblance in the answers that a lot of respondents mentioned. Organizations that use calculating methods want more certainty in deliverables of revenue. This explains why organizations find fixed price, CPL, CPS, and the hybrid model most promising. Advertisers are using CPM and CPC a lot, but the uncertainty is high in what it will produce when implementing it. With fixed price, CPL, CPS, and the hybrid model, organizations can calculate future revenue in a better way. According to the interviews it seems that there is a shift from CPM and CPC to the other calculating methods.

The most promising online revenue models

Earlier it was shown that respondents do not specific mention the 5 online revenue models from the literature as very promising for organizations in the internet and

media sector. It means that respondents have a different view regarding the online revenue models in comparison to the literature. Therefore, to the question why are the online revenue models mentioned most promising, the following quotes give a good picture of the overall views of the respondents:

- *"Web shops are taking over the traditional shops on the street"*
- *"With direct sales, a lot more is possible. All kinds of products can be sold on the internet, there is no limit to it"*
- *"Lead generation is very promising because it produces direct revenue for the advertiser and it is measurable"*
- *"Target advertising is promising because then an organization exactly knows for which consumers it goes. And this is possible in the new economy, being 'massively personal"*
- *"Syndicated content is important, mainly because it cannot be copied"*
- *"The combination of content and customer profiles is interesting for entering a new market"*

Out of the answers of the respondents it can be concluded that there is a great dissension between the answers given regarding the most promising online revenue models. Some organizations find direct sales like web shops very promising. This is mainly due to the deliverance of direct sales and due to the growth at the moment. Organizations think that a web shop can be build relatively easy.

Advertising is seen as the most promising online revenue model according to the interviews. It is also the most used model inside the organizations. Advertising is a broad concept. In the answers regarding advertising there is also a great dissension. Mainly lead generation and target advertising is seen as most promising. This is similar to the answers given regarding the calculating methods. Reasons for this are because these models are seen as more trustworthy, more producing, and more profitable. A combination of content and customer profiles is also seen as very promising. From the answers to these questions it could be interesting to get a combination between lead generation, target advertising and customer profiles. These three factors are very close to each other and they could be mixed in order to be very profitable. A lot of publishers have big customer profiles with a lot of information. If they could find a way to threat these profiles responsible, target advertising would be a lot easier and leads could be delivered better.

....and in the near future?

The goal of asking the question which online revenue models will your organization use in the upcoming 2 years, is to see if the organizations are planning to use the same online revenue models that they already have, or maybe the organizations would implement totally different online revenue models in the upcoming years. The answer to this question is in general the same for most of the organizations. 18 out of 20 respondents expressed that they are searching for newer, more innovative online revenue models, and they will also keep on using the current online revenue models. 2 out of 20 respondents say that they will keep using the current revenue models, and they will not implement other online revenue models. Remarkable to hear is that every organization is busy searching for new opportunities and some are already implementing and starting to use other online revenue models. A lot of organizations are already changing to other online revenue models in order to produce more sales. Often mentioned future online revenue models are lead generation, target advertising, and trying to earn money through customer profiles.

Success factors for optimal using online revenue models

It is also interesting to find out what organizations find critical success factors in order to implement and use online revenue models. Therefore the following question has been asked: What are the critical success factors for implementing and using online revenue models?

The respondents first gave their opinion on these critical success factors and on what they think are critical success factors for online revenue models. After this the respondents got a sheet with the 12 success factors identified by Sung (2004). On every success factor the respondent could choose between the following categorization:

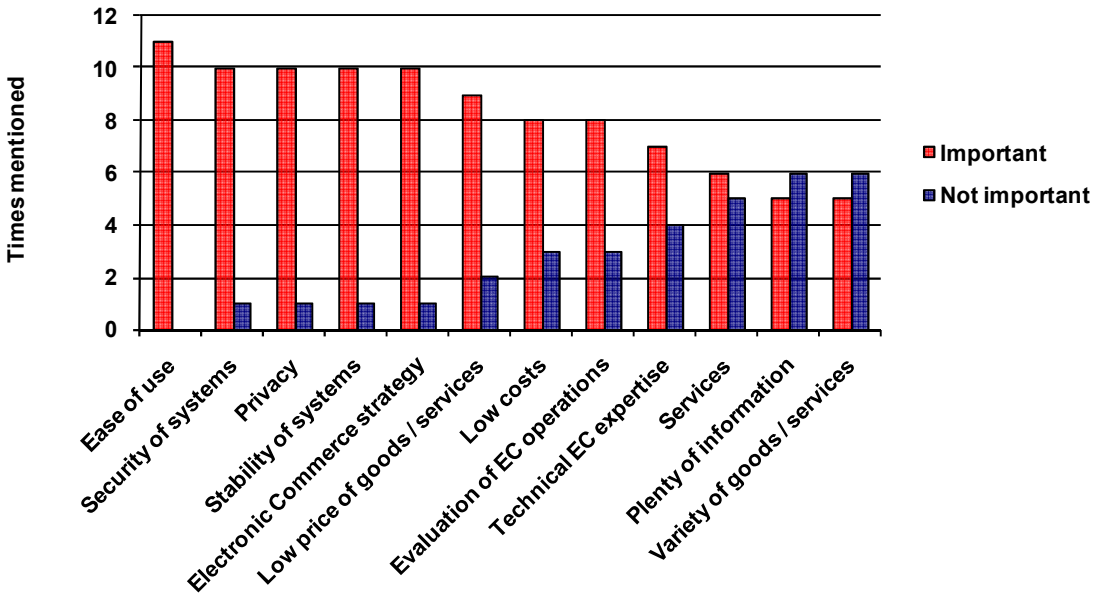
- Very important
- Important
- Not really important
- Not important

To give a clear overview of these results the categorization has been decreased to the following:

- Very important } Important
- Important
- Not really important } Not important
- Not important

The results can be found in figure 5.

FIGURE 5: Most important critical success factors according to the respondents (N=11)



It is remarkable that not one respondent is finding 'ease of use' unimportant. It is seen as a critical success factors by every respondent. Next to this, 'security of systems', 'privacy', 'stability of systems' and 'electronic commerce strategy' are seen as important and only 1 respondent find these factors not important. With the other critical success factors can be seen that there is more variety in the answers given and the tendency is going more towards 'not important'. Outliers hereby are 'variety of goods/services', 'plenty of information', 'services', and 'technical EC expertise'. Respondents vary in their opinion about the importance of these factors. 'Variety of goods/services' and 'plenty of information' are even more often named unimportant than important. Note that only 11 respondents gave an answer to this question. This is

due to the addition of this question in a later stage of the research. During the first interviews it became clear that critical success factors are very relevant and therefore the problem definition is partially changed in a later stage.

Without mentioning the 12 success factors of Sung (2004), the respondents mentioned a lot of interesting success factors in what they think is important. A few interesting success factors that have been mentioned:

- Interactivity between the consumers and the organizations
- The target group needs to be clear and consistent
- Extremely well measuring is important, you need to know what the performance is
- Dare things, just do it
- Openness, share knowledge with competitors
- Easy accessibility

Remarkable is that a lot of different critical success factors are given. Every respondent is giving a clear and consistent answer to the question, but a lot of differences in the outcomes are measured. A factor that respondents name more than once is that the website of an organization needs to attract enough reach. But how create reach and attract potential customers to websites? Reach could be depending on a lot of other factors. Examples of this could be 'easy accessibility of the website', 'low price of goods/services', and 'plenty of information'. This means that one critical success factor is not enough in order to get the full potential out of online revenue models. More critical success factors need to be present for one organization in order to implement online revenue models and to produce a lot of turnover. Future research could find an answer to this question. Another remarkable finding is that a lot of critical success factors given by the respondents indicate that organizations find the online market difficult to enter; the market is very unique, changing and difficult to the organizations. When respondents name 'extremely well measuring', 'openness with competitors', and 'use young people because they have more knowledge of online', then it can be concluded that it is very difficult to operate in the market for these organizations. Maybe the knowledge of the possibilities and technical capability

of the organization itself is not yet good enough and the organizations need to transform more too transparent organizations.

The 12 success factors mentioned by Sung (2004) have a lot of overlap and a clear overview is absent, they have been categorized according to the 4 pillars of the business model of Osterwalder (2001). For the understandability the categorization is mentioned once again:

Customer relationship:
- *Privacy of information*
- *Ease of use*
- *Plenty of information*
- *Services*

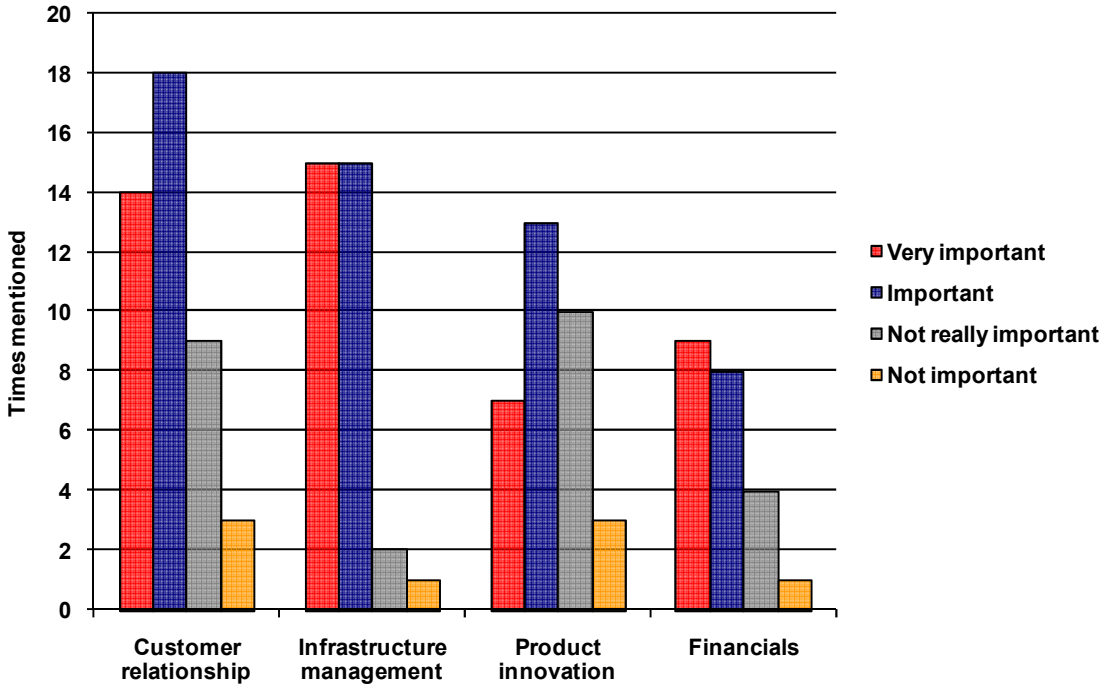
Infrastructure management:
- *EC strategy*
- *Stability of systems*
- *Security of systems*

Product innovation:
- *Technical EC expertise*
- *Variety of goods / services*
- *Evaluation of EC operations*

Financials:
- *Low-costs*
- *Low price of goods / services*

When grouping these 12 critical success factors into the 4 pillars of Osterwalder (2001), it is clearer in which corner of the pillars respondents find critical success factors the most important. Organizations could find critical success factors regarding 'customer relationship' more important than critical success factors regarding 'infrastructure management'. If there is a big difference in the outcomes of the pillars, then organizations know what is important to focus on. A note must be made that there is a difference in the amount of factors in every pillar. This could have an influence on the outcomes of the question. An argument against this is that although there are more factors that could be chosen, every factor could be filled in from 'important' to 'not important'. The results of the outcomes can be found in figure 6.

FIGURE 6: The 12 success factors classified into the 4 pillars of the business model of Osterwalder (N=11)



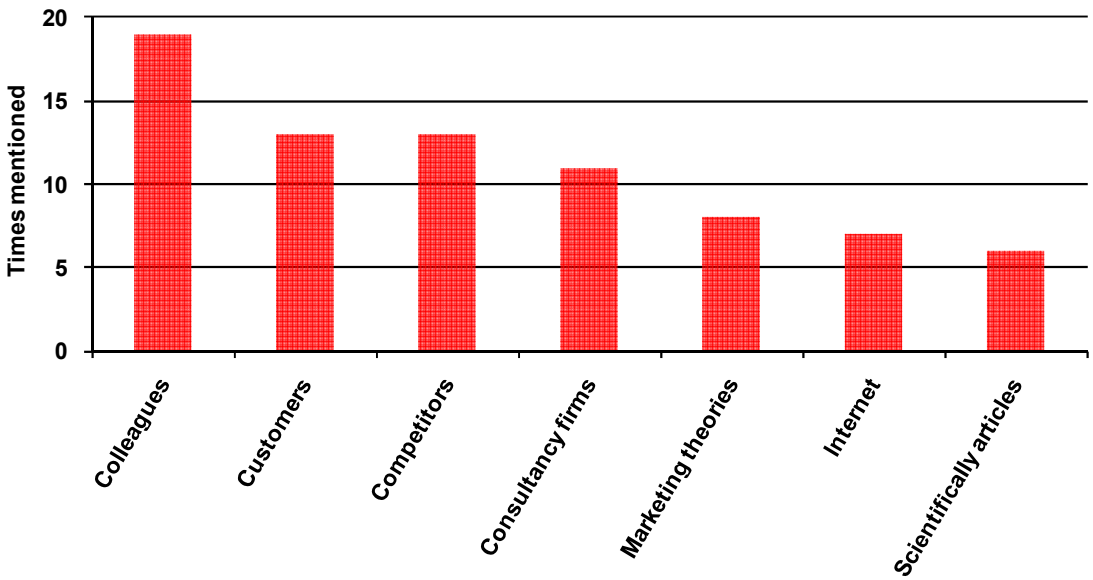
As can be seen in figure 6, the critical success factors of Sung (2004) are in general (very) important to the respondents. For this research it is thought that organizations with a lot of financials and a unique product (product innovation) are very good in using and implementing online revenue models. It is remarkable that the respondents find it more important to have a good customer relationship and to manage the infrastructure in a proper way. Remarkable is also that not a lot respondents find 'infrastructure management' and 'financials' not (really) important. Overall it could be said that there is not a great difference in importance between the 4 pillars. All the pillars of Osterwalder (2001) are interesting in the search for critical success factors regarding online revenue models. 'Infrastructure management' and 'customer relationship' are mostly named as (very) important, but 'product innovation' and 'financials' are also (very) important factors according to the respondents. It can be concluded that the literature review on critical success factors has a lot of match with the organizations interviewed.

How organizations in the internet and media sector use online revenue models

A few questions are also asked about the processions of the organizations regarding the online revenue models. The following question is the first question out of a sequel of 8 questions.

The outcome of the question, how does the organization develop her knowledge about online revenue models at the moment, can be seen in figure 7. It can be concluded that most of the information that organizations get about online revenue models is from the colleagues of the organization itself. Almost every respondent gives this answer to the question. Remarkable is that the least information is gathered from scientifically articles and from internet. Especially internet is a bit strange due the bulk of information about online revenue models on the World Wide Web. The reason that internet is not named very often could be due to the reason that internet is seen as a normal resource that employees always use. Respondents find scientifically articles not very useful in order to develop knowledge about online revenue models as also can be seen in the outcome of question 20 of this chapter.

FIGURE 7: Sources used by organizations in order to gather and develop knowledge about online revenue models (N=20)



For this research it is interesting to see if the organizations dedicate the implementation and use of online revenue models to one department or if there is no clear distribution of tasks inside the organization concerning online revenue models.

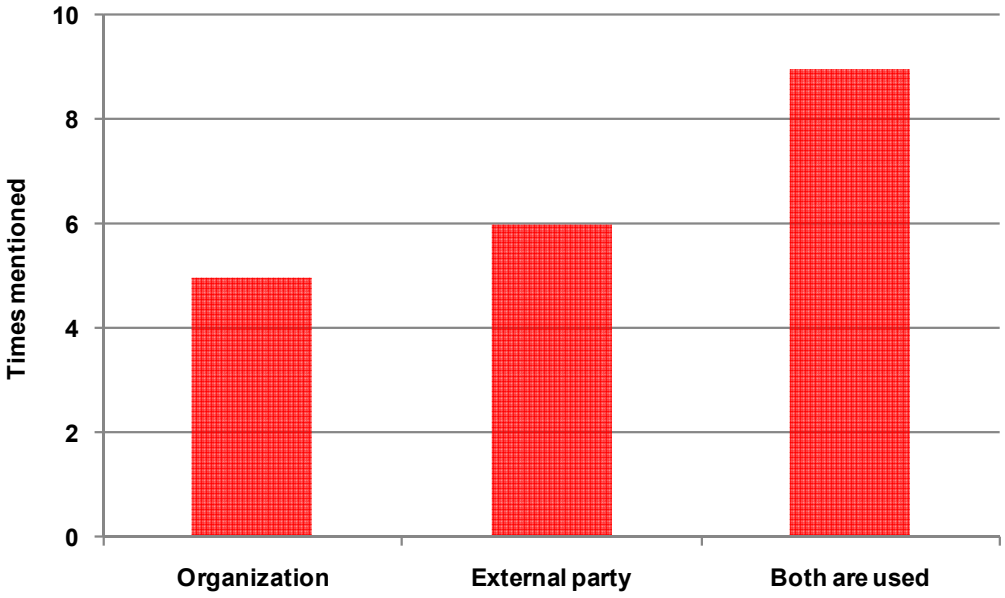
It is remarkable that only 50% of the interviewed organizations have a separate department which works on online revenue models. Only 10 out of 20 organizations have a separate department while almost every organization finds online revenue models very promising for the future. The departments that work on online revenue models are:

- Online marketing department (4 times)
- The sales department (3 times)
- Online media (3 times)

The other 10 organizations have no such apartment. For these organizations the responsibility for online revenue models is over different departments. The tasks concerning online revenue models exist also out of the implementation of (new) online revenue models. This could be a difficult and time consuming work. To find out if the interviewed organizations do this by themselves or if they hire external parties the following question has been asked: Are the online revenue models technically and organizationally being implemented by the organization or by an external party?

In figure 8 the outcome of this question can be seen in one glance. It is remarkable that only 5 organizations out of 20 implement all the online revenue models by themselves. These organizations do not hire an external party to do this. The answers do not say anything about the future of the organizations. It could be that these organizations will hire an external party in the future. 6 organizations hire external parties when implementing online revenue models. These organizations do not have the technical and organizational expertise themselves. 9 organizations hire an external party occasionally due to the technical expertise that organizations have. Some online revenue models can be implemented by themselves.

FIGURE 8: Who does the technical and organizational implementation of online revenue models (N=20)



Concluding it could be said that organizations in the internet and media sector use in most of the cases an external party for implementing and the maintenance of online revenue models. A lot of these organizations do not have the technical expertise by themselves and they need to hire external parties in order to do this.

Reasons for using online revenue models

All the organizations in the internet and media sector start to use online revenue models. There could be several reasons why these organizations start using these models by often hiring an external party. And there could still be reasons why they are using online revenue models. Obviously these organizations want to make a profit and therefore they start using online revenue models, but there could also be other underlying reasons. To get an answer to this the following question has been formulated: What are the reasons for using online revenue models?

Before asking this question to the respondents, an expert panel of Atos Consulting came up with the most important reasons for using online revenue models. The expert panel came up with a series of arguments that can be seen in table 6. The question has first been asked spontaneously to see if respondents came up with the same reasons (1st column). After this, every respondent was asked if the reasons did occur in the organization in the past (2nd column). This has been done by reading every reason up loud, and then the respondent reacted to this.

If the question is asked spontaneously, it can be seen that almost every respondents says that the organization uses online revenue models due to the reason that 'it could generate a lot of revenue'. If the reasons are being read out loud to the respondents it can be seen that the respondents react differently and then not only one reason is outstanding present. The most named reasons are:

- Competitors are doing it
- Internet is a flexible medium with little time to market
- Reactions of customers can be measured better than with offline media

TABLE 1: Reasons for using online revenue models named in numbers and percentages

REASONS	RESPONDENTS (N=20)*	
	Named spontaneous	Named after being read aloud
Competitors are doing it	**0 (0%)**	**10 (50%)**
The costs of online advertising is lower for the organizations	**0 (0%)**	**5 (25%)**
It could generate a lot of revenue	**15 (75%)**	**4 (20%)**
Reactions of customers can be measured better than with offline media	**0 (0%)**	**9 (45%)**
Online revenue models are the future	**0 (0%)**	**8 (40%)**
Advertising on the internet can be enriched with flash animations, video, and sounds	**0 (0%)**	**7 (35%)**
The marketing activities are better measurable	**0 (0%)**	**6 (30%)**
It can be more professional	**1 (5%)**	**5 (25%)**
Internet is a flexible medium with little time to market	**0 (0%)**	**9 (45%)**
It gives especially new joiners (customers) chances in the market	**0 (0%)**	**6 (30%)**
TOTAL ARGUMENTS MENTIONED	**16**	**69**

** Percentages add to more that 100% due to multiple responses*

If the most named reasons are analyzed, it can be seen that the organizations are using online revenue models due to the fact that they are better compared to 'traditional revenue models'. Online revenue models are more flexible and reactions of customers can be measured better.

When the question is asked spontaneously, respondents came up with other reasons than are formulated by the expert panel. A few important reasons mentioned by the respondents:

- Intuitive is online close to print, because we offer both information and advertising, so the models are also deducted from each other
- We need to come along with the developments
- We believe that their is a big market for us in video, this is why we are doing it
- We want to be innovative in the market
- Traditional canals are diminishing
- We want to go together with the customer, who is also going online. So it is necessary in order to stay competitive

The reasons that are given indicate a trend from traditional models to online revenue models. It seems that the organizations do not have another option and they need to change towards online revenue models. If the organizations want to remain innovative and profitable, they need to adjust towards online revenue models in the future. The market is getting bigger and bigger for these organizations, and it can not be neglected anymore.

Reasons for not using online revenue models

As can be seen in the previous paragraph, there are a lot of reasons why organizations use online revenue models. It is interesting to see what the opposite of this is due to the fact that there should be a lot of reasons why organizations do *not* use online revenue models. Therefore the following question is asked: What are the reasons for not using online revenue models?

This question is once again asked spontaneously in first place in order to see what the reasons are. After this, the reasons in table 2 (formulated by the expert panel of Atos Consulting) are been read out loud and the respondents reacted to this.

TABLE 2: Reasons for not using online revenue models named in numbers and percentages

	RESPONDENTS (N=20)*	
REASONS	**Named spontaneous**	**Named after being read aloud**
It is a threat of the brand and the value of the brand	**2 (10%)**	**8 (40%)**
It is too unfamiliar	**3 (15%)**	**10 (50%)**
It is too expensive to implement	**4 (20%)**	**9 (45%)**
The knowledge of employees is not adequate	**3 (15%)**	**12 (60%)**
It is not (enough) profitable	**7 (35%)**	**10 (50%)**
It takes too much time to implement and maintain	**3 (15%)**	**14 (70%)**

It is not promising enough	**1 (5%)**	**14 (70%)**
The technique is not capable enough for the new models	**5 (25%)**	**5 (25%)**
It is a thread of the editorial freedom	**2 (10%)**	**8 (40%)**
It is sensitive for fraud	**0 (0%)**	**5 (25%)**
It is not good for the existing revenue	**1 (5%)**	**8 (40%)**
TOTAL ARGUMENTS MENTIONED	**31**	**103**

** Percentages add to more that 100% due to multiple responses*

Not like in table 1, one reason is obvious present when named spontaneously, but here the answers are more distributed. It is also remarkable that almost 2 times more reasons are mentioned for not using online revenue models, 31 versus 16 and 103 versus 61. Remarkable is also that a lot of respondents find certain online revenue models 'not (enough) profitable', and therefore they will not use them. Next to this, the 2nd most named reason is that 'the technique is not capable enough for the new online revenue models'. This means that the organizations need to hire external parties or they need to invest in their own employees and techniques.

When all the reasons are read out loud, most of the respondents find online revenue models 'not promising enough', it takes 'too much time to implement and maintain', and 'the knowledge of employees is not adequate'. Again, it means that organizations are not yet capable enough to work with online revenue models. Other reasons that are often mentioned are 'it is too unfamiliar', and 'it is not (enough) profitable'.

When the question is asked spontaneously to the respondents, they come up with other reasons than formulated by the expert panel. A few important reasons mentioned by the respondents:

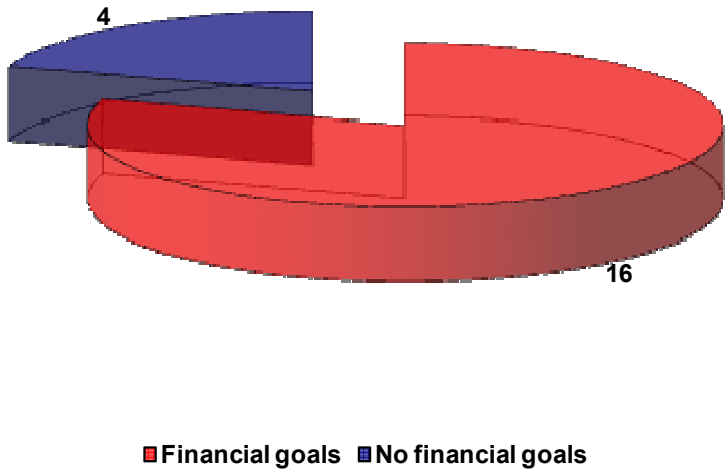
- Certain online revenue models are not in line with our believing
- We are thinking too much in print
- It is too small-scale
- We do not want ringtones, sex, or gambling because we have a special interest group
- If we damage our customers with it we will not use it
- It is too new, the customers are not yet ready for it

There is a sort of overlap in reasons given spontaneously and reasons of the expert panel. Nevertheless it can be concluded that every organization is thinking differently about this and the reasons are very diverse and in abundance present. Remarkable is that a lot of organizations take into account their customers. The organizations do not want to loose their current customers, and they are very careful with this before they will implement new online revenue models.

Financial goals regarding online revenue models

In this paragraph the outcomes are given of the questions regarding financial goals of online revenue models. It is interesting to see that there is a lot of differentiation in the answers given to these questions. The first question that has been asked to all the respondents: In what way does your organization have financial goals according to the online revenue models?

FIGURE 10: The amount of financial goals that organizations have regarding online revenue models (N=20)



In figure 10 the outcome of this question can be seen. Out of 20 respondents, 16 organizations have financial goals regarding online revenue models. This means that they have separate goals for online revenue and that they are not included in the general financial goals. A lot of organizations find online revenue very important due to the fact that they formulate separate financial goals for them. But what kind of financial goals do these organizations have? There is a big difference in the kind of

financial goals. A few interesting quotes on these financial goals are mentioned below:

- *"We have goals like; in the upcoming year 50% of the turnover needs to be from online revenue models. The goals are not separated for every online revenue model. This is because the market and the online revenue models are subject to change at the moment"*
- *"In 2009 we have the goal to get 40% of the turnover from other revenue models than 'print'"*
- *"We have clear growth goals regarding online revenue models. They are higher than the goals regarding print"*
- *"In 2009 we want to get 10% of our turnover from online revenue models"*
- *"We have got substantial financials goals for the upcoming 5 years regarding online revenue models"*
- *"We do have financial goals. They are being documented according European level"*

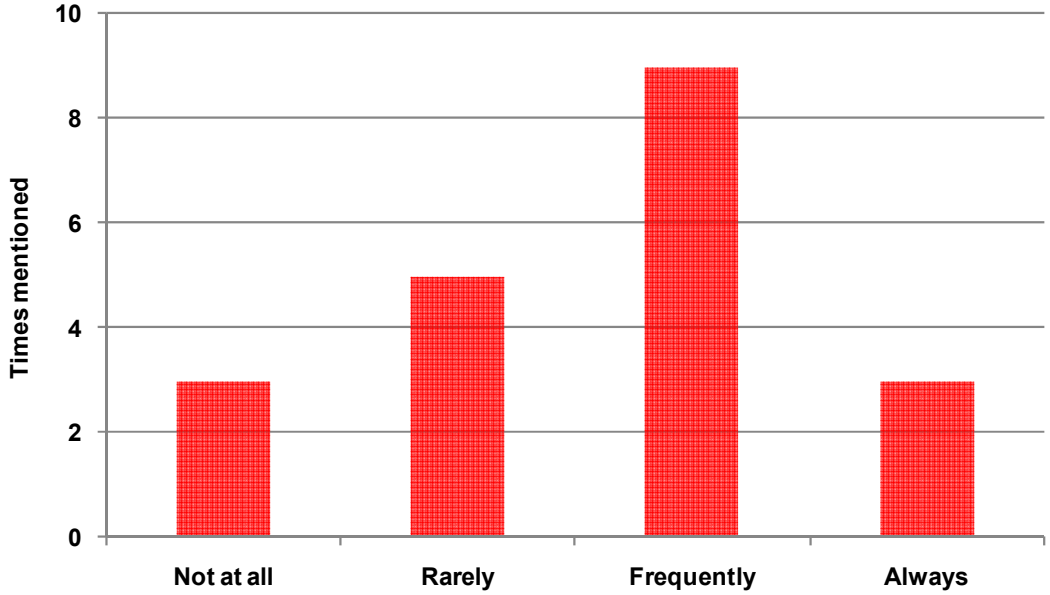
A lot of the financial goals regarding online revenue models exist out of a certain percentage that needs to be obtained in relation to the general turnover. Other financial goals have to do with the growth of online revenue models or simply a certain amount of turnover. A lot of organizations have formulated financial goals, but whether these financial goals are being achieved is another point. Therefore a multiple choice question has been asked to every respondent: In what way did the organization succeed in accomplishing these financial goals?

To this question they could answer in the following way:

- Not at all
- Rarely
- Frequently
- Always

The outcome of this question can be found in figure 12. The financial goals have been accomplished relatively often. 12 out of 20 organizations reached their goals in 2007 frequently or always. This means that these organizations work efficiently or it could also mean that the financial goals that have been formulated are too easy to accomplish. Future studies can research this. Out of 20 organizations, also 8 organizations do not or rarely accomplish their financial goals. They need to adjust their financial goals or they need to work more efficiently in order to reach these goals.

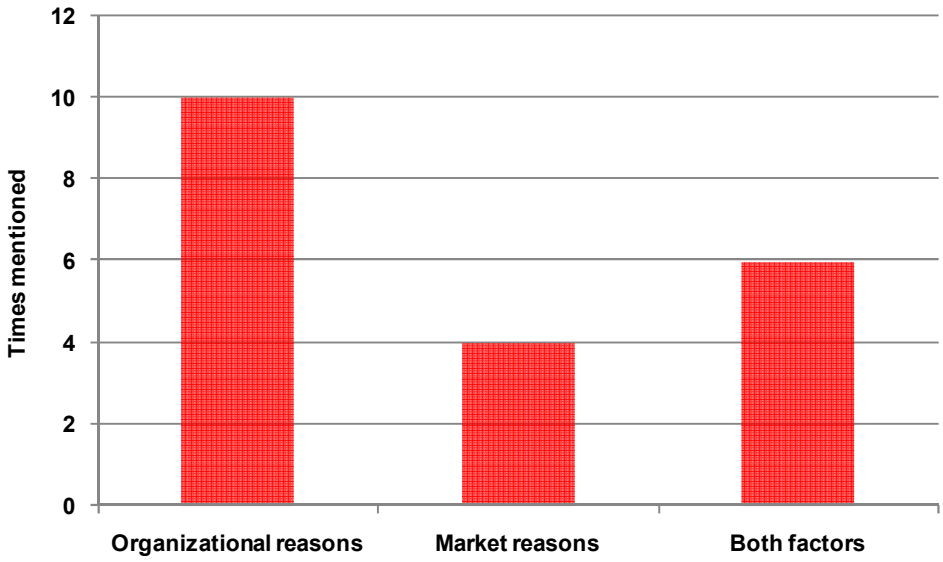
FIGURE 12: Accomplishment of financial goals in the year 2007 (N=20)



A lot of financial goals are (not) being accomplished. Therefore it is interesting to see why these financial goals are (not) being accomplished. Will the reasons be due to the current market situation or will these reasons be due to the situations inside the organization. The following question has been asked in order to get a clear answer: Why are the financial goals (not) accomplished?

The outcome of this question can be found in figure 11. It is interesting to see that most of the respondents say that organizational reasons are responsible for (not) accomplishing financial goals. Only 4 respondents say that market reasons are responsible for (not) accomplishing financial goals. It can be concluded that organizations have the most influence on these financial goals, and they are also aware that it are organizational reasons. They must organize themselves in such a way that financial goals can always be accomplished.

FIGURE 11: Reasons for (not) accomplishing the financial goals in 2007 (N=20)



Future research according to the respondents

During the interviews there are also questions asked about future (scientifically) research regarding online revenue models. It is interesting to see how organizations think about all the research that has been done until now about online revenue models. To get an answer the following questions have been asked: Do you think there is more necessity for scientifically research on online revenue models? And do you think there is more necessity for factual research on online revenue models?

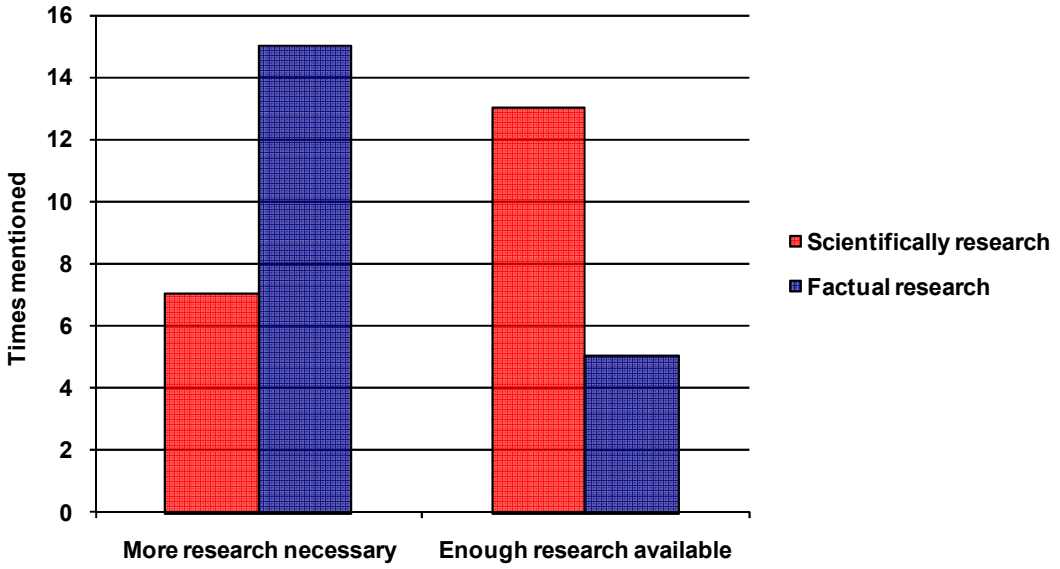
There is not a definition on factual research and scientifically research. Therefore in every interview an own definition of factual and scientifically research has been given:

'Factual research is research on data, facts, and accomplishments of online revenue models of organizations in the internet and media sector.'

'Scientifically research consists of the collection of data through observation and experimentation, and the formulation and testing of hypotheses.'

The results of the questions can be found in figure 12.

FIGURE 12: Which research do organizations find more necessary for the future (N=20)



It is clear that the organizations who are interviewed are more interested in factual research. When clarifying their answers, it is often said that the organizations want to know what the average turnover of certain online revenue models is. Next to this, most organizations find that there is enough scientifically research available on online revenue models. This is also due to the fact that not a lot of organizations are using scientifically articles in order to gather information about online revenue models.

Examining relationships, differences and trends

In this section the relationship between the literature study and the results from the interviews will be discussed. In the literature study certain results have been found. These results will be compared with the interview results. The outcomes could match each other or maybe there are a lot of differences. After this, the trends regarding the outcomes are made clear.

Online revenue models

According to the literature the 5 online revenue models of Chaffey (2002) are the most used in E-business. They are the most used online revenue models in order to produce turnover. These online revenue models are:

1. Direct product sales of product or service
2. Subscription or rental of service

3. Commission-based sales (affiliate, auction, marketplace)
4. Advertising (banner ads, sponsorship)
5. Sales of syndicated content or services (for media owner)

In the interviews there is a great difference in the use and knowledge of these online revenue models. Advertising is far more known and used by organizations in the internet and media sector. If these organizations think about online revenue, the first and most associations are with advertising. Next to this, organizations also think about direct sales when they are confronted with online revenue models although this is less then with advertising. Commission-based sales, syndicated content, and subscriptions are less familiar with the organizations who are interviewed. Although the amount of interviews was only 20, and it was not a quantitative research, it can be concluded out of the in-depth conversations that these online revenue models are used less than advertising and direct sales.
When asking respondents about the most promising online revenue models, they go more in detail. The respondents do not very often answer with a specific online revenue model out of the literature when is asked to the most promising online revenue model. When they answer one of these online revenue models, then direct sales is most frequently named as promising. Next to this, also syndicated content and advertising is sometimes named as most promising.

In general, these specific online revenue models are not named as most promising for the future. The most promising online revenue models according to the organizations are certain types of one of the 5 online revenue models mentioned in the literature. E.g. Respondents do not mention direct product sales as most promising, but they mention online travel agencies as most promising. Especially certain types of advertising are found promising; lead generation and target advertising are named often when talked about promising online revenue models. The combination of customer profiles and content is interesting for organizations.

Critical success factors

According to the literature there are also a lot of success factors for optimal working with E-business. These success factors will also be critical for online revenue models. Sung (2004) made a clear overview of all the success factors mentioned by different

authors. He came up with a total of 16 success factors. For this research they are minimized to a total of 12 success factors due to the overlap in them or the relevance of some success factors. In this paragraph the results of the literature study and the interviews will be compared and it will be clear if the organizations in the media and internet sector find the success factors of online revenue models as important as they are in the past literature.

If the results of the literature study on critical success factors and the results from the interviews are compared to each other, it can be concluded that the outcomes are in a general sense the same. A few success factors that are important according to the literature are also important according to the respondents that are interviewed. 'Ease of use', 'security of systems', 'privacy', 'stability of systems', and 'electronic commerce strategy' are seen by more than 90% of the respondents as important. It must be noticed that there are also differences in the importance of the critical success factors mentioned in the literature. The respondents find certain critical success factors more important than others. Some critical success factors are even more often named 'unimportant' than 'important'; 'Variety of goods/services' and 'plenty of information'. 'Low price of goods/services', 'low costs', 'evaluation of EC operations', 'technical EC expertise', and 'services' are mentioned more often 'important' than unimportant', but also more than one respondent find these critical success factors not that important.

Next to the comparison of the critical success factors out of the literature and the opinion of the respondents on these critical success factors, there are also other critical success factors spontaneously mentioned by respondents during the interviews. These quotes can be found in the appendices in table 11. There is a comparison between these spontaneously mentioned critical success factors and the critical success factors from the literature. 'The technical expertise needs to be enough', which is mentioned spontaneously, is comparable to the critical success factor 'technical EC expertise' of the literature. 'Direct and correct delivery' is comparable to the critical success factor 'services'. It is remarkable that there are also a lot of other and different critical success factors mentioned regarding online revenue models. It means that organizations do not have a shared opinion regarding success factor that are very important and used in every organizations when implementing and using online

revenue models. From the results of this research it can only be concluded that 'ease of use' is a critical success factor that is always important when implementing and using online revenue models.

CONCLUSION AND DISCUSSION

There are a lot of critical success factors that could be important when implementing and using online revenue models (Sung, 2004). 'Ease of use' is the only critical success factor that is found important by every organization in this research. When implementing online revenue models, organizations have to take this factor always into account. In order to be successful, organizations should also be aware of all the other success factors mentioned by Sung (2004). Not one critical success factor is important for the succession of online revenue models, but a combination of more than one critical success factors are relevant

Online revenue models remain a subject which is relatively new to organizations and a lot of them are not up-to-date or professional enough to make the most of these online revenue models. The technical expertise needs to be present and the right persons need to be attracted by the organizations in order to meet up with expectations regarding profitability. Online revenue models will only turn out to be successful and beneficial if they deserve full attention of skilled employees within organizations. Financial goals need to be achievable and the organization itself has the most influence on this.

The most significant trend is the rise of certain types of advertising like target advertising and advertising with content and customer profiles. The consequences of this rapid change of innovative web-based technologies lead to a reconfiguration of organizations in the internet and media sector. Understanding these changes is crucial for creating a reliable, profitable, and working online revenue model. Further research could be done on the changing environment regarding online revenue models. Reach is also said to be an important factor for the success of online revenue models, especially advertising. But how do you create reach and attract potential customers to your website? Reach could be depending on a lot of other factors. Examples of this

could be ‘easy accessibility of the website’, ‘low price of goods/services’, and ‘plenty of information’. Future research could find an answer to this question. Suggestions are future studies regarding financial goals of online revenue models and technical expertise inside the organizations.

This study provides clear support for an assertion that organizations in the internet and media sector need to choose the right online revenue model that fits the organization in order to take the most out of it. In this research, advertising is seen as the best known and most used online revenue model. Organizations think that advertising is the most promising for the future, but other online revenue models could also be promising for certain organizations. The technical and organizational expertise is often not good enough to implement and maintain the right online revenue model. Hiring external parties is sometimes also relevant in order to innovate and be quick to the market. In some cases it could also be cost saving. Next to this, critical success factors are in abundance and a combination of them could be relevant for online revenue models. Therefore they should be evaluated thorough by every organization. Although in this research ‘ease of use’ is seen as the most critical success factor, it could be of less importance in some cases in comparison to other critical success factors.

Future research

Respondents in this research find further scientifically research on online revenue models in general not necessary. They prefer factual research, data and results regarding online revenue models are more interesting for organizations in the internet and media sector. When future research will be done, there are a few suggestions that could be taken into account.

Now that a study has been done, suggestions for further research are quantitative researches like surveys. For this research a literature study has been done and 20 in-depth interviews have been achieved. Although 20 in-dept interviews are a reliable amount for a qualitative research, there could not be reliable percentage comparison. A percentage comparison could be very interesting for future research.

For this research 20 organizations in the internet and media sector have been interviewed. In every organization, one senior manager has been interviewed. Persons from different departments have been interviewed. For future research, more persons inside one organization could be interviewed. This could raise reliability and validity regarding the conclusions made.

The most significant trend is the rise of certain types of advertising like target advertising and advertising with content and customer profiles. The consequences of this rapid change of innovative web-based technologies lead to a reconfiguration of organizations in the internet and media sector. Understanding these changes is crucial for creating a reliable, profitable, and working online revenue model. Further research could be done on the changing environment regarding online revenue models. Reach is also said to be an important factor for the success of online revenue models, especially advertising. But how do you create reach and attract potential customers to your website? Reach could be depending on a lot of other factors. Examples of this could be 'easy accessibility of the website', 'low price of goods/services', and 'plenty of information'. Future research could find an answer to this question.

References

1. Adams, G. & Schvaneveldt, J. (1991). *Understanding Research Methods.* (2nd edn). New York: Longman

2. Athey, T. (2000). Leadership challenges for the future. 35–39.

3. Barua, P., Konana, A.B., Whinston, & Yin, F. (2000). Making e-business pay: eight key drivers for operational success. 2–10.

4. Bartussek, J. (2001). Vom Newspaper zum Newsfilter. *Medienmanagement: Content gewinnbringend nutzen, Trends, Business-Modelle, Erfolgsfaktoren, Wiesbaden*, 63-73.

5. Bleyen, A. & van Hove, L. (2006). Western European newspapers and their online revenue models. *World association of Newspapers,* 2006.

6. Bourke, L.B. & Clarke, V.A. (1994). *Processing data: the survey example.* London: Sage. 1-88

7. Bryman, A. & Burgess, R.G. (1999). *Qualitative Research.* London: Sage.

8. Bryman, A. (1988). *Quantity and Quality in Social Research.* London: Unwin Hyman.

9. Carvalho, A.X. & Puterman, M.L. (2004). Learning and pricing in an internet environment with binomial demands. 320-336.

10. Chaffey, D. (2002). *E-business and E-commerce management* (3rd edn). Harlow: Pearson Education Uitgeverij.

11. Chatterjee, P., Hoffman, D.L. & Novak, T.P. (2003). Modeling the clickstream: implications for Web-Based advertising efforts. 520-541.

12. DeYoung, R. (2005). The performance of internet based business models: Evidence from the banking industry. 893-947.
13. Dreze, X. & Hussherr, B. (1999). Internet advertising; is anybody watching? 1-45.
14. Easterby-Smith, M., Thorpe, R. & Lowe, A. (2002). *Management Research: An Introduction* (2nd edn). London: Sage.
15. Edelman, B., Ostrovsky, M. & Schwarz, M. (2006). Internet advertising and the generalized second-price auction: selling billions of dollars worth of keywords. 1-25.
16. Elofsen, G. & Robinson, W.N. (1998). Creating a custom mass-production channel on the Internet. 56–62.
17. Farhoomand, A. & Lovelock, P. (2001). Global e-Commerce.
18. Foddy, W. (1994). *Constructing Questions for Interviews and Questionnaires,* Cambridge: Cambridge University Press.
19. Friedman, T.L. (2006). The World is Flat. London: Penguin books
20. Fulkerson, B. (1997). A response to dynamic change in the market place. 199–214.
21. Gonsalves, G.C., Lederer, A.L., Mahaney, R.C. & Newkirk, H.E. (1999). A customer resource life cycle interpretation of the impact of the World Wide Web on competitiveness: expectations and achievements. 103–121.
22. Gretzel, U., Yuan, Y. & Fesenmaier, D.R. (2000). Preparing for the new economy: Advertising strategies and change in destination marketing organizations. 146-156.
23. Hagel, J. & Rayport, J.F. (1997). The coming battle for customer information. 53–65.
24. Han, K.S. & Noh, M.H. (2000). Critical failure factors that discourage electronic commerce growth. 25–44.
25. Hoffman, D.L. & Novak, T.P. (2000). Advertising pricing models for the World Wide Web. 1-22.
26. Hong, W. & Zhu, K. (2005). Migrating to internet based e-commerce: Factors affecting e-commerce adoption and migration at the firm level. 204-221.
27. Huff, S. Wade, M. Parent, M. Schneberger, S.C. & Newson, P. (2000). *Cases in Electronic Commerce.* Columbus: Irwin/McGraw-Hill.
28. Hutjes, J.M. & van Buren, J.A. (1992). *De gevalsstudie Strategie van kwalitatief onderzoek.* Meppel, Amsterdam & Heerlen: Boom.
29. Krueger, C., Swatman, P.M.C. & Van der Beek, K. (2003). Business Model Formation within the Online News Market; the core+ complement business model framework, *16th Bled eCommerce Conference eTransformation, Bled, Sloveni*
30. Krueger, C. & Swatman, P.M.C. (2003). Who are the internetproviders? Identifying a realistic taxonomy of content providers in the online news sector. *The proceedings of IFIP 13E, Sao Paolo, Brasil*
31. Lai, V.S. & Wong, B.K. (2005). Business types, E-strategies and performance. Communications of the ACM, Volume 48 , Issue 5, p80-85
32. Linder, J. & Cantrell, S. (2000). Changing Business Models: Surveying the Landscape. Accenture Institute for Strategic Change
33. Manchala, D.W. (2000). E-commerce trust metrics and models. 36–44.
34. Mccoy, S., Everard, A., Polak, P. & Galetta, D.F. et al (2007). The effects of online advertising. 84-88.
35. Miles, M.B. & Huberman, A.M. (1984). *Qualitative data analysis: A sourcebook of new methods.* Londen: Sage.

36. Mitchell, V. (1996). 'Assessing the reliability and validity of questionnaires: an empirical example'. *Journal of Applied Management Studies 5*. 199-207.
37. Niewiarra, M. (2001), "Der Rahmen: Content Management in der dritten Generation der Telekommunikation", in Vizjak, A., Ringlstetter, M. (Eds),*Medienmanagement: Content gewinnbringend nutzen, Trends, Business-Modelle, Erfolgsfaktoren*, Gabler Verlag, Wiesbaden, pp.45-59.
38. Ngai, E.W.T. (2001). Selection for websites for online advertising using the AHP. 233-242.
39. Noe, T. & Parker, G. (2005). Winner takes all: competition, strategy, and the structure of returns in the internet economy. 141-164.
40. Osterwalder, A., Dubosson-Torbay, M. & Pigneur, Y. (2001). Ebusiness model design, classification & measurements. 1-22.
41. Osterwalder, A. & Pigneur, Y. (2002). An Ontology for e-Business models. 1-26.
42. Osterwalder, A., Gordijn, J. & Pigneur, Y. (2005). Comparing two business model ontology's for designing e-business models and value constellations. 1-17.
43. Osterwalder, A. (2004). The business model ontology, a proposition in a design science approach. 1-169.
44. Plant, R. (1999). *eCommerce: Formulation of Strategy*. Upper Saddle River: Prentice-Hall.
45. Ranganathan, A. & Campbell, R.A. (2000). Advertising in a pervasive computing environment. 1-12.
46. Ratnasingam, P. (2003). Trust in inter-organizational exchanges: a case study in business to business electronic commerce. 525-544.
47. Rayport, Jeffrey F. (1999) The Truth About Internet Business Models. *Strategy + Business, 3rd Quarter.*
48. Reichheld, F. & Schefter, P. (2000). E-loyalty. Harvard Business Review, 78. (4): 195–213.
49. Rietberg, E. & Schaik, R. (2007). *Mediafeitenboekje Nederland.* Amsterdam: Carat.
50. Riggins, F.J. (1999). A framework for identifying web-based electronic commerce opportunities. 234–253.
51. Robson, C. (2002). *Real World Research.* (2nd edn) Ocford: Blackwell.
52. Salam, A.F., Iyer, L. & Singh, R. (2005). Trust in E-commerce. 73-77.
53. Saunders, M., Lewis, P. & Thornhill, A. (2002). *Research Methods for Business Student.* (4 rd edn). Harlow: Pearson Education Limited.
54. Shafer, S.M., Jeff Smith, H. & Linder, J.C. (2005). The power of business models. 199-207.
55. Silverman, D. (1993). *Interpreting Qualitative Data.* London: Sage.
56. Stevens, E. & Berg, A. (2008). *Succesvolle internet businessmodellen.* Apeldoorn: Het Spinhuis
57. Sung, T.K. (2004). E-commerce critical success factors: East vs West. 1161-1177.
58. Swatman, P.M.C. & Krueger, C.C. (2003). Who are the internet content providers?
59. Sykes, W. (1991). Taking stock: issues from the literature in validity and reliability in qualitative research. 3-12
60. Tabor, S.W. (1998). An examination of electronic commerce and the Internet: role of technology, critical success factors and business strategy.

61. Tesch, R. (1990). *Qualitative Research: Analysis types and software tools.* New York: Falmer.
62. Timmers, P. (1998). Business Models for Electronic Markets. *Journal on Electronic Markets.* 3-8.
63. Weill, P. & Vitale, M.R. (2001). Place to Space, Migrating to eBusiness Models. Harvard Business School Press, Boston, MA, .
64. Wirtz, B.W. (2001). Medien- und Internetmanagement, Wiesbaden.
65. Yin, R.K. (2003). *Case study research: Design and Methods*. (3rd edn). Beverly Hills: Sage.

"Entrepreneurial Management" as a Strategic Choice in Firm Behavior:

Linking it with Performance

Paper to be presented at the HTSF Conference in Twente, The Netherlands

by Birte Kuhn*, Sean Patrick Sassmannshausen* & Roxanne Zollin[+]

*Schumpeter School of Business and Economics, University of Wuppertal
[+]Queensland University of Technology (QUT), Brisbane, Australia

Contact with authors: sassmannshausen@wiwi.uni-wuppertal.de

Abstract

Establishing the core principals of "entrepreneurial management" within an organization describes a certain strategic choice that affects a company in six dimensions, according to Stevenson (1983). Our aim is to empirically measure entrepreneurial management (it's existence and degree) and to link this measured strategic choice (for or against) entrepreneurial management with firm performance. Our argument here is that companies that follow core principals of entrepreneurial management should outperform other more administrative firms in certain measures of strategic performance. This paper builds on an empirical investigation published by Brown, Davidson & Wiklund (2001), who have developed and tested a reliable measurement instrument for Stevenson's definition of "entrepreneurial management" (Stevenson 1983, Stevenson & Jarillo 1990). In the first part of our paper we aim to replicate and to some extent improve this study. In the second part we link the measured degree of "entrepreneurial management" with firm performance. To our knowledge, even so Stevenson's definition of entrepreneurial management is commonly acknowledged and Brown et al. (2001) developed a reliable instrument to empirically capture this behavioral approach to management, the construct of entrepreneurial management never before has been linked to firm performance in an empirical study. Since most papers on corporate entrepreneurship and firm performance are based on Covin & Slevin's (1991) or Miller's (1983) concept of entrepreneurial orientation, we contribute to the literature on corporate entrepreneurship in a novel way, given the fact that the entrepreneurial management dimensions measured in our study can theoretically and empirically be clearly distinguished from the construct of entrepreneurial orientation as defined by Covin & Selvin (1991).

1 Introduction

Entrepreneurship, traditionally concerned with the start-up of new firms, has additionally become accepted as a firm-level phenomenon deserving scholarly attention. Especially under the aspect of today's environmental uncertainty, turbulence, and heterogeneity, organizations are facing a host of strategic and operational challenges (Eisenhardt and Brown 1998). To deal with these challenges successfully, one of the firms' core competencies might be the effective use of corporate entrepreneurship (Covin and Miles 1999). While aspects of corporate entrepreneurship are relevant

for any organization, vitality and flexibility are especially important for large firms with mainly inflexible and highly hierarchical structure. Moreover, corporate entrepreneurship can help to improve the corporation's competitive position in domestic and international markets by renewing its capabilities of acquiring and using new competence. The recent literature reveals a general although certainly not complete consensus around the position that successful corporate entrepreneurship is linked to improvement in firm performance (Ireland, Hitt et al. 2001; Antoncic and Hisrich 2003; Covin, Ireland et al. 2003; Kuratko, R. Duane Ireland et al. 2004). Most research about corporate entrepreneurship and firm's performance is based on Covin & Slevin's (1991) concept of *entrepreneurial orientation* that consists of three dimensions or behaviours: innovativeness, pro-activeness and risk taking. These three dimensions have been used to discriminate between entrepreneurial and less-entrepreneurial firm-behaviour (Covin & Slevin 1991).

The behavioural approach to entrepreneurship is relatively young. Howard H. Stevenson published the likely first article on this approach in 1983 and therefore could be named the founder of the behavioural approach (besides Gartner 1988/89). Stevenson (1983) holds that *entrepreneurial management* practices can help firms remain vital and contribute to firm and societal level value creation. He describes entrepreneurship as an "approach to management" which is characterized by "the pursuit of opportunity without regard to resources currently controlled" (Stevenson 1983:23). Stevenson (1983) argues that entrepreneurial value creation process can take place in any type of organization. According to Stevenson & Jarillo (1990:25) "entrepreneurship is more than just starting new business […] entrepreneurial management may be seen as a 'mode of management' different from traditional management". Based on Stevenson's (1983) conceptualization Brown, Davidsson & Wiklund (2001) developed an instrument to examine these propositions and measure entrepreneurial behaviour within an organization. In the following years over hundred articles reference aspects of Brown's, Davidsson's & Wiklund's paper. But surprisingly their survey and their achievement in creating a measurement for entrepreneurship as opportunity-based firm behaviour have been hardly mentioned. Nor has their measurement ever been linked to firm performance.

A reliable entrepreneurial measurement instrument would make it much easier for organizations to assess their degree of entrepreneurial management. Further, it could help to develop more effective strategies to enhance the entrepreneurial behaviour. Brown, Davidson & Wiklund's (2001) measure is believed to provide such a reliable measurement instrument. Therefore it is the point of departure for this paper. For further validation of the universality of the measure it would be interesting to know whether the results hold for other business cultures and in other languages (than Swedish). Generally, the entrepreneurship literature is characterized by a lack of reliable, internationally comparable data (Hisrich, Langan-Fox et al. 2007). Therefore this paper will start to close the gap by undertaking a follow up survey according to Brown, Davidsson & Wiklund (2001) in the Australian business context. Furthermore some improvements of the measure may be advisable. Particularly the Resource Orientation and the Reward Philosophy index didn't have a very satisfactory reliability. This might be solved by adding a few items to the scale. Including new items to an already existing scale instead of developing an entirely new one has several advantages, as Davidsson puts it:

> *"Replication provides us with much better truth criteria than other tools at our disposal. Replication therefore facilitates the building of cumulative knowledge, which is what research is all about [...]. Also importantly, replication has a sound, humbling effect that make us less prone to over interpret single study results regarding relative important explanatory variables; prematurely disregard antecedents that do not turn out significant in an individual study, or show*

an undue level of confidence in a result that happens to be (marginally) statistically significant in one study." (Davidsson 2004:188)

In fact the operationalization of this survey differs slightly from the archetype of the model as this study focused on different firms, in a different country, with a slightly different questionnaire (additional questions) and the intention to interview more than one person per company. This decreases the value of the replication as a test of internal validity while it actually increases the value as a test of external validity (Hubbard, Vetter et al. 1998). In other words, the theory test is even tougher. If the result of the original study was positively influenced by an artefact of the specific operationalization this influence does not carry over to the replication. Furthermore, if the replication isn't a simple copy, it may add value to both studies. Besides the aspect of further validation of the earlier study the comparison of the prior and the follow-up study might give some explanations and allows some interpretations.

Over and above aiming to improve the scale, this study is focusing on the relationship between the level of entrepreneurial behaviour and firm performance. Brown's et al. instrument has proven to be a reliable measurement instrument of entrepreneurial management. Nevertheless, most research about corporate entrepreneurship and firms' performance is still based on Covin & Slevin's (1991) concept of *entrepreneurial orientation*, but none research that would be known to the authors focuses on *entrepreneurial management* according Stevenson (1983) and Brown et al.

If both of these concepts – entrepreneurial orientation by Covin & Slevin (1991) and entrepreneurial management by Stevenson (1983) – are covering different but equally important aspects of corporate entrepreneurship, it seems even more surprising that no known study about the relation between Stevenson's concept and firm performance exists, whereas several studies examine the relationship between entrepreneurial orientation and companies' performance. Therefore this study contributes fundamentally to the corporate entrepreneurship research by abolishing this obvious lack of research in this area.

A sample of 994 employees (from 157 Australian public companies) was selected, including company sizes between 10 and 249 employees. The target respondents were the CEO and Top managers. The questionnaire was designed according to Brown et al. using items of a forced choice type, with pairs of statements representing the opposites of traditional managed companies and entrepreneurial managed companies, according to Stevenson's view (explained in more detail hereafter). Further, eight new questions for the entrepreneurial dimensions "Resource Orientation" and "Reward Philosophy" were included. Different from Brown et al. the scale was reduced from a 10-intervall to a 6-intervall scale. This reduction is due to the much smaller sample size. All analyses were conducted using Excel 2007 and SPSS16-17/PASW Statistics 18.

Even though there isn't a consensus about the definition of corporate entrepreneurship, it is crucial to find a suitable definition for this study. For the purpose of the current research, corporate entrepreneurship is defined according Stevenson as "a process by which individuals inside organizations pursue opportunities independent of the resources they currently control" (Stevenson & Jarillo 1990: 23). The focus thereby is on entrepreneurial management. Stevenson (1983) holds that entrepreneurial management, defined as a set of opportunity-based management practices, can help firms remain vital and contribute to firm and societal level value creation. Accordingly, corporate entrepreneurship refers to all innovative activities and orientations, entrepreneurial strategies and behaviour. As the current study is concerned with assessing the relationship between corporate en-

trepreneurship and firm performance, we will use Stevenson's conceptualisation of entrepreneurship as opportunity-based firm behaviour as a point of departure.

2 Stevenson's Definition of "Entrepreneurial Management"

Stevenson's conceptualizes entrepreneurship as opportunity-based management behaviour. He describes entrepreneurial behaviour and administrative behaviour as the two extreme opposites of an entrepreneurship continuum. This continuum describes the entire spectrum of possible firm behaviours with the promoter firms placed at the entrepreneurial end and the trustees at the administrative end. Whereas the promoter intent to pursue and exploit new opportunities regardless of resources controlled, the trustee strives to use his or her resource pool in the most efficient way on given purposes.

Although Stevenson only describes six dimensions in his first model (1983), in his later work two other key dimensions are mentioned that are important to his conceptualization of entrepreneurship. These dimensions are *Growth Orientation* (Stevenson and Jarrillo-Mossi 1986) and an *Entrepreneurial Culture* (Stevenson and Jarillo 1990). All dimensions will be discussed in more detail, since our measurements for corporate entrepreneurship are based on these dimensions (and so had been those by Brown et al. (2001).

Entrepreneurial focus (promoter)	**Conceptual dimension**	**Administrative focus (trustee)**
Driven by perception of opportunity	***Strategic Orientation***	Driven by controlled resources
Revolutionary with short duration	***Commitment to opportunity***	Evolutionary with long duration
Many stages with minimal exposure at each stage	***Commitment of resources***	A single stage with complete commitment out of decision
Episodic use or rent of required resources	***Control of resources***	Ownership or employment of required resources
Flat, with multiple informal networks	***Management Structure***	Hierarchy
Based on Value creation	***Reward Philosophy***	Based on responsibility and seniority
Rapid growth is top priority; risk accepted to achieve growth	***Growth Orientation***	Safe, slow, steady
Promoting broad search for opportunities	***Entrepreneurial Culture***	Opportunity search restricted by resources controlled; failure punished

Source: Brown et al. (2001), see Stevenson (1983).

Table 1: Stevenson's conceptual dimensions of entrepreneurial management

Strategic Orientation

Strategic Orientation describes what factors drive the formulation of strategy. It can be described as the philosophy that effects every decision about strategy. The pure promoter' strategy is solely driven by the opportunities that exist and not limited by the resources that may be required to exploit them. Because the strategy is opportunity-driven, almost any opportunity is relevant to the firm. Acquiring and marshalling the necessary resources represents a secondary step and only follows after an opportunity is identified. The other extreme, the pure trustee's strategy is to utilize the

resources of the firm most efficiently. Even though the trustee is aware that opportunities exists and are important, only opportunities that relate to existing resources are relevant as the strategy is resource-driven.

Commitment to Opportunity

The second dimension is also related to strategic issues. But whereas Strategic Orientation is about the identification and election of opportunities, the commitment to opportunity is about its pursuit. The promoter is *action-orientated* and therefore willing and able to act in a very short time frame. He or she can therefore chase an opportunity quickly (Stevenson 1983). This means the promoter is able to commit and decommit to actions rapidly. On the other hand, the trustee tends to be stationary. His decision process is time-consuming and, once made, leads to a commitment of long duration. Accordingly the trustee's administrative behaviour tends to be slow and inflexible as a result of multiple decision constituents, negotiated strategies, and an eye towards risk reduction (Brown, Davidsson et al. 1999). As a result, the promoter is more likely than is the trustee to pursue a given opportunity. Once the trustee decides to pursue an opportunity however, it would be with a much larger initial investment and with an intention to remain in this line of business for considerable time.

Commitment of Resources

While both, trustee and promoter need resources to pursue an opportunity, they differ in the way of the commit to these resources. The promoter attempts to maximize value creation by minimizing the resource set. Therefore his commitment of resources is multistage and with a minimum exposure at each stage or decision point. This commitment of resources in a multi-step manner allows the promoter to stop and change direction rapidly, if and when circumstances change. This flexibility allows the promoter to take new information about the opportunity or the environment into account and to change his strategy accordingly very quickly. Furthermore by minimizing the resources that the promoter must invest in order to initially pursue an opportunity, the amount of resources at risk that could turn out to be sunk costs is also minimized. However, the accumulation of resources creates an organizational pressure, (e.g. capital allocation system, formal planning systems, certain) that makes it difficult to maintain this type of resources commitment.

On the other hand, the trustee's commitment of resources is characterized by thorough analyses in advance and large single stage investments. Instead of minimizing the resources invested at once, his or her strategy to minimize risk is to use in-depth analyses of all available information before deciding to act. But once the decision to pursue an opportunity is made, the investment of resources is not easily reversed.

Control of Resources

Related to the commitment of resources is the way those resources are owned and controlled. The promoter tries to further reduce as much as possible the amount of used and *owned* resources. The promoter is less concerned about the ownership of resources, but more concerned about having access to others' resources (e.g. financial capital, intellectual capital, skills, competencies). This strategy provides more flexibility and the opportunity to participate on the latest technology, knowledge and market development. However, as a firm grows it becomes increasingly difficult to follow this approach to resource control, as the growth quite often leads to resource accumulation.

In contrast, the trustee focuses on the ownership or employment of resources and the accumulation of further resources. His or her advantage in this strategy is an immediate access to owned resources

without being depended on markets. Furthermore the trustee might be able to use the resources he or she owns more effectively as he or she is familiar with them.

Management Structure

As the differences of commitment and control of resources were discussed above, the trustee's and promoter's management structure differs according to their use and control of resources. While the management structure of the entrepreneurially managed firm (promoter) is organic with multiple informal networks, the 'traditional' managed firm's structure (trustee side) is more formalized with a complex hierarchy. As the promoter doesn't own all the resources being used, those resources can't be managed within a formal organization. This creates the need of nontraditional means of organization. Therefore the promoter's management structure is designed to coordinate key non-controlled resources as well as to be flexible and to create an environment where employees are encouraged to create and seek opportunity.

On the other hand, the trustee's management structure is well suited for the internal efficiencies of allocating own resources. For this purpose there are clear roles and responsibilities, highly routinized work, and a layer of middle management to manage the use of the firm's resources (Hisrich, Peters et al. 2008). In other words, the trustee's management structure focuses more on efficiency and good administration rather than detecting and rapidly acting on changes in the environment.

Reward Philosophy

As the promoter is focused on pursuing opportunities for new entries which represent new value for the firm, the reward philosophy is toward compensations based on contributions towards the discovery and exploitation of opportunities. Consequently, employees often have the freedom to experiment with potential opportunities and are rewarded according to their value creation. A management structure of independent action and accountability enhances this evaluation. If the success of creating new value is related to a team, the entrepreneurial managed firm is also more comfortable in rewarding teams.

In contrast, in a firm managed more administratively, rewards are based on responsibilities (which is traditionally determined by the amount of resources that this employee controls), hierarchy, and on seniority. Consequently employees are rewarded with promotion, which provides a higher level of responsibility and therefore further scope of rewards. Furthermore, whereas the creation of new value requires a longer term view, the trustee's measure of performance is more related to short-term profit targets.

Growth Orientation

Even as all firms may desire to grow (unless environmental circumstances require systematic shrinking) the effort putting into it and the pace of growing are different in entrepreneurial and traditional managed firms. As the promoter has a great desire in rapid growth, the trustee prefers a slower growth at a steady pace, because anything faster could be unsettling for the firm. For their management structure isn't that flexible they prefer a more manageable pace of growth, by putting at risk the exploitation of opportunities within a given window of opportunity, but not the jobs and the power of top management (Stevenson & Jarrillo-Mossi 1986).

Entrepreneurial Culture

Entrepreneurial Culture describes the firm's culture to generate and value new ideas. The entrepreneurial managed firm encourages employees to generate ideas, experiment, and engage in other

tasks that might produce creative output. Because opportunity is the starting point, creative output is highly valued as it often is the source of opportunities for new entries. Therefore a much broader range of ideas are worth seeking and considering (Stevenson & Jarillo 1990).

In contrast, the trustee begins with an assessment of the resources under control. Using the currently controlled resources as a starting point, only ideas that relate to these resources are relevant. Due to this restriction, the flow of ideas judged worthy of considering automatically is much smaller. Therefore, promoters create a work environment full of ideas, while trustees create a work environment with just enough ideas to match the controlled resources.

3. Brown, Davidsson and Wiklund's measurement instrument – a scale for placement on the entrepreneurial management continuum

Brown, Davidsson & Wiklund (2001) took the challenge to create a measurement for Stevenson's (1983, Stevenson & Jarrillo-Mossi 1986, Stevenson & Jarillo 1990) definition of entrepreneurial management, hoping to develop reliable indices of the eight dimensions of Stevenson's conceptualization (described above), as well as combining them into an overall *scale for the placement of firms on an 'entrepreneurial management vs. administrative management'-continuum*. The following description provides a brief overview of Brown et al. (2001) study, as it is the basic work to our replicatory part of our study.

The items were developed according to Stevenson's (1983, Stevenson & Jarrillo-Mossi 1986, Stevenson & Jarillo 1990) detailed conceptualization. His eight dimensions of entrepreneurial management provide guidelines for the relevant construct domain and even some specific questions. The items were designed as a two-sided forced choice type Likert scale with pairs of statements, representing the opposite ends of the promoter/ trustee continuum. The respondents were asked to mark the number of the ten-point scale, which best represented the view of their firm. Out of 29 developed items, 20 were included in the final scales.

According to Stevenson's description of entrepreneurship as a management approach relevant to many different types of firms, Brown, Davidsson & Wiklund (2001) chose diverse sample with analysable sub-groups. The total sample consisted of 2455 Swedish firms, chosen by the sampling criteria: industrial sector (manufacturing, professional services, wholesale/ retail and other services), number of employees (10-49 and 50-249) and corporate governance. The response rate was 52,1% which is an effective sample of 1233 firms for the main analysis. Further, in this study Brown et al. (2001) 'replicated themself'. In other words, they had a large and stratified sample, large enough to test their theses on several, separate sub-samples. As internal replication they re-ran the factor analysis for different strata for a total of ten sub-sample analyses. As a results of this sub-sample analyses the cumulative variance explained is very similar in every analysis, the right number of factors in extracted in all analyses but one, and also very important, the extracted factors remain the same across sub-samples. Therefore they had made a much stronger case for the validity of their operationalization than if they had only examined one of the sub-samples (see Davidsson 2004).

Using factor analysis (principal components extraction and varimax rotation) Brown et al. (2001) were finally able to isolate six empirically distinct dimensions: Strategic Orientation, Resource Orientation, Management Structure, Reward Philosophy, Growth Orientation and Entrepreneurial Culture. Stevenson's Dimension commitment to opportunity, though certainly a theoretically

important aspect of entrepreneurial management, could not be empirically isolated as an independent dimension. The items developed for this dimension showed a clear conceptual overlap with Strategic Orientation and/or Commitment of Resources. Furthermore, the two dimensions Commitment of Resources and Control of Resources appeared to be overlapping as well and therefore merged into one factor named Resource Orientation (see Figure 3.1). Brown's et al. (2001) interpretation is that the isolated six empirical dimensions represent Stevenson's eight conceptual dimensions.

In order to examine the convergent validity they compared their entrepreneurial management scale with Covin & Slevin's (1989) entrepreneurial orientation scale. After testing reliability and the correlation between their six dimensions and Covin & Slevin's three dimensions (innovation, proactiveness and risk taking) they concluded that all nine dimensions are conceptually sound and empirically separable. In other words, they suggested that the construct of entrepreneurial orientation and entrepreneurial management are measuring different aspects of the broad and complex concept of firm-level entrepreneurship.

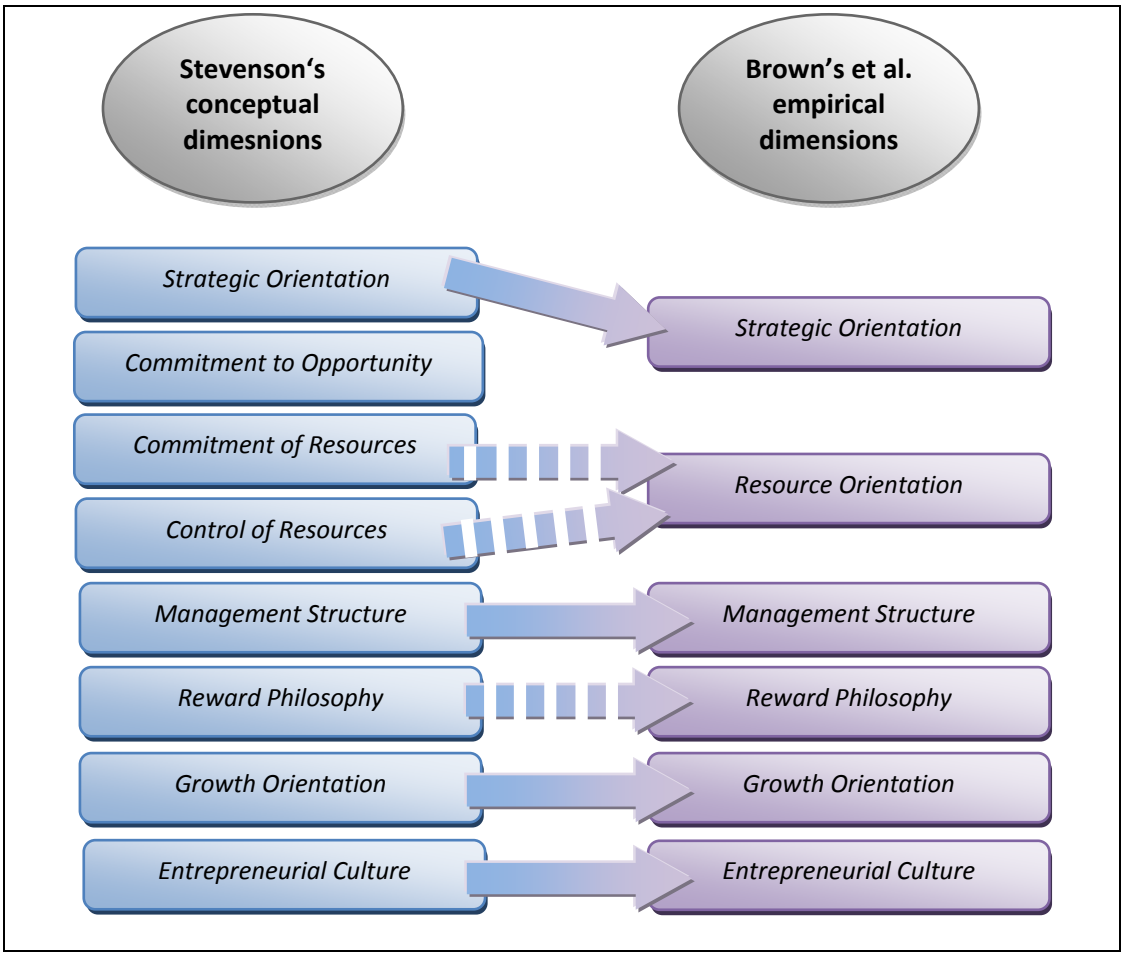


Figure 1: Stevenson's conceptual dimensions and Brown's et al. empirical dimensions

4. Research hypothesis

There is more than little empirical research focusing on the link between corporate entrepreneurship and company performance. In fact, there is extensive evidence of strong, statistically significant relationships between levels of entrepreneurship within a firm and a number of different indicators

of company performance (e.g. Miller & Friesen 1982; Zahra 1991; Morris & Sexton 1996). For example, Covin & Slevin (1986) reported a simple correlation of $r = 0{,}39$ ($p < 0{,}001$) between their entrepreneurial posture scale and a multi-item index of firm performance. Zahra (1991) reported a positive association between corporate entrepreneurship activities and profitability, growth, and risk-related measures of company performance. It is suggest that corporate entrepreneurship is positively associated with a company's growth and profit (Covin & Slevin 1991; Zahra 1991). Further, many researchers suggest that entrepreneurial orientation is positively related to a firm's financial performance, in particular (Miller 1983; Covin & Slevin 1989; Zahra 1993a).

Studying the research in this area so far, one comes to notice that several studies use Covin &Slevin's (1991) model of entrepreneurial orientation as a base for a measurement scale. Researchers have agreed that entrepreneurial orientation is a combination of three dimensions: innovativeness, pro-activeness, and risk-taking (e.g. Wiklund 1999). Innovativeness reflects a tendency to support new ideas, novelty, experimentation, and creative processes, thereby departing from established practices and technologies (Lumpkin & Dess 1996). Proactiveness refers to a posture of anticipating and acting on future wants and needs in the marketplace, thereby creating a first-mover advantage in comparison to competitors (Drucker 1993, Lumpkin & Dess 1996). Several studies show a positive relationship between those entrepreneurial orientation dimensions and firm performance (e.g. Zahra & Covin 1995; Brown 1996; Wiklund 1999). Zahra & Covin (1993) found that firms with an entrepreneurial orientation could target premium market segments, charge higher prices, and were faster to the market. These firms tend to monitor market changes, respond quickly, and capitalize on emerging opportunities. Innovation and pro-activity kept them ahead of competitors, leading to better financial results.

The sheer number of studies relying on Covin & Slevin's scale indicates the success and validity of this measurement instrument. Most empirical studies support the proposition that the relation between a firm's entrepreneurial orientation and performance is positive, i.e. that firms which adopt a more entrepreneurial strategic orientation perform better (Zahra 1991; Wiklund 1999; Zahra, Neubaum et al. 2000). However, the small number of studies using different measurement instruments to maybe capture different aspects of the corporate entrepreneurship and performance relationship is surprising. One reason, why most researchers seem to rely on entrepreneurial measurement scales that have been tested before (i.e. Covin & Slevin's 1993 measurement instrument of entrepreneurial orientation) could be that finding a suitable measurement for corporate entrepreneurship and companies' performance can be challenging. Lyon, Lumpkin and Dess (2000), suggested the challenges in measuring the strength of the relationship between entrepreneurship and performance are possibly due to problems with the operationalization and measurement of entrepreneurship. In this regard to explore new aspects of the complex and comprehensive field of corporate entrepreneurship and firm performance it is important to test different measurement instruments. Therefore *this paper focuses in particular on the relationship between entrepreneurship as opportunity based firm behaviour according to Stevenson (1983) and firm performance*. Gagnon, Sicotte et al. (2000) state that it is justified to believe that Stevenson's model is adequate to identify the behaviour of managers in terms of their actions in different processes. In their remarkable study Brown et al. (2001) developed a measurement instrument based on Stevenson's conceptualization, which is the only measurement instrument known to the author that measures corporate entrepreneurship according to Stevenson's behavioural approach. However, to our knowledge this instrument never has been re-used or linked to firm performance.

However, Brown et al. (2001) discovered a substantial positive correlation between the items of the two concepts by Covin & Slevin 1993 and by Stevenson (1983), which shows that they are both measuring different aspects of corporate entrepreneurship. Yet, the fact that none of the correlations was very high, suggests that the aspects of entrepreneurship discussed by Stevenson as well as Covin & Slevin are conceptually sound and empirically separable. But if both of these concepts are covering different equally important aspects of corporate entrepreneurship, it seems even more surprising that several studies examine the relationship between entrepreneurial orientation and performance using Covin & Slevin's scale, whereas no known study about the relation between Stevenson's concept and firm performance exists. Therefore this study should contribute to the corporate entrepreneurship research by abolishing this obvious lack of research in this area. As Brown et al. (2001) instrument has proven to be a reliable measurement instrument of entrepreneurial management and researchers generally agree on the positive relationship between entrepreneurship within an organization and its performance, it can be assumed that entrepreneurial behaviour according to Stevenson is positive related to firm performance.

Hypothesis:

There is a significant positive relationship between the adaption of an entrepreneurial management style, measurable in the degree of firm level entrepreneurial behaviour, and companies' financial performance.

Brown's et al. (2001) measure of Stevenson's conceptualisation of entrepreneurship as opportunity based firm behaviour is a reliable measurement instrument of the degree of entrepreneurship within an existing firm. More than a hundred studies where counted that cite their work. However, no attempt has been made so far to validate or further develop this instrument of measurement. Therefore, using Brown's et al. measurement scale as a basis for this paper, will not only help testing the hypothesis. Additionally, it will lead to a further validation of Davidsson's, Brown's & Wiklund's measure by examining the scale in the context of another country (Australia).

Further, in the area of corporate entrepreneurship and firm performance, there seem to be a lack of research with a longer time frame. Zahra, Jennings et al. (1999) were only able to find two studies which recognized the possibility that the effect of entrepreneurship is long-term in nature (Zahra 1991; Zahra & Covin 1995). The short time period used (1–2 years), or high attrition among companies in the sample, meant that the long-term effects of entrepreneurship on a company's performance were unclear. As there seem to be an obvious research gap in exploring the relationship of corporate entrepreneurship and companies' performance over a longer time frame, this paper will further contribute to entrepreneurial research by including companies' performance over a longer period (3-4 years) into the analyses.

5. Research model and methods

As Entrepreneurial behaviour is a mental construct the model of this paper is a latent variable model (see Bartholomew & Knott 1999). The research model is displayed in figure 2. The underlying construct of this model is entrepreneurial management. This construct consists of six aspects, the entrepreneurial dimensions defined by Stevenson. Those dimensions are the latent variables of the model. In other words, those dimensions are what the measurement instrument in this paper intent to measure, even though they can't be measured directly, as they are not directly observable.

Rather, their affect can be measured with the help of separate items (questions of the questionnaire), which add up to a scale. With the help of those items, which are supposed to tap the entrepreneurial dimensions, the degree of entrepreneurial behaviour for each company can be concluded. Finally this degree of entrepreneurial management will be examined in regard to its relationship to firm performance (hypotheses).

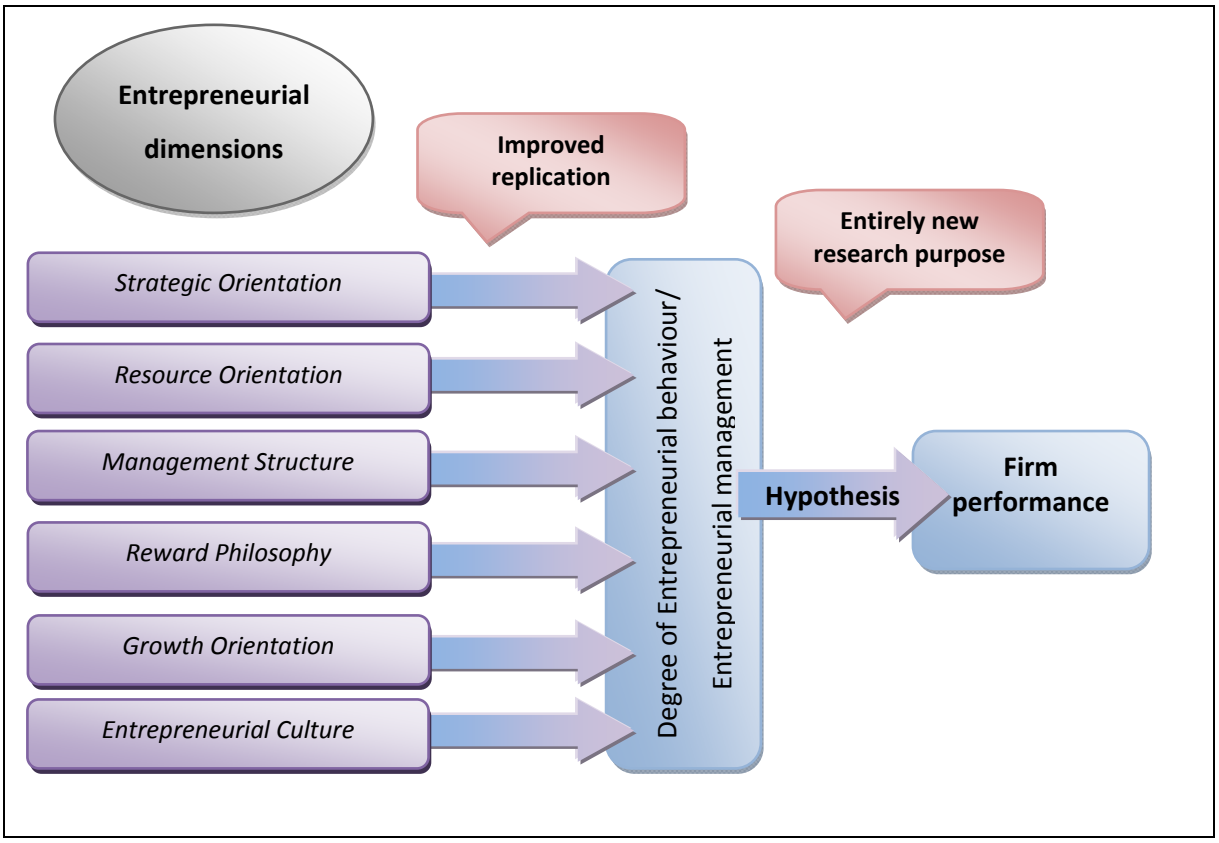


Figure 2: The relationship between entrepreneurial management and firm performance as research model

Before being able to test the hypothesis the measurement instrument of the degree of corporate entrepreneurship will be developed on basis of Brown's et al. scale. As one aspect of this paper is the improvement and further development of the scale some additional questions for the dimensions Resource Orientation and Reward Philosophy will be developed, hoping to achieve better reliability (Cronbach's alpha value) for those dimensions. In a second step the hypothesis will be tested. Daily & Dalton (1992) note that the multidimensionality of organizational performance makes it unlikely that any one corporate performance measure could sufficiently capture those multiple performance dimensions. Therefore, this paper will concentrate on companies' financial performance. To test the hypothesis, three different financial performance measures will be tested individually regarding their relationship to the companies' degree of entrepreneurial management with the help of a regression analysis. The measures of organizational performance served as the dependent variable, with Brown's et al empirical dimensions as independent variable. The data needed to calculate the performance measures was extracted from a commercially available database, which regularly publishes the annual financial data of more than 35 million public and private companies worldwide. The financial performance over three to four years was included into the study. The values of those years were merged into one indicator by generating the average for this time period. One indicator for the six dimensions of entrepreneurial management was generated by adding the scores for each question and dividing it by the number of questions. In case that all three analyses show a significant

positive relationship between performance measures and the degree of entrepreneurial management the hypothesis would be supported. In case of a negative outcome of the regression analyses the hypothesis will be declined.

A sample of 994 employees (from 157 Australian companies) was selected in a two-step manner using two different commercially available databases. First of all the companies were chosen with regard to the selecting criteria Brown et al. (2001) referred to for their research in Sweden. One of the selecting criteria according to Brown et al. was the size of the companies. Only companies were chosen which employed between 10 and 249 employees. Another sampling criterion was the industrial sector, which was divided in four groups of manufacturing, professional services, wholesale/retail and other services. Furthermore the sample was also divided according to the corporate governance structure into independent firms, members of company groups with fewer than 250 employees and members of company groups with 250 employees and more. Beyond we chose publicly traded companies in Australia as performance data for those firms were easier available. After utilising a sample of firms the next step was to generate a list of employees working within these firms to participate in the survey. For this task a second database was used. We were able to sent questionnaires to all key managers of each firm.

6 Scale Improvement

Browns et al developed items for each of Stevenson's eight entrepreneurial dimensions. However, after intensive pretesting they were only able to successfully isolate six empirically distinct factors from Stevenson's eight conceptual dimensions. Those six empirical dimensions were: Strategic Orientation, Resource Orientation, Management Structure, Reward Philosophy, Growth Orientation, and Entrepreneurial Culture. Unfortunately, they experienced three problems. Firstly, they were unable to extract a separate factor for Stevenson's dimension Commitment to Opportunity. As the items intended not to tap this dimension and new items tend to overlap with Strategic Orientation or Commitment of Resources the dimension dropped out of the analysis. Secondly, the reliability of the factor Reward Philosophy (alpha = 0,58) wasn't very satisfying. Finally, the two conceptual dimensions Commitment of Resources and Control of Resources merged into one factor, which they named Resource Orientation. Unfortunately this factor turned also out to have a less than satisfactory reliability (alpha = 0,58). Brown, Davidson & Wiklund's interpretation of the analysis was that their six empirical dimensions represent Stevenson's eight conceptual dimensions.

A closer look at Stevenson's two dimensions Commitment of Resources and Control of Resources shows that the boundary between those dimensions is indeed indistinct. This observation makes it relatively easy to agree that merging those two dimensions into Resource Orientation can be done without any loss of information on entrepreneurial behaviour. On the other hand, the case of the dimension Commitment to Opportunity isn't that simple. The dropping of this dimension seems remarkable as dealing with opportunity has been discussed at one of the key aspects of entrepreneurship itself (e.g. Stevenson 1983, Stevenson & Gumpert 1985, Hills & Lumpkin 1997, Venkataraman 1997, Shane & Venkataraman 2000, Shane 2000, Gaglio & Katz 2001, Shane 2003, Shane & Eckhardt 2003). One possible explanation is that opportunity recognition is indirectly reflected in the remaining dimensions. However, this argument doesn't seem very satisfying. Another explanation would be, that Stevenson couldn't capture the core of this dimension in his conceptualisation what therefore made it impossible for Brown et al to tap it. Brown et al. argue

Commitment to Opportunity would overlap with Strategic Orientation and/or Commitment to Resources and would therefore be indirectly represented in their scale. Even though this would be another interesting point for further research, it would go far beyond this paper. Therefore we will accept Brown's et all explanation and will concentrate on the improvement of the reliability of the dimensions Reward Philosophy and Resource Orientation by creating new items for the related scales.

In developing new items, we followed the guidelines in scale development made by DeVellis (2003). According to him the first step in developing a scale is to determine clearly what is intended to be measured. This first step is very important, because the more vague the idea about what should be measured is, the harder it will be to generate good items. The second step is to generate an item pool. This item pool should contain a large number of items that are relevant to the content of interest so it can function as a rich source from which a scale can emerge. After generating the item pool one need to determine a response format for those items. There are many possible types of scales and different formats of questions that might have different influence on the success of the measurement. Therefore it is essential to choose the most suitable format carefully (step three). Step number four should be having the initial item pool reviewed by experts. This review serves multiple purposes in order to maximize the content validity of the scale. Reviewers can for example evaluate the items clarity and conciseness or rate how relevant each items is to what should be measured. After having the item pool reviewed DeVellis (2003) recommends to consider the inclusion of validation items. It is often advisable to include some additional items in the same questionnaire that will help detecting various response biases and determining the validity of the final scale. The sixth step would be to administer items to a development sample. In other words it means utilizing a representative sample to fill out the questionnaire in order to generalize the data. The further step is the evaluation of the performance of the individual items and the factor analysis. DeVellis (2003) describes this step as the heart of the scale development process. Finally, the eighth and last step is to optimize the length of the scale by dropping 'bad' items.

Fortunately in this case, the first step is fairly simple as we can rely on Brown, Davidsson & Wiklund's definition of Reward Philosophy and Resource Orientation. But it ought to be mentioned that their definitions also rely on Stevenson's conceptualization of entrepreneurial management. By measuring Resource Orientation we want to describe to what extend an organisation controls and commits to resources. In other words, it should be examined whether the organisation commits small amounts of resources in a multi-step manner or large amounts of resources (all resources needed to undertake a project) right at the beginning of a project and also, whether it tend to own as many resources as possible or as little as necessary. Measuring Reward Philosophy should capture how an organisation rewards and compensates employees. That means it should be measured whether an organisation's reward system is more driven by the creation of value in the longer term or is more oriented in achieving short-term profit targets (Stevenson 1983).

After clarifying what the objects of the measurement scale are, the next step is to generate an item pool. This often difficult task was facilitated by the fact that Stevenson's conceptualisation is fairly detailed and provides a good guideline for the development of further questions (Stevenson 1983; Stevenson & Gumpert 1985). The items' format was an extended Likert Scale with pairs of statements representing the opposite end of the entrepreneurial firm/traditional firm continuum (e.g. Schnell, Hill et al. 2005:187). The advantage of using this scale in a survey is that the statements can define and clarify one another (Bortz and Döring 2002). However, it can also be a risk as participants might be confused if the question doesn't clearly appear as opposite statements to

them, especially, if the content is very complex (Harms 2004). Therefore even though this implies that each item needs two opposite statements, we started to collect statements for both sides separately trying to stay as close to Stevenson's definitions as possible. Only afterwards the opposite statement to each statement was crafted. We avoided creating pairs of opposite statements by simply changing a statement from a positive to a negative wording or vice versa. Further, for questions the same style was adopted that Brown et al. used for their items to ensure they wouldn't stand out against the later in the final scale. Due to the length of the final scale the number of new items needed to be cut down. Therefore the items were searched for redundancies and checked for the length and the reading difficulty level. Finally we selected three new items developed for Reward Philosophy and five new items for Resource Orientation.

To ascertain the construct validity researchers should consider the inclusion of validation items. There are at least two types of items to consider. The first type of items serves to detect undesirable response tendencies. Respondents might be influenced by other motivations than the researcher assume. One type of motivation is social desirability, what means an individual is motivated to present himself/herself in a way that society regards as positive (DeVellis 2003). Strahan and Gerbasi (1972) developed a 10-item scale that can be useful for detecting those motivations. Beyond there are other sources for detecting response biases (Anastasi 1968) that could be included in the scale. In this survey the primary interest is not about any personal information of the respondent but about the organisation she or he is employed with. It can be argued that this will weaken the risk of social desirability. Still it could be argued that employees could tend to present his or her firm as entrepreneurial and innovative as possible. To reduce this tendency the statements for the entrepreneurial firm appear on the right as well as on the left side of the scale, as already mentioned earlier.

The second type of items that can serve as evidence of the scale validity is the inclusion of other measurement instruments measuring the same phenomenon. For this purpose Brown et al. chose the Miller (1983) and the Covin & Slevin (1986; 1988; 1989) entrepreneurial orientation scale and included it in their survey instrument. Their results reveal that both constructs, entrepreneurial orientation (Miller 1983, Covin & Slevin 1989) and entrepreneurial management (Stevenson 1983) are reliable (α= 0,73) and positively related (sig. correlation 0,58). In other words they generated a valid measure of entrepreneurship as defined by Stevenson which is only partly overlapping with the entrepreneurial orientation construct and therefore gauge different and distinct factors of entrepreneurship. However, as Brown's et al. (2001) items are part of the questionnaire we hereby included a valid construct.

As a pre-test (this refers to DeVellis fourth step in scale development, the review of the items) the questionnaire was handed out to some entrepreneurship academics and a number of business students. During the pre-test we experienced some difficulties with the scale. Attempting to use the same survey design as Brown et al. we used a 10-items scale. This 10-items scale represents the in Stevenson's conceptualization described promoter-trustee-continuum. Therefore, dividing the whole range of infinite, only marginal different behaviour between the two extremes (pure entrepreneurial management and pure administrative management) into 10 groups seems to be a clear simplification already. Unfortunately we experienced that the participants of the pre-test often had difficulties with so many gradual variations to choose from, as the differences between two sequent numbers seemed to be too small to justify a reasonable decision between them. In fact for the questionnaire the differences between some items of the scale seem marginal. Another reason why we were concerned to simply replicate Davisson, Brown & Wiklund's survey was the number of participants, for we were afraid of getting too little answers per item to get some significant results, if the scale

had too many intervals. In consequence we reduced the number of intervals to 6. Further we clearly defined the meaning of each of those values in the introduction of the questionnaire. This modification of the scale shouldn't be a problem for the attempt to verify Brown's et al. scale, as Davidson (2004:176) argues the "real power of a theory is demonstrated through replication. If a theory is any good, it will show its effect in several slightly different empirical samples, and also be robust against (valid) variations in operationalization."[1]

7. Data collection

A mailed questionnaire (with a pre-addressed stamped envelope and a personalized cover letter, addressed to the respondent) was used to collect the data (questionnaire and cover letter can be requested from the authors). With expiration of the time limit for answering the questionnaire provided email addresses were used to send out almost 200 reminder emails. Additionally, some people from the mailing list were called to ask for permission to send them the questionnaire via email. Even after the remainder only a total number of 34 responses were achieved. After allowing for undeliverable surveys (approximately 12,3% or 122 questionnaires of the total sample, N= 994), this describes a response rate of 3,9%.

About the reasons of the low response rate can only be speculated. First of all, it is not difficult to imagine that CEOs and top manager generally have a busy schedule. Additionally, the general economic situation might have influenced the result as well. As this survey unfortunately fell just right within the economic crisis and the exact days the Australian stock markets crashed, it would make it even harder to convince CEOs and top manager to spend time on filling out a questionnaire. Further, one factor might be the cultural background. Only a few years ago Loane & Bell (2006) conducted a survey about entrepreneurial firms in Australia, Ireland and Canada. They achieved a response rate for Australian companies significantly smaller than the response rates in Ireland and Canada. Another aspect might be that even though the recipients of the survey were personally addressed in the cover letter, they weren't called on the phone prior to sending out the questionnaires. This probably diminished the chance of a higher response rate. An additional influencing factor might be that the institution (University of Wuppertal) was likely to be generally unknown to most of the recipients of the survey.

8. Results

8.1 Descriptive Analysis and testing of the scale

Presenting the results is divided in two parts, exploring the data file (chapter 6.1) and testing the research hypothesis (chapter 6.2).

Item	Mean	Median	Mode	Minimum	Maximum	Standard Deviation
item 1	3.74	4	5	1	6	1.483
item 2	4.12	4	5	1	6	1.493

[1] Further as a result of pre-testing we had two little changes on two of the original questions from Davidsson, Brown & Wiklund. We changed the word order of question 3, turning it into a passive sentence, for a better understanding. We also changed one word in question 17, which seemed to be likely to negatively influence the participants. However both changes didn't have an impact of the content of the questions.

item 3 (reversed)	3.74	4	5	1	6	1.483
	3.86					

Table 2: Descriptive Measures of Strategic Orientation

The maximum and minimum values for the *Strategic Orientation* questions indicate that the responses are spread across the full range of the 6-item scale. The standard deviation has a value lower than 1.5 for all three questions and is therefore equally acceptable. According to the responses there seems to be two groups of firms, those whose Strategic Orientation is more entrepreneurially and those whose Strategic Orientation tendencies are more towards the administrational side (U-shaped distribution). However, the group of firms tending towards an entrepreneurial Strategic Orientation is significantly bigger.

Index	Mean	Median	Mode	Minimum	Maximum	Standard Deviation
item 4	4.09	4	5	1	6	1.334
item 5 (reversed)	3.50	3	3	1	6	1.261
item 6 (reversed)	3.06	3	3	1	6	1.301
item 7	3.68	4	4/ 5	1	6	1.319
item 8 (reversed)	3.59	4	2/ 5	1	6	1.417
item 9	2.68	3	2	1	5	1.065
item 10 (reversed)	2.53	2	2	1	5	0.929
item 11 (reversed)	3.44	3,5	4	1	6	1.284
item 12	3.41	4	4	1	6	1.158
	3.33					

Table 3: Descriptive Measures of Resource Orientation

For the dimension *Resource Orientation* we formulated 5 new questions (item 8-12 had not been used by Brown et al. 2001). The results for question 9 and 10 differ from the rest. Whereas the mean for the other items varies between 3 and 4, question 9 and 10 has a significant lower value. The same occurs for the median and the mode. Even the standard deviation which lays between 1.16 and 1.42 for the other items has a lower value for question 9 and 10. Taking a closer look at the values for minimum and maximum one get a first idea, what the cause of these significantly lower values might be. The responses for question 9 and 10 are not spread across the entire range of the scale, but only across the first five items of the scale. There could be problems with the formulation of the questions. The way the questions were formulated could be too strong on the entrepreneurial end so that none of the participants could identify their company with this extreme. Further, question 9 contains the expressions “long term commitment” and “short period of time” which might be too vague. Question 10 uses the formulation “even though this strategy may increase the risk of failure” which might be misleading as obviously every firm tries to reduce the risk of failure. The new questions 8, 11 and 12 seem to perform equally well in comparison to the adopted questions. In total, gain we find a U-shaped distribution with the bigger share of respondents on the entrepreneurial side of the scale.

Index	Mean	Median	Mode	Minimum	Maximum	Standard Deviation
item 13	2.38	2	2	1	5	1.074
item 14 (reversed)	3.41	3,5	2	1	6	1.351
item 15	3.56	4	4	2	5	0.991
item 16 (reversed)	4.32	4	4/ 5	2	6	1.093
item 17	3.79	4	4	1	6	1.225
	3.49					

Table 4: Descriptive Measures of Management Structure

The results for the dimension *Management Structure* didn’t turn out ideally. Observing the minimum and maximum value of questions 13, 15 and 16 one can see that the responses of those questions

didn't cover the complete range of the 6-item scale. Question 13 and 16 cover 5 values and question 15 only covers 4 values. The values for the standard deviation are accordingly low. The high values of mean, median and mode of question 16 indicate a negatively skewed deviation. On the opposite, the low values for question 13 suggest a positive skewed deviation. Reasons for not covering the full range of the scale could be the formulation of the questions, which might prevent respondents to choose an extreme answer, or the number of responses. As Brown et al. (2001) didn't experience any troubles with those questions in their survey the problem might be based on the second reason here.

Index	Mean	Median	Mode	Minimum	Maximum	Standard Deviation
item 18	4.15	4	5	1	6	1.209
item 19	3.56	3,5	3/ 5	1	6	1.260
item 20 (reversed)	4.03	4	4/ 5	2	6	1.167
item 21	4.35	5	5	2	6	0.981
item 22	3.42	4	4	2	5	1.146
item 23(reversed)	3.48	3	2	2	6	1.202
	3.83					

Table 5: Descriptive Measures of Reward Philosophy

For the dimension *Reward Philosophy* we created three new questions (question 21 to 23). Even though the responses for question 19 cover the full range of the scale and median and mean are exactly 3.5 and 3.56, the distribution shows that the responses are almost spread equally between 2 and 5 on the scale, so firms seem neither extremely entrepreneurial, nor administrative. This leads to question 20 to 23, where difficulties with the range can be discovered as well. Question 20, 21 and 23 only have a range of 4, whereas question 22 even has a range of only 3 values. Question 22 and 23 are similar to the deviation of question 19. Their responses are piled up only in the middle of the scale.

Index	Mean	Median	Mode	Minimum	Maximum	Standard Deviation
item 24 (reversed)	3.76	4	3/ 5	1	6	1.437
item 25	2.94	3	2/ 3	2	6	1.029
	3.35					

Table 6: Descriptive Measures of Reward Philosophy

Looking at the results for the dimension of *Growth Orientation* it can be observed that the range for question 25 again is only 4. In consequence, the standard deviation shows a low value of 1,03. In total, the results hint to an in two groups divided scale, like it could be found in some questions before already, indicating a clear distinction of entrepreneurial and administrative firm behaviour.

All questions of the dimension *Entrepreneurial Culture* only have a range of 4. Accordingly the values for the standard deviation are very low. The new questions 26 and 28 have a negatively skewed deviation whereas question 27 has a slightly positively skewed deviation.

Index	Mean	Median	Mode	Minimum	Maximum	Standard Deviation
item 26 (reversed)	4.85	5	5	2	6	0.989
item 27	3.85	4	5	2	6	1.258
item 28 (reversed)	4.18	4	4	2	6	1.086
	4.29					

Table 7: Descriptive Measures of Entrepreneurial Culture

The descriptive analyses show some difficulties with the range as some questions (13 out of 28) only reached a range of 4 or even 3 instead of 5 or 6. This could be an effect of the sample size as it was a problem for adopted (and thereby previously empirically approved) questions and new questions

alike. The first two dimensions Strategic Orientation and Resource Orientation performed well in this regard. Their graphs display curves with two peak points and therefore allow for discerning entrepreneurial and administrative enterprises. The questions of the dimension Reward Philosophy caused some problems with the range, however the results were still acceptable. The distribution curves of questions related with Reward Philosophy are all (beside the last question) negatively skewed, indicating a more administrative approach to management in this dimension. The results for the dimension Management Structure seem to be very diverse what makes it hard to detect any characteristics they have in common. The outcomes for the questions for Growth Orientation are very diverse as well. The number of only two questions makes it even more difficult to interpret the outcomes at this stage of analysis. For the dimension Entrepreneurial Culture more companies ranked themself towards the entrepreneurial side.

In sum, it can be observed that most distribution curves of the single questions are negatively skewed (for 21 out of 28 questions). In other words, the companies in this research sample tend towards the entrepreneurial management style. This result could suggest that the answers were partly motivated by social desirability as Wiklund (1999:80) state that currently, "entrepreneurship' is a very popular term and there is a tendency to regard it as something inherently good, something firms should always pursue". However, certain techniques were used to minimise the risk of social desirability. Further, the assumption that this could be related to specific company characteristics can't be confirmed as the research sample is very diverse. The only characteristic the companies have in common where the cultural background (Australian firms), the maximum size and the fact that the sample only consists of public companies. The first two characteristics might have a positive influence on the general tendency towards entrepreneurial management. However, the results are not significant enough to draw a conclusion about a general effect connected with the Australian culture or the maximum company size and the degree of entrepreneurial management.

Finally, it can be observed that some of the new questions should be checked for their formulation, but generally the new questions did perform equally to the transferred questions. However, new questions as well as adopted questions might perform better for a bigger sample size. Concluding this could be an interesting option for further research, as according to the first impression the new questions seem to provide the tools for further development of the scale.

8.2 Factor analysis

Factor analysis refers to a variety of statistical techniques whose common objective is to represent a broad set of variables in terms of a smaller number of hypothetical variables. It is based on the fundamental assumption that some underlying factors, which are smaller in number than the number of observed variables, are responsible for the covariation among the observed variables (Lewis-Beck 1994, Stevens 1996 or Tabachnick & Fidell 2001). In this case we have a set of 28 items, from which (ideally six) different dimensions as underlying latent variables should be extracted, describing the dimensions of the construct of entrepreneurial management behaviour.

There are two different types of using factor analysis. The *exploratory* factor analysis is used as an expedient way of ascertaining the minimum number of hypothetical factors that can account for the observed covariation. It is often used for possible data reduction. The *confirmatory* factor analysis is used as a means of confirming a certain hypothesis that there are a certain anticipated number of underlying dimensions and that certain variables belong to those dimensions (Lewis-Beck 1994). In practice, the division between exploratory and confirmatory factor analysis is not always clear-cut. In

the context of this study the focus will be more on the confirmatory part as it is based on the assumption of six existing empirical dimensions as variables describing the construct of entrepreneurial management behaviour. There is already an assumption about what items describe which dimension, analyses will hopefully confirm this assumption.

Before starting a factor analysis there are two main issues to consider in determining whether a particular data set is suitable for factor analysis: the sample size and the strength of the relationship among the variables or items (Pallant 2005). In this case the sample size might be a critical issue for the purpose of a factor analysis. The reason is that in small samples the correlation coefficients among the variables might be less reliable. Factors obtaining from small data sets do not generalise as well as those derived from larger samples. However there is little agreement among authors concerning how large a sample should at last be. Tabachnick & Fidell (2001) suggest including at least 300 cases for factor analysis. However, they mention that a smaller sample size should be sufficient if solutions have several high loading marker variables. Stevens (1996) argues that the sample size requirements advocated by researchers have been reducing over the years as more research has been done on this topic. Nunnally (1978) recommends a 10 to 1 ratio: that is, 10 cases for each item. Others suggest that 5 cases for each for each item is adequate in most cases.[2] Unfortunately, for this case none of those recommended requirements can be achieved. However, we have more than five cases for each item theoretically connected with one latent variable but Resource Orientation. Still, there should be an awareness of difficulties with the factor analysis that might result from the sample size. Generalisations should be derived with great care. According to Brosius (2008) there are four steps of a factor analysis: generating correlation matrix, factor extraction, factor rotation and finally factor scores and interpretation.

Latent variables construct

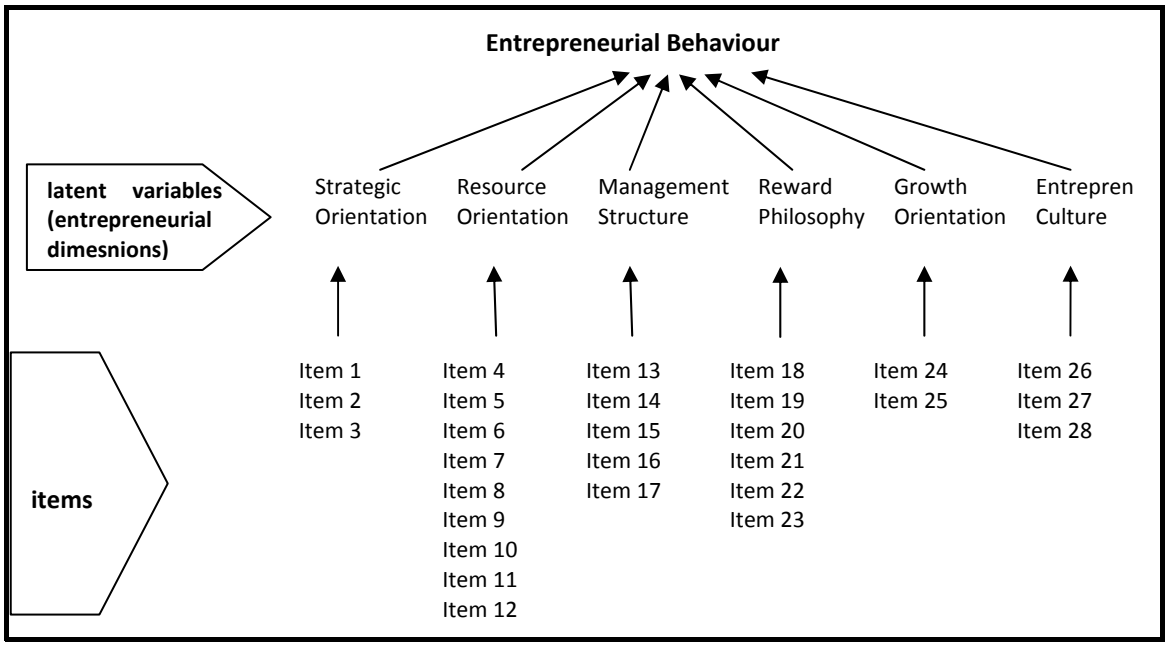


Figure 3: Latent variables and the underlying construct

2 See discussion in Tabachnick and Fidell (2001)

8.2.1 Eigenwert Analyses

Every factor analysis should start with an assessment of the data for this analysis. The ultimate quality one seeks in an item is a high correlation with the true score of the latent variable. Consequently, it is most important for the analysis that the items which assemble a latent variable (dimension of entrepreneurial management) are highly intercorrelated. The correlation matrix display how intercorrelated the items are (the correlation matrix for this study can be found in the appendix). The very first step is to look for significant correlation coefficients, recommended are strength of correlations of 0.3 and above and p values for significances < 0.5 (Tabachnick and Fidell 2001; Pallant 2005). Due to the small sample size even p values < 0.1 seem acceptable. The correlation matrix for this study shows several significant correlation coefficients above 0.3. However, not all items that were expected to measure the same dimension are highly intercorrelated. On the other hand, some items that were assumed to measure different dimensions seem to be highly intercorrelated.

Beside the correlation matrix there are two further statistical measures, which help to assess the factorability of the data. The first one is the Bartlett's test of sphericity (Bartlett 1954), which should be significant ($p<0.05$) for the factor analysis to be considered appropriate. For this study the Bartlett's test of sphericity is smaller 0.0005 and therefore significant. The second measure is the Kaiser-Meyer-Olkin measure (KMO) of sampling adequacy (Kaiser 1970, 1974). The KMO index ranges from 0 to 1, with 0,6 suggested as the minimum value for a good factor analysis (Tabachnick & Fidell 2001). Yet in the KMO index for the underlying data reaches only 0,391. However this divergence didn't seem enough to already reconsider the use of factor analysis but clearly indicates that generalizations should only be stated with extreme care.

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy		.391
Bartlett's Test of Sphericity	Approx. Chi-Square	583.158
	Df	378
	Sig.	.000

Table 8: Kaiser-Meyer-Olkin Measure and Bartlett's Test for the purpose of assessing factorability

The main object of the extraction step in exploratory factor analysis is to determine the minimum number of common factors that would satisfactorily produce the correlations among the observed variables. Given an exact fit between the factorial model and the data, the communalities and the number of common factors can be obtained through the estimation of the rank of the adjusted correlation matrix (the adjustment of the correlation matrix requires inserting the communalities in the main diagonal). However, this might work in theory, but in actually collected data samples there will most certainly be sampling errors. As the ultimate criterion for determining the minimum number of common factors is how well the assumed common factors can reproduce the observed correlations, the objective of factor extraction can be explained as finding criteria by which to decide *when to stop extracting common factors*. This involves determining when the discrepancy between the reproduced correlations and the observed correlations can be attributed to the sampling variability (Lewis-Beck 1994).

There are a variety of approaches that can be used to identify the number of underlying factors or dimensions. Some examples are principal components; principal factors; image factoring, maximum likelihood factoring; alpha factoring; unweighted least squares; and generalised least squares. The

most commonly used approach is principal components analysis, which will be used in this analysis. However, the main reason for choosing this approach for this study was a better comparability with Brown's et all study as they too used the principal component analysis.

Determining the number of factors, which best describes the underlying relationship among the variables, involves balancing conflicting needs: the need to find a simple solution with as few factors as possible, and the need to explain as much of the variance in the original data set as possible. Tabachnick & Fidell (2001) recommend to experiment with different numbers of factors until a satisfactory solution is found. Techniques that can be used to assist in the decision concerning the number of factors to retain are for example the Kaiser's criterion, the scree test and parallel analysis.

Kaiser's criterion or Kaiser's eigenvalue rule (e. g. Nunnally 1967) is based on retaining only factors that explain more variance than the average amount explained by one of the original items. Using this rule, only factors with an eigenvalue of 1 or more are retained for further investigation. Unfortunately, this criterion often results in extracting too many factors (Zwick & Velicer 1986).

This extract of the 'total variance explained' (the complete table can be found in the appendix) shows that nine factors have a total eigenvalue of more than 1. According to the recommendation to retain only factors with an eigenvalue of 1 or more this would suggest retaining nine factors. Those nine factors would explain 77,993% of the variance of the model which would fulfil the need to explain as much of the variance in the original data set as possible. On the other hand, nine factors wouldn't serve the need for a simple solution. And it would imply to consider the existence of nine, not six, seven or eight dimensions of entrepreneurial management. Further, this method could overestimate the number of factors, as was mentioned earlier already. Besides, Kaiser's criterion is not a fast statistical rule but rather a guideline. Therefore it should be explored whether another number of factors would be more suitable for this model.

	Initial Eigenvalues			Extraction Sums of Squared Loadings		
Component	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	5.838	20.849	20.849	5.838	20.849	20.849
2	3.277	11.702	32.551	3.277	11.702	32.551
3	2.432	8.685	41.236	2.432	8.685	41.236
4	2.364	8.443	49.679	2.364	8.443	49.679
5	2.188	7.815	57.495	2.188	7.815	57.495
6	1.883	6.723	64.218	1.883	6.723	64.218
7	1.519	5.424	69.642	1.519	5.424	69.642
8	1.256	4.487	74.129	1.256	4.487	74.129
9	1.082	3.864	77.993	1.082	3.864	77.993
10	.964	3.442	81.436			
11	.897	3.203	84.638			
12	.764	2.727	87.366			

Extraction Method: Principal Component Analysis.

Table 9: Part of the table 'Total Variance Explained'

From table 9 it is obvious that the first factors have a relatively high eigenvalue, whereas the eigenvalues of the factors below are smaller and decline steadily. The assumption for this survey was that the model could be explained sufficiently with six factors. But even seven factors would be in accordance with theory as two of Stevenson's (1983) theoretical dimensions were merged into the dimension Resource Orientation. In the case of seven factors the cumulated variance explained would be 69,642%. For six factors the cumulated variance explained would still be 64,218% (Brown et

al. reached a value of 63,6%). The results for Kaiser's eigenvalue criteria therefore appear to be satisfying and comparable to the study we replicate.

Carttell's scree test (Cattell 1966) is another widely used method for factor extraction. This approach involves plotting the amount of variance explained (based on factor's eigenvalue) by each successive factor. Because each factor explains less variance than the preceding factors, an imaginary line connecting the markers for successive factors generally runs from the top left of the graph to the bottom right. The purpose of this plot is to find the 'elbow' as a point below which factors explain relatively little variance and above which they explain substantially more (DeVellis 2003). In the plot this elbow usually appears as a point at which the shape of the curve changes direction and becomes more horizontal. Looking at the scree plot for this survey (figure 4) there is obviously a clear break between the third and fourth component. Components one and two, and to some extent three, explain or capture much more of the variance than the remaining components. Certainly, extracting only three components would be an oversimplification for this model, as only 41.236% of the variances in the model would be explained (see table 9). Interestingly, it appears to be a little inflexion point of the plot at component no. 7, as there is a change in gradient. This might be a hint that the assumption of six or seven variables could find at least some support from empirical evidence.

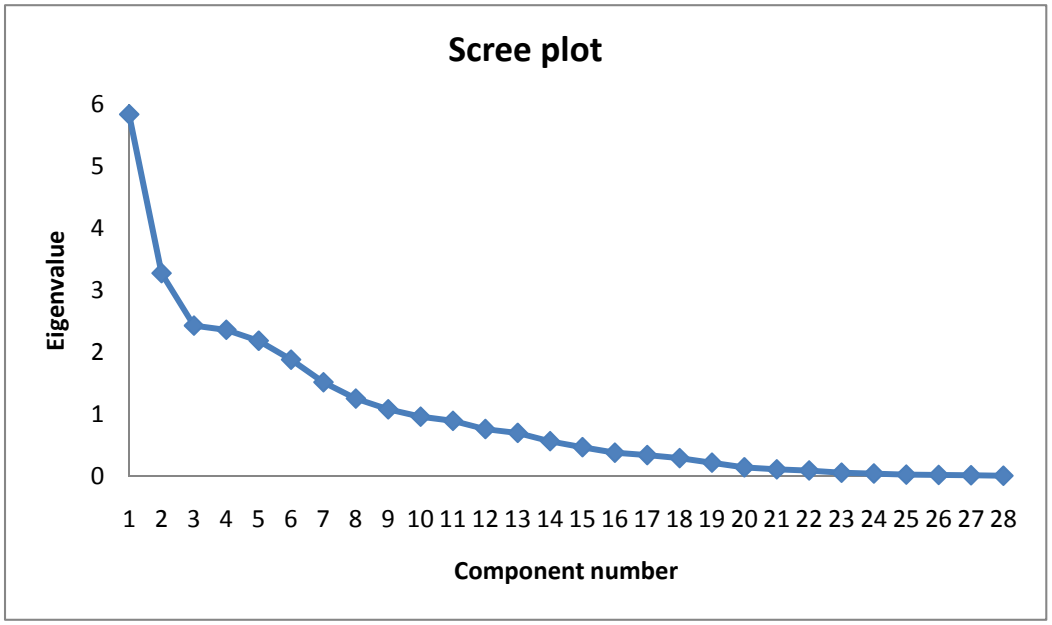


Figure 4: Scree plot of Eigenvalues for Carttell's factor extraction test

Methods like Kaiser's criterion and Carttell's scree test are techniques to explore the minimum of factors, which can explain the model satisfactorily. Yet, these techniques don't provide any information whether the relation between the extracted factors and the components of the data set can be reasonably explained or whether the relation is random and doesn't have any significance or explanatory value for the model. Therefore, one needs to take a look at the *component matrix* before deciding on a number of factors to retain. The component matrix shows the loadings of each of the items on the four components. Especially for the first three factors most items load quite strongly well above 0,4. Furthermore, for the factors 4 to 6 there are little less items with loadings above 0.4 but still several items with factors above 0,3. However very few items load on factors 7 to 9 and most of these loadings are just above 0,3. These findings support to retain only six factors for further investigation.

An additional check for the appropriateness of the number of factors that were extracted is to generate the correlation matrix that would result if the extracted factors were the only factors of the model. That matrix is called the *reproduced correlation matrix*. The closer the values in the reproduced matrix are to the values in the original correlation matrix the better do the factors represent the true underlying model. The reproduced correlation matrix also shows the residuals, which display how the reproduced correlations deviate from the observed correlations. As the reproduced matrix should be very similar to the original correlation matrix, the residuals should be close to zero. In this case there are 184 (48.0%) nonredundant residuals with absolute values greater than 0.05 for a model with 6 factors. This can be seen as an indicator for the fit of the overall model. More precise information provides the single residuals. The reproduced correlation matrix can be found in the appendix.

	Component								
	1	2	3	4	5	6	7	8	9
Q 1	,682			-,394					
Q 2	,609		-,334	-,312		-,383			
Q 3	,693					-,385			
Q 4	,636		-,393						
Q 5	,446				-,551	,307			
Q 6	,390		-,438	,622					
Q 7		,745							
Q 8	,639	-,372				,316			
Q 9	,447			-,380	,403			-,336	
Q 10					,568	,518			
Q 11	,715		-,322		,300				
Q 12	,561	,384		,440					
Q 13		,454			,308	,374	-,309	,407	
Q 14			,415	-,455	,454				
Q 15		,565						,394	
Q 16			,495	,675					
Q 17	,539		,327		,484	-,397			
Q 18	,559	-,491	,320						-,317
Q 19	,620	,430						-,387	
Q 20	,346		,456	,487			-,426		
Q 21		,324					,764		
Q 22		,635				,343			
Q 23	,507		,677						
Q 24	-,385					,461			,573
Q 25		-,307					,533	,519	
Q 26	,442	-,514	,335						
Q 27	,540	,338	-,321		,337		,335		
Q 28	,417				-,519	,344			

Extraction Method: Principal Component Analysis.
9 components extracted; only absolute values above 0.3 are displayed

Table 10: Component matrix for 9 extracted components

8.2.2 Factor rotation

After identifying a suitable number of factors for the model, the next step is to try to interpret them. Therefore factor rotation involves finding simpler and more easily interpretable factors through rotation, while keeping the number of factors and communalities of each variable fixed. There are two main approaches to rotation, resulting in either orthogonal or oblique factor solutions. Orthogo-

nal factors are the result of keeping factors perpendicular (statistically independent) with respect to one another in the process of rotation. When this is done, the true value of an item on any given factor is independent of its true value of an item on any other factor that has been extracted. In other words, knowing an item's value on one factor tells you nothing about its value on any other factor. Alternatively, oblique rotation can be used, which means factors are rotated so that the axis corresponding to each successive factor is fitted optimally without the constraint of keeping them perpendicular.

According to Tabachnick & Fidell (2001), orthogonal rotation results in solutions that are easier to interpret and to report. However, they do require the researcher to assume that the underlying constructs are independent. Oblique approaches allow for the factors to be correlated, but they are more difficult to interpret describe and report. In practice the two approaches (orthogonal and oblique) often result in very similar solutions, particularly when the pattern of correlations among the items is clear (Tabachnick & Fidell 2001). Consequently, it might be advisable to conduct both orthogonal and oblique rotations to choose the clearest. The ideal case of a 'simple structure' involves each of the variables loading strongly on only one component, and each component being represented by a number of strongly loading variables, ideally all items connected with a single dimension of entrepreneurial management.

Within the two broad categories of rotational approaches there are a number of different rotational techniques (e.g. orthogonal: Varimax, Quartimax, Equamax; oblique: Direct Oblimin, Promax). The most commonly used orthogonal approach is the Varimax rotation method, which attempts to minimise the number of variables that have high loadings on each factor. The most commonly used oblique technique is Direct Oblimin. The Promax rotation is particularly suitable for lager samples and therefore not suitable in case of our sample.[3] To achieve a good comparability with Brown's et al. study we should also take into account what methods they had used. For this and the reasons explained before, we first use Varimax rotation.

The result of the varimax rotation for a 6 factor model is shown in table 6.10. There are only values more than 0,3 displayed and the highest value for each item is highlighted. First of all, it shows that every item (besides item 21 and 25) has a loading significantly higher than 0,4. The loadings of the items 21 and 25 are only 0,336 and -0,361. Comparing these results with the component matrix (see table 10) of the 9 factor model, it is obvious that exactly those two items had the highest loadings on factor 7 and 8 which didn't retain in this model.

Further, in an exploratory factor analysis the varimax rotation can be used to help identify the nature of the underlying latent variable represented by each component. But in this case some assumption about the underlying latent variables already exists. Already the questionnaire was designed with an idea about what question should be measuring which dimension. The first three questions were supposed to measure the dimension Strategic Orientation. Indeed all three questions have their highest loadings (all above 0,65) on component 2. Those questions are obviously measuring the same latent variable. But there are two other items, question 4 and question 16, which have their highest loading on the same component, unexpectedly. Questions 4 to 12 were expected to measure the dimension Resource Orientation. The highest loadings for these items are mainly scattered over components 3 to 5, with only one exception for item 8, which highest loading is on component 1. Through including all loadings with a value higher than 0,3 into the investigations we can see that

3 For a comparison of the characteristics of each of these approaches, see Tabachnick und Fidell (2001, p.615)

three third of the questions 4 to 12 are loaded on component 3. Beside questions of the dimension Resource Orientation, question 27 is the only other question loading on this component.

Questions 13 to 17 were assumed to measure the dimension Management Structure. The highest loadings of those questions are wide spread over components 2, 4, 5 and 6. Therefore according to this matrix it seems like those items wouldn't describe the same underlying latent variable. Interestingly this was one of the two dimensions that Brown et al. (2001) had some problems with as well. Questions number 18 to 23 were intended to measure the underlying latent variable Reward Philosophy. The highest loadings of those items are split between component 1 and 4. Questions number 24 and 25 should measure the dimension Growth Orientation. Both items have their highest (and single) loading on component 6. Finally questions 26 to 28 were intended to measure Entrepreneurial Culture. The highest loadings for those questions are on components 1, 3 and 4 and therefore don't support the assumption of one common underlying latent variable.

	Component					
	1	2	3	4	5	6
Q 1		,775				
Q 2		,756				,411
Q 3	,450	,651				,314
Q 4		,700	,351			
Q 5		,357		,627	-,313	
Q 6			,812			
Q 7	-,341			,534		,501
Q 8	,632		,347			
Q 9					,689	
Q 10			,387		,634	-,336
Q 11			,796			
Q 12			,735			
Q 13				,433	,461	
Q 14					,780	
Q 15				,533		
Q 16	,383	-,624				,406
Q 17	,333				,423	,647
Q 18	,725	,351				
Q 19		,306		,635		
Q 20	,687					
Q 21				,336		
Q 22				,766		
Q 23	,750					,314
Q 24						-,617
Q 25						-,361
Q 26	,692					
Q 27			,711			
Q 28		,365		,572		

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.
a. Rotation converged in 13 iterations.

Table 11: Rotated component matrix

8.2.3 Interpretation of varimax rotation

Unfortunately, the questions cannot be assigned to the expected dimension that clearly. Only the dimensions Strategic Orientation and Growth Orientation can be clearly assigned. Strategic

Orientation has all its highest loadings on factor 2. Growth Orientation has all its highest loadings on factor 6. Therefore, it can be argued that those two dimensions could be extracted. The questions for the dimension Resource Orientation have their highest loadings scattered across the first five factors. If you take the second highest loadings into consideration as well, most of those questions have high loadings on the third factor. So it can be assumed carefully, that the factor 3 is actually measuring the dimension Resource Orientation. The questions for the dimension Reward Philosophy load equally on factor 1 and 4. Only from the results of the factor rotation it is impossible to decide on one of them. The questions for the dimension Management Structure have their highest loadings scattered over factor 2, 4, 5 and 6. The similar scenario can be observed for the dimension Entrepreneurial Culture. The questions for this dimension are distributed over factor 1, 3 and 4. However, due to the small sample size one should not generalize from the results. A statement that the six distinguished dimensions of entrepreneurial management as defined by Stevenson (1983) do not exist would clearly over burden the underlying data of this study.

8.2.4 Reliability analysis

While developing a measurement scale one need to be aware of two characteristics: reliability and validity. Both of these factors can influence the quality of the data obtained. The validity of a scale serves as an indicator for the adequacy of a scale as a measure of a specific variable. In other words, it refers to the degree to which it measures what it is supposed to measure. There are three different types of scale validity: content validity, criterion-related validity and construct validity. *Content validity* concerns item sampling adequacy – that is, the extent to which a specific set of items reflects a content domain. In theory, a scale has content validity when its items are a randomly chosen subset of the universe of appropriate items. *Criterion-Related Validity* means an item or scale is required only to have an empirical association with some criterion or 'gold standard'. Thus criterion validity per se is more an issue because it is not concerned with the understanding of a process but merely with predicting it. In fact, criterion related validity is often referred to as *predictive validity. Construct validity* is directly concerned with the theoretical relationship of a variable to other variables. It is the extent to which a measure 'behaves' the way that the construct it purports to measure should behave with regard to established measures of other constructs. Unfortunately there is no one clear-cut indicator of a scale's validity. Therefore every analysis underlies the assumption of scale validity.

Reliability refers to the extent to which a measure is free of random measurement error (Tharenou et al. 2007). Whereas validity concerns whether *the* variable is the underlying cause of item correlation, reliability concerns how much *a* variable influence a set of items. Even reliability has different aspects but the most important question in regard to the reliability of a scale is internal consistency. *Internal consistency* is concerned with the homogeneity of the items comprising a scale. If the items of a scale have a strong relationship to their latent variable, they will have a strong relationship to each other. Although we cannot directly observe the linkage between items and the latent variable, we can certainly determine whether the items are correlated to one another. A scale is internally consistent to the extent that its items are highly intercorrelated. High inter-item correlations suggest that the items are all measuring the same thing. It further can be concluded that strong correlation among items imply strong links between items and latent variable (DeVellis 2003). Internal consistency is typically equated with Cronbach's coefficient alpha (in short Cronbach's alpha; Cronbach 1951).

In general, a more reliable scale increase statistical power for a given sample size (or allow a smaller sample size to yield equivalent power), relative to less reliable measures. However, while different levels of reliability are required, depending on the nature and purpose of the scale, Nunnally (1978) recommends a minimum level of 0.7. According to others the alpha value is already significant for a value of 0,6 and above (e.g. Hair, Anderson et al. 1998). However, Cronbach's alpha values are dependent on the number of items in the scale. When there is a small number of items in the scale (fewer than ten), Cronbach's alpha values can be quite small.

Index	Cronbach's alpha	Corrected item-total correlation	Cronbach's Alpha if Item Deleted
Strategic Orientation	**,814**		
Item 1		,626	,783
Item 2		,701	,706
Item 3		,667	,742
Resource Orientation	**,648**		
Item 4		,393	,604
Item 5		,310	,625
Item 6		,396	,604
Item 7		-,193	,735
Item 8		,419	,597
Item 9		,196	,647
Item 10		,299	,628
Item 11		,692	,526
Item 12		,552	,570
Management Structure	**,547**		
Item 13		,232	,533
Item 14		,281	,515
Item 15		,382	,456
Item 16		,194	,554
Item 17		,488	,370
Reward Philosophy	**,610**		
Item 18		,249	,605
Item 19		,471	,508
Item 20		,327	,572
Item 21		,215	,610
Item 22		,226	,610
Item 23		,582	,458
Growth Orientation	**,295**		
Item 24		,182	-
Item 25		,182	-
Entrepreneurial Culture	**,261**		
Item 26		,088	,295
Item 27		,125	,241
Item 28		,222	,012

Table 12: Reliability analysis with Cronbach's alpha for the scale

Another information of interest is the corrected item-total correlation. As the set of items should be highly intercorrelated, each individual item should correlate substantially with the collection of remaining items. We can examine this property for each item by computing its item-total correlation. The uncorrected item-total correlation correlates the item in question with the entire set of candidate items, including itself. The corrected item-scale correlation correlates the item being evaluated with all the scale items, excluding itself. As every item will necessarily correlate with itself, the corrected version makes more sense. Generally applies the higher the value the better the item. Nunnally (1967) recommends a value of 0.4 or more for the item-total correlation, whereas others

recommend a minimum of 0.3 (e.g. Pallant 2005). Here, due to the large number of items and the small sample size, a minimum of 0.3 seems sufficient. Low values may indicate that the item is measuring something different from the scale as a whole.

Table 12 shows the results for the reliability analysis for this study (all generated reliability statistics can be found in the appendix). Looking at the Cronbach's alpha value of 0.814 for Strategic Orientation it shows to be higher than the recommended minimum level of 0.7. This value comes very close to the result provided by Brown et al. (2001), who extracted an alpha value of 0.82. None of the items could be removed from the scale without reducing Cronbach's alpha coefficient.

The alpha coefficient for Resource Orientation is 0.648 and therefore higher than the alpha value detected by Brown et al. (2001) with 0.58. In other words, one of the objectives of this paper, to gain a better reliability for the dimension of Resource Orientation through including new questions, has been achieved. Further, the new items seem to perform quite well in regard to the scale reliability. According to Hair, Anderson et al. (1998) the alpha value above 0.6 indicates the reliability of the scale. By removing item 7 an even higher alpha value of 0.735 could be reached. Surprisingly, item 7 is one of the adopted items, not one of our newly edited questions.

The scale of the dimension Management Structure shows a dissatisfactory result for Crobach's alpha. With a value of 0.547 it is significant lower than the alpha in Brown's at al (0.78). Further, all but one item in this scale have a lower corrected item-total correlation than recommended. Through exclusion of factor 16 a slightly higher Cronbach's alpha coefficient of 0,554 could be obtained. But even according to Hair, Anderson et al. (1998) it would still be under the minimum value of 0,6 to achieve reliability. Therefore, Management Structure cannot be proven replicable, but however, the small sample size does not allow any generalization based on this result.

In addition to the dimension Resource Orientation we also added new question to the dimension of Reward Philosophy in order to achieve a better reliability for the scale. With an alpha coefficient of 0.610 (in comparison to 0.58 in Brown's et al. study) the scale for Reward Philosophy is reliable. Nevertheless, both items 21 and 22 show low item-total correlations of 0.215 and 0.226. Anyhow, their exclusion from the scale wouldn't lead to any changes of the alpha value. Therefore, in regard to the principle of simplicity it could be advisable to exclude them. The newly added item 23 on the other hand produces the highest item-total correlation for this dimension and therefore seems to capture an additional aspect of Reward Philosophy.

The scales of the last two dimensions, Growth Orientation and Entrepreneurial Culture, perform very poorly in the reliability analysis with values of 0.295 and 0.261. All corrected item-total correlations are below 0.23. By removing item 26 a slightly higher alpha coefficient of 0.295 could be reached for Entrepreneurial Culture, but this would still be far from reliable. For the dimension Growth Orientation the value for Cronbach's alpha after deleting one of the items even turned out negative due to a negative average covariance among items. As this violates reliability model assumptions they are not displayed in the table. Surprisingly, the outcome of the factor rotation in the factor analysis seemed promising for Growth Orientation, as both items were exclusively loaded on one dimension. Concerning Growth Orientation, the ongoing economic crises possibly stunted the perception of items related to growth.

In sum the scales of the dimensions Strategic Orientation, Resource Orientation and Reward Philosophy achieved alpha coefficients above 0,6, which means they are reliable (Hair, Anderson et al. 1998). The reliability of the scale of the dimension Management Structure couldn't be verified, as the alpha value lies just below the recommended minimum. Unfortunately, the dimensions Growth

Orientation and Entrepreneurial Culture performed really poorly. A methodological explanation for the poorly performing items might be the small number of items in the scale. As mentioned earlier a small number of items (less than 10) might cause lower alpha values.

The aim of including new question for the dimensions Resource Orientation and Reward Philosophy was to try to comprise some aspects of those dimensions that seem to be missing in the scale of Brown's et al. study. In the case of Resource Orientation this attempt succeeded as all new questions add to the alpha value making it significant. But even in the case of the dimension Reward Philosophy one of the three added questions produces a significant alpha value.

9 Evaluation of the scale – results

The scale analysis of this exemplary study provides some interesting results. The analysis found some significant characteristics of the measurement instrument. However, some problems that occurred could be related to the small number of responses, as for some items the maximum span of values remained under-utilized. In this context, the reduction of the 10-item scale from Brown's et al. study to a 6-item scale turned out to be the right decision to make. Furthermore, in regard to the low response rate this reduction of the size of the scale was beneficial, if not necessary. However, the under-utilized range in values of some questions could also be related to the wording of the questions. For further research the wording of some questions should be reconsidered.

Another peculiarity was that exactly two dimensions, Strategic Orientation and Resource Orientation, don't show a normal distribution curve. The graphs of 6 out of 12 questions are split into two groups. Their curves have two peak points, reassembling a U-shaped distribution. According to those questions it can be assumed that a classification of the companies into two groups (administrative and entrepreneurial group) could be easily accomplished. Even though participants were forced to position their company at either the entrepreneurial or the administrative side, due to the 6-item scale, the results could have still be piled up in the middle. Reasons for the U-shaped distribution could have something to do with the nature of those two dimensions (Strategic Orientation and Resource Orientation) or underlying characteristics of the entrepreneurial management construct. Possibly Strategic Orientation and Resource Orientation forces a company more than the other dimensions to position itself clearly on one of those sides more than the other dimensions do.

Further it is obvious that the distribution curves are mostly (for 21 out of 28 questions) skewed towards the entrepreneurial side. This could be caused by a general tendency to answer accordingly to social expectations. Participants want to present their company in a desirable way. In this study we minimized the risk of answers motivated more by social desirability than the actual situation in the participant's company by reversing some questions. On the other hands, the effect could also be interpreted in the way that most of the participating companies implemented a more entrepreneurial management style. This observation could be caused by cultural characteristics (Australia, a young and pioneering, fast growing country) or by industry and firm size specific strategies. Another reason for a tendency towards the entrepreneurial side could be the flow of time. Stevenson's approach, novel in 1983, has – in the meanwhile – gained strong influence in mainstream management and on the advice given by strategic management consultants. E.g. flexible capital structures, flat hierarchies, networks and value based compensations are more common practice today than they used to be back when Brown et al. conducted their original survey.

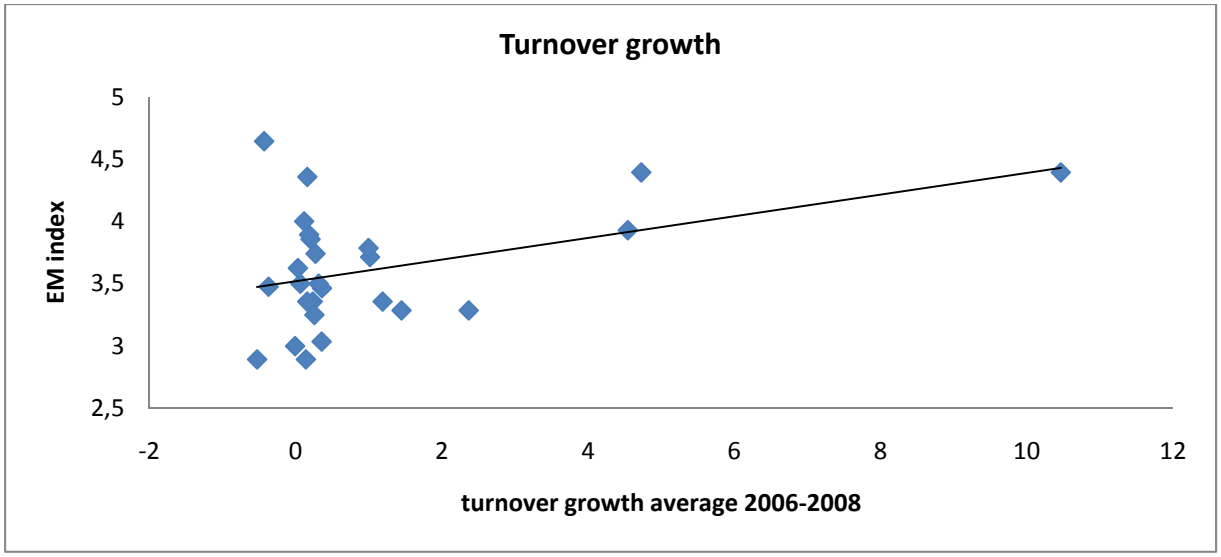
In general, a high level of correlations between items indicates that they are measuring one common underlying construct of entrepreneurial management. But by far not all correlations proved to be significant. Yet, the factor extraction didn't turn out like expected too. However, according to the eigenvalue rule 9 factors could still be extracted, whereas the scree plot indicates that the assumption of three, six or seven factors might be applicable as well. This finding is supported by the component matrix which indicates six dimensions, totally in accordance to the underlying construct. The low number of significant correlations could indicate that the implication of just some – nowadays modern – principles of entrepreneurial management – e.g. outsourcing – does not suffice to create "entrepreneurial management" in its full account throughout the organization. Likely, to be a more entrepreneurial organization, it is not enough to score "entrepreneurial" just on some modest items, but neglecting other dimensions. In short: The missing significance of so many correlations could be caused by the fact that too many companies don't head for entrepreneurial management consequently enough, but only pick some attributes which can easily be adopted within an organization that is still administrative at its core.

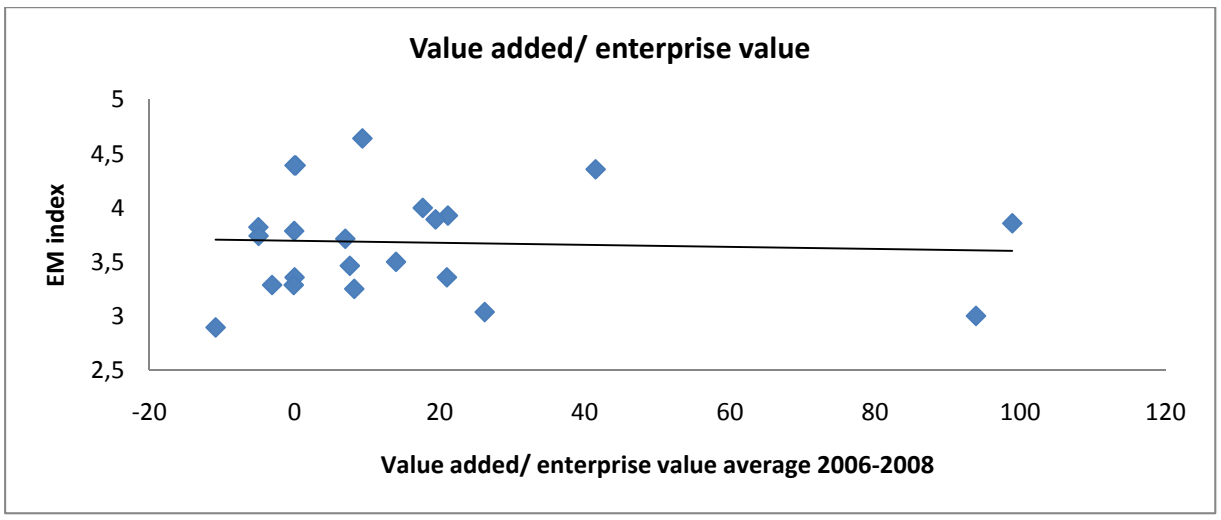
Moreover, the development of any scale always requires checking whether the measurement instrument is in fact measuring the underlying construct or whether it might measure some secondary factors. The challenge in the case of the model of entrepreneurial management is the complexity of the model itself. In this paper even though the extraction of the individual dimensions turned out to be difficult, the overall result of testing the scale was still quite acceptable, especially when taking into account the sample size. The –nothing more than moderate – results from the factor analysis partly arise from the approach of the analysis. With an exclusively exploratory factor analysis the results might have turned out a bit better. The minimum requirement of any confirmatory factor analysis is that one hypothesizes beforehand the number of common factors. However, the hypothesis must be based on an understanding of the nature of the variable under consideration, as well as on expatiations concerning which factor is likely to load on which variables. For this factor analysis we relied on the results of Brown's et al. study and expected therefore to get similar results. Therefore, to concentrate on only one possible outcome out of the almost limitless variety of options is obviously restricting the results (Lewis-Beck 1994), but the only way to strive for replication effectively.

One of the objectives of this paper is to gain a better reliability for the dimension of Resource Orientation and Reward Philosophy by including new questions. Generally, the reliability analysis didn't result in a satisfactory alpha value for all associated variables. The reliability of the dimensions Growth Orientation and Entrepreneurial Culture can't be verified (and due of the small sample size, can't be denied in general either, but is put in question). The alpha values for the other dimensions are between moderate to extensive. The dimensions Resource Orientation and Reward Philosophy could achieve a clearly better alpha value than in the study of Brown et al. Therefore the objective of this paper in that respect has been achieved. Further, the new items seem to perform quite well in regard to the scale reliability. Generally the new questions did perform equally to the replicated questions. However, new questions as well as replicated questions might perform even better for a bigger sample size. Concluding the study was partly successful and provides many interesting options for further research, as the new questions certainly provide tools for further development of the measurement of "entrepreneurial management".

10 Linking Entrepreneurial Management to Firm Performance

Based on the survey results, an Entrepreneurial Management Index has been calculated for each firm. Firms can reach an index score from zero (absolutely administrative) to five (very entrepreneurial). We have used five performance indicators. These indicators have been selected because they are likely to especially capture the impact of entrepreneurial performance and are of strategic relevance, namely turnover growth, value added (enterprise value), return on total assets, and return on shareholder funds. Scatterplots for all performance measures and EM index indicate no empirical linkage between the index score and firm performance. Accordingly, tests for correlations didn't bring any significant results for both, Pearsons *r* and non-parametric tests. Our explorative study therefore failed to show any significant influence of Entrepreneurial Management on firm performance. However, due to the small sample size and the diversity of the sample set, this result should not be overemphasized. Further empirical research with narrower (i.e. less heterogeneous) but bigger samples is needed for drawing conclusions. For the moment, a simple saying that "entrepreneurial management is always the better strategic choice" does not hold in the light of empirical results.





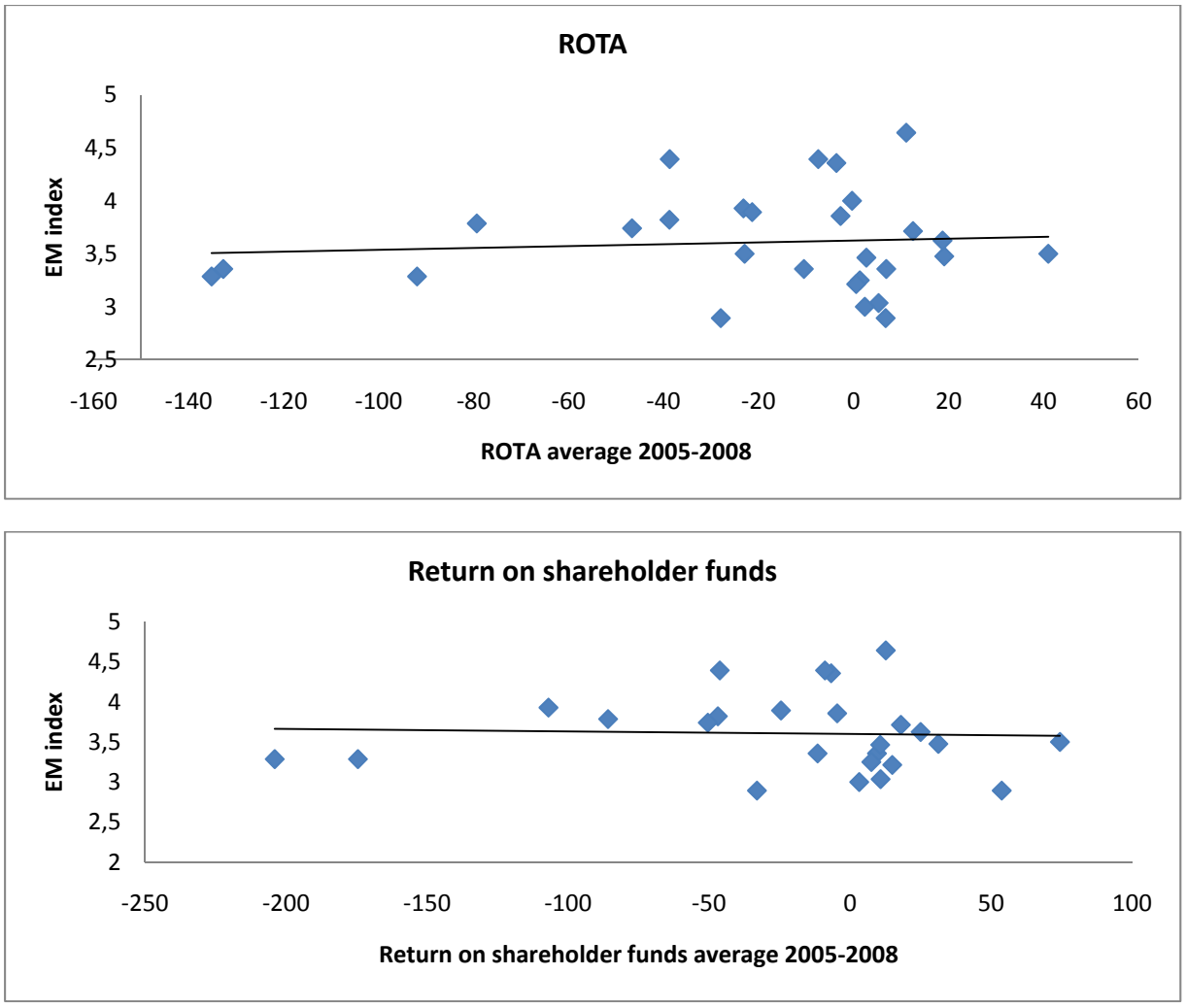


Figure 5: Performance Measurements in Relation to Entrepreneurial Management Index

References

Anastasi, A. (1968). Psychological testing. New York, Macmillan.

Antoncic, B. and R. D. Hisrich (2003). "Clarifying the intrapreneurship concept." Journal of Small Business and Enterprise Development **10**(1): 7.

Antoncic, B. and R. D. Hisrich (2003a). "Privatization, Corporate Entrepreneurship, and Performance: Testing a Normative Model." Journal of Developmental Entrepreneurship **8**(3): 197.

Antoncic, B. and R. D. Hisrich (2004). "Corporate entrepreneurship contingencies and organizational wealth creation." The Journal of Management Development **23**(5/6): 518.

Baden-Fuller, C. (1995). "Strategic innovation, corporate entrepreneurship and matching outside-in to inside-out approaches to strategy research." British Journal of Management **6**: 3 (14 pages).

Barringer, B. R. and A. C. Bluedorn (1999). "The relationship between corporate entrepreneurship and strategic management." Strategic Management Journal **20**(5): 421-444.

Bartholomew, D. J. and M. Knott (1999). Latent Variable Models and Factor Analysis. London, Arnold,a member of the Hodder Headline Group.

Bellu, R. R. (1987). Towards a therory of entrerpeneurial behaviour. Ann Arbor, MI, UMI.

Borch, O. J., M. Huse, et al. (1999). "Resource configuration, competitive strategies, and corporate entrepreneurship: An empirical examination of small firms." Entrepreneurship Theory and Practice **24**(1): 49 (22 pages).

Bortz, J. and N. Döring (2002). Forschungsmethoden und Evaluation: Für Human- und Sozialwissenschaftler. Berlin, Springer.

Brosius, F. (2008). SPSS 16. Heidelberg, mitp.

Brown, T. E., P. Davidsson, J. Wiklund (2001). "An operationalization of Stevenson's conceptualization of entrepreneurship as opportunity-based firm behavior." Strategic Management Journal **22**(10): 953.

Busenitz, L. W. and J. B. Barney (1997). "Differences between entrepreneurs and managers in large organizations: Biases and heuristics in strategic decision-making." Journal of Business Venturing **12**(1): 9 (22 pages).

Carland, J. W., F. Hoy, et al. (1984). "Differentiating Entrepreneurs from Small Business Owners: A Conceptualization." Academy of Management. The Academy of Management Review **9**(2): 354 (6 pages).

Cattell, R. B. (1966). "The scree test for number of factors." Multivariate Behavioral Research(1): 245-276.

Covin, J. G. (1991a). "Entrepreneurial Versus Conservative Firms: A Comparison of Strategies and Performance." The Journal of Management Studies **28**(5): 439.

Covin, J. G., R. D. Ireland, et al. (2003). Exploring and exploitation functions of corporate venturing. Seattle, WA, Paper presentation: Academy of Management, Annual Meeting.

Covin, J. G. and M. P. Miles (1999). "Corporate entrepreneurship and the pursuit of competitive advantage." Entrepreneurship Theory and Practice **23**(3): 47 (17 pages).

Covin, J. G. and D. P. Slevin (1986). "The development and testing of an organizational-level entrepreneurship scale." Frontiers of entrepreneurship research: 628-639.

Covin, J. G. and D. P. Slevin (1988). "The Influence of Organization Structure on the Utility of an Entrepreneurial Top Management Style." The Journal of Management Studies **25**(3): 217-34.

Covin, J. G. and D. P. Slevin (1989). "Strategic Management Of Small Firms In Hostile And Benign E." Strategic Management Journal **10**(1): 75-87.

Covin, J. G. and D. P. Slevin (1991). "A Conceptual Model of Entrepreneurship As Firm Behavior." Entrepreneurship Theory and Practice **16**(1): 7.

Covin, J. G. and D. P. Slevin (1993). "A response to Zahra's 'Critique and Extension' of Entrepreneurship Model." Entrepreneurship Theory and Practice **17**(4): 23.

Covin, J. G., D. P. Slevin, et al. (2000). "Pioneers and followers: Competitive tactics, environment, and firm growth." Journal of Business Venturing **15**(2): 175.

Cronbach, L. J. (1951). "Coefficient alpha and the internal structure of tests." Psychometrika **16**: 297-334.

Daily, C. M. and D. R. Dalton (1992). "The Relationship Between Governance Structure and Corporate Performance in Entrepreneurial Firms." Journal of Business Venturing **7**(5): 375 (12 pages).

Davidsson, P. (2004). Researching entrepreneurship. Boston :, Springer.

Davidsson, P. (2008). The Entrepreneurship Research Challenge. Cheltenham :, Edward Elgar Publishing Limited.

Dess, G. G., G. T. Lumpkin, et al. (1999). "Linking corporate entrepreneurship to strategy, structure, and process: Suggested research directions." Entrepreneurship Theory and Practice **23**(3): 85 (18 pages).

DeVellis, R. F. (2003). Scale Development - Theory and Applications. Thousand Oaks, Sage Publications.

Drucker, P. (1970). "Entrepreneurship in business enterprise." Journal of Business Policy **1**(1): 3-13.

Drucker, P. F., Ed. (1986). Innovation and entrepreneurship : practice and principles. London, Pan Books.

Eisenhardt, K. M. and S. Brown, L. (1998). "Competing on the edge: Strategy as structured chaos." Long Range Planning **31**(5): 786.

Foster, J. J. (2001). Data Analysis Using SPSS for Windows. London, Sage Publications.

Gaglio, Connie M. / Katz, Jerome A. (2001): The Psychological Basis of Opportunity Identification: Entrepreneurial Alertness. In: Small Business Economics, S. 95-111

Gagnon, Y.-C., H. Sicotte, et al. (2000). "Impact of SME Manager's Behavior on the Adoption of Technology." Entrepreneurship Theory and Practice: 43-57.

Gartner, W B. (1988): Who is an Entrepreneur? Is the Wrong Question. In: American Journal of Small Business, Vol. 12, Nr. 4, S. 11-32.

Gravetter, F. J. and L. B. Wallnau (2000). Statistics for the behavioral science. Belmont, CA, Wadsworth.

Hair, J. F., R. E. Anderson, et al. (1998). Multivariante Data Analysis. Upper Saddle River, N.J., Prentice Hall.

Harms, R. (2004). Entrepreneurship in Wachstumsunternehmen: Unternehmerisches Management als Erfolgsfaktor. Wiesbaden, Deutscher Universitäts-Verlag.

Hills, G. E. / Lumpkin, G. T. Et Al. (1997): Opportunity Recognition: Perceptions and Behaviors of Entrepreneurs. In: Reynolds, P. D. et al. (Hrsg.): Frontiers of Entrepreneurship Research. Wellesley MA: Babson College.

Hitt, M. A., R. D. Ireland, et al. (2001). "Guest editors' introduction to the special issue: Strategic entrepreneurship: Entrepreneurial strategies for wealth creation." Strategic Management Journal **22**(6/7): 479.

Hubbard, R., D. E. Vetter, et al. (1998). "Replication in strategic management: Scientific testing for validity, generalizability, and usefulness." Strategic Management Journal **19**(3): 243 (12 pages).

Ireland, R. D., M. A. Hitt, et al. (2001). "Integrating entrepreneurship and strategic management actions to create firm wealth." The Academy of Management Executive **15**(1): 49 (15 pages).

Ireland, R. D., D. F. Kuratko, et al. (2003). Antecedents, elements, and consequences of corporate entrepreneurship strategy. Seattle, WA, Best Paper Proceedings: Academy of Management, Annual Meeting.

Kuratko, D. F., R. Duane Ireland, et al. (2004). Corporate entrepreneurship behavior among managers: a review of theory, research, and practice. Corporate entrepreneurship. J. A. Katz and D. A. Shepherd. Oxford, Elsevier Ltd. **7:** 7-45.

Landau, S. and B. S. Everitt (2004). A Handbook of Statistical Analyses using SPSS. Boca Raton, Champman & Hall/ CRC.

Lewis-Beck, M. S. (1994). Factor Analysis & Related Techniques. London, Sage Publications.

Loane, S. and J. Bell (2006). "Rapid internationalisation among entrepreneurial firms in Australia, Canada, Ireland and New Zealand." International Marketing Review **23**(5): 467.

Lumpkin, G. T. and G. G. Dess (1996). "Clarifying the entrepreneurial orientation construct and linking it to performance." Academy of Management. The Academy of Management Review **21**(1): 135.

Lumpkin, G. T. and G. G. Dess (1997). Proactiveness versus competitive agressiveness: Teasing apart key dimensions of an entrepreneurial orientation. Frontiers of Entrepreneurship Reserach. P. D. Reynolds. Wellesley, MA: Center for Entrepreneurial Studies**:** 47-58.

Lyon, D. W., G. T. Lumpkin, et al. (2000). "Enhancing entrepreneurial orientation research: Operationalizing and measuring a key strategic decision making process." Journal of Management **26**(5): 1055.

Miller, D. (1983). "THE CORRELATES OF ENTREPRENEURSHIP IN THREE TYPES OF FIRMS." Management Science (pre-1986) **29**(7): 770.

Miller, D. and P. H. Friesen (1982). "Innovation in Conservative and Entrepreneurial Firms: Two Models of Strategic Momentum." Strategic Management Journal **3**(1): 1 (25 pages).

Miller, D. and P. H. Friesen (1983a). "Strategy-Making and Environment: The Third Link." Strategic Management Journal **4**(3): 221.

Morris, M. H. and D. L. Sexton (1996). "The concept of entrepreneurial intensity: Implications for company performance." Journal of Business Research **36**(1): 5 (9 pages).

Nunnally, J. C. (1967). Psychometric Theory. New York, N.Y., McGraw-Hill.

Nunnally, J. C. (1978). Psychometric Theory. New York, N.Y., McGraw-Hill.

Pallant, J. (2005). SPSS survival guide. New York, Open University Press.

Schnell, R., P. Esser, et al. (2005). Methoden der empirischen Sozialforschung. München, Oldenburg Verlag.

Shane, S. (2000): Prior Knowledge and the Discovery of Entrepreneurial Opportunities. In: Organization Science, Vol. 11, No. 4, pp. 448-469.

Shane, Scott (2003): A General Theory of Entrepreneurship: The Individual-Opportunity Nexus. Cheltenham, UK: Edward Elgar.

Shane, S./ Eckhardt, J. (2003): The Individual-Opportunity Nexus. In: Acs, Z. J. / Audretsch, D. B. (ed.): Handbook of Entrepreneurship Research: An Interdisciplinary Survey and Introduction. Boston MA etc.: Kluwer Academic Publishers, pp. 161-191.

Shane, S. and S. Venkataraman (2000). "The promise of entrepreneurship as a field of research." Academy of Management. The Academy of Management Review **25**(1): 217 (10 pages).

Sharma, P. and J. J. Chrisman (1999). "Toward a reconciliation of the definitional issues in the field of corporate entrepreneurship." Entrepreneurship Theory and Practice **23**(3): 11 (17 pages).

Shepherd, D. A. and J. A. Katz (2004). Innovation and Corporate Entrepreneurship. Corporate Entrepreneurship. D. A. Shepherd and J. A. Katz. Oxford, Elsevier Ltd. **7:** 1-6.

Shepherd, D. A. and N. F. Krueger (2002). "An intentions-based model of entrepreneurial teams' social cognition." Entrepreneurship Theory and Practice **27**(2): 167-85.

Smart, D. T. and J. S. Conant (1994). "Entrepreneurial orientation, distinctive marketing competencies and organizational performance." Journal of Applied Business Research **10**(3): 28 (11 pages).

Stevens, J. (1996). Applied multivariate statistics for the social science. Mahway, NJ, Lawrence Erlbaum.

Stevenson, H. H. (1983). "A perspective on entrepreneurship." Harvard Business School Working Paper **9-384-131**.

Stevenson, H. H. and D. E. Gumpert (1985). "The Heart of Entrepreneurship." Harvard Business Review **63**(2): 85.

Stevenson, H. H. and J. C. Jarillo (1990). "A Paradigm of Entrepreneurship: Entrepreneurial Management." Strategic Management Journal **11**: 17-27.

Stevenson, H. H. and J. C. Jarrillo-Mossi (1986). "Preserving Entrepreneurship as Companies Grow." The Journal of Business Strategy **7**(1): 10-23.

Stopford, J. M. and C. W. F. Baden-Fuller (1994). "Creating corporate entrepreneurship." Strategic Management Journal **15**(7): 521 (16 pages).

Strahan, R. and K. Gerbasi (1972). "Short, homogenous version of the Marlowe-Crowne Social Desirability Scale." Journal of Clinical Psychology **28**: 191-193.

Tabachnick, B. G. and L. S. Fidell (2001). Using multivariate statistics. New York, HarperCollins.

Tharenou, P., R. Donohue, et al. (2007). Management Research Methods. Melbourne, Cambridge University Press.

Venkataraman, S. (1997): The Destinctive Domain of Entrepreneurship Research: An Editor's Perspective. In: Katz, J. / Brockhaus, J. (Hrsg.): Advances in Entrepreneurship, Firm Emergence, and Growth. Greenwich, CT: JAI Press, pp. 119-138.

Vesper, K. H. (1990). New venture strategies. Englewood Cliffs, N.J., Prentice Hall.

Wiesner, R., J. McDonald, et al. (2007). "Australian small and medium sized enterprises (SMEs): A study of high performance management practices." Journal of Management and Organization **13**(3): 227-248.

Wiklund, J. (1999). "The sustainability of the entrepreneurial orientation--performance relationship." Entrepreneurship Theory and Practice **24**(1): 37 (12 pages).

Zahra, S. A. (1986). "A canonical analysis of corporate entrepreneurship antecedents and impact on performance." Proceedings of the National Academy of Management **46**: 71-75.

Zahra, S. A. (1991). "Predictors and Financial Outcomes of Corporate Entrepreneurship: An Exploratory Study." Journal of Business Venturing **6**(4): 259.

Zahra, S. A. (1993). "Environment, corporate entrepreneurship, and financial performance: A taxonomic approach." Journal of Business Venturing **8**(4): 319 (22 pages).

Zahra, S. A. (1993a). "A conceptual model of entrepreneurship as firm behavior: A critique and extension." Entrepreneurship Theory and Practice **17**(4): 5.

Zahra, S. A. and J. G. Covin (1993). "Business strategy, technology policy and firm performance." Strategic Management Journal **14**(6): 451 (28 pages).

Zahra, S. A. and J. G. Covin (1995). "Contextual influences on the corporate entrepreneurship-performance relationship: A longitudinal analysis." Journal of Business Venturing **10**(1): 43 (16 pages).

Zahra, S. A., D. F. Jennings, et al. (1999). "The antecedents and consequences of firm-level entrepreneurship: The state of the field." Entrepreneurship Theory and Practice **24**(2): 45.

Zahra, S. A., D. O. Neubaum, et al. (2000). "Entrepreneurship in medium-size companies: Exploring the effects of ownership and governance systems." Journal of Management **26**(5): 947.

Zwick, W. R. and W. F. Velicer (1986). "Comparison of five rules for determining the number of components to retain." Psychological Bulletin(99): 432-442.

Appendix: List of items

		Strategic Orientation		
1.	As we define our strategies, our major concern is how to best utilize the resources we control.	1 2 3 4 5 6	As we define our strategies, we are driven by our perception of opportunity. We are not constrained by the resources at (or not at) hand.
2.	We limit the opportunities we pursue on the basis of our current resources.	1 2 3 4 5 6	Our fundamental task is to pursue opportunities we perceive as valuable and then to acquire the resources to exploit them.
3.	Opportunities control our business strategies.	1 2 3 4 5 6	Our business strategies are significantly influenced by the resources we have.
		Resource Orientation	
4.	Since our objective is to use our resources, we will usually invest heavily and rapidly.	1 2 3 4 5 6	Since we do not need resources to commence the pursuit of an opportunity, our commitment of resources may be in stages.
5.	All we need from resources is the ability to use them.	1 2 3 4 5 6	We prefer to totally control and own the resources we use.
6.	We like to employ resources that we borrow or rent.	1 2 3 4 5 6	We prefer to only use our own resources in our ventures.
7.	In exploiting opportunities, access to money is more important than just having the idea.	1 2 3 4 5 6	In exploiting opportunities, having the idea is more important than just having the money.
8.	We divide a project into several stages and decide about the required resources for each stage individually, before starting it.(multiple step commitment)	1 2 3 4 5 6	Before starting a project we decide which resources are needed throughout the project and clearly commit those. (full commitment)
9.	Our managers are dedicated to the same	1 2 3 4 5 6	Our managers devote their efforts to the same projects

	projects with long term commitment.		only for a short period of time and are then challenged by a new project.
10.	To maximize our return we invest as little resources as possible even though this strategy may increase the risk of failure.	1 2 3 4 5 6	We believe that the chances of success are better the more resources we invest.
11.	Borrowing, renting and contracting resources when we need them keep us up to the latest market developments and technologies.	1 2 3 4 5 6	Owning and controlling the resources we need makes us independent of market changes.
12.	We prefer the stability and the rapid availability of using resources that we own and are familiar with.	1 2 3 4 5 6	We like the flexibility of borrowing or renting resources we need for a project.
		Management Structure	
13.	We prefer tight control of funds and operations by means of sophisticated control and information systems.	1 2 3 4 5 6	We prefer loose, informal control. There is a dependence on informal relationship.
14.	We strongly emphasize getting things done even if this means disregarding formal procedure.	1 2 3 4 5 6	We strongly emphasize getting things done by following formal processes and procedures.
15.	We strongly emphasize holding to tried and true management principles and industry norms.	1 2 3 4 5 6	We strongly emphasize adapting freely to changing circumstances without much concern for past practices.
16.	Managers operating styles are allowed to range freely from very formal to very informal.	1 2 3 4 5 6	There is a strong insistence on a uniform management style throughout the firm.
17.	There is a strong emphasis on getting line and staff personnel to adhere closely to their formal job descriptions.	1 2 3 4 5 6	There is a strong tendency to let the requirements of the situation and the personality of the individual defines proper job behaviour.
		Reward Philosophy	
18.	Our employees are evaluated and compensated based on their responsibilities.	1 2 3 4 5 6	Our employees are evaluated and compensated based on the value they add to the firm.
19.	Our employees are usually rewarded by promotion and annual raises.	1 2 3 4 5 6	We try to compensate our employees by devising ways so they can benefit.
20.	An employee's standing is based on the value s/he adds.	1 2 3 4 5 6	An employee's standing is based on the amount of responsibility s/he has.
21.	An employee's performance is evaluated by short-term profit targets.	1 2 3 4 5 6	An employee's performance is evaluated by longer-term value creation for the firm.
22.	Rewarding in our firm is based on the employee's individual performance.	1 2 3 4 5 6	Rewarding teams for a good team performance is a common practice in our firm.
23.	We reward our employees by giving them more job flexibility and access to resources they might need to develop new ideas.	1 2 3 4 5 6	Increased responsibility levels are a common method of rewarding employees.
		Growth Orientation	
24.	It is generally known throughout the firm that growth is our top objective.	1 2 3 4 5 6	Growth is not necessarily our top objective. Long term survival may be at least as important.
25.	It is generally known throughout the firm that steady and sure growth is the best way to expand.	1 2 3 4 5 6	It is generally known throughout the firm that our intention is to grow as big and as fast as possible.
		Entrepreneurial Culture	
26.	We have many more promising ideas than we have time and the resources to pursue.	1 2 3 4 5 6	We find it difficult to find a sufficient number of promising ideas to utilize all of our resources.
27.	Changes in the society-at-large seldom lead to commercially promising ideas for our firm.	1 2 3 4 5 6	Changes in the society-at-large often give us ideas for new products and services.
28.	We never experience a lack of ideas that we can convert into profitable products/ services.	1 2 3 4 5 6	It is difficult for our firm to find ideas that can be converted into profitable products/ services.

The Entrepreneurial Orientation of Rapidly Internationalizing Service Firms and its Link to International Operations

Competitive Paper Submitted to:

The Eighteenth Annual High Technology Small Firms Conference

Enschede, Netherlands

May 27-28, 2010

Author: Fabian L. Sepulveda
Doctoral Researcher
Aalto University School of Economics
Helsinki, Finland
Email: fabian.sepulveda@hse.fi
Tel.: +358 (0) 40 353 8389
Fax: +358 9 4313 8880

ABSTRACT

This paper studies the international entrepreneurial orientation of rapidly internationalizing services firms (RISFs) and its relationship to three of their foreign market activities. Using multiple case studies we explore the research question: How does the international entrepreneurial orientation of rapidly internationalizing service firms affect their foreign market entry, market penetration, and growth? We build on entrepreneurship and international services literature to develop our research question that leads to the advancement of seven propositions as a foundation for further research. Three entrepreneurial orientation elements were investigated, of which proactiveness and innovativeness seemed to have the strongest links to RISF foreign activities. The analysis also uncovered interesting insights about RISF innovativeness some of which contradict extant services literature. Our paper makes three contributions: it provides *empirical* insights about RISFs, addressing a historical shortage of international services firm studies; it answers calls for further research in this area; it introduces an empirical analysis on service firm innovativeness at an international level, lending weight to similar future studies. We separately hope our research contributes to International Entrepreneurship research via our results linking RISF foreign activities and international entrepreneurial orientation.

Introduction

The importance of service firms in the global economy is unquestionable. Services have become the largest part of the world economy and their export growth has more than doubled in the past decade (UNCTAD 2008), which is evidence of an increasing trend in services internationalization. Yet international service firms have been historically understudied (Erramilli, 1990, 1992; Clark et al. 1996; Chadee & Mattsson 1998; Clark & Rajaratnam 1999; Samiee 1999; Davis 2004) and our knowledge about such organizations is relatively new (Knight 1999) and quite limited (Samiee 1999). As a consequence and despite a growing number of investigations into Born Globals (e.g. Knight & Cavusgil 2004; Gabrielsson et al. 2008), International New Ventures (e.g. Oviatt & McDougall 1994, 1995) and similar firms, little is known about the entrepreneurial orientation of Rapidly Internationalizing Service Firms (RISFs), that is, service companies that internationalize shortly after inception. This is problematic for two reasons: first, because numerous scholars believe that entrepreneurial behavior is related to superior firm performance (Covin & Slevin 1991; Lumpkin & Dess 1996, 2001; McDougall & Oviatt 1996; Knight 2001; Balabanis & Katsikea 2003) yet little is known about service firm entrepreneurial orientation; and second, because the particular challenges faced by service firms are frequently overlooked, such as having limited choices of foreign entry modes (Erramilli 1990), facing unique regulation and government policy (Davis 2004), and other operational difficulties unique to services (Zeithaml et al 1985). This situation prompts our main research question: how does the international entrepreneurial orientation of RISFs impact their foreign market entry, market penetration, and growth?

Studies about service companies have made a number of significant contributions including Erramilli's seminal works on international market entry (Erramilli 1990, 1992; Erramilli & D'Souza 1993; Erramilli et al 2002), marketing (Zeithaml et al 1985), typologies (Lovelock & Yip 1996; Clark et al 1996; Clark & Rajaratnam 1999; Patterson & Cicic 1995), sector specific internationalization (Majkgård & Sharma 1998; Coviello & Martin 1999), and comparisons to products firms (e.g. Peters & Brush 1996; Morris & Johnston 1987; Vargo & Lusch 2004). Yet these studies' application to RISFs is limited because most focus on well established, mature companies and few adequately explain *how* these firms behave entrepreneurially. At the same time, an emerging body of literature on service firm innovation shows that service firms face unique challenges and opportunities when they innovate, and innovativeness is a fundamental element of entrepreneurial orientation (Schumpeter 1934; Covin & Slevin 1991; Zahra & Covin 1995; Lumpkin & Dess 1996). However, few of these studies consider the relationship innovativeness may have with the foreign activities of service firms, particularly those that internationalize rapidly. This paper aims to contribute to this gap.

Based on a review of entrepreneurship and international services literature, we develop arguments that position our research question. We then briefly discuss our methods and findings, after which we advance seven propositions driven by our empirical results. Finally, we conclude with the aimed contributions to both theory and management, and areas for further research.

Literature Review

International Entrepreneurship

Largely fueled by the Born Global phenomenon, International Entrepreneurship (IE) attempts to explain the pursuit of international business opportunities through the integration of multiple disciplines (Dimitratos & Jones 2005; Oviatt & McDougall 1994; Zucchella & Scabini 2007). Although the field is still at an embryonic stage, several studies have already made significant contributions including conceptualizing IE (Oviatt & McDougall 1994, 2005; McDougall & Oviatt 2000; Jones & Coviello 2005; Zucchella & Scabini 2007), investigating differences between IE and domestic entrepreneurship (McDougall 1989; McDougall & Oviatt 1996); and exploring links between a firm's performance and its international entrepreneurial orientation (Knight 2001). In particular, these studies seem to have at least four characteristics in common. First, IE involves entrepreneurial behavior; second, it involves the crossing of domestic borders; third, it differs significantly from domestic entrepreneurship (McDougall 1989, McDougall & Oviatt 1996; McDougall et al. 2003); and fourth, it requires the *ongoing* pursuit of international opportunities (Zahra & George 2002). Although the mentioned contributions are significant and valuable, there are still other important areas in International Entrepreneurship that necessitate further investigation. To this end, our review revealed that little is known about the international entrepreneurship of *services* firms mainly due to three reasons. First, much of the entrepreneurship literature concentrates on new venture creation (e.g. Gartner 1988) or large firms (Covin & Slevin 1991; Zahra & Covin 1995) in the manufacturing sector and inside domestic borders. As a result, such studies lack an international focus and tend to overlook service firms. Second, the entrepreneurship field has long struggled to gain consensus on *what* constitutes entrepreneurship and what *entity* is entrepreneurial (Gartner 1988; Jantunen et al. 2005) fueling its conceptual fragmentation and making it difficult to separate entrepreneurial service firms from others. Third, innovativeness—a fundamental aspect of entrepreneurship (Schumpeter 1934; Covin & Slevin 1991; Lumpkin & Dess 1996)—in service firms is subject to unique challenges and opportunities (Gallouj & Weinstein 1997; Sundbo 1997; Van der Aa & Elfring 2002), and service innovation studies are scant and rarely include an international focus.

As a result, in this study we address these shortages as follows. We adopt Oviatt & McDougall's (2005) view of IE as "*the discovery, enactment, evaluation, and exploitation of opportunities—across national borders—to create future goods and services*" (p.540), but we emphasize that such pursuit of international opportunities must be *continual* and extend well beyond venture creation. To this regard, we agree with Zahra & George (2002) in their assertion that entrepreneurial behavior "*is an ongoing process that unfolds over time*" (p. 258). Furthermore, we take support from Lumpkin & Dess (1996) and Covin & Slevin (1991) to define International Entrepreneurial Orientation as behavior that is characterized by proactiveness, innovativeness, and risk-taking in a firm's pursuit of international opportunities. In this respect, a *proactive* firm has the capacity to anticipate and act on future needs and aggressively pursues opportunities; an *innovative* firm has a tendency to support new ideas, new combinations of extant ideas, entry to new markets, experimentation and new processes; *risk-taking* indicates the will to commit proportionately large amounts of resources despite a high potential for failure (Covin & Slevin 1991; Lumpkin & Dess 1996; Shane & Venkataraman 2000; Zucchella & Scabini 2007).

International Services

Our review of international services literature uncovered several contributions, three of which are most relevant for this paper. First, services have unique characteristics in comparison to other offering types (Zeithaml et al. 1985). Second, the characteristics of services limit the international entry options for the related companies (Erramilli 1990; 2002). Third, service firms face significant obstacles in their foreign operations as a result of heavy government regulation, labor laws, etc (Samiee 1999; Davis 2004). Each of these is briefly reviewed next.

Services have four main characteristics that differentiate them from other types of offerings: intangibility, perishability, heterogeneity, and inseparability (Zeithaml et al. 1985). In brief, these mean that services cannot be stored or readily displayed (intangibility); cannot be inventoried and perish after consumption (perishability); have variable quality and standardization making them difficult to control (heterogeneity); and often require production and consumption to be simultaneous, which means the consumer may be an active participant in the production process (inseparability). These characteristics pose unique challenges for service firms abroad, particularly in their international entry and foreign operations. The international market entry of service firms tends to be restricted (Erramilli 1990) since only those firms with the ability to decouple the production and consumption process –i.e. *hard services* firms—are able to export in a similar fashion as manufacturing companies (Erramilli 1990; Erramilli et al. 2002). Conversely, *soft services* firms—those in which the offering is inseparable between producer and consumer—are forced into choosing a more restricted set of market entry options like licensing, franchising, joint ventures, or wholly owned subsidiaries (ibid). These and other studies also show that the market entry behavior of services firms is considerably diverse, and this behavior seems to be moderated *inter alia* by the degree of uniqueness of the firm's offering (Erramilli et al. 2002). At the same time, rendering services in a foreign country typically requires firms to manage unique obstacles including immigration and labor policies, differing tax laws, the absence of bilateral tax treaties, government protectionism and policy (Samiee 1999, Davis 2004). In many instances, such obstacles prevent the rapid penetration of foreign markets (Lovelock & Yip 1996), particularly because of challenges in conducting foreign operations. Services are labor intensive (Davis 2004), have significant 'production' variability, and are highly susceptible to governmental monitoring (Morris & Johnston 1987). *People* render services and thus 'production' can only be increased by hiring additional staff, making economies of scale difficult to achieve (Davis 2004). Similarly, mass production is unachievable since producer and consumer must be proximate and co-participate in the 'production' process, which prevents the use of distributors and makes it difficult to balance supply and demand without the benefit of inventories (Zeithaml et al. 1985; Clark & Rajaratnam 1999). Similarly, in the 'production' of services, both producers and consumers are being transformed and are the transforming sources, making the inputs, outputs, and performance of 'production' difficult to specify in advance (Morris & Johnston 1987). At the same time, services sell *competences* (Gallouj & Weinstein 1997) which, at an international level, requires the hiring and training of individuals with particular characteristics, including multi-language abilities, cultural sensitivity, international business acumen, and local customer orientation (Clark & Rajaratnam 1999). This is an important point because a client's perception of quality and value depends highly on the manner in which that service is delivered (Clark & Rajaratnam 1999; Davis 2004), particularly because services cannot be typically be evaluated independently and in advance of the 'production' process (Patterson & Cicic 1995). As a result, the 'production' of services is

characterized by high variability and uncertainty (Morris and Johnston 1987) and quality assurance is difficult to predict, measure, and standardize (Zeithaml et al. 1985). Finally, international services firms face labor-related barriers such as immigration laws, labor regulation and policy, licensing or certification requirements (e.g. accountants, lawyers, surgeons, etc.), and local acculturation of hiring practices (Clark & Rajaratnam 1999; Davis 2004).

Under such challenging conditions, it is difficult to envision how young services firms make their journey into foreign markets. Yet many firms within the Born Global and similar literature are in services (e.g. Coviello 2006). However, the majority of these service firms tend to be technology developers (Coviello & Jones 2004) with few exceptions (e.g. Majkgård & Sharma 1998), leaving the internationalization of other service firms types overlooked. What remains understudied is what happens to young small services firms after they enter markets and how successful is their continued operation in their respective international markets, in terms of growth and market penetration. Our study aims to contribute to this gap.

Innovation in Services

As we have mentioned, according to the Schumpeterian school of thought, innovation is a significant element of entrepreneurship (Schumpeter 1934), and we agree. But given the particular characteristics of services mentioned above, a more detailed explanation of innovation is necessary. For this, we take support from Gallouj & Weinstein (1997) and view innovation in services as a process of introducing changes to the service 'product', delivery of that service, competences of the firm, or competences of the client, which are novel, repeatable, and have a lasting benefit on the firm (economic, strategic or otherwise). With this understanding of innovation in services, we found three types of innovation that appear to be the most prominent in the literature: product, process, and market innovations. An additional type that is commonly found among services firms but frequently neglected in academic research are *ad hoc* innovations (Gallouj & Weinstein 1997; Sundbo 1997).

In this study we will use the preceding explanation of innovation in services that takes support from Gallouj & Weinstein (1997). For purposes of brevity, our focus will be on *product* innovations, which refer to new service offerings that require fundamental changes in the type of services rendered, the competences of the producer and consumer, and may also involve changes to the service delivery process (Gallouj & Weinstein 1997). Furthermore, our study compares *radical* versus *incremental* innovations in order to investigate their respective impact on the foreign market operations of service firms. In this respect, radical innovations require the development of a complete new set of service characteristics, delivery processes, and competencies including recruitment, training, etc., which make it difficult (but not impossible) to apply in services (Gallouj & Weinstein 1997; Sundbo 1997); while incremental innovations are characterized by the addition or substitutions of elements (e.g. comprehensive versus collision-only car insurance) or combinations of services (Gallouj & Weinstein 1997; Sundbo 1997; van der Aa & Elfring 2002).

Methodology

The research question guiding this study is of an explanatory nature, since it investigates links between the international entrepreneurship and foreign operations of RISFs. As a result, a holistic multiple-case study design (Yin 2009) was considered most adequate for three reasons. First, because case studies are best positioned to answer "how" and "why" inquiries (Yin 2009), as is the case with our research question. Second, because we wished to acquire rich, in-depth data (Wright et al. 1988, Yin 2009). Third, because case studies facilitate the inductive gathering of new insights (Sutton 1997), which may have been originally unknown to the researchers.

We selected three case firms based on theoretical sampling (Eisenhardt & Graebner 2007) because they were particularly suitable for illuminating and extending the relationships we are investigating. Our case companies emerged from a wider set of firms operating inside a large Finnish business incubator as well as from other firms known to the researchers. In order to be selected as a case, companies had to pass through three 'filters'. First, all companies had to be purely within the services industry and not manufacture any physical goods. Second, all firms had to meet Oviatt & McDougall's (1994) definition of an International New Venture in that from inception, the firm sought to "derive significant competitive advantage from the use of resources and the sale of outputs in multiple countries" (p. 49). Third, they had to be organizations that were originally incepted as new firms (i.e. not spinoffs, joint ventures, etc.) at different stages of development and growth. (e.g. Gabrielsson et al. 2008). Furthermore, we excluded firms that had no sales because of difficulties in evaluating the market acceptance of their products or services. A brief description of the selected firms is included in table 2 below.

Table 1. Case Firm Summaries

MPS	Since 1975, Management Personnel Services (MPS) has created a market for many Human Resource (HR) services that previously did not exist in several of its current locations. From personnel assessment at inception to a portfolio of seven services today, (including HR strategy development, Executive coaching, Executive Search and helping organizations in their transitions), the two-person startup grew into a firm with more than 50% sales growth in nine years. Having entered its first foreign market just five years after inception, the firm now operates in over 30 countries across the globe. The firm is headquartered in Finland, has a staff of over 120, and has offices in 10 countries. MPS is now a mature organization with a strong brand and an established reputation.
Citec	Citec provides technical solutions and project services across many disciplines for clients in the Power, Civil, Rail Vehicles, Telecom, Life Science, and Process industries. In addition, the firm provides a wide range of technical communication services and solutions. Founded in 1984 by two colleagues, the firm has grown to into two divisions that employ a combined 1100 employees. In the past ten years, the firm's revenues have grown by an annual average of 33%. After an 8-year period of domestic growth, the firm entered Sweden as its first international market. It has since expanded to more than eight countries in Europe and Asia. The firm is headquartered in Finland, has offices in four locations across Europe and Asia. Citec is now a mature organization with strong brand and established reputation.
DynaRoad	Since inception in 2000, DynaRoad has developed software solutions for some of the largest civil engineering and construction companies in the Nordic region. After developing its 1st product, the firm grew domestically and abroad only three years after inception. Through a brief period of external ownership in 2003-2005, the firm remained autonomous and virtually with

	the same management team. It has since expanded its operations to six countries across three continents. Despite significant sales growth, the firm has yet to achieve profitability, which it expects to reach in 2010. The firm is headquartered in Finland, hires seven people, and is actively pursuing entry into additional foreign markets.

To gather data, we conducted semi-structured interviews and supplemented them with company and public documentation. Using an interview guide, data was collected per Yin's (2009) description of focused interviews and each case was treated as an independent experiment. In all questions, interviewees were asked to describe the progression of the particular topic from inception until today (e.g. "how has your firm's proactiveness developed from inception until today?"). All interviews included at least one of the original founders, and in the case of DynaRoad, the current Managing Director was also interviewed. In all cases, the founders were still active members of the leadership or executive team, except DynaRoad, which meant that the whole history of the firm resided with the original entrepreneurs. In DynaRoad's case, the original founder and the present Managing director were both interviewed, providing an entire picture of the firm's development.

Our data analysis followed the cross-case pattern matching guidelines set by Eisenhardt (1989) and Yin (2009) and was aided by NVIVO. More specifically, data was 'coded' into two sets of three constructs each. The first set included proactiveness, innovativeness, and risk-taking, which attempted to capture entrepreneurial orientation elements of the firm. Data coding into each of these three constructs had to be consistent with their explanation set forth in the literature review section. Proactiveness data was captured whenever a firm took specific action to discover, develop, and/or exploit business opportunities. When a firm created a new product, new offering, new market, or combination thereof, we logged it as innovativeness data. Similarly, risk-taking proclivity was recorded whenever the firm took actions that demonstrated a commitment of resources in the face of uncertainty or possibilities of substantial loss. The second set included firm growth, market entry, and market expansion, and these attempted to capture the progression of the firms' foreign activities. Firm growth was captured via annual sales, and in the absence of such information, we used employee growth and number of foreign markets entered as proxies. Market *entry* data was coded whenever a firm took action to enter particular foreign markets and such action led to revenues. Similarly, we coded market *penetration* data whenever the company actively tried to increase its client base and/or revenues in entered markets. The data results were then analyzed and synthesized into the findings reported in the sections that follow. NVIVO significantly facilitated the impartiality of data coding, the finding of relationships between the two sets of constructs, as well as the management of data.

Empirical Findings

International Entrepreneurial Orientation of RISFs

The international entrepreneurial orientation of the case firms appeared to be idiosyncratic to each organization. In general, all case firms had the intention to become international firms from the start, were aggressive in pursuing opportunities, created new innovations and/or markets, and demonstrated tolerance for risk-taking. These three elements of entrepreneurial orientation are analyzed further in detail next.

Proactiveness

All three firms were successfully able to anticipate and commercialize emerging opportunities. In two cases, alertness to new opportunities led to the introduction of new services that resulted in significant and sustained revenue growth for MPS and Citec. Similarly, DynaRoad's active search for opportunities led to the creation of its flagship products and hence its main source of revenues. Networking and 'cold-calling' were the two most frequent activities whenever all case firms pursued such opportunities both domestically and internationally. The companies seemed to be strongly active in networking for two main reasons. First, two of the companies (MPS & DynaRoad) initially had to create their own market as their services did not previously exist in their target geographies, and network relationships seemed to offer the easiest venue to 'educate' potential clients about the new services while simultaneously generating demand. As a result, both firms aggressively employed their extant networks and actively sought to enlarge them. Moreover, Citec and MPS believed that new business opportunities are best pursued by nurturing client relationships, delivering quality, and securing positive references. Consequently, their networking activities focused on preserving the (perceived) value in their client relationships rather than on activities to purely extract further revenues. Second, the organizations rely heavily on clients for novel ideas, co-development, references, or reputation building, in an effort to identify and pursue new business. In addition to networking, two of the firms vigorously sought and won significant new business via 'cold-calling' customers outside their known network of relationships. One of Citec's single largest clients and many of DynaRoad's recent customers were obtained through cold-calling.

Today, all companies remain highly proactive in their pursuit of new opportunities and continue to use networking activities both to generate new revenues and pursue emerging opportunities. However, given their larger size, MPS and Citec also employ partnerships and acquisitions as additional venues for growth, whereas DynaRoad continues to use the same venues mentioned above.

Innovativeness

The case firms demonstrated strong innovativeness by creating services that did not previously exist or solving existing problems in new ways. All organizations had both radical and incremental innovations, but not from the start: Only two of the firms were incepted to pursue radical innovations, while Citec's radical innovations came at a later stage. Although all firms continue to produce innovations, only MPS and Citec seem to have developed subsequent radical innovations, whereas Dynaroad's have been primarily incremental. The degree of innovation in

DynaRoad's original product has been difficult to replicate since the products that followed have been enhancements to the original creation. Citec has a handful of radical innovations, which are backed by patents and seem to be outnumbered by incremental innovations. Lastly, two of MPS's innovations can be considered radical (personnel assessment and outplacement services) because at the time when they were introduced, such services were rare or non-existent in many of MPS's target markets. The differences in the production of radical innovations may be related to differences in the firms' development, because as both MPS and Citec are mature firms, they may have had more time to develop subsequent radical innovations than DynaRoad, who is emerging from its initial stages. That said, the data suggested that incremental innovations (as compared to radical innovations) were the most frequently produced by all firms.

As a result of their radical innovations, MPS and DynaRoad went through a period of 'product' or market development, which *inter alia* kept them domestic for five and three years respectively. The firms deemed this necessary in order to develop completely new markets, a mature product (DynaRoad), and a strong reputation (MPS) prior to engaging in international markets. In all instances, radical innovations facilitated entry to foreign markets, while incremental innovations seem to have become more relevant in markets where the firm was already operating. The data seemed to reveal that the radical innovation is what initially attracted the business to the foreign country whereas incremental innovations occurred most frequently once the firm and client(s) were already working together. Citec's innovations were less related to its delayed entry into foreign markets. More specifically, the firm's founder believed no international customer would be interested in their services unless the firm demonstrated a history of positive results, prompting Citec to develop its domestic sales *prior* to going international.

It is important to note that not all firms co-created their innovations with clients. MPS explained that all of its business ideas emerged from within the firm. Citec *identified* some of innovations during client engagements, however, the *development* of such innovations (some of which were later patented) was not co-created with customers. Conversely, DynaRoad has always developed their innovations jointly with clients.

Risk-Taking

All three firms seemed to have a preference to internationalize in nearby markets before going further outward. Sweden, Denmark, or Norway was most frequently sought as the first international market, although DynaRoad's first foreign entry was fortuitously in the USA as a result of attending a local academic conference.

To cope with internationalization risks, all firms seem to rely on their networks, although DynaRoad has also risked international entry without its networks. More specifically, it seems that MPS prefers to enter countries via partnerships while Citec's recent international acquisitions are companies that had a history with the firm. Similarly DynaRoad has a policy to secure at least one customer to fund and jointly develop products, perhaps restricting its ability to independently choose entry into particular foreign markets.

All companies continue to pursue additional international opportunities, but their risk-taking proclivity seems to have changed. That is, MPS and Citec will only explore new opportunities that fit or complement their services portfolio. Although DynaRoad continues its policy to secure

at least one customer to fund and jointly develop products, it is significantly strengthening its internationalization efforts via additional funding and hiring. We believe the differences in entrepreneurial orientation between firms are related to differences in their development phase, with DynaRoad being the least developed. More explicitly, the data suggests that the younger the firm, the more it was willing to pursue new ideas, but as the firm grows, that willingness becomes more structured and less spontaneous.

Foreign Activities of RISFs

International Market Selection & Entry

The international market selection and entry of all firms seemed to be both deliberate *and* fortuitous. On the one hand, when entry was deliberate, the most common criteria to select countries were the availability of networks in target locations, market attractiveness & perceived opportunities, and language capabilities of firm staff. Entry was typically achieved through networking, partnerships, acquisitions, subsidiaries, or cold-calling. For example, MPS's founder describes their entry into Japan: *"we recruited a Japanese person [in Finland]…who took care of our Japanese clients in Scandinavia…for more than ten years, and then [he] moved back to Japan…and represented us there".* On the other hand, when entry was serendipitous, it typically emerged from events such as attending international academic conferences, organizing or participating in trade shows, obtaining direct international orders, etc. These findings revealed that the *fit* between foreign markets and the firms' innovations as a reason to *select* particular locations for entry was often subordinate to the other reasons mentioned above. However, the companies' innovations *did* facilitate the actual entry process in several cases, particularly when such innovations were patented.

Although our case firms are similar in that they operate in highly-specialized service sectors, their speed to internationalization varied significantly. DynaRoad's ability to license and export its products abroad facilitated its international entry only three years after inception. However, the international entry of the two other firms appeared to delay for two reasons. First, the firms needed to establish a new highly-specialized market for services that were rare, non-existent, or required the 'education' and 'training' of target customers. Second, MPS and Citec sought to build a strong reputation on their way to international markets because the founders of both firms believed that this was a fundamental way to secure business, particularly as the founders of both firms remarked that in services, the company's reputation is absolutely fundamental. In addition, Citec's international entry was further delayed because the founders begun working on a full-time basis at the firm four years after inception, (taking the firm international three years after that).

International Market Penetration

During their early stages, all case companies seemed to experience difficulties in expanding operations in their respective foreign markets. Three elements that emerged as causes for delays in expansion were the degree of 'novelty' in the services offered, the maturity of the target market (that is, whether the target market was more or less developed than the domestic market,

helping to determine the level of adjustment required to the services offered), and the level of interconnectedness between target clients.

As we have previously mentioned, the high degree of novelty in MPS' and DynaRoad's services, required the firms to educate their target market at the beginning stages in order to create demand. In short, this meant that further expansion required further client 'educating' and therefore took time. At the same time, the companies depended on the overall development of their target markets. For example, as MPS grew, the markets in which it operates also developed, significantly raising awareness for the firm's services, thus making market penetration easier. Similarly, when DynaRoad's markets were more 'advanced' than that of Finland, the firm's products were adjusted to satisfy clients' needs, and when they were 'less advanced', the firm defaulted back to 'educating' customers. In DynaRoad's case, two additional reasons have hindered market penetration: first, DynaRoad believes its target clients are not well interconnected (as in other industries) and hence rarely share or disseminate information about the firm's products; second, clients consider DynaRoad's products a competitive advantage and therefore do not wish to divulge the existence of such products.

Firm Growth

The case firms have achieved varying levels of growth in terms of sales, number of employees, or number of foreign markets entered. Citec and MPS are the most developed by all three measures, and they are also the oldest. In turn, Dynaroad, is the youngest and is still working toward profitability. Today, MPS has the broadest world coverage with operations in thirty countries, whereas Citec and DynaRoad have a presence in seven and six international markets respectively.

Table two below provides a summary of our empirical results.

Table 2. Empirical Results Summary

	International Entrepreneurial Orientation	**Market Entry, Market Penetration, and Firm Growth**
MPS	Strongly proactive in networks during early stages and today. Incepted to pursue radical innovation, and created a least two radical innovations and multiple incremental ones. All innovations emerged from within the firm. Risk appetite to internationalize strong during early stages but more structured today.	Seemed to have a preference for Nordic countries as first points of international entry. Radical innovations kept firm domestic briefly but later facilitated foreign entry. Seems to prefer partnerships as main foreign entry mode. Has achieved tremendous growth in terms of employees and number of foreign markets entered.

Citec	Demonstrates strong proactiveness via networking and cold-calling. Started with incremental innovations and later developed several radical ones. Some innovations developed in-house and others jointly with clients. Risk tolerance to internationalize strong but structured.	Seemed to have a preference for Nordic countries as first points of international entry but now has major operations in other regions. Chose to have domestic growth prior to internationalizing. Both incremental and radical innovations facilitated foreign entry and penetration. Employs partnerships, acquisitions, and whole subsidiaries as venues for international entry. Has achieved significant growth in revenues, employees, and number of foreign markets entered.
DynaRoad	Aggressive in both networking and cold-calling. Started with radical innovation and has yet to duplicate it, but has produced multiple incremental innovations. All innovations jointly developed with clients as a matter of policy. Risk appetite to attach international markets is as strong today as during inception.	Did not appear to have particular regional preference for first points of foreign entry. Ability to license enabled its fast international entry. Radical innovations kept firm domestic briefly but later facilitated foreign entry. Has achieved growth in revenues, employees, and number of foreign markets entered, but has yet to achieve profitability.

Discussion and Proposition Development

In this section, we discuss our empirical findings in order to identify emerging patterns and compare them to extant research. More specifically, we analyze the international entrepreneurial orientation (IEO) and foreign activity constructs to identify relationships between them and juxtapose such relationships with earlier studies. On the basis of this analysis, we advance seven propositions, of which five are about the aforementioned relationship and two are about the innovation of RISFs.

Proactiveness and firm growth

As we previously mentioned, all firms demonstrated strong proactiveness mainly via networking and cold-calling activities. Not only did our case firms aggressively seek out, establish, and expand their own networks, but they used such networks to anticipate and act upon emerging opportunities: Citec's and DynaRoad's largest customers emerged from within the firms' networks and MPS used its networks to successfully commercialize two radical innovations at separate points in time. These findings contradict Sundbo (1997) who suggests *service* firms are not very efficient in establishing or using external networks. On the other hand, our results find support in (non-service specific) studies that suggest networks are a primary source for the discovery and exploitation of entrepreneurial opportunities (Håkansson & Snehota 1995; Hoang & Antoncic 2003; Harris & Wheeler 2005; Zhou et al. 2007). DynaRoad and Citec were also very active in cold-calling new clients, which yielded positive results including Citec's market entry into Norway. This finding contradicts much of the internationalization literature which suggests companies internationalize through networks (e.g. Johanson & Mattsson 1988, 1992) or that service firms establish foreign operations to follow clients or seek new markets (Erramilli 1990; Majkgård & Sharma 1998) because in this particular instance, Citec simply pursued the opportunity directly, without the benefit of networks in Norway or without having already targeted Norway as a potential market.

The data suggests that the years when the firms achieved their strongest results appear to coincide with the firms' most proactive efforts to grow. For example, the year after DynaRoad emerged from external ownership, the firm revamped its full-time sales staff and realigned its sales strategies, which led to revenue growth of more than 230% that year (in comparison to a yearly growth average of 128% up to that point). Similarly, in 1989 Citec began to experience unprecedented revenue growth because of their partnering efforts and the founders' switch from part-time to full-time employees. In the words of one of the founders:

"from '84 to '89, five years…[Citec] was growing very slowly, I think [in] '89 we were six employees ... But then we [joined] a company…that was an engineering company…that gave an umbrella…[and in '89] I started one hundred percent to work for the company… I should say, then it started to grow very fast, this company"

These and other efforts have taken Citec from a two-man operation to over 1100 employees in numerous locations across Europe and Asia. In a similar vein, MPS funded its aggressive internationalization activities by plowing back all dividends during its first 20 years, by which time MPS was firmly established in Nordic, the Baltics, central Europe, and Japan. MPS's also grew from its original two founders to well above 120 employees in offices across ten countries. These findings suggest a strong relationship between proactiveness and firm growth, and extant

research supports this finding (e.g. Lumpkin & Dess 1996, 2001). However, our results differ slightly from Lumpkin and Dess (1996) who propose that entrepreneurial orientation has a stronger link to performance when the firm is in a technologically sophisticated environment than the opposite low-tech environment. Our findings suggest that the performance of all case firms had a positive link with entrepreneurial orientation—regardless of technological sophistication. Based on the preceding discussion, we believe that proactiveness and firm growth, (when an increase in sales, employees, or number of foreign markets is viewed as firm growth) are related, particularly when the firm operates in international markets. Consequently, we advance our first proposition:

Proposition 1*: The proactiveness of a RISF is positively related to firm growth in foreign markets*

Innovativeness and its links to market entry and penetration

In investigating links between RISF innovativeness and market entry & expansion, we focused our analysis in three areas. First, we evaluated the firm's innovativeness in terms of radical and incremental innovations. The aim was to identify the firms' ability to create and duplicate such innovations at various points in their development. Second, we searched for emerging patterns between innovativeness and market entry and penetration. Third, we wished to identify additional patterns related to RISF innovativeness and foreign operations that we may not have initially considered. Each of these is discussed next.

As previously mentioned, all case firms had both radical and incremental innovations, but the development of these found mixed support in extant studies. Consistent with *services* literature (Gallouj & Weinstein 1997), Citec's innovations progressed from incremental to radical. However the two other firms were *incepted* to pursue radical innovations as suggested in Born Global and similar literature (e.g. Gabrielsson et al. 2008). This latter finding suggests that the development of radical versus incremental innovations is idiosyncratic to each firm and at times may be different than a 'trial-and-error' development process that culminates in radical innovations (Gallouj & Weinstein 1997). Having said that, the firms generated more incremental innovations than radical ones, and only MPS and Citec have successfully commercialized subsequent radical innovations. As a result, we believe that the progression from incremental to radical may be present in the innovations of all firms but at different points in their development—even though their starting innovation type may differ, they seem to eventually enter the same innovation production 'circle' that fluctuates between incremental and radical. This may be particularly true as international service offerings must typically be adjusted to local environments (Clark et al. 1996; Lovelock & Yip 1996; McLaughlin & Fitzsimmons 1996; Samiee 1999), hence promoting the creation of incremental innovations (as enhancements or adaptations) more so than radical ones. Based on these results, we propose:

Proposition 2: *The radical innovation(s) of RISFs:*

> ***2a****: are seldom replicated;*
>
> ***2b****: tend to occur less frequently than incremental innovations;*
>
> ***2c****: fluctuate between incremental innovations, if subsequent radical innovations are generated*

Interestingly, the radical innovations of some firms seemed to both delay *and* facilitate the companies' international entry. On the one hand, the degree of 'radicalism' or novelty of the firms' innovations caused a delay in the firms' international entry. This delay was prompted by a need to develop a mature product (DynaRoad), a drastically new market (MPS), and a strong reputation (MPS) prior to engaging in international markets. More specifically, Dynaroad delayed its international market entry after attending international conferences and trade shows where it determined that its products needed to be adjusted to better satisfy international standards and expectations. Similarly, MPS went through a brief period of domestic growth, which it considered necessary to develop its market and build a reputation prior to internationalizing. These results suggest that, contrary to some of the Born Global and related literature (Oviatt & McDougall 1995; Gabrielsson et al 2008), the 'novelty' in some of our case firms' innovations prompted the companies to *delay* international entry, even if at times the innovations could offer a competitive advantage over indigenous firms. This finding aligns with Erramilli et al. (2002) who propose that service firm market entry is moderated *inter alia* by the degree of uniqueness of the firm's offering. On the other hand, once Citec and DynaRoad had decided to go international, their radical innovations facilitated their ability to enter foreign markets: Four of Citec's patents paved their market entry into Japan and several locations in central Europe; while DynaRoad's product uniqueness facilitated entry into six countries in three continents. In turn, the data suggests that incremental innovations are the most frequently used in *penetrating* extant markets because after the firms enter a foreign market, they frequently adjust service offerings to meet local expectations, prompting incremental innovations that may yield additional revenues. However, MPS seems to be an exception in that the firm generated an additional radical innovation that was used to penetrate business in all extant locations. Based on these results we make the following two propositions:

Proposition 3*: The more radical the innovation, the longer a RISF takes to develop its extant foreign markets*

Proposition 4*: Radical innovations facilitate the foreign market entry of RISFs while incremental innovations help penetrate extant markets*

One of our early intuitions in this investigation was that the fit between innovativeness and target foreign market would be a fundamental reason to select and enter particular foreign markets, as implied in some of the services literature (e.g. Ekeledo & Sivakumar 1998; Erramilli et al. 2002). But as the data revealed, this reason was subordinate to other seemingly more important reasons in choosing foreign markets, as supported by extant research, including availability of networks in target geographies (Coviello & Martin 1999; Majkgård & Sharma 1998), market attractiveness & perceived opportunities (Erramilli 1990; Majkgård & Sharma 1998), and language capabilities of firm staff. We therefore propose:

Proposition 5*: The fit between a RISF's innovation(s) and a foreign market as a reason to enter that market is subordinate to other reasons including (1) availability of networks at the target country or (2) market attractiveness*

As we analyzed our data, we identified additional interesting patterns related to RISF innovativeness, which we had not originally considered. One such pattern is that not all firms jointly developed innovations with clients as frequently suggested by services research (Morris & Johnston 1987; Lovelock & Yip 1996; Vargo & Lusch 2004). As MPS explained, all of its

innovations emerged from within the firm, some of which were radical. Because MPS was creating a completely new market that had neither a precedent nor a comparable substitute, no knowledge could come from sources outside the firm, and we believe this is partially why all MPS innovations were incepted in-house. We also believe this view is supported in Sarasvaty's (2001) effectuation concept, which is appropriate to analyze the creation of firms and markets that have little or no precedence, as was the case with MPS. Based on these results we advance our next proposition:

Proposition 6*: Some of a RISF's innovations are not jointly created and/or developed with clients, and these tend to be radical innovations*

Risk-taking and market entry

The relationship between risk-taking and market selection was present, but it appeared to be much weaker than we originally thought. Contrary to much of service internationalization literature (e.g. Clark & Rajaratnam 1999; Lovelock & Yip 1999; Davis 2004), none of the case firms reported to have faced particular difficulties in entering their extant foreign markets due to government policy & regulation, labor laws, or the characteristics of services. However, they did emphasize that company reputation was of utmost importance due to the tangibility element of their offerings. Consequently, perceived foreign risks (specific to services companies) did not appear to be a primary factor in our firms' selection and entry of foreign markets. Instead, other elements seemed to be of stronger concern to the firms when going international, such as availability of local networks, market attractiveness, and likeness to domestic markets among others. This last point is strongly supported by much of the extant internationalization literature (Erramilli 1990; Coviello & Martin 1999; Majkgård & Sharma 1998) as we previously mentioned. In short, the RISFs' risk-taking appetite did not appear to be a primary factor in the selection and entry of foreign markets, hence:

Proposition 7: *The risk-taking proclivity of RISFs has a weak influence in market selection & entry, and is subordinate to other influences including (1) availability of networks at the target country or (2) market attractiveness*

Conclusion

This paper was an empirical study about the international entrepreneurship orientation (IEO) of rapidly internationalizing services firms (RISFs) and its relationship to three of their foreign market activities. Based on entrepreneurship and international services literature, we developed our research question: How does the international entrepreneurial orientation of rapidly internationalizing service firms affect the firm's foreign market entry, market expansion, and growth? Based on our findings we developed seven propositions, of which five are directly tied to the research question, and two that emerged from our analysis of RISF innovativeness.

Our analysis revealed the presence of a relationship between a RISF's international entrepreneurial orientation and its international activities, however, the findings varied across the elements examined. In summary, strong levels of proactiveness coincided with firm growth and international expansion. We also found that the more radical the innovation, the longer a RISF took to develop foreign markets, although radical innovations facilitated international entry while incremental innovations helped penetrate extant markets. Furthermore, the *fit* between a firm's innovation and a foreign market as a reason to enter that market was found to be subordinate to other reasons. Separately, risk appetite appeared to be idiosyncratic to each firm, but seemed to have a weak influence in some firms' foreign market selection and entry. Two of our most interesting findings were about a RISF's innovativeness. First, radical innovations were seldom duplicated, tended to be outnumbered by incremental ones, and their production fluctuated between periods of incremental innovation production. Second, some of the firms' innovations were *not* jointly developed with customers as it is often professed in extant services literature, and those tended to be radical innovations.

We acknowledge that the international operations and performance of RISFs are influenced by other elements than those discussed in this paper, including networks, internal resource development, and exogenous events. However, for purposes of focus our study concentrated only in the aforementioned elements. We also recognize that longitudinal studies may be better suited to understand RISF innovativeness and international performance, as both are ongoing processes that develop over time and may change as a result of numerous factors. In addition, this was an exploratory investigation mainly intended to identify extant patterns in RISFs' international entrepreneurial orientation. As a result, we believe there is significant value in further research about RISFs in general, but also about their *continual* international entrepreneurial orientation and international performance. One particularly interesting area for further research would be a study about the international entrepreneurial orientation of RISFs through the lens of causation and effectuation (Sarasvathy 2001) in order to understand how the firms manage the creation of totally new international service markets.

We believe our study contributes to theory by providing empirical results about a RISFs international entrepreneurial orientation; addressing a historical shortage of studies about international services; and introducing empirical insights about international service firm innovativeness that may lend weight to future studies in this area. We also hope the results help RISF managers in making decisions about internationalizing their innovations, particularly, in their strategic use of radical versus incremental innovations.

Acknowledgements

This research is part of the "Born Globals - Growth Stages and Survival" -cooperation project between the Helsinki School of Economics, the University of Vaasa, and six companies. We would like to thank the financiers of the project: the LIITO-program of the Finnish Funding Agency for Technology and Innovation (Tekes), and the partner firms.

References

Balabanis, George I., Katsikea, Eva. S. (2003). Being an entrepreneurial exporter: does it pay? International Business Review 12: 233–252.

Chadee, D., Mattsson, J. (1998). Do service and merchandise exporters behave and perform differently? European Journal of Marketing, 32(9/10): 830-842

Clark, T., Rajaratnam, D., Smith, T. (1996). Toward a Theory of International Services: Marketing Intangibles in a World of Nations. Journal of International Marketing, 4(2): 9-28

Clark, T., Rajaratnam, D. (1999). International services: perspectives at century's end. Journal of Services Marketing, 13(4/5): 298-310.

Covin, J., Slevin, D. (1991). A Conceptual Model of Entrepreneurship as Firm Behavior. Entrepreneurship Theory and Practice. Fall, 7-25.

Coviello, N.E. (2006). The network dynamics of international new ventures. Journal of International Business Studies, 37: 713–731.

Coviello, N.E., Jones, M.V. (2004). Methodological issues in international entrepreneurship research. Journal of Business Venturing, 19: 485–508.

Coviello, N.E., Martin, K. A.-M. (1999). Internationalization of Service SMEs: An Integrated Perspective from the Engineering Consulting Sector. Journal of International Marketing, 7(4): 42-6.

Davis, Tim R.V. (2004). Different service firms, different international strategies. Business Horizons 47(6): 51-59.

Dimitratos, P., Jones, M. (2005). Future directions for international entrepreneurship research. International Business Review, 14:119–128.

Eisenhardt, K. (1989). Building Theories from Case Study Research. Academy of Management Review, 14(4): 532-550

Eisenhardt, K., Graebner, M. (2007). Theory Building from Cases: Opportunities and Challenges. Academy of Management Journal, 50(1): 25-32

Ekeledo, I., Sivakumar, K. (1998). Foreign Market Entry Mode Choice of Service Firms: A Contingency Perspective. Journal of the Academy of Marketing Science, 26 (4): 274-292.

Erramilli, K. (1990). Entry Mode Choice in Service Industries. International Marketing Review, 7(5): 50-62.

Erramilli, K. (1992). Influence of Some External and Internal Environmental Factors on Foreign Market Entry Mode Choice in Service Firms. Journal of Business Research, 25: 263-276.

Erramilli, K. and D'Souza D. (1993). Venturing into Foreign Markets: The Case of the Small Service Firm. Entrepreneurship Theory & Practice, 17(4): 29-41.

Erramilli, K., Agarwal, S., Dev, C. (2002). Choice Between Non-Equity Entry Modes: An Organizational Capability Perspective. Journal of International Business Studies, 33(2): 223-242

Gabrielsson, M., Kirpalani, V.H.M., Dimitratos, P., Solberg, C.A., Zucchella, A. (2008). Born globals: Propositions to help advance the theory. International Business Review, 17: 385–401.

Gallouj, F. Weinstein, O. (1997). Innovation in Services. Research Policy, 26: 537-556.

Gartner, W.B. (1988). "Who Is an Entrepreneur?" Is the Wrong Question. Entrepreneurship Theory & Practice, Spring, 1988, 47-68.

Harris, H., Wheeler C. (2005). Entrepreneurs' relationships for internationalization: functions, origins, and strategies. International Business Review, 14: 187-207.

Hoang, H., and Antoncic, B. (2003). Network-based research in entrepreneurship: A critical view. Journal of Business Venturing, 18: 165-187.

Håkansson, H., Snehota I. (1995). Developing Relationships in Business Networks. Routledge, London.

Jantunen, A., Puumalainen, K., Saarenketo, S., Kyläheiko, K. (2005). Entrepreneurial Orientation, Dynamic Capabilities and International Performance. Journal of International Entrepreneurship 3: 223–243.

Johanson, J. & Mattsson, L.-G. (1988). Internationalization in Industrial Systems—A Network Approach. In: Hood N. and Vahlne J-E. (eds) Strategies in Global Competition. Croom Helm, New York, pp. 87-314.
Johanson, J. & Mattsson, L.-G. (1992). Network positions and strategic action—an analytical framework. In: Axelsson B. and Easton G. (eds) Industrial Networks: A New View of Reality. Rougledge, London, pp. 205-217.
Jones, M.V., Coviello, N.E. (2005). Internationalisation: conceptualising an entrepreneurial process of behavior in time. Journal of International Business Studies, 36: 284–303.
Knight, Gary A. (2001). Entrepreneurship and strategy in the international SME. Journal of International Management, 7: 155–171.
Knight, Gary A., Cavusgil, Tamar S. (2004). Innovation, Organizational Capabilities, and the Born Global Firm. Journal of International Business Studies, 35: 124-141.
Lovelock, C.H., Yip, G.S. (1996). Developing Global Strategies for Service Businesses. California Management Review, 38(2): 64-86.
Lumpkin, G. T., Dess, G. G. (1996). Clarifying the Entrepreneurial Orientation Construct and Linking It to Performance. The Academy of Management Review, 21(1): 135-172
Lumpkin, G. T., Dess, G. G. (2001). Linking Two Dimensions of Entrepreneurial Orientation to Firm Performance: The Moderating Role of Environment and Industry Life Cycle. Journal of Business Venturing, 16, 429-451.
Majkgård, A., Sharma, D. Deo (1998). Client-Following and Market-Seeking Strategies in the Internationalization of Service Firms. Journal of Business-to-Business Marketing, 4(3): 1-41.
McDougall P.P. (1989). International versus Domestic Entrepreneurship: New Venture Strategic Behavior and Industry Structure. Journal of Business Venturing, 4: 387-400.
McDougall P.P., Oviatt, B.M. (1996). New Venture Internationalization, Strategic Change, and Performance: A follow-up study. Journal of Business Venturing ,11: 23-40.
McDougall P.P, Oviatt, B.M. (2000). International Entrepreneurship: The Intersection of Two Research Paths. The Academy of Management Journal, 43(5): 902-906.
McLaughlin, C.P., Fitzsimmons, J.A. (1996). Strategies for globalizing service operations. International Journal of Service Industry Management, 7(4): 43-57.
Morris, B., Johnston, R. (1987). Dealing with Inherent Variability: The Difference Between Manufacturing and Service. International Journal of Operations & Production, 7(4): 13-22.
Oviatt, B.M., McDougall P.P. (1994). Toward a theory of international new ventures. Journal of International Business Studies, 25(1): 45-64.
Oviatt, B.M., McDougall P.P. (1995). Global start-ups: Entrepreneurs on a worldwide stage. Academy of Management Executive, 9 (2): 30-43.
Oviatt, B.M., McDougall P.P. (2005). Defining International Entrepreneurship and Modeling the Speed of Internationalization. Entrepreneurship Theory and Practice. September, 537-553.
Patterson, P., Cicic, M. (1995). A Typology of Service Firms in International Markets: An Empirical Investigation. Journal of International Marketing, 3(4): 57-83.
Peters, M.P., Brush, C.G. (1996). Market Information Scanning Activities and Growth in New Ventures: A Comparison of Service and Manufacturing Businesses. Journal of Business Research, 36: 81-89
Sarasvathy, S. (2001). Causation and Effectuation: Toward a Theoretical Shift from Economic Inevitability to Entrepreneurial Contingency. The Academy of Management Review, 26(2): 243-263.
Samiee, S. (1999). The internationalization of services: trends, obstacles, and issues. Journal of Services Marketing, 13(4/5): 319-328
Schumpeter, J.A., 1934. The Theory of Economic Development: An Inquiry into Profits, Capital, Credit, Interest and the Business Cycle. Harvard University Press, Cambridge, MA.
Shane, S. & Venkataraman, S. (2000). The promise of entrepreneurship as a field of research. Academy of Management Review, 25: 217–226.

Sundbo, Jon. (1997). Management of Innovation in Services. The Service Industries Journal, 17(3): 432-455.
Sutton, Robert. (1997). The Virtues of Closet Qualitative Research. Organization Science, 8(1): 97-106
United Nations Conference on Trade and Development (UNCTAD). (2008). UNCTAD Handbook of Statistics 2008. Accessed online: http://stats.unctad.org/Handbook/ReportFolders/reportFolders.aspx
Van der Aa, W., Elfring, T. (2002). Realizing innovation in services. Scandinavian Journal of Management, 18: 155-171.
Vargo, S.L., Lusch, R.F. (2004). The Four Service Marketing Myths: Remnants of a Goods-Based, Manufacturing Model. Journal of Service Research, 6(4): 324-335.
Wright, L., Lane, H.W., Beamish, P.W. (1988). International Management Research: Lessons from the Field. International Studies of Management and Organization, 18(3):55-71
Yin, R. (2009). Case Study Research. Design and Methods. Fourth Edition. London: Sage.
Zahra, S.A., Covin, J.G. (1995). Contextual Influences on the Corporate Entrepreneurship-Performance Relationship: A Longitudinal Analysis. Journal of Business Venturing, 10: 43-58.
Zahra, S.A., George, G. (2002). International Entrepreneurship: The current status of the field and future research agenda. In M. Hitt, D. Ireland, D. Sexton, & M. Camp (Eds.), *Strategic Entrepreneurship: Creating an integrated mindset* (pp. 255-288). Oxford: Blackwell.
Zeithaml, V., Parasuraman, A., Berry, L. (1985). Problems and Strategies in Services Marketing. Journal of Marketing, 49: 33-46
Zhou, L., Wu, W.-P., Luo, X. (2007). Internationalization and the performance of born-global SMEs: the mediating role of social networks. Journal of International Business Studies, 38(4): 673-690.
Zucchella, A. and Scabini P. (2007). International Entrepreneurship: Theoretical Foundations and Practices. Palgrave MacMillan, Hampshire, UK.

VALUEPOLE,
AN EX-ANTE PREDICTIVE REVENUE PERFORMANCE TOOL FOR NPD IN SMES

Corresponding Author:
Ann Sheahan,
ManOPT Systems Ltd., InnovationWorks, National Technology Park, Limerick. Ireland
Ann.Sheahan@ManOPT.com
Telephone: +353 61 503104

Ann Ledwith,
Dept. Manufacturing & Operations Engineering, College of Science & Engineering,
University of Limerick, Limerick, Ireland.
Ann.Ledwith@ul.ie

Con Sheahan,
Dept. Manufacturing & Operations Engineering, College of Science & Engineering,
University of Limerick, Limerick, Ireland.
Con.Sheahan@ul.ie

Abstract

Decision makers within SMEs face many competitive threats but also have a range of development opportunities available to them to advance the competitive position of their firm. These opportunities typically include development of new products and/or the improvement of their process performance. However it is very difficult to decide, ex-ante i.e. before-the-event, to which combination of new product development and/or improvement opportunities the SME should devote resources for the firm to maximise its economic performance. This is of strategic importance, given the limited resources available to SMEs. The ValuePOLE project addresses this challenge. ValuePOLE, a collaborative research project between academics and SME practitioners, is funded under the EU's Seventh Framework Programme, Research for the Benefit of SMEs. Its objective is to deliver a Model, an ICT Tool and a Methodology to answer this challenge for the SME decision maker so that they can maximise their competitive position with the minimum investment of resources. This paper describes the project as well as the results to date at the four SME case study firms.

Background

Competitive advantage and sustainability for European manufacturers require that they are competitive in many domains [Manufuture, 2006]. Traditionally a manufacturer would be competitive if they produced a product that met the quality, cost and delivery requirements of the market. Today and in the next decades, European industry in general, and SME firms in particular, are presented with many seemingly conflicting performance objectives:

1. improve efficiency in the entire value chain in order to meet 'better, cheaper, faster' competitive objectives,
2. meet 'greener, safer, securer' EU socio-technical policy objectives,
3. while simultaneously juggling strategies for incremental and breakthrough innovation in product and process development.

In order to thrive in the '*new real economy'* Small and Medium Sized Enterprises (SMEs) face two performance objectives; they need to be efficient ***and*** innovative to participate in the new knowledge based economy. [Factories of the Future, 2009]. There are very few economies that can compete on both manufacturing efficiencies and radical innovations. Japanese industry has developed highly lean efficient production systems but their innovation strategies are mainly based on continual modification and upgrading of existing components and products. Lam [2004] reports that Japan does not excel in sectors which require more than incremental upgrading of system components (e.g. aerospace; supercomputers) and or those in which fast-paced radical innovation are crucial for success (e.g. pharmaceuticals and biotechnology)". On the other-hand, Silicon Valley, Route 128 and other clusters in the US economy, are recognised for rapid innovation and commercialisation in fast growing technological fields such as microelectronics, semiconductors, computer networking and more recently biotechnology. Such firms however lag in operational efficiencies. While China, India, and Taiwan have become the 'factory of the world'; they have yet to attract significant manufacturing of knowledge based goods. This is primarily attributed to policies which require multinational companies to form joint ventures with indigenous firms [Pereira, 2004].

To address this problem the ValuePOLE project, funded under the EU's Seventh Framework Programme, is proposing a new model and methodology so that European SMEs can be both operationally efficient and innovative to maximise value in the entire lifecycle of products and processes in the extended value-chain.

Problem for the SMEs

An SME is fundamentally different from a large firm in both make-up and management philosophies [Randoy and Goel, 2003]. It is often dependant on a single decision maker for tactical and strategic decision making; typically an owner/manager [Feltham, 2005]. SMEs have limited resources, both financial and human capital [Hudson et al., 2001] [Garengo et al., 2005]. At an operational level, the SME needs to know how to mobilise their resources to deliver the best outcome for the firm [Sheahan and Sheahan, 2006]. At a tactical level, they need to know before they invest these limited resources in either new product development (NPD) or process improvement projects (PIP) what the likely impact will be on their enterprise. A key concern of SMEs is that they could commit resources to a new product or project at the expense of a better opportunity. Unlike larger enterprises, who often have a wider portfolio of new product

development projects, SMEs will have a limited number of projects / new product opportunities as well as limited resources. The enterprise consequence of the decision for an SME is therefore greater.

Project Selection for NPD and PIP

When SME decision makers review their NPD or PIP options, they currently rely on their own empirical knowledge and judgement about the impact that these projects could have on the strategic and operational performance objectives of the enterprise. Indeed, Allinson, Chell and Hayes (2000) report that owner-managers are more intuitive in their cognitive style than the general population of managers. However, research by Cooper (2001) has shown that the most successful approach for project portfolio selection, among large firms, is to select projects using a formalised hybrid selection model including financial, risk and project ranking factors. He found that firms that used formalised project selection techniques incorporating risk analysis as well as financial analysis were more successful. Relatively little research has been completed to test this approach in small firms. In one case, Lawson et al (2006) have built and tested a hybrid project selection method based on their prior research at Cranfield University. The hybrid model contains a filter step whereby the user scores the new project risk on six criteria (technical risk, corporate and strategic fit, regulatory risk, market risk, financial risk and application risk). A Cost Benefit Analysis (CBA) is then applied to the new project. The model was tested at a small UK aerospace engineering firm by applying it to a research programme previously undertaken by the SME. Management at the case study firm concluded that the risk analysis tool would not be used because their normal selection considerations were included in the tool without the cost of maintaining the tool. They did however see a benefit in linking cash flow to individual projects. Management wanted to see a tool whereby they could 'easily predict the cash flow consequences of a project running late over the initially estimated time schedule and budget'. The research is limited in that their model is designed to assess one project on its own and does not establish the best portfolio mix of projects. The research does confirm the need for a hybrid model for new product project selection using predictive financial measures.

The Lean Six Sigma methodology, and variants thereof which use scientific methods for problem solving, are the most widely used methods for gaining efficiencies in manufacturing processes. While many benefits are to be gained, Dinesh Kumar et al (2007) report on a survey among major aerospace companies where fewer than fifty percent of companies have been satisfied with the results from six-sigma projects. They conclude that 'wrong project selection' is the main reason for failure. Furthermore, they recommend a measurement system to measure the impact of the project on the financial performance of the firm. Similarly, Banuelas et al (2006) have concluded, following an extensive literature review, that project selection and prioritisation is a critical success factor for achieving benefits from improvement projects. Furthermore, since the projects compete for scarce resources, they should be closely tied to business goals. Similar to NPD project selection, they recommend, from a national survey in the UK, a hybrid model of top-down and bottom-up method for improvement project selection.

Performance Management in SMEs

The value of having an effective performance management process, focused around effective Key Performance Indicators (KPIs) has long been proven [Kennerely and Neely, 2003]. In general, it is accepted that in order to improve the performance of a firm it has to be measured.

Large firms adapt performance management systems such as the Performance Prism [Neely and Adams, 2001] and the Balanced Scorecard [Kaplan and Norton 1992]. While these tools are appropriate for larger enterprises, there is sufficient literature to suggest that the SME sector has been slow to adopt performance management systems [Wilson and Sheahan, 2006].

A performance management process that reviews the status of KPIs and then looks at ways to drive improvement towards a pre-defined target is an *ex-post* (i.e. after the event) system. While the targets for achievement are placed at some point of time in the future, the improvement initiatives based on actual (or past) performance are always going to be reactionary at best [Melnyk, Stewart, Swink, 2004]. This is a serious limitation of existing performance management theory and practice [Carlsson, Turban, 2002]. The challenge on business performance in a very competitive market place demands a future looking perspective to the business [Shapiro, 2004]. Success in the future often depends on decisions made today with incomplete information. Management within firms need a view of what the expected performance outcomes of their decisions are likely to be as well as diagnostic support in how to meet performance goals. Wouters and Verdaasdonk (2002) have examined how operation managers can use accounting information to examine the economic consequences of operational decisions on the firm before they make the decision. They thus define *ex-ante* (i.e. before the event) accounting information as information about the expected financial impact of a decision alternative on one or more financial criteria (e.g. net present value, profit).

Wouters and Verdaasdonk (2002) have described various cases where the team used simulation modelling at the case study firm. They reported that in general it was a complex task to gather the knowledge related to the decision from various people working in various functions at various hierarchal levels. They report that it 'usually took a lot of time to try to bring together such knowledge in one model of the decision'. This would be true for simulation modelling in general. Simulation modelling has been applied in the past in large production manufacturing operations to give decision makers a forward looking perspective on the potential impact of their decisions. Simulation has however been of limited use in small firms due to several factors. Modelling of the problem is an expensive and time consuming process that often requires skilled people knowledgeable in both the operations of the system as well as modelling and simulation techniques and software. The construction of the model is often a complex. The analysis of the data produced by a model can also be difficult and can require additional skills such as competency in statistical analysis. Simulation is thus not viable for most SMEs.

Wouters and Verdassdonk have demonstrated that *ex-ante* accounting information is useful in three different operational management decision situations, which are similar to decisions in new product development and process improvement projects. They are (1) when a decision is new or seldom taken, (2) when the decision is familiar but new considerations must be taken into account and (3) when knowledge about the various consequences is dispersed across different people or functions.

In the ValuePOLE project, we extend the concept of ex ante accounting information to ex-ante prediction performance for a suite of Key Performance Indicators. We also overcome the problems described above for simulation, by building one enterprise model for the firm that can be used to model decision scenarios for multiple problems for multiple KPIs.

Measuring New Product Development

The importance of measuring new product success is also widely recognised, yet it remains elusive particularly to SMEs. Huang et al [2003] suggest that the reasons are due to the multidimensional nature of success; the different levels of analysis that can be examined, and the multiple stakeholders who look for different things in the NPD process. The time lag between cause and effect is also a factor to be considered. This is particularly important for longer new product development cycles.

In a recent study of 106 small Irish firms, Ledwith and O'Dwyer [2009] examined the relationships among market orientation, new product performance, and organisational performance. They found that of three market orientation dimensions examined, only one, competitor orientation, was found to have a significant impact on new product performance. Additionally, of the five measures of new product performance only two, market-level and financial performance, were linked to organisational performance. One of the key recommendations from the study is that small firms need to put more effort into measuring the financial performance of their new products, for example, development costs, contribution, profitability, and return on investment (ROI) or internal rate of return (IRR).

We can make a number of conclusions from the literature.

i. Project selection is fundamental to the successful delivery of new products and performance improvement projects in small firms.
ii. The project selection model should be a hybrid model of financial and non-financial measures. Market level measures are also important.
iii. The model should promote data driven decision making within the small firm while also leveraging the intuitive decision making capability of typical owner managers in small firms.
iv. Performance management should drive decision making at different levels within the firm, meeting the needs of all the stakeholders.
v. The model should facilitate the decision maker in understanding the performance consequences for the firm before the decision is committed, i.e. provide for ex-ante performance prediction.
vi. The model should facilitate project portfolio selection.

ValuePOLE Project Objectives

In the remainder of this paper we discuss the design, development and implementation of a data driven project portfolio selection model using ex-ante performance prediction, ValuePOLE , which addresses the gaps identified in the above literature. The primary objective of the ValuePOLE consortium is to develop and implement an ICT tool, with a supporting model and methodology, which will prioritise the best value improvement opportunities for SMEs from a portfolio of potential new products or process improvements. This will enable the decision maker to rapidly identify the risk/reward position of any project or combination of projects vis-à-vis a suite of pre-defined key performance indicators.

The ValuePOLE project is a joint industry and academic collaborative research project funded under the EU's Seventh Framework Programme (FP7): Capacities Theme Research for the benefit of SMEs, FP7-SME-2007-1. A key feature of this EU research programme is that the requirements of SMEs in the consortium drive the research objectives of the research partners.

The ValuePOLE consortium (Annex 1) consists of three academic partners from three countries as well as five SMEs from three EU countries (Ireland, UK and Denmark). The SMEs include a software development company as well as four engineer-to-order and design-to-order manufacturing companies. The engineer-to-order and design-to-order small firms operate within Business-to-Business (B2B) value chains.

Research and Development Methodology

The traditional waterfall paradigm for software development, first proposed by Royce 1970, proposes that the stages of the software development process are performed in sequence: requirements gathering, specification, design, coding, and testing. This method has a number of drawbacks. In particular, it assumes that requirements are known at the start of the project and that there are no changes done during the project execution. This method is not suitable for cases where a higher level of end user involvement is needed. Instead, an iterative development model, [Basili 2005] was used in ValuePOLE. In an iterative process, software is developed, implemented, and delivered to the customer in phases, where the functionality of a new piece of software is usually an increment to the functionality of the previous delivery. This avoids the 'big bang' approach and facilitates change management at the small firm.

Based on user requirements, the first iteration of ValuePOLE focused on:

1. One financial KPI, Sales Revenue On-Time-in-Full (OTIF), and
2. Improving both the short-term operational decision making within the firm, and medium term selection and deployment of operational performance improvement projects, to improve the KPI.

Predicted Sales Revenue OTIF is a new performance indicator developed within the project. It measures the sales revenue that will ship on time in full to the customer. It is a hybrid metric which includes both financial and market level metrics. Financially, cash flow has always been critical to the viability of small firms. In the current economic crisis access to working capital is a key concern for small firms across Europe. Small firms need to prioritise their limited resources on sales orders, NPD projects and PIPs with the highest added value to the firm. ValuePOLE, as discussed later, facilitates the decision maker to prioritise highest added value activities within the firm. Small firms also need to focus on market level metrics to ensure the longer term sustainability of the firm. Supplying customers with products that they want, when they want them and at a price they are willing to pay is fundamental to any business. It is particularly important for small firms, such as the engineer-to-order and design-to-order firms within the project, which produce high value products and compete on delivery times to market. The 'OTIF' portion of the metric focuses on shipping customer orders to the customer on time and in full. The 'on time' data is the delivery date that the customer wants and that has been agreed to; not earlier, not later but on the day. The 'in full' data is the full order quantity; not short on either quantity or features.

Thus far, the ValuePOLE consortium has succeeded in developing a prototype tool that models and optimises SMEs' value streams required for the definition and efficient fulfilment of market demand. The tool generates predictive performance reports for future Sales Revenue, OTIF. We discuss the tool in the next section of this paper.

Prototype Development to-date

The ValuePOLE tool consists of three modules: an enterprise modeller, an optimiser and a performance manager as shown below in Figure 1.

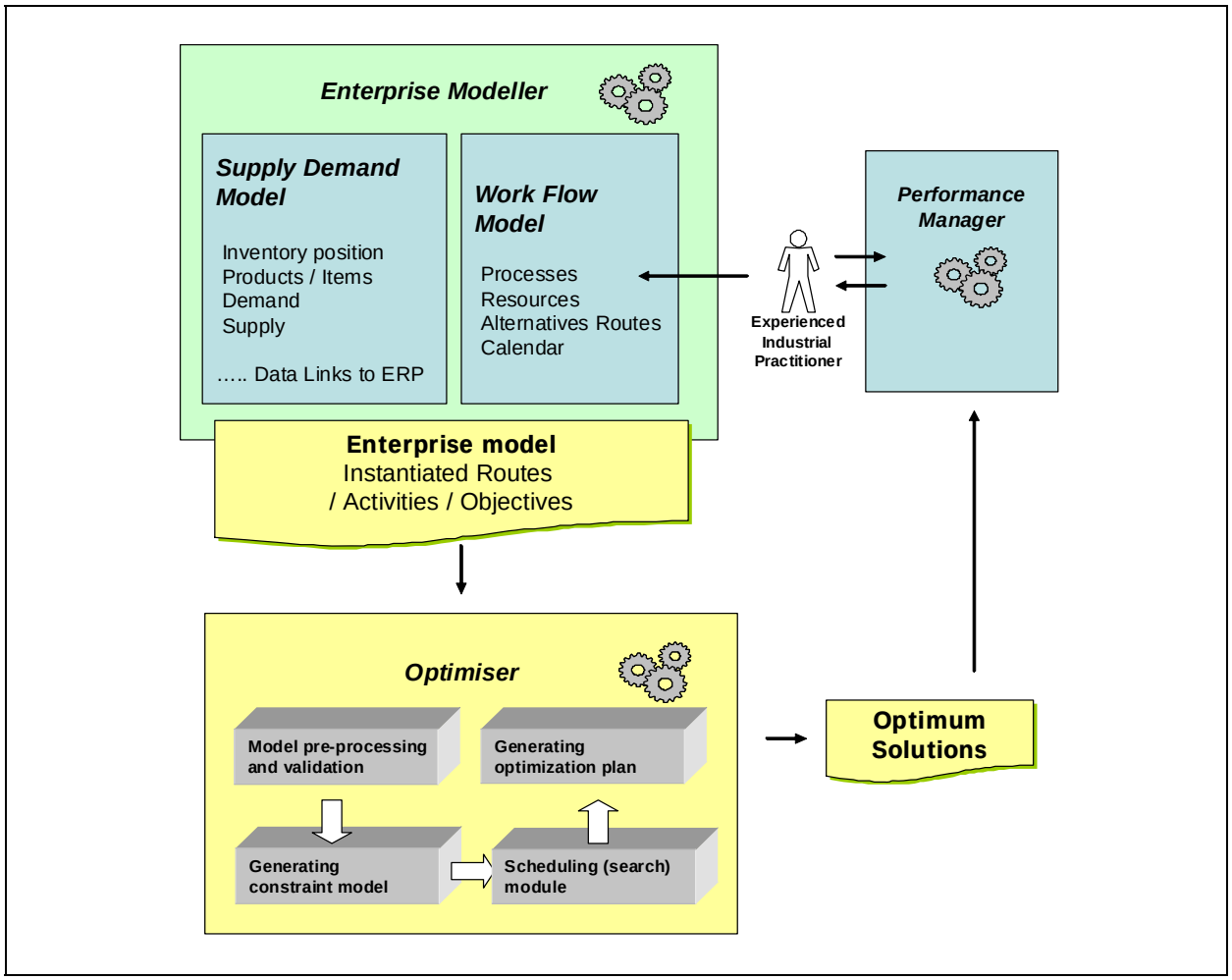


Figure 1: ValuePOLE Modules

(1) The end user interacts with the **Enterprise Modeller Module** to tell the system the, who, what, when, where and how their products are made i.e. describe's the entities in the organisation at enterprise level relevant to the main KPI. To make this task easier we've implemented a workflow editor. This tool allows the user to denote the states in a process flow and define the relationships between them. Alternative routes are catered for using split and join constructs – (also referred to as branch and merge). The data for the Supply-Demand Position is extracted real-time from the ERP system and / or databases such as spreadsheets.

A key feature of the modeller is that it is intuitive to use. Decision makers in small firms would not usually have the modelling expertise required to run advanced simulation-like tools. Using the ValuePOLE tool, decision makers can model their firm, trying out multiple 'what-if' scenarios before committing to a decision.

(2) Using this information the **optimiser** make's informed choices on how best to make the product to meet the constraints of the firm and the customer demand. The **Optimisation Module** then plans multiple resources using the KPI as the objective function. The advantage of using a hybrid metric such as Sales Revenue OTIF is that it provides a common language for both the decision maker and the mathematical optimisation functions. The optimisation algoithms developed for the ValuePOLE tool optimise multiple resources versus multiple KPIs.

A key feature of the optimiser is the speed of the solution. The optimiser can produce solutions in near to real-time (minutes) for a typical engineer-to-order small firm. This is imperative if the decision maker is to interact with the tool, using his/her intuitive capability to generate alternate scenarios / models.

(3) The **Performance Manager Module** shows the decision maker what is the best possible outcome for the firm given the inputs from the Enterprise Modeller. For example, it will show the decision maker the predicted Sales Revenue that will ship on-time-in-full in any given time period (e.g week) over any time horizon (e.g. quarter, year). This ex-ante prediction of Sales Revenue OTIF is based on optimisation algorithms for the current order books, (actual and forecasts), as well as the state of all resources within the firm. The decision maker is presented with diagnostic screens to rapidly identify which resources, entities and processes within the firm are constraining the firm from achieving Sales Revenue OTIF within the future planning horizon. This allows the decision maker to make improved decisions, typically on the allocation of resources, today that will affect future Sales Revenue OTIF. The decision maker is also given diagnostics of where the opportunities for improvement lie within the firm for organisational performance improvement. This allows the decision maker to prioritise improvement projects that will directly affect the KPI. The decision maker can also make decisions on new products based on the affect that the project will have on the Sales Revenue position of the firm given all the existing commitments of the firm.

A key feature of the performance manager is in the visualisation of the solution. The performance management tool has multiple 'drill down' features so that the decision maker can view the performance of each entity in the model and how it affects the overall performance of the firm.

Case Study Results To-Date

The prototype tool has been deployed and tested to various degrees at four small case study firms in the engineer-to-order / design-to-order firms in Ireland, the UK and Denmark. Each of the firms is a market leader in their respective countries and either export at present or are exploring export markets.

SME #1 is a specialist manufacturer of hydraulic cylinders for Original Equipment Manufacturers. SME #1 is a family owned company, based in Ireland and exports over 80% of all sales, with the German market accounting for 50% of these exports. SME #1 primarily concentrates on the construction and quarry Original Equipment Manufacturer, but also produces

for agricultural, automotive, construction and industrial OEM's. They have a policy of delivering directly to customers in all European countries on a 'Just in Time' basis. Prototype manufacture is seen as an opportunity rather than a problem.

SME #2 are a wood technology company based in rural Ireland. They manufacture kitchen and wardrobe cabinet doors and panels. They manufacture all products from MDF melamine or veneer board. They offer a complete range of standard and off-standard sizes available in all finishes. They supply both end users and distributors; typical customers are cabinetmakers & DIY stores, primarily in Ireland and the UK.

SME #3, based in the UK, design and manufacture high quality wooden products for the Playgroup, Nursery, Education and Retail Markets. Their range includes Play and Learn, Role-play, Pretend, Storage and Activity Equipment, Nursery Cots and Furniture and Children's Wooden Toys. The current business is centred on products for the Early Years Play and Learn education and nursery market, for up to 8 year olds. However, their broad experience and design and manufacturing techniques mean that they can diversify into other markets and areas of business that require the medium of wood and wood based boards - such as shop fitters display units, gifts, household and nursery furniture, garden furniture etc.

SME #4, based in Denmark, has almost 150 years of experience with the manufacture of wood-burning stoves and has always been at the forefront of developing new stove types. They offer significant variation to their customers in terms of design, size, stove type and output. They have a long tradition of product innovation. It was at SME #4 that the original cast-iron stove was created. Since then, they have become one of the world's leading suppliers of cast-iron wood-burning stoves and today exports stoves to all parts of the world, irrespective of the climate – from northern Scandinavia to South Africa, from the USA and Canada to Australia and Japan. Their stoves are used in over 25 countries.

The results to-date, both empirical and quantitative are given in Table 1. Overall, the most critical organisational performance improvement in ValuePOLE has been in the time based competitive capability of the end user SMEs. At the end of this project the SMEs using the tool have achieved the following performance outcomes:

1 Sales Revenue OTIF delivery performance (to the original order promise date) increased to over 95% from the previous estimated level of 40%. On-time-delivery is important for most manufacturing companies, it is critical in Engineer-to-Order and Design-to-Order firms. Such firms can compete, even in high wage economies, based on competitive delivery performance. It is important in measuring OTIF to use the first agreed order promise date with the customer i.e. the original order promise date. Many software tools do not have the facility to record changes made to the order promise date and will apply the last order promise date.

2 Sales Order Lead-time reductions of greater than 30%

3 Reduce planning time by greater than 60% and planning effort by greater than 50%.

SME #1 (Full Deployment)

- **reduced their sales order lead-time from a range to 2-16 weeks to an average of 4 weeks**
- **improved their on-time-in-full shipments from a range of 40-90% to an average of 85%**
- **reduced planning time from 2 days a week (with hours for replanning when perturbations occurred) to 0.5 days per week with updates possible in 5 minutes.**
- **Their planning effort was reduced from 3 people to 2 people freeing up the Purchasing Manager from routine planning tasks.**

SME #2 (Near Full Deployment)

- **reduced their sales order lead-time from 4 days to 3 days (while at the same time doubling their production volume).**
- **maintained their on-time-in-full shipments from a range of 95% to an average of 96%**
- **reduced planning time from 4 days a week continuous planning to 1 day per week with updates possible in 15 minutes. Their planning effort was reduced by 25% for both the operations and production manager.**

SME #3 (In the set-up phase, Full Deployment Planned)

- **Improved operator utilization via improved planning techniques.**
- **Additional training was provided in parallel to the project to create a more flexible work force to enable better departmental balancing.**
- **Jobs that could not be completed due to material shortages would not be started reducing WIP.**
- **The sales department has a much clearer view of what could be manufactured and when.**
- **Tracking of specific orders becomes much simpler through a manual tracking process.**
- **Team leaders roles are changed from reactive to proactive.**
- **Methods of tracking and agreeing change have been formalised and therefore become standard practice.**

SME #4, Contributed to Requirements Engineering and Evaluation of Demonstrations.

Table 1: Performance Impact on SMEs to-date

Summary and Conclusions

In order to thrive in the 'new real economy', SMEs face a number of performance challenges. They need to be effective in their operations as well as innovative in their new product and process development. However, resources are scarce in small firms. They need to know the potential impact of NPD or PIP decisions on their organisational performance before they firm commit limited resources to the project. Cooper (2001) has shown that large firms that use project portfolio selection techniques, based on hybrid financial performance and risk assessment criteria, are more successful at NPD. SMEs however rely on their intuition or empirical experience to select new product or improvement projects. Lawson et al (2006) have identified a need for hybrid approach in the selection of new product projects. 'Wrong project selection' is also found to be a reason for failure of Lean Six Sigma to deliver performance objectives Kumar (2007).

The SME sector has been slow to adopt performance management systems [Wilson and Sheahan 2006]. Performance management systems report performance after an activity, or set of activities, has been completed. They are said to be ex-post. Wouters and Verdaasdonk have proposed how operations managers can use ex-ante accounting information to examine the economic consequences of operational decisions before the decision alternate is chosen. They thus define *ex-ante* (i.e. before the event) accounting information as information about the expected financial impact of a decision alternative on one or more financial criteria (e.g. net present value, profit). Simulation technology is one method of prediction, it is however of limited use to small firms. The modelling effort is considerable and requires simulation expertise.

Measuring new product success has also remained elusive, particularly to SMEs, [Huang, 2003]. Ledwith and O'Dwyer have proposed that small firms put more effort into measuring the financial performance of their new products, as well as market level measures, as these two measures were found to correlate well with overall organisational performance.

We extended the concept of ex ante accounting information to ex-ante prediction of a suite of KPIs in the ValuePOLE project. Based on user requirements, the first iteration of ValuePOLE focused initially on one KPI, Sales Revenue On-Time-in-Full (OTIF). It is a hybrid metric which includes a financial metric (sales revenue) as well as a market level measure (on-time-in-full delivery performance to the customer). The focus to-date in the project has been on the improving both the short-term operational decision making within the firm, and the medium term selection and deployment of operational performance improvement projects. We also overcome the problems with simulation, by building one enterprise model for the firm that can be used to model decision scenarios for multiple problems for multiple KPIs.

The prototype tool has been deployed and tested at four small case study firms in the engineer-to-order / design-to-order firms in Ireland, the UK and Denmark. Each of the firms is a market leader in their respective countries and either export at present or are exploring export markets. They have achieved significant performance improvements in their Sales Revenue OTIF delivery performance.

We can conclude from the prototypes deployments to-date that small firms will use, and benefit from, data driven data decision tools that compliment their intuitive capability. We also conclude that performance management is of benefit to small firms where it can be applied ex-ante to compliment decision making capabilities.

Future Work

In order to thrive in the '*new real economy'* Small and Medium Sized Enterprises (SMEs) face two performance objectives; they need to be efficient ***and*** innovative to participate in the new knowledge based economy. The work completed to date has focused on decision-making for efficient, effective and sustainable manufacturing process. We have focused on one KPI, Sales Revenue OTIF. We have also focused on incremental innovations on the current configurations of products and processes. Future work, within the ValuePOLE project, will focus on the extension of the predictive performance concept to a suite of KPIs.

We will now focus on extending the model to include decisions related to the innovation of new products, processes and supply-chains. A conceptual framework has been developed based on our existing work, see Figure 2. In order to predict the potential impact of a new product on the performance of the firm, we need to model potential market demand. We are currently developing a diagnostics method to establish if the accumulated demand for new products can be based on the past performance of similar products. With this diagnostics tool in hand it is now possible to diagnose whether or not the in-period demand profile is independent as assumed in theory, or in fact depends on previous accumulated demand profiles.

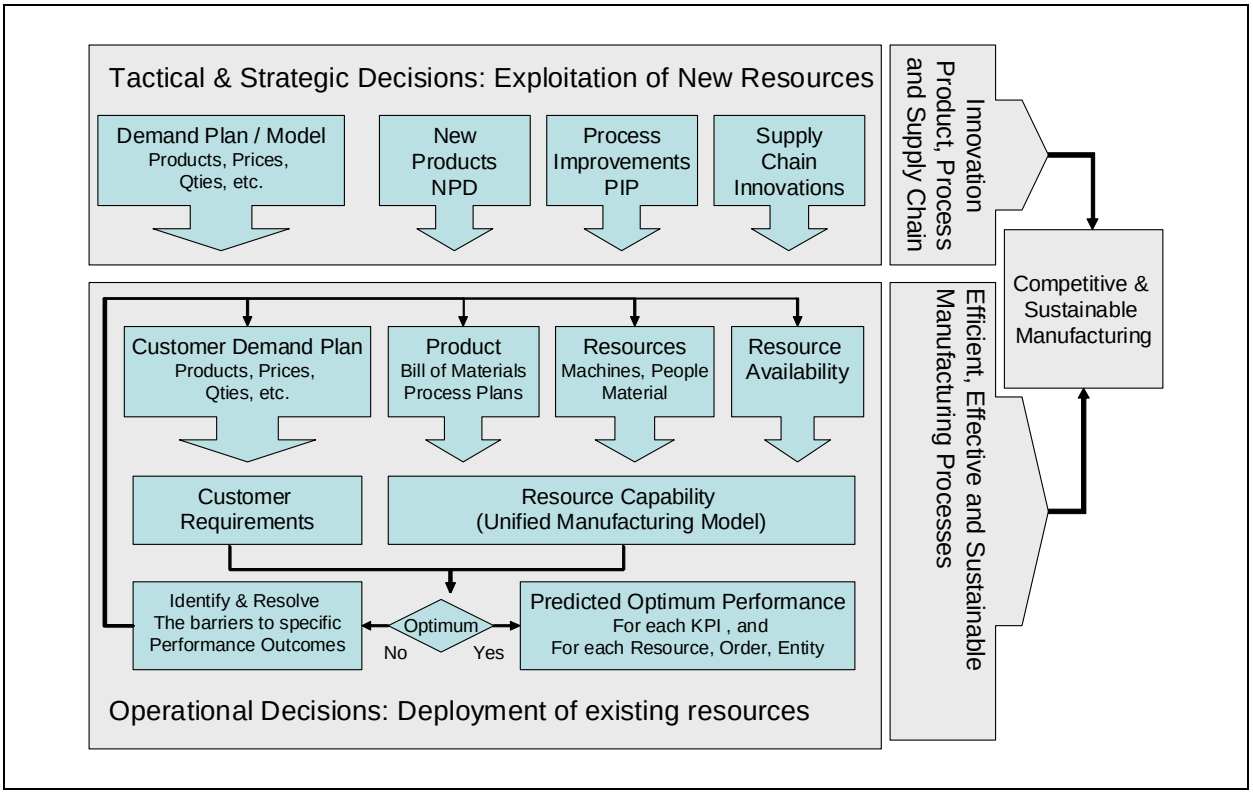


Figure 2: ValuePOLE Model

Annex 1:

Partners in the ValuePOLE Consortium

Name	Short name	Country
1. UNIVERSITY OF LIMERICK	UL	Ireland
2. UNIVERZITA KARLOVA V PRAZE	Karlova	Czech Republic
3. AALBORG UNIVERSITET	Aalborg	Denmark
4. MANOPT SYSTEMS LTD.	ManOPT	Ireland
5. TIPPO INTERNATIONAL LTD.	Tippo	Ireland
6. BURNSIDE EUROCYL LTD.	Burnside	Ireland
7. MILL HOUSE MANUFACTURING DESIGN LTD.	MillHouse	United Kingdom
8. MORSØ JERNSTØBERI A/S.	Morsoe	Denmark

References

Allinson, C. W., Chell, E., & Hayes, J. (2000). Intuition and entrepreneurial behaviour. *European Journal of Work and Organizational Psychology, 9*(1), 31-43.

Banuelas, R., Tennant, C., Tuersley, I., and Tang, S. (2006). 'Selection of six sigma projects in the UK', *The TQM Magazine,* Vol 18, No. 5, 514-527.

Basili, V.R, and Turner, Iterative enhancement, a practical technique for software development, *IEEE Transactions on Software Engg.*, 1(4), Dec 1975.

Carlsson, C., Turban, E., (2002), 'Introduction: DSS: Directions for the next decade', *Decision Support Systems*, 33 (2), 105-110.

Factories of the Future PPP – Strategic Multi-annual Roadmap, November 2009

Feltham, J. B. (2005). "The Dependance of Family Business on a Single Decision Maker." Journal of Small Business Management.

Garengo, P., Biazzo, S., Bitica, U. S. & Venezia, V. (2005) Performance measurement systems in SMEs: a review for a research agenda. *International Journal of Management Reviews,* 7**,** 25-47.

Hudson, M., Smart, A. & Bourne, M. (2001) Theory and practice in SME performance measurement systems. *International Journal of Operations and Production Management,* 21**,** 1096-1115.

Jerrard, R. N., Barnes, N., & Reid, A. (2008). Design, risk and new product development in five small creative companies. *International Journal of Design, 2*(1), 21-30.

Kaplan, R.S., and Norton, D.P., (1992). *The balanced scorecard: measures that drive performance*. *Harvard Business Review* Jan – Feb pp71-80.

Kennerley, M., Neely, A., (2003), 'Measuring performance in a changing business environment', *International Journal of Operations & Production Management*, 23 (2), 213-229. Neely, A., Gregory, M. Platts, K., (1995), 'Performance measurement system design: a literature review and research agenda', *International Journal of Operations & Production Management*, 15 (4), 80-116.

Lam, A. (2003). 'Organizational learning in multinationals: R&D networks of Japanese and US MNEs in the UK', *Journal of Management Studies*, 40/3: 674-703.

Lam, A (2004). Organizational Innovation, BRESE, School of Business and Management, Brunel University, April 2004

Lediwth, A; O'Dwyer, M; *"Market Orientation, NPD Performance, and Organizational Performance in Small Firms"*, Journal of Product Innovation Management 2009; 26:652-661

Manufuture Platform full report n° 1/2006

Melnyk Steven, A.,Stewart, D. M., Swink, M., (2004) 'Metrics and performance measurement in operations management: dealing with the metrics maze', *Journal of Operations Management*, 22, 209-217.

Neely, A., C. Adams, et al. (2001). *The performance prism in practice*. Measuring Business Excellence 5(2): 6-12.

Pereira, A. (2004) State Entrepreneurship and Regional Development: Singapore's Industrial Parks in Batam and Suzhou, *Entrepreneurship and Regional Development* 16: 129-44.

Randøy, T. and Goel, S., (2003). *Ownership structure, founder leadership, and performance in Norwegian SMEs: implications for financing entrepreneurial opportunities*. Journal of Business Venturing 18(5): 619-637.

Royce, (1970) Managing the development of large software systems, *IEEE Wescon*, Aug. 1970, reprinted in *Proc. 9th Int. Conf. on Software Engineering (ICSE-9)*, 1987, IEEE/ACM, pp. 328-338.

Dinesh Kumar, U., Saranga, H. (2007). Six Sigma Project Selection using data envelopment analysis. *The TQM Magazine*, Vol 19, No. 5, 419-441.

Shapiro, J. F., (2004), 'Challenges of strategic supply chain planning and modeling', *Computers & Chemical Engineering*, 28 (6), 855-861.

Sheahan, A; Sheahan, C. (2006) "Enterprise Modelling and Performance Optimisation for SMEs", (PMA) *Performance Measurement and Management: Public and Private 25-28 July 2006*, Cranfield School of Management, London, UK.

Wouters, M., Verdassdonk, P. "Supporting Management Decisions with Ex ante Accounting Information", *European Management Journal* Vol. 20, No. 1, pp. 82–94, 2002

Exploiting Science:
An In-depth Study of a Regional Collaborative Development Strategy

Peter Svensson

Linköping University

IEI/PIE/HELIX Excellence Centre (Sweden)

peter.svensson@liu.se

Abstract

This paper explores how a new knowledge base centred on an emerging technology in a declining industrial city can spill over into the surrounding environment. Using a qualitative approach, it presents an in-depth case study of a Swedish urban region in order to explore who the actors are, how they have collaborated in the process, and what the outcomes have been. It discusses the impact of a regional collaborative strategy and bottom-up processes. It found a distinct difference between supportive and operative actors in relation to the creation of economic output, which has theoretical and policy implications. It concludes by categorising different bottom-up commercialisation processes.

Keywords: strategy, emerging technology, barrier, collaboration

1. Introduction

Policy makers after the Second World War tended to regard economic growth policy from a national-level perspective and considered large companies to be more efficient than small ones. This contributed to a decreased interest in regional development and firm formation (Krugman, 1992; Audretsch, 2009). They also perceived technological change as an exogenous variable that improved economic output but appeared in the economy as if it were manna from heaven (Solow, 1956; Audretsch, 2005).

The understanding of knowledge as an endogenous variable and regions as important constructs for understanding economic growth gradually replaced these paradigms (Romer, 1986; Krugman, 1992). Several studies also found that knowledge is an externality of the activities of research and development (R&D) organisations that refuels regional economies and knowledge-based regional development, primarily by the transferring mechanism of new firm formation (Cooke, 2002; Etzkowitz and Klofsten, 2005; Audretsch et al, 2006).

R&D organisations can be either large companies, research institutes, or universities. Audretsch et al (2005) and Etzkowitz and Klofsten (2005) have identified universities as increasingly the most important organisations for invigorating stalled economies. Only a few ways exist to exploit findings in science and technology emerging from research universities. These are commercialisation through licensing, generating start-ups, and knowledge transfer activities (Klofsten and Jones-Evans, 2000; Sharma et al, 2006; Svensson, 2007).

Converting scientific research into economic output, however, seems to be obstructed by such institutional and organisational problems as knowledge filters (Audretsch and Aldridge, 2009; Carlsson et al, 2009). Improving universities' institutional and organisational functions is therefore of increasing interest to regional and national policy makers (Sharma et al, 2006; Petrusson, 2007; Mowery et al, 2001).

A division exists, however, in how both scholars and policy makers perceive regional innovation systems (Ylilenpää, 2009). One perception is that the creation of a specific type of knowledge and its related innovation activities within a spatially restricted area takes place in the unplanned entrepreneurial activities of bottom-up actors and is therefore difficult for policy makers to affect (Johannisson, 1998; Johannisson and Lindholm-Dahlstrand, 2009). The other perception has a more systemic perspective and provides suggestions of how policy makers can create the ingredients for innovation systems (Porter, 1990; Edquist, 1997). Both these schools of thought apparently guide management behaviour, especially public policy, but the different streams of research stemming from them, although studying the same phenomena, do not cross-fertilise (Ylilenpää, 2009). This paper examines how regional top-down initiatives can be transferred to local bottom-up economic activities in knowledge-based regional development in order to shed light on both its institutional and entrepreneurial aspects.

2. Theoretical Framework

2.1. Knowledge-Based Regional Development

Many consider knowledge to be an externality that is an important factor in economic growth, as ideas are non-rival and therefore spread over borders and throughout economies (Romer, 1990; Audretsch et al, 2006). Factors apparently exist, however, that hinder the conversion of science into economic output. The existence of such knowledge filters between organisations involved in science and commercial users of innovation is at least partly due to such characteristics of knowledge as uncertainty, asymmetric information, and transaction costs (Arrow, 1962; Audretsch and Aldridge, 2009; Carlsson et al, 2009).

These organisational and institutional challenges are of interest in regard to understanding knowledge-based regional development because of the local nature of commercialisation, especially since the academic system freely reveals and rapidly diffuses local science production, which means that useful scientific research can be commercialised elsewhere, making regional gains minimal (Audretsch et al, 2005). Regional policy has therefore gradually undergone a transition from one of regions poaching or capturing each other's resources to the creation of new resources, typically based upon some knowledge advantage (Svensson et al, forthcoming).

Out of the three types of R&D organisations that contribute to new knowledge, research universities play an increasingly important role as institutions for facilitating the discovery of entrepreneurial opportunities and reinvigorating their regions' knowledge bases. They play an increasingly important role in science-based innovations because of their open science system, which increases the flow of new ideas. (Carlsson et al 2009; Etzkowitz and Ranga, 2009).

Shah and Tripsas (2007) found that the university environment attracts some sectors' end-user entrepreneurs who are more inclined to test radical or disruptive ideas. For instance, in Silicon Valley the research universities have been crucial factors for sectoral succession, the example being the silicon knowledge of the semiconductor industry transferring into the digital knowledge of the software industry and then into the current design and general information-technology knowledge of social networks. This succession compensates for decreases in the development of the regional economic base due to employment losses in such older sectors as the semiconductor industry resulting from waning competitiveness or relocation. Lucky regions or those that manage these transitions successfully experience positive outcomes in regard to population, income, and growth.

These sectoral-succession phenomena, moreover, occur in more sectors than those reliant on science-based innovations, and may also be found in regional forms of specialisation involving the reinvigoration of such varied older sectors as semiconductor engineering, financial services, and fashion design. (Agarwal et al, 2007; Storper and Scott, 2008). This regional-knowledge path dependency is at times called creative construction, a shift from Schumpeter's (1911) creative destruction. This perspective views creative destruction as valid on an aggregate level in economies, but also sees connections as tending to exist between knowledge bases regionally.

Innovation spaces emerge in knowledge-based regional development processes in order to exploit knowledge creation's opportunities (Etzkowitz and Klofsten, 2005). One of the reasons for innovation spaces is that the actors who are socially close to such knowledge creators as researchers often exploit knowledge spatially close to its creation. Information has a high degree of stickiness to the location where it is created (von Hippel, 2005; Sorenson et al, 2006).

Start-up firms in particular tend to locate themselves near a knowledge base. This tendency is therefore important to local economic development, since by locating geographically close to universities they contribute positively to university districts' business environments (Di Gregorio and Shane, 2003). The Association of University Technology Managers (1999) reported that 79% of the US's 364 Technology License Office start-up firms in 1998 were located in the same state as the licensing institution. Start-up firms are therefore valuable entities for local economic development and agglomeration economies (Zucker et al, 1998). Audretsch et al (2005) found that how recently a firm has started up affects its decision whether to locate close to a university, as when such firms first start up they depend on external knowledge, but when they become established they tend to have their own ways of creating new knowledge, such as R&D departments.

Porter (1990) attributed the benefits of a regional agglomeration process to the benefits of spatial proximity between suppliers and manufacturers, the resulting relationships and social closeness then become important for helping the knowledge to spill over. This implies that a region's chief asset is its sets of relationships, which take a long time to develop and are difficult to imitate. These relational assets are the key input for new firm formation, the economic process therefore centring on innovation through conversations and co-ordination rather than by improving efficiency. Such intangible assets represent a significant resource, albeit one that requires further investment and the construction of a viable strategy, ideally by engaging with the full range of relevant actors to realise its potential (Storper, 1997).

Ylinenpää (2009) found two different research streams in regard to regional innovation systems, the institutional and the entrepreneurial. Most studies are institutional, addressing how top-level actors in different organisations interact in order to create regional development, which is the research focus of the innovation-system, cluster, and triple-helix approaches. Entrepreneurial regional innovation-system studies focus on the creation of innovations and on how entrepreneurs develop new ideas into economic activities. This approach tends to centre on such terms as action-oriented, experimental learning, emergent, and effectuation, while the institutional approach tends to centre on such terms as planning-oriented, mechanistic, and causation.

Etzkowitz and Klofsten (2005) and Svensson et al (forthcoming) have, however, identified and attributed different characteristics to the top, middle, and bottom-level actors in triple-helix formation. National actors primarily supply the financial means and support development by stimulating knowledge for development processes. Regional actors, local actors, or both tend to set the agenda, set the scene for the enrolment of actors, acquire resources, and develop know-how. Furthermore, the bottom-level actors attract external human and financial capital, develop and commercialise new technologies, and facilitate the sharing of knowledge and information. Van de Ven (1993) and Storper (1997) have found that the significance of cooperation between different types of actors within a regional context is crucial to regeneration efforts.

2.2. Exploitation of Science

The bottom-up perspective of knowledge-based regional development focuses on the creation of new innovations from a knowledge base (Ylinenpää, 2009). The exogenous shock of new knowledge creates business opportunities, but the quantity of new opportunities depends on the nature of the new knowledge and which actors are close to the knowledge's creation. If the new knowledge is generic, such as multi-purpose technologies, it is more likely to result in many different applications than a single-purpose technology. A new knowledge's tacitness or codifiability also affects the number of opportunities it creates. Furthermore, whether the knowledge is isolated or part of a complex system also tends to shape the type and volume of opportunities it makes available for discovery and exploitation (Eckhardt and Shane, 2003).

This inside-out perspective of the transformation of knowledge creation into business opportunities also sees university researchers as entering academic loops with little effort, such as by moving from basic research to applied research and patents. When researchers enter a commercial loop, however, they need to acquire skills in marketing, and the interpersonal relationship skills required also change. The incentive to commercialise is of course usually monetary. Only some researchers are equipped to manage such changes, however, and therefore many new opportunities stay within academic organisations (Svensson and Öhrwall, forthcoming).

Klofsten and Dylan-Jones (2000) made distinctions between such activities involved in

transferring academic knowledge to the commercial market as large-scale science projects, contracted research, consulting, patenting and licensing, spin-off firms, external teaching, sales, and testing. The effects of the different knowledge-spillover activities are diverse, and it therefore seems reasonable to divide them into the categories of commercialisation through licensing, generating start-up firms, and knowledge-transfer activities (Audretsch et al, 2005; Sharma et al, 2006; Svensson and Öhrwall, forthcoming). This conforms with the understanding that incumbent companies in general often search for process innovations and that start-up firms base themselves on new service or product offerings, which in turn has implications for sectoral succession and employment growth (Utterback, 1994).

Knowledge-transfer activities benefit Swedish university researchers by producing increased research funding that results in high-technology equipment, skilled teaching, and high-level training that they can use to solve industrial problems (Jones-Evans and Klofsten, 1999). In commercialisation activities, however, the innovation-transfer processes involve know-how, the actual technology, and in some cases market knowledge, all of which move between organisations. In addition, an innovation's level of complexity is positively correlated to its transaction costs. Another factor affecting an innovation transfer's size and success is the receiving party's absorptive capacity. (Teece, 1977; Cohen and Levinthal, 1990; Afuah, 1998). Social proximity is therefore a crucial factor in the transfer of complex knowledge. This means that actors socially close to new knowledge or an invention tend to commercialise it or otherwise benefit from it during its knowledge-transfer processes (Sorenson et al., 2006).

Successful entrepreneurs have superior knowledge or information in regard to market or technology factors within the scope of the operations of their business, which means that the business opportunities involved are based on asymmetric information (Shane, 2000). Innovations, furthermore, consist of problem information and solution capability, and it is often superior knowledge of the latter that triggers university researchers to commercialise their discoveries.

Certain university departments, however, seem to accumulate more end-user entrepreneurs than others. These are nascent entrepreneurs with full problem information and a high level of solution capability. For example, when Sergey Brin and Larry Page, who were graduate students in the Stanford PhD computer science programme, wanted to find solutions for improving internet searches they had solution capability and also full information about a major problem area. They chose to act and created the search-engine company Google. When such lead-users, or those leading a trend, of existing products and services turn into innovators and end-user entrepreneurs, as in the cases of Yahoo! and Google, rapid growth tends to occur (von Hippel, 2005; Shah and Tripsas, 2007).

Audretsch and Aldrige (2009) found that those scientists who have a prolific publication record and who receive the most citations tend to have a higher propensity to patent. They also observed that institutional location mattered, finding that scientists in California and New England had a greater propensity for patenting even after controlling for other factors. This implies that a geographic location's institutions and culture affect the propensity to patent.

Powers (2005) had previously found that the presence and utilisation of such professional service providers for the exploitation of research findings as university technology-transfer offices increase the chances of successful commercialisation. A university's level of intellectual eminence, together with its having policies of making equity investments and maintaining a low inventor's share, are positive factors for its generating start-up firms. Di Gregorio and Shane (2003), however, found no correlation between the availability of industrially sponsored and venture capital and the number of start-up firms launched. Anand and Khanna (2000), furthermore, found that such prior relationships as personnel histories,

common board memberships, and alliance activities positively affected whether companies license their technology to others.

3. Scope and Research Questions

This paper focuses on the measures that local actors in a particular case undertook after the establishment of a knowledge space and the subsequent emergence of an innovation space resulting from the municipality involved changing its regional development strategy to a knowledge-oriented one (Etzkowitz, 2002; 2009, Svensson et al, forthcoming). As the organisational and institutional environment affected the subsequent knowledge spillover, this study examines local strategy formation and the bottom-up processes of academic entrepreneurship. It addresses the research questions of (a) who the main organisational actors in the formation of a viable local strategy for exploiting an emerging technology were, (b) what the results of the implemented strategy have been, and (c) in what activities to reduce the barriers to the exploitation of the emerging technology those involved have engaged.

It should be noted in regard to this paper that in Sweden any intellectual property resulting from university research belongs to the researchers themselves and not to the university in the absence of a contract stipulating otherwise. This means that Swedish researchers have the exclusive right to exploit their research results, unlike in most other countries, where universities hold the intellectual property rights (IPR). Another Swedish institutional factor is that it has a managed economy, which has resulted in a low entrepreneurial rate (Audretsch, 2009).

4. Methodology

This study employed qualitative research based on a detailed case study of a deindustrialising Swedish urban region named Norrköping and its redevelopment actors, including its university, regional industry, research institute, entrepreneurs, and governmental agencies. In 2008 and 2009 I conducted more than 20 in-depth, semi-structured, face-to-face interviews that lasted from 45 minutes to two hours and which I complemented with telephone interviews. The interviews were tape-recorded and transcribed and the interviewees checked the text for factual mistakes. I supported the interview data with an extensive secondary data collection of research applications, applications for funds, and thorough meeting notes in order to increase its validity (Yin, 1989).

I began by holding an introductory meeting with the participants, who were from Norrköping municipality and the Norrköping Science Park (NOSP). I then interviewed the head of a cluster initiative at length and participated in cluster meetings involving a particular technology field the regional university and research institute had established at their new campus. The next step was to interview the political leadership, specifically the municipality's current chairman and former director, followed by people from the industry involved, academia, and research institutes.

I then presented the collected data to the key actors and used their feedback to improve the subsequent in-depth interviews with those who had been part of the establishment of the new campus from the outset. Extensive studies of secondary material and archival records were included. I then presented the written material to three key informants who checked it for factual mistakes, ambiguous meanings, and the need for additional facts. The empirical data's construct validity may therefore be considered extremely high (Yin, 2003). Parts of the final document were printed as an empirical working paper and have been distributed to key informants (Svensson, 2009). In addition, the municipality of Norrköping has signed a contract with Linköping University (LiU) that states that the municipality shall be open for

research. This means that it is highly accessible and has an interest in the production of high-quality research.

I conducted process tracing as a within-case analysis and searched for congruence in the empirical material based on existing studies and theory. In this process I discovered patterns in the material and mapped these patterns in order to describe casual mechanisms (George and Bennett, 2005).

From 2004 to 2006 I had conducted a study of three research groups within one research programme in Sweden, focusing on the knowledge and technology transfer activities of the research groups (Svensson, 2007). One of the research groups was part of a department of LiU called the Institute of Technology and Natural Sciences (ITN) and was active in the emerging field of printed electronics (PE). This study led me to a pre-understanding of both Norrköping's contextual environment and PE's commercialisation processes. I then conducted a large, in-depth, empirical case study of Norrköping's urban renewal in 2009. Svensson et al (forthcoming) uses part of this study to analyse how the municipality's leadership joined with the regional LiU to establish the basis for an influx of new knowledge into its urban-renewal process. This pre-understanding increases this study's construct validity (Yin, 2003).

5. The Case of Printed Electronics Arena (PEA)

PE is an emerging technology based on the discovery of organic electronics in the 1970s, the originators of which received the Nobel Prize for Chemistry in 2000. Organic electronics and related scientific fields have been important parts of research at LiU, and this research has served as a base for the idea that electronics could also be printed on paper. The Printed Electronics Arena's (PEA) (2010, n.p.) website explains that:

> "Printed Electronics is a new technology that can lead to the production of simple, fast, and cheap electronic products by making use of conventional printing methods. This automatically involves a radical rejuvenation of production methods by incorporating new materials and methods, which in turn leads to producing electronics in a completely new way, thereby opening the door to the development of entirely new products." [Translated from Swedish by the author]

PE technology emerged in the late 1990s from the microelectronics research institute Acreo, also located in Linköping, which is near Norrköping, in an environment characterised by short feedback loops from industry. This research was application-oriented from the outset. At that time Acreo was searching for larger facilities, which it found in Norrköping. LiU had established a campus in Norrköping in 1997 (Svensson et al, 2010). Due to an industrial heritage within the electronics industry from Ericsson and Phillips, it located its ITN, which included electronic design, in Norrköping when the new campus was established.

The need to increase activity at the new campus and the synergistic effects of combining the ITN's and Acreo's human resources and special equipment were the main reasons for the move. The university's vice chancellor joined with the municipality's board to arrange for Acreo to move to the new campus. The transfer and upgrade of facilities received grants from the municipality and from the Swedish Agency for Innovation Systems (VINNOVA), which recognises the advantage of collaboration among different regional actors, not only by making it a requirement for funding but also by establishing helpful prices to help regions establish collaboration as part of their redevelopment processes. Acreo moved into the same building as the ITN and shared its microelectronic laboratory. The two organisations then started to work together with the new technology.

At the same time the municipality of Norrköping implemented a knowledge-based economic renewal strategy. The newly founded municipality fund, the Norrköping Regional Foundation (NRDF), was therefore able to sponsor projects for the PE researchers in regard to establishing market relationships. The overall objective of all this activity has been to help clusters of research and business involving technological knowledge to develop, making the municipality's industrial structure more differentiated and the region consequently less vulnerable to recessions.

In 2004 the newly appointed managing director of the local science park, later to be called the NOSP, realised that no formal relationship existed between it and Acreo. Later that year he met with representatives from the ITN and Acreo. At the time both organisations were well underway with their research and exploitation of the emerging PE technology and were actively in pursuit of industry feedback. Organic electronics researchers wanted to shorten the feedback loop between market input and research development in order to take years off development time and to hasten the discovery of successful market applications based on organic electronics.

Acreo recognised that many obstacles need to be lowered for new technologies to reach the market. The ITN, Acreo, and NOSP therefore created a prototype factory in order to help overcome the obstacles to exploiting PE for both start-up firms and established ones. They founded an organisation for commencing production of PE based on industry's needs, renaming it PEA Manufacturing (PEA-M) in 2008, which would also enable firms to test products based on PE without interfering with their own production. Material and equipment suppliers for the production of PE would also be able to test new materials and new equipment there.

They planned for what they called this greenhouse for production to be a focal point and meeting place where the ITN, Acreo, NOSP, and the industry could produce prototypes, develop new production processes, and produce PE applications. This strategy further included plans for PEA-M's assets and capabilities to be crucial for the retention of any international companies that PE managed to attract to the region, and to lower the costs and increase the speed of start-up companies in producing small series. PEA-M is organisationally a part of Acreo due to the two organisations' interrelated activities

PEA-M had to overcome several obstacles to establishing its production facilities. One involved the production of small series of prototypes with the advanced reel-to-reel printing equipment, as the equipment moves too fast, thereby creating too much waste material when experimenting with small series. PEA-M has corrected this with a simpler printing machine to complement the reel-to-reel one.

5.1. The National Programme

While this co-operation and the establishment of PEA-M was in progress, VINNOVA put out a call for applications it called the VINNVÄXT 2005 – Innovation Systems in Early Phases programme, a scheme that aimed to develop regional innovation systems. VINNOVA based this on the triple helix model for managing regional growth, which stresses the importance of collaboration among academia, industry, and the public sector. It set up the programme as a competition among different regional initiatives. The winners of the first stage received SEK100,000 for the further development of their growth strategies.

Acreo took the lead, and together with NOSP and the ITN sent in the application. The aim was to exploit the research conducted in Norrköping by Acreo and the ITN, to stimulate companies that could gain new business opportunities based on the new technology, and to develop the infrastructure for commercialisation and production. To reach these goals the

Norrköping conglomerate applied for marketing and network resources for PEA, which is basically an umbrella organisation. At the end of 2005 the PEA initiative received the first grant. Ten of 86 applications succeeded and received their first development contributions. The rationale for PEA's award was that VINNOVA (2009, n.p.) judged its:

> "initiative to have great growth potential and a good opportunity to become an internationally competitive innovation system. Furthermore, it has a high potential for renewal, especially because the technology creates added value to traditional products. LiU and Acreo have strong R&D capabilities. Some dedicated companies are in the region and they have many potential customers and application companies in Sweden." [Translated from Swedish by the author]

Acreo, NOSP, and municipality representatives had to attend workshops at VINNOVA after the first stage of the application procedure. These workshops provided information about how the triple helix model works. NOSP benefited from these workshops because its people learnt new management tools for regional development. The concept of the triple helix model's management tools confirmed the validity of Norrköping's collaborative path and helped NOSP's regional representatives to focus on three cluster initiatives, one of which was PE. After the workshops Acreo and NOSP put together an application for VINNVÄXT's next stage. The management tools provided a foundation for this second application by providing them with a more specific vocabulary and showing them how to deliver an application conforming to VINNOVA's ideas.

The municipality was also involved in the application, but took a less active role in it. In 2006 PEA received a SEK2 million award over two years. The project had to be financed equally by other sources, but this could be delivered in kind. The NRDF, Acreo, and LiU co-financed PEA. Representatives of Acreo, NOSP, the municipalities of Norrköping and Katrineholm, and regional industries became members of PEA's board. VINNOVA announced the final stage of VINNVÄXT at end of May 2008, and four regional initiatives won the prestigious prize, with PEA receiving SEK4 million annually for the next eight years. PEA applied for SEK1 million over three years from the NRDF in July 2008 in order to assure continuity for the region's market development and concurrent research. It intended for this application to be a base for further financing and to provide regional industries with support and information for increased product development based on PE.

5.2. PEA's Strategy and Organisation

PEA's vision is to create sustainable, long-term economic growth in the Norrköping region through the commercialisation and exploitation of the new-technology area of PE. Its goals are to create more jobs in the region with either start-up companies or established ones. Its long-term objectives, for 2016, are for the Norrköping region to become a world-leading cluster for electronics printed on paper, to achieve a world-leading position in PE research, and for PEA itself to have contributed to the creation of successful spin-off firms, the business development of established companies, and the attraction of foreign direct investment to the region. Other objectives include PEA-M being used, PEA becoming the region's centre point for industrial networks, and the Swedish paper and packaging industry's competitiveness strengthening due to PE. The PEA Strategy Document (2008, n.p.) stated that:

> "PEA shall: a) effectively support the exploitation of the new technology, b) gather and diffuse information about new printed electronics technology to companies in the Norrköping region, and c) engage established industry and entrepreneurs in the technology's use in competitive new offerings." [Translated from Swedish by the author]

The activities planned for the three-year period of 2008 to 2011, as presented in the application, are for PEA to assist regional companies in the development of PE technology and its applications, for PEA to serve as NOSP's branch for maintaining and developing the services for technology transfer and knowledge within PE, for NOSP to assist regional companies through PEA in capturing the benefits realised from PE's global development, and for PEA to continue to develop relationships with such national actors as the Invest in Sweden Agency, the Packaging Arena, the Swedish Agency for Economic and Regional Growth, VINNOVA, and VINNOVA's triple helix research, and with international networks as well.

The steering group consists of 10 representatives from the local municipalities of Norrköping, and Katrineholm, LiU, Acreo, and the regional companies Cloetta Fazer and Billerud. This is based on the strategy of using the triple helix model as a key driver of regional development. The PEA steering group meets four to six times annually and is responsible for strategic, operational, and financial matters. The execution of the steering group's strategies is the responsibility of a working committee and a person with the title of process leader.

Working committees consisting of people from the different stakeholder organisations assist the process leader. The processes being addressed are (a) leadership and marketing (NOSP), (b) research and development (LiU's head), (c) products (Acreo), and (d) support for commercialisation (NOSP). Product managers are to take part in product panels with the task of creating product ideas and prototypes for specific markets. The PEA restructured its working committee into a production committee in the autumn of 2008 in order to adapt to changing situations by overseeing the development of PEA-M. It had identified a bottleneck in the production of customised PE components and systems that required PEA's organisation to reemphasise its production facilities and in order to increase its production capabilities. The strategies reflect the ideas of the steering committee and the cluster coach, who said, "I believe in working with the existing companies and making them more competitive rather than setting up new industries." [Translated from Swedish by the author.]

Acreo was instrumental in establishing relationships with the packaging industry. A dialogue arose in the meeting between representatives of established industry and researchers. The researchers received industry input about how the existing packaging technology worked, and the new possibilities PE creates inspired the industry's representatives.

PEA's strategy also evolved from 2006 to 2008. It includes the same general goals, but started to specify its activities in more detail. It created a communication platform in order to bridge commercialisation gaps by increasing regional awareness of PE.

The main financier, VINNOVA, demands that those receiving VINNVÄXT take on co-financiers, a demand that has generated collaboration among PEA's participating organisations. PEA receives co-financing from the NRDF, the regional development council Östsam, Acreo, and LiU, both in cash and in kind. Another of VINNOVA's conditions is that regional growth be generated within what it calls a functional region, which is a geographically coherent area with the country. This means that it does not consider several PE hubs scattered about the country to constitute a functional region.

Acreo considers this condition to be an obstacle to PE's commercialisation process in Sweden because its potential customers and users are everywhere in the world and considering Sweden as a functional region would provide it with a stronger and more complete research base to market. Furthermore, the ITN's and Acreo's PE research is better known abroad than in Sweden, with Acreo having found more interest and commercial possibilities in continental Europe, Japan, and the US than at home. Acreo wanted PEA to be a core for all Swedish PE hubs, but VINNVÄXT could only award money to organisations with a regional scope.

VINNOVA does allow PEA to use the national network of PE knowledge, but it may only promote growth in the Norrköping region.

/see table 1 in appendix/

5.3. PEA's Activities and Results, 2006-2008

As an umbrella organisation, PEA works through a strategy it calls House of Brands, in which its stakeholders conduct the operational activities. It is a meeting place for coordinating those activities and for sharing information. The stakeholders described in Table 1 have different tasks connected with both their own internal aims and the goals related to PEA's strategy.

One result of this cooperation has been that in 2006 Acreo and LiU started Centerprise, a PE research centre financed by VINNOVA, Acreo, and LiU and supported by PEA. From 2006 through 2008 it created a road map for the development of PE technology, opened up such new research areas as bioelectronics, published in academic journals, created an IPR strategy, produced patentable technology, applied for patents, increased the number of PhD students in the PE field, took on visiting researchers, and participated in and arranged international conferences.

PEA has established three networks related to the assets of Norrköping's industries. The Erfapack network is based on companies involved in the regional packaging industry. The Erfadisplay network involves the regional printing industry, and the Erfabygg network is based on the building-materials industry. The goal of the first two is to integrate PE into new products to enable regional companies to increase their competitiveness. Erfabygg, with a slightly different perspective, aims to find specific PE applications in such areas as logistics services within the building-materials industry. These industry networks meet regularly to receive information about PE's development and to discuss how it may fit into their industries. By offering separate PE prizes at a yearly business-plan competition, PEA has encouraged entrepreneurs, students, and PhD candidates to write business plans centred on PE technology.

A cluster coach organises these PEA activities, in which many external stakeholders participate. The activities between 2006 and 2008 emphasised marketing PE and the formation of meeting places. One marketing instrument is PEA's monthly newsletter, which informs readers about international PE events and PEA's regional activities. It pays for PEA's stakeholders to receive the newsletter. When, for example, the cluster coach visited a conference in the UK, the newsletter was partly based on what he learnt at there.

PEA builds relationships with other hubs in Sweden. For example, the Packaging Arena cluster in Karlstad is in discussion with it about print production. Norrköping has many packaging manufacturers, but none of their customers. PEA's firm networks include one end-user of packages, Cloetta, which is a candy and chocolate manufacturer. The Faraday Packaging Network in the UK is one of PEA's partners, and it has many end-users. Faraday, however, focuses on all future packaging trends and not just PE.

Cluster meetings over lunch take place once or twice a month so such people responsible for PE production as researchers from LiU, Acreo representatives from both production and marketing, and people from NOSP and PEA can share information. PEA held seminars preceded by an international keynote speaker for 85 participating researchers, users, and stakeholders from industry and society in November 2007, then held another seminar in May 2008 for researchers and representatives of local companies. It also sends such representatives as researchers and marketing people from Acreo and the ITN to numerous conferences around the world annually. All these activities promote the region's PE knowledge hub.

PEA also participates in research conferences and bilateral research meetings. On a global level, it is involved in an EU project and the Organic Electronics Association's international conference took place in Norrköping in 2008. PEA is developing further international relationships and conducts intelligence surveillance through different types of international networks.

Table 2 presents PEA's first economic results of the House of Brands strategy and of having university research in Norrköping. Its PE R&D has attracted external interest that has resulted in the development of some cooperative research efforts. Some start-up firms based on PE have also emerged. This paper's appendix presents some illustrative cases of its economic outcomes or potential ones. The established local company Billerud appreciates being informed about PE developments and sees the benefits of being part of the local network, but has not yet seen any advantages in engaging in R&D activities based on PE. The start-up firm Neoplex, however, established itself in order to exploit PE.

Table 2 PEA's industry relationships 2006-2008 (PEA, 2008)

Events	**Industry (n)**	**SME (n)**
Paying customers at Acreo and LiU	9	5
Companies engaged in Acreo technology assessment	35	
Companies contributing in kind with Acreo and LiU	10	6
Start-up firms		5
Regional companies involved in the Erfa networks	50	
Regional companies acting as subcontractors for R&D projects and spin-offs	10	

6. Analysis

PEA's case shows how informal relationships can be formalised on a regional level into a collaborative strategy. Relationships on a regional leadership level created bottom-level spaces within which actors with a common interest in the emerging PE technology could network. This conforms with existing findings in regard to knowledge, innovation, and consensus spaces (Etzkowitz and Klofsten, 2005; Etzkowitz and Ranga, 2009). Furthermore, the Norrköping urban region has historical roots in both paper manufacturing and the electronics industry, and this along with many other factors contributed to PE becoming the source of potential sectoral succession or creative construction (Agarwal et al, 2007; Storper and Scott, 2008).

In regard to the research question of who the main organisational actors in the formation of this viable local strategy for the exploitation of an emerging technology have been, prior to PEA's founding Acreo and ITN had started to find ways to facilitate the exploitation of the emerging PE technology, but the establishment of closer relationships with NOSP and the municipalities created new local networks that increased its marketing and commercialisation resources immensely.

As Table 3 illustrates, the PEA case's main activities for exploiting PE have been knowledge creation, barrier reduction, resource mobilisation, and innovation (Romer, 1986; Braunerhjelm, 2010; Svensson et al, forthcoming; Audretsch, 2009). Knowledge creation has been based on research conducted by both Acreo and ITN. Acreo performed the barrier

reduction activities in the form of applied science, the PEA-M prototype factory, and PEA as the creator of relationships to bridge the gap between market needs and PE's available solution capacity. Resource mobilisation for knowledge creation and barrier reduction benefited from the collaboration among actors within academia, the public sector, and industry. PEA-M and Acreo have been involved in innovation activities, becoming expert PE organisations as well as partners with external organisations interested in PE.

Table 3 Impact of organisational actors

Main impact	**Organisational actors**
Knowledge creation	ITN, Acreo
Barrier reduction	Collaborative projects (PEA-M, and PEA), and all the participating organisations
Resource mobilisation	Municipality, NOSP, Acreo, and ITN
Innovation	Start-up firms

In regard to the research question about what the results of the strategy implementation and the activities to reduce the barriers to exploiting PE have been, the municipality leadership's strategy of establishing a research university and the vice chancellor's and the national government's assistance in doing so led to PE research being based in Norrköping. Help from the top and middle level of the public sector and additional assistance from private local pockets of wealth also reinforced PE's local development.

The application of the emerging organic electronics technology took a strategic turn towards paper in Norrköping due to the field's possibilities, the researchers' creativeness, and the interest of local donors. This is one factor involved in Schumpeter's (1911) theory of creative destruction being different on a regional level, where it becomes creative construction due to path-dependent regional factors (Agarwal et al, 2007). The strategy, furthermore, has primarily mobilised regional actors and regional networks, which has resulted in a regional understanding of what PE is, of what it is capable, and global scientific progress in it.

These top-level strategies led to the localisation of a knowledge space, and bottom-level actors do need to be spatially and socially close to an emerging technology for start-up firms to commercialise new ideas. The conversion from science and knowledge to technology and economic activities involves bottom-level processes by actors either involved in knowledge creation or in business development (von Hippel, 2005). The case of the start-up firm Neoplex, detailed in this paper's Appendix, illustrates the importance of PEA's barrier-reduction activities, especially PEA-M, as the close cooperation between Neoplex's founder and PEA-M's engineers was fundamental for its progress.

Furthermore, Neoplex's founder testified that he had had to invest a large amount of time in understanding PE's possibilities and limitations. Socially close actors often exploit knowledge spatially close to where knowledge creation takes place. This implies a high degree of stickiness of information to where it is created (Di Gregorio and Shane, 2003; von Hippel, 2005; Sorenson et al, 2006). The case's findings support the conclusion that how recently firms have started up affects their decisions whether to be close to a university because new firms are more likely to depend on knowledge created in university cities (Audretsch et al,

2005). Furthermore, general-purpose emerging technologies are more likely than narrower ones to have many different applications (Eckhardt and Shane, 2003).

Many knowledge-transfer activities took place, creating close networks among local industry actors and researchers. This has yet to lead to any R&D investment, but industry representatives have spent much time learning about PE. Furthermore, the international business intelligence in regard to PE that PEA and the researchers have provided has apparently been of value for such participants as Billerud, and Acreo has pursued its licensing activities professionally with an experienced licensing team who are present in global arenas. This has led to several research-related cooperative relationships between multinational companies and research groups.

The generation of start-up firms based on PE has so far had three sources. Two companies are spin-offs from Acreo. Another source was an entrepreneurial PhD student who found new applications in the course of his research. The third source was an entrepreneur who discovered a market opportunity and found PE to be a solution for satisfying it. This last phenomenon is also of interest due to PE's absorptive capacity. It is a pull effect that attracted the entrepreneur who launched a knowledge-intensive start-up firm. He resided two hours away from Norrköping but commuted there to build up a network with the actors in the knowledge and innovation spaces.

Table 4 Preliminary indications of innovation

Technology transfer modes	**Important conditions**	**Companies**
Externally generated entrepreneurs	Problem needs are identified	Neoplex
Internally generated entrepreneur	Converting solution capability to a search for applications	Inorel, Soleve
Licensing agreements	Acreo having technology-transfer capability	PEAB, Japanese company, StoraEnso
Spin-off from Acreo	Being close to the Acreo's activities	Webshape, Paperdisplay

7. Concluding Discussion

Both knowledge-based and regional factors have had special importance in the search for economic development (Romer, 1986; Krugman, 1992). Knowledge-based regional development centres on knowledge spillover in close geographical proximity to the knowledge's source. The sources of knowledge creation are R&D organisations as universities, research institutes, and large companies. Academic research organisations in particular are increasingly important knowledge creators, and such studies as Braunerhjelm et al (2010) have pointed out that such institutional and organisational obstacles as knowledge filters make a major difference in knowledge's economic output.

This study has shown that local actors can understand the importance of reducing knowledge-filter barriers and can mobilise resources to do so. They have dedicated these resources to

facilitating the commercialisation of an emerging technology and have used them to create local as well as international networks, a prototype factory, and a consensus space for the regional actors involved.

This study therefore concludes that although many actors have been involved, only a few specific actors and processes have been essential for turning the new knowledge into potential economic output in the four categories of internally and externally generated start-up firms, license agreements, and research-institute-initiated spin-offs (See Figure 3). These activities are all bottom-up processes that people initiate based on the technology's potential uses, the distribution of information about its potential among nascent innovators, and how low the barriers are for actors who want to exploit solution capability and problem information jointly. These findings suggest that knowledge-based regional economic development is based on the bottom-up processes of problem information, solution capability, and entrepreneurship.

References

AFUAH, A. (1998) **Innovation Management; strategies, implementation and profits**. New York: Oxford University Press.

ANAND, B.N. and KHANNA T. (2000) The Structure of Licensing Contracts, **Journal of Industrial Economics**, 48(1), pp. 103-136.

ARROW, K. (1962) **Economic welfare and the allocation of resources for invention**. In: Nelson, R. (Ed.), The Rate and Direction of Inventive Activity. Princeton University Press, Princeton, NJ.

ASSOCIATION OF UNIVERSITY TECHNOLOGY MANAGERS (1999) **AUTM Licensing Survey**. Association of University Technology Managers, Norwalk, CT.

AUDRETSCH, D.B. (2009) Emergence of the entrepreneurial society, **Business Horizons**, 52, pp. 505-511.

AUDRETSCH, D.B. (2005) **The knowledge spillover theory of entrepreneurship and economic growth** in The Emergence of Entrepreneurial Economics, G.T. Vinig and R.C. van der Voort (eds.), Elsevier, 43, pp. 37-54.

AUDRETSCH, D.B., LEHMANN E.E., and WARNING S. (2005) University spillovers and new firm location, **Research Policy**, 34(7), pp. 1113-1122.

AUDRETSCH, D.B., ALDRIDGE, T.T., and OETTL, A. (2006) Preliminary Draft: Prepared for the Ewing Marion Kauffman Foundation, March 29th, 2006

AUDRETSCH, D.B. and ALDRIDGE, T.T. (2009) Scientist commercialization as conduit of knowledge spillovers. **The Annals of Regional Science,** 43, pp. 897-905.

BRAUNERHJELM, P., ACS, Z.J., AUDRETSCH, D.B. and CARLSSON, B. (2010) The missing link: knowledge diffusion and entrepreneurship in endogenous growth, **Small Business Economics**, 34(2), pp. 105–125.

CARLSSON, B., ACS, Z.J., AUDRETSCH, D.B., and BRAUNERHJELM, P. (2009) Knowledge creation, entrepreneurship and economic growth: a historical review, **Industrial and Corporate Change,** 18(6), pp. 1193-1229.

COHEN, W.M., and LEVINTHAL, D.A. (1990) Absorptive capacity: A new perspective on learning and innovation. **Administrative Science Quarterly,** *35*(1), pp. 128-152.

COOKE, P. (2002) Regional innovation systems: general findings and some new evidence from biotechnology clusters. **Journal of Technology Transfer,** 27, pp. 133–145.

COOKE, P., DE LAURENTIS C., TÖDTLING, F. and TRIPPL, M. (2007) **Regional knowledge economies, markets, clusters and innovation, New horizons in regional science.** Cheltenham: Edward Elgar.

COOKE, P. and LEYDESDORFF, L. (2006) Regional development in the knowledge-based economy: The construction of advantage. **Journal of Technology Transfer**, special issue, pp. 1-11.

DI GREGORIO, D., and SHANE, S. (2003) Why do some universities generate more start-ups than others?, **Research Policy**, 32(2), pp. 209–227.

EDQUIST, C. (1997) **Systems of Innovation: Technologies, Institutions, and Organizations**. London and Washington DC: Pinter.

ECKHARDT, J. and SHANE, S. (2003) Opportunities and entrepreneurship. **Journal of Management,** 29(3), pp. 333–349.

ETZKOWITZ, H. (2008) **The Triple Helix of University-Industry-Government: Innovation in Action**. London: Routledge.

ETZKOWITZ, H. and KLOFSTEN, M. (2005) The innovative region: Toward a theory of knowledge-based regional development. **R&D Management,** 35(3), pp. 243-255.

ETZKOWITZ, H. and RANGA, M. (2009a) From spheres to spaces: The dynamics of the triple helix concept, in A. RICKNE, S. LAESTADIUS and H. ETZKOWITZ (Eds) **Regional Innovation Systems: The Swedish Experience of Policy, Governance and Knowledge Dynamics.** In press.

ETZKOWITZ, H. and RANGA, M. (2009b) A trans-Keynesian vision of innovation for the contemporary economic crisis: 'picking winners' revisited, **Science and Public Policy,** 36(10), pp. 799-808.

GEORGE, A.L. and BENNETT, A. (2005) **Case Studies and Theory Development in the Social Sciences**. Cambridge, MA: MIT Press.

JOHANNISSON, B. (1998) Entrepreneurship as a Collective Phenomenon. Paper presented at the **RENT XII** Conference**,** Lyon, France, November 26-27.

JOHANNISSSON, B., and LINDHOLM DAHLSTRAND, A. (2009) Bridging the Functional and Territorial Views on Regional Entrepreneurship and Development: The Challenge, the Journey, the Lessons, **European Planning Studies,** 17(8), pp. 1105-1115.

JONES-EVANS, D., and KLOFSTEN. M. (1999) Creating a bridge between university and industry in small European countries: The role of the Industrial Liaison Office, **R&D Management** 29, no. 1: 47.

KLOFSTEN, M. and JONES-EVANS, D. (2000) Comparing Academic Entrepreneurship in Europe – The Case of Sweden and Ireland, **Small Business Economics,** 14(4), pp.299-309

KLOFSTEN, M. (2005) New venture ideas: An analysis of their origin and early development, **Journal of Technology, Analysis and Strategic Management,** 17(1), pp. 105-119.

KRUGMAN, P. (1992) **Geography and Trade.** Leuven: MIT Press

MOWERY, D., NELSON, R., SAMPAT, B. and ZIEDONIS, A. (2001) The effects of the Bayh-Dole Act on US academic research and technology transfer, **Research Policy**, 30, pp. 99-119.

UTTERBACK, J.M. (1994) Reprint 1996. **Mastering the Dynamics of Innovation**. Boston: Harvard Business School Press.

PEA – PRINTED ELECTRONICS ARENA (2008) VINNVÄXT – Innovationssytem i tidiga skeden. Lägesrapport 2008-03-31

PETRUSSON, U. (2007) **Universitetet i kunskapsekonomin**. VINNOVA FORUM VFI 2007:01

PORTER, M. (1990) **The competitive advantage of nations**. Simon & Schuster: New York

ROMER, P. (1986) Increasing Returns and Long-run Growth, **Journal of Political Economy**, 94(5), pp. 1002-1037.

ROMER, P. (1990) Endogenous Technological Change, **Journal of Political Economy**, 98(5), pp. S71-102.

SARASVATHY, S.D. (2001), Causation and Effectuation: Toward a Theoretical Shift from Economic Inevitability to Entrepreneurial Contigency, **Academy of Management Review**, 26(2), pp. 243-263.

SCOTT, R. (2000) **Institutions and Organizations.** 2nd ed. Stanford, CA: SAGE.

SHAH, S. and TRIPSAS, M. (2007) The Accidental Entrepreneur: The Emergent and Collective Process of User Entrepreneurship, **Strategic Entrepreneurship Journal** 1(1), pp. 123-140.

SHANE, S. (2000) Prior knowledge and the discovery of opportunities, **Organization Science,** 11(4), pp. 448-469.

SHANE, S. (2004) **Academic Entrepreneurship: University Spinoffs and Wealth Creation.** Aldershot, UK: Edward Elgar.

SHARMA, M., KUMAR U., and LALANDE L. (2006) Role of University Technology Transfer Offices in University Technology Commercialisation: Case Study of The Carleton Univesity Foundry Program, **Journal of Services Research**, 6, 109.

SOLOW, R.M. (1956) A contribution to the theory of economic growth, **Quarterly Journal of Economics,** 70, pp. 65-94.

SORENSON, O., RIVKIN J.W. and FLEMING, L. (2006) Complexity, networks and knowledge flows, **Research Policy,** 35(7), pp. 994-1017.

STORPER, M. (1997) **The Regional World: Territorial Development in a Global Economy**. London: Guilford.

SVENSSON, P. (2007) Capitalizing on science. **Licentiate Dissertation.** Department of Management and Engineering, Linköping Institute of Technology, Linköping.

SVENSSON, P. (2009) Establishing triple helix relationships: The case of PEA. **HELIX Working Papers.** Linköping University, Linköping.

SVENSSON, P., KLOFSTEN, M., and ETZKOWITZ, H. (2010) The Norrköping Way: A Knowledge-based Strategy for Renewing a Declining Industrial City, (forthcoming)

SVENSSON, P and ÖHRWALL RÖNNBÄCK, A. (2010) Towards a framework for science-based innovation: An in-depth study of a Swedish research programme, (forthcoming)

TEECE, D. J. (1977) Technology Transfer by Multinational Firms: The Resource Cost of Transferring Technological Know-How, **The Economic Journal**, 87(346), pp. 242-61.

VAN DE VEN, A.H. (1993) The development of an infrastructure for entrepreneurship, **Journal of Business Venturing**, 8(3), pp. 211-230.

VINNOVA. (n.d.) **About VINNOVA**. Available from: http://www.vinnova.se/en/ About-VINNOVA/

VON HIPPEL, E. (1988) **Sources of Innovation.** Cambridge, MA: The MIT Press.

VON HIPPEL, E. (2005) **Democratizing Innovation.** Cambridge, MA: The MIT Press.

YIN, R.K. (1994) **Case Study Research: Design and Methods.** 2nd ed. Applied social research methods series, 5., Thousand Oaks, CA: Sage Publications.

YLINENPÄÄ, H. (2009) Entrepreneurship and innovation systems: Towards a development of the ERIS/IRIS concept, **European Planning Studies**, 17(8), pp. 1153-1170.

ZUCKER, L., DARBY, M., and BREWER, M. (1998) Intellectual human capital and the birth of US biotechnology enterprises, **American Economic Review,** 88(1), pp. 290–305.

Table 1 PEA's actors and their activities (PEA, 2008)

Activities	**Actors**						
Coordin-ation:	PEA: Vision, Strategy, Networking, Marketing, Meeting-places, Services						
	Public actors		Academy			Industry	
	Municipalities, Östsam, NOSP, LEAD	Innova-tionsbron	LiU	Acreo	PEA-M	Established and start-up firms	VC
Research:			Material, components	Systems, production methods		Material, equipment, products, and market demands	
Creation:	Business idea contest, idea seminars, entrepreneurial activities		Ideas, entre-preneurs	Ideas, entrepreneurs, technology dissemination	Ideas, entre-preneurs	Ideas, entrepreneurs, products, and market demands	
Starting:	Start-up firms, incubator, ENP, soft landing, Venture Cup	Seed capital		Technology transfer, start-up firms	Prototype resources	Technology implementation	
Develop-ment:	Testing, management, human capital development		Basic techno-logical problems	Development projects	Test, pilot production	Applications	Com-pany
Growth:	Coordinating capital				Production resources	Sales, marketing	Capital

Appendix

Illustrative Cases of Commercialisation of an Emerging Technology

Initiative within established firms: Some examples.

Large companies interested in PE have approached Acreo with different proposals. PEA finds it easier to work with established companies because such companies know what they are doing, have financial clout, and have indicated a willingness to develop the product or service involved. PEA assists its members with market appraisals and information about state-of-the-art technology, what components are available, and structural information.

StoraEnso, a multinational pulp and paper company, is launching a controlled delaminating material product, which is glue that can be electronically delaminated that Acreo helped to create. It may be used to glue together primary packaging units for transport, which can then be detached at the click of a button to form individual packages for store shelves.

A large multinational security company with a regional presence has joined with Acreo and LiU in developing a tag to certify the authenticity of one of its products. It plans to integrate the tag into a mass-produced product and launch it on the market within two years, with the production line to be located in the region.

A Japanese company has joined with Acreo in developing commercial posters to be used in the retail and transport sectors. Their displays are matrix addressed, which means that their messages can therefore be changed within seconds. The company has one part-time employee at PEA-M.

A research project in Katrineholm called Brains and Bricks, financed by the construction company PEAB, has created a sensor based on organic materials and PE. It is possible to integrate these sensors into new houses to discover quickly if they are suffering from damp and to read them using wireless technology.

Start-up initiatives: Some examples.

Entrepreneurs with business ideas with a technological core based on PE need to gain access to the technology through Acreo, which manages all the IPR in this field. The businesses described in the following paragraphs are those that have been mentioned in applications to PEA's and Acreo's financiers.

Reeltronics-WebShape bases its activities on an environmentally friendly process that uses board foil to produce parts of antennas, heaters, and printed circuit boards, products that would otherwise be produced by an environmentally damaging slow-etching process. Acreo developed the technology, which involves a reel-to-reel process that can run at speeds up to 150 metres per minute. The company's business idea is to achieve a positive cash flow first and then to create its own products further up the value chain, where better margins exist.

PaperDisplay is a newly formed business area within Acreo aimed at commercialising paper displays. Acreo created it after receiving several requests to provide technology to customers who need low-cost displays called smart tags for their products. Discussions are currently underway with 28 regional, national, and international companies that want to license the production technology or buy the finished displays. Local production will be at the printers in PEA's networks and at PEA-M.

Inorel is a company being created to develop intelligent labels that monitor such transport conditions as temperature in transit and that indicate if any are incorrect. This business idea won the Venture Cup East 07-08, a business-plan competition.

Soleve is a company being created to develop and commercialise low-cost solar cells for large areas using organic materials.

Billerud: A large business case.

Billerud is a large packaging-paper company based in Norrköping that has 2,300 employees in 10 countries and a turnover of SEK8 billion. It outsources all its research to different university research groups, but mostly to KTH, the Royal Institute of Technology in Stockholm. Although it conducts no in-house research, it does undertake many development processes, which always involve a customer with a special need. This means that its R&D is always market-pull driven.

It joined the PEA network to obtain access to other packaging-paper companies. Doing so cost it little and such networks are inadequately established within the Norrköping region despite the number of companies in the industry. Although it might be interested in PE in the future, this is not why it joined. The international Organic Electronics Association, which briefs the network's members on the development of organic electronics around the world, offers a great means for Billerud to increase its business intelligence cheaply. Whether PE will be of interest to Billerud depends on what applications result from its research and technological development. Billerud is of course likely to be interested in any applications it sees as useful to its business.

According to the Billerud (2008) website's homepage, "The company's business concept is to offer demanding customers packaging material and solutions that promote and protect their products – packaging that is attractive, strong and made of renewable material." It focuses on the three market trends of "increased environment awareness, improved cost conditions in the conversion process and agreement that paper packaging provides a more luxurious feeling compared to many other materials."

Neoplex: A small business case.

The founder of a start-up firm based on PE called Neoplex, said that his idea started out as a need he had heard identified by a major incumbent firm in the Swedish gambling industry that, with its retail partners, had seen an increasing share of gambling revenues migrating from the physical world to online. The retail stores' representatives were concerned about the decreasing market for a product from which they not only made considerable profits but which also attracted customers into their stores.

The gambling-industry firm currently sells approximately 180 million of these lottery tickets in Sweden annually. The founder had worked as a business-development consultant with it and started to search for a new technology that might bring customers back into the stores. His research led him to PE, and he learnt that Acreo in Norrköping is one of the leaders in the field. He therefore initiated some meetings with Acreo in order to discuss the possibility of using their technology for new gambling and lottery products.

Acreo was excited about the idea, and they created a small pilot project together, the August 2005 evaluation of which was particularly positive. A two-day pilot study in Norrköping indicated that the displays worked. The founder then started to search for pre-seed financing. The local office of the national governmental development foundation, Technology Bridge Linköping, suggested Iteksa Ventures, an early-stage investment firm owned by Technology Bridge, SAAB, and Industrifonden. Its representative mentioned that Rendera, a small early-stage fund governed by the Technology Bridge Linköping, might be interested. Rendera decided to back the idea and the entrepreneur with SEK700,000, with further financing

coming from Almi and the Technology Bridge, which provided SEK150,000 each. By Christmas 2005 these financiers had invested SEK1 million in Neoplex.

The founder then went on paternity leave for three months while Acreo worked on the prototype, encountering many different problems. Just before summer 2006 the prototype was working and Neoplex demonstrated it to the gambling-industry firm and an almost functional prototype to Iteksa. Neoplex had a deal with the gambling-industry firm that stated that the firm would provide it with expert advice and information about the market in exchange for the exclusive rights to sell the lottery tickets in Sweden.

The Östergötland County Administrative Board called Neoplex and asked if it wanted to borrow SEK400,000, having received advice to do this from the Innovation Bridge and Almi. Neoplex then issued new shares, with Iteksa investing SEK700,000 and Rendera SEK300,000. This enabled Neoplex to further its technological development. The founder noted that, "I think Acreo and PE are very dependent on external entrepreneurs, companies, and other actors putting demands on them. Otherwise they would be conducting research without any particular commercial direction or goal" [Translated from Swedish by the author.]

The founder had told Acreo how he wanted the technology to perform. In order to do so he had had to develop a thorough understanding of the inner workings of PE technology. He also acquired a deeper understanding of the gap between businesses' commercial culture and universities' research culture. He perceived Acreo to be a highly professional organisation, although some misunderstandings did occur during technology development discussions due to differing expectations. Attempting to describe these differences, he said that he thought the problem lay in how different cultures set priorities during a development process. He said further that the business community defines its customers and that for it the end product is what counts, but that in the research community it is discoveries, articles, and how to satisfy research financiers that matters.

Neoplex received SEK1.4 million for technological verification in 2007. The technology was then due for production in a small series for an estimated cost of SEK8 million. After Iteksa dissolved later that year, Rendera took over its position as lead investor and wanted to invest a further SEK3 million. In February 2008 Neoplex received an order from the gambling-industry firm to buy the first batches of prototypes. StoraEnso Venturing indicated its interest in investing, but an organisation within it needed a sponsor, which created some inner tensions, and it therefore pulled out. This put Neoplex in a catch-22 situation, as it had its first order but insufficient development resource.

A US patent is pending that aims to protect the application of PE to lottery tickets. Neoplex may need to use all of Acreo's IPR abilities in the gambling market, with it acquiring 5% of the company due to the SEK8 million worth of injections. It had a potential stake in the company and it would be of great marketing interest for PE in general if Neoplex were to succeed. Despite this, however, no extra money has been available for prototyping due to the global financial crisis.

HTSF Doctoral Workshop and Conference, May 25-28th 2010, University of Twente, Enschede, The Netherlands

SPATIAL REACH IN LEARNING OF ACADEMIC SPIN-OFFS – A FOCUS ON ABSORPTIVE CAPACITY

Mozhdeh Taheri* and Marina van Geenhuizen**

*PhD candidate at the Faculty of Technology, Policy and Management, Delft University of Technology.
Contact: m.taheri@tudelft.nl
**Professor of Innovation and Innovation Policy in Urban Economies at the same faculty.
Contact: m.s.vangeenhuizen@tudelft.nl

Abstract
The current paper explores the extent of international learning among university spin-off firms and enhancing factors of this learning. Drawing on survey data of 100 university spin-off firms, the relationship is explored between absorptive capacity and international learning, alongside other factors. A small majority of spin-off firms is engaged in international learning and the most powerful influences tend to be R&D expenditure and international market orientation. The implications of the results and future research steps are discussed.

1. Introduction

In the development of regional innovation systems, universities are recognized as a main source of new knowledge and innovations. By introducing commercialization of university knowledge among others through "university spin-offs" (McQueen and Wallmark 1982) universities have claimed a new role in regions' and countries' economies since the early 1980s and even more strongly since the early 2000s. Spin-off firms not only develop university inventions towards application in the market; they also contribute to a wider diffusion of university knowledge into the business community, to the enhancement of entrepreneurship in the region, and to an improvement of infrastructures supporting high-tech entrepreneurship (e.g. Shane, 2004; Benneworth et al., 2009). Spin-off firms provide places for university students to gain experience (internships) and if quickly growing and in need for new knowledge, these firms on their turn may finance specific research projects at the university.

A central issue in the discussion on innovation systems is "space" and whether we bound it in local, regional or international context. As discussed by Autio (1998), a firm may link with different partners such as universities, research institutes, customers, suppliers, etc. both nationally and internationally, dependent upon the need for specialized knowledge. Nevertheless, many empirical studies embracing the idea of agglomeration economies (cities) or cluster economies, have shown that small high-tech firms benefit from knowledge spillovers and collaboration with partners in close physical proximity (Audretsch and Feldman 1996; Braunerhjelm et al. 2000).

Since the increased popularity of network analysis picturing real-life knowledge relationships, however, some doubt has arisen about the importance of local learning, and the idea has emerged of some differentiation between high-tech firms in this respect (van Geenhuizen, 2008). By nature, small high-tech firms are in short of specialized knowledge and sophisticated services, most likely not all available in their local environment (Torre 2008). Dependent upon their specific technology and market, these firms may need to connect with partners who possess additional (core or complementary) knowledge and information which help them in developing products, designing prototypes, testing them, and introducing the products to market, etc. Dependent upon the strength of the own R&D intensity and related investments, and on previous knowledge and experience, they acquire and exploit the external knowledge more or less efficiently. The differentiation among high-tech firms does not only hold for the spatial reach in learning but also for the type of knowledge sources involved, research-related or market-related.

The utilization of external knowledge resources is increasingly seen as a key condition for the performance of small high-technology firms. With the grown specialization in research and development across the globe, it is particularly the utilization of international knowledge sources and collaboration that is seen as one of the most important processes underlying firms' innovative activities (Kafouros et al. 2008; Pittiglio et al. 2009). It is precisely for these reasons that absorptive capacity has become a popular construct in the past two decades. Absorptive capacity is the dynamic capacity that enables firms to create value and to gain and sustain competitive advantage through the management of external knowledge. Following Zahra and George (2002) and according to our conceptualization of absorptive capacity, a distinction is made between four components, i.e. acquisition and assimilation (as potential absorptive capacity), and transformation and application (as realized absorptive capacity).

What has rarely been studied so far is how internationalization of learning links with different components of small firms' absorptive capacity. Establishing (and maintaining) learning networks abroad is unlikely to be an easy task, and most probably requires various investments by the firms, among others in absorptive capacity. A recent study shows that it is absorptive capacity that contributes to an explanation of internationalization processes in a broad sense (Sedoglavich et al. 2009), whereas another recent study shows that a higher level of potential absorptive capacity positively relates with learning collaboration with more distant partners (de Jong and Freel 2010).The last study however uses a limited approximation of absorptive capacity, namely through R&D expenditures and R&D intensity. Therefore, this study attempts to broaden the scope of absorptive capacity by using indicators with a larger coverage of the four components. The following questions will be addressed:
1. In which respects is absorptive capacity different between small high-tech firms?
2. How are various components of absorptive capacity, alongside other factors, related to patterns of international learning?

Our study draws on a sample of 100 spin-off firms from two universities, Delft University of Technology in Delft, The Netherlands, and National Technical University of Norway in Trondheim, Norway. The paper is structured as follows. Relevant theory on distance in learning, absorptive capacity and firm characteristics is examined in section 2, and serves as an underpinning of a conceptual model of internationalization in learning. In section 3, the methodological steps in the study are discussed, including data description. This is followed by section 4, that presents a descriptive analysis of absorptive capacity and of internationalization in learning, and section 5 that presents the outcomes of a first exploration of the causal background of international learning. Implications of the outcomes and further analysis are addressed in the final section.

2. Theoretical views

2.1. Learning and distance

Knowledge and information - whether it is technical or non-technical - are a valuable source of competitive advantage for firms at different development stages (Grant 1997). Young technology firms by nature have a limited set of internal knowledge available, and particularly young spin-off firms in technology fields are in short of market-related and management-related knowledge

(van Geenhuizen and Soetanto 2009). Therefore, such firms need to acquire external knowledge and information to survive and grow. Firms may learn through their science-based channels such as universities and research institutes, and through market-based relations such as with customers and suppliers.

Learning can be described as the ways in which firms build, supplement and organize knowledge and routines around their activities and within their cultures, and adapt and develop organizational efficiency by improving the use of broad skills of their workforce (Dodgson, 1992). There are two main types of learning, i.e. learning to solve particular problems on a day-to-day basis and learning to learn, i.e. the capability to learn in an efficient and effective way. The latter type connects with the concept of absorptive capacity. As defined by Zahra and George (2002) absorptive capacity is a set of organizational routines and processes by which firms acquire, assimilate, transform and exploit knowledge to produce a dynamic organizational capability. Learning as developing capacity to acquire and later assimilate existing knowledge (Cohen and Levinthal 1990), may be different between the scientific fields concerned. Asheim et al. (2007) presented different forms of learning: science-based and adaptive learning (market-based). Science-based learning is close to knowledge exploration and usually related with radical innovations. Life science and material science (nanotechnology) are in this category. Laws of nature and know why are key in this type of learning. While adaptive learning (know how) is more about finding applications and solutions based on market demand and stands on the exploitation side of knowledge. Mechatronics in which customer relations are important in firm's learning is in this category. In addition to these features, Asheim et al.(2007) also suggest a difference in spatial orientation. While science-based learning tends to be globally oriented (except for the first stages) due to its universal character, adaptive learning is context specific, deals more with tacit knowledge and tends to benefit from face-to-face interaction, eventually in local clusters. This idea motivates us to include *technology* in our exploratory model of internationalization in learning.

Boschma (2005) describes proximity in five dimensions; among them are cognitive proximity and geographical proximity. He posits that geographical proximity is neither a necessary nor a sufficient condition for inter-organizational learning and effective innovative collaboration, but it may facilitate innovation through strengthening other dimensions of proximity. According to Boschma, cognitive proximity exists if organizations are similar in terms of their knowledge base, a situation that determines whether these organizations can interact effectively in a learning process. This suggests that cognitive proximity could be a trade-off for geographical proximity. In other words, organizations with higher cognitive proximity could collaborate more effectively even within a geographical distant context.

In innovation studies, much attention has been paid to the supply/exchange of new knowledge in urban places. Many authors take for granted that high-tech firms benefit from a location in large cities and metropolitan areas due to a relatively large availability of information (knowledge spillovers) and large pools of specialized workers and talented people (e.g. Audretsch and Feldman1996); this as opposed to small cities and rural and peripheral places . In most of these views, importance is attached to cultural and social proximity that goes along with spatial proximity. Accordingly, a common history/culture connected with spatial proximity facilitates trust in interaction and social networks allowing for tacit knowledge transfer (e.g. Maskell and

Malmberg, 1999). Given these ideas we include *location* of the firm in our exploratory analysis, because 'availability of knowledge' like complementary knowledge to the core invention, knowledge from launching customers, etc. differs between the urban places in our study. Delft is part of the large metropolitan area of Randstad in the Netherlands, whereas Trondheim is a rather isolated town in the middle of Norway. It seems plausible that firms in Trondheim feel themselves urged to go abroad more quickly than the ones in Delft, looking for the knowledge they need. Distant collaboration may be a response to knowledge shortages in the local area.

2.2 Firm characteristics and market

It is suggested in the literature that young and small firms are more tied to local places due to limited human and financial resources for searching and coordinating the acquisition of knowledge in wider areas, particularly abroad. This would explain the phenomenon that younger and smaller firms locate more close to organizations with which they are familiar (for example, through their origin) and wish to collaborate with. For these reasons, we include *age* and *size* of firms in our analysis.

However, the literature indicates that there is more differentiation between firms in spatial reach in learning. This holds for uncertainty in the market, for example when the invention turns out to be a breakthrough without a market or when access to the market is heavily regulated (trials and tests in medical science). A strong uncertainty may drive the firms abroad in search for even more specialized knowledge. In addition, what is already proven in some empirical research is that the spatial orientation in the customer market influences the reach in learning. There is a clear link between the reach in product markets and innovation collaboration (Arndt and Sternberg, 2000). In addition, de Jong and Freel (2010) confirm that operating in export markets is associated with a greater reach in learning activity. Given the above insights, we include age and size, market (uncertainty) and market-orientation in our conceptual model.

2.3 Absorptive capacity

A quite recent study shows that it is absorptive capacity that contributes to an explanation of internationalization processes (Sedoglavich et al. 2009). Accordingly, high-tech small and medium-sized enterprises possess technological absorptive capacity which influences their strategies including internationalization (mainly export). Cohen and Levinthal (1990) perceive a firm's absorptive capacity as its ability to value, assimilate and apply external knowledge which depends on its prior related knowledge. Here we could bridge cognitive proximity with "absorptive capacity" concept. Both claim that organizational search for new knowledge is limited by its existing inventory of knowledge and experience. Therefore, learning is seen to be a collective and path dependent process for which prior knowledge will facilitate new knowledge acquisition, assimilation and later exploitation. Thus, several characteristics of founding entrepreneurs (or teams), such as previous working experience and level and multidisciplinarity of education, seem important as dimensions of absorptive capacity in the role of prior knowledge accumulation within firms.

Zahra and George (2002) define absorptive capacity as a set of organizational routines and processes by which firms acquire, assimilate, transform and exploit knowledge to produce a dynamic organizational capability. The authors make a distinction between two dimensions: potential absorptive capacity (PACAP) and realized absorptive capacity (RACAP). PACAP

makes the firm interested to acquiring and assimilating external knowledge (Lubatkin and Lane 1998) while RACAP makes a firm capable of leveraging its knowledge by using the absorbed knowledge. Therefore, a firm may acquire and assimilate knowledge but might not have the capability to transform and exploit it for innovation or profit generation. So, high potential absorptive capacity does not necessarily imply a better performance. Distinguishing between potential and realized absorptive capacity helps to explain why some firms are more efficient than others in using absorptive capacity. Zahra and George (2002) mention that most studies on absorptive capacity reflect a firm's realized capacity comprising knowledge transformation and exploitation while focusing on innovative outcomes in measurement (Cohen and Levinthal 1990). Thus, potential capacity, including knowledge acquisition and assimilation capabilities, has received less attention in empirical scrutiny.

University spin-off firms are usually small firms in short of (highly) specialized knowledge, be-it technical or market-related. These specialized firms may have a different *potential* absorptive capacity, for example dependent on a team/single start and if a team, on the composition of the team. If a strong potential absorptive capacity, these firms tend to connect with external sources of knowledge concerning the same technology or complementary technology. In this sense, spin-off firms find themselves cognitively close to other firms with strong technical absorptive capacity (Torre 2008). It could also be claimed that a strong absorptive capacity enables firms to increase their cognitive proximity with potential partners even across geographical distances. Although small high-tech firms prefer fairly close partners for innovative collaboration (Jong and Freel 2010), costs of overcoming distance could be compensated by acquiring highly specialized knowledge or sophisticated services in places across the globe (Drejer and Vinding 2005).

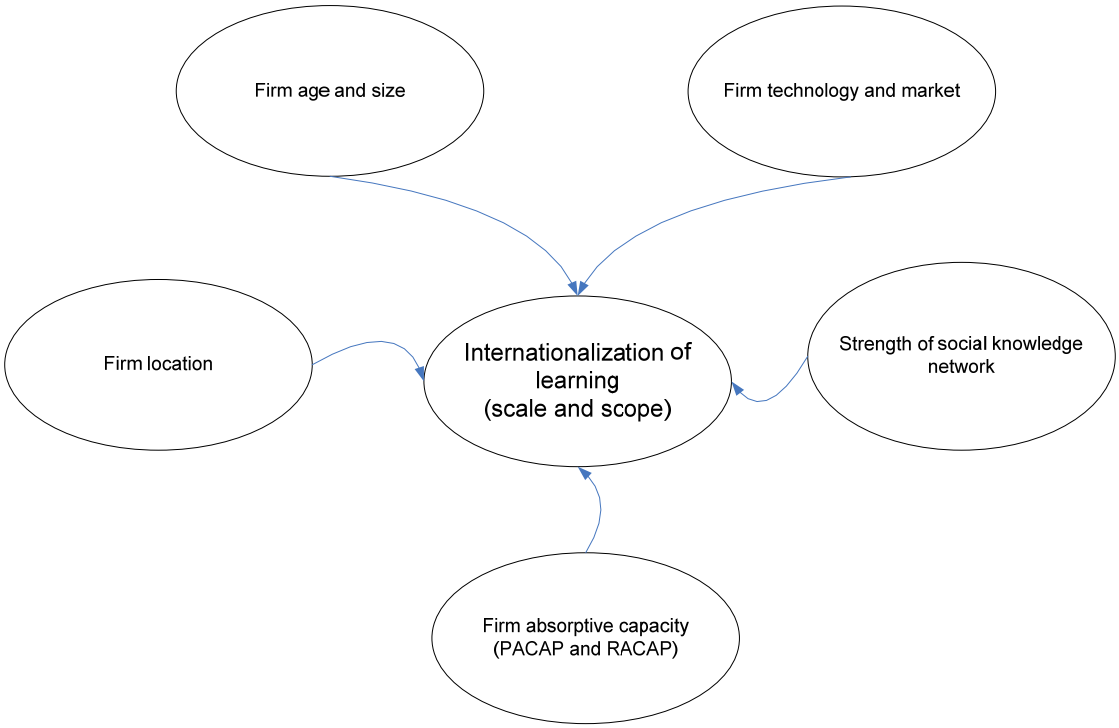
2.4 Social network profile

In the literature, the step to go international in learning is also connected with the role of social (personal) networks. The idea is a stage-based development model in which young high-tech firms first build a relatively strong and 'safe' social network at their home base/region, before they to go abroad for accessing more formal learning relations (e.g. Johannisson, 1998). In their early years, high-tech firms seem to elaborate relatively strong (dense) personal networks. Such a development would mean that international learning goes along with strong social learning networks. However, there is no consensus in the literature. According to the born-global literature particular segments of high-tech firms step into global networking immediately after their inception or shortly after, rejecting the idea of a stepwise development (e.g. Madsen and Servais, 1997; Andersson and Wictor, 2003).

2.5. Conceptual model

Given the above inventory of influences on international learning, we use a division into three (1) the firm's characteristics location, firm size and age, firm technology and market, (2) firm's absorptive capacity including PACAP and RACAP, and (3) firm's social network characteristics, focusing on strength (Figure 1).

Figure 1- Causal diagram of explanatory factors of firm's internationalization



3. Methodological Aspects

3.1. Steps and variables

The analysis in this paper unfolds in three steps: 1) a descriptive analysis of international learning and of absorptive capacity, 2) a broad exploration of the conceptual model based on bivariate correlation analysis, and 3) based on the outcomes of the previous step, model construction and testing of the model using multiple regression analysis. First, we need to discuss which variables we select in measuring the concepts and what the characteristics are of the sample of spin-off firms we use. Appendix 1 and Appendix 2 provide more detail on the construction of the variables and on the outcomes of them.

The *dependent* variable in this study is *internationalization of learning.* We measure this as a dichotomous variable showing whether the spin-off expands its learning activity with the use of more formal knowledge sources abroad (yes/no). In addition, we distinguish between two variables of internationalization, i.e. scale and scope (van Geenhuizen, 2008). *International scale* refers to the geographical pattern of actors in knowledge networks. Knowledge acquisition may be extended into neighboring countries only, all over Europe and/or the world. Scale is defined as an ordinal variable using three categories: high, low and no internationalization. *International scope* is an indicator for the number of different knowledge sources to which a firm is connected internationally and for the differentiation within these sources given knowledge oriented sources

(e.g. universities, government research center) and business oriented sources (e.g. customers, commercial laboratories). Accordingly, scope is defined as an ordinal variable using three categories: high, low and no internationalization.

Firm characteristics. Location is measured in two classes: Delft or Trondheim. Delft represents a city in a large metropolitan area close to the urban heartland of Europe, whereas Trondheim represents a city in an isolated region in the periphery of Europe. As firm characteristics, we have taken firm age (number of years since a firm's foundation), firm size (number of employees) and firm market (including the type of market in terms of uncertainty and national/international output markets). Markets are divided into two categories: relatively certain markets and relatively uncertain markets. Uncertain markets are defined as: highly regulated markets with high risks or not yet existing markets (in case of radical innovations). Also sectors which are highly sensitive to economic downturns e.g. related to the chips industry are defined as uncertain. Based on the categorization of technology and concomitant learning by Asheim et al. (2007), we distinguish two main categories of firms: science-driven ones, dealing with some basics of chemistry, life-sciences, nanotechnology, flow mechanics, optics, etc., and remaining ones dealing with adaptive learning in response to user needs.

Absorptive capacity. Measuring (potential) absorptive capacity of spin-offs (Table 1), we include R&D spending (R&D expenditure as a percentage of revenues) and number of R&D employees as the main source of technical knowledge acquisition in firms. We also include several variables representing the initial state of knowledge accumulation, such as entrepreneur's previous working experience, level of education of founders (by the degree they hold), type of education of founders (whether the team composition is just technical or is multidisciplinary), type of business start (team or single) and number of team members as dimensions of potential absorptive capacity. In order to measure realized absorptive capacity, we use variable "newness" in two categories based on the entrepreneur's evaluation on whether his/her product is a breakthrough and/or new to the sector. Development stage indicates the stage of technology development at the time of the interview (a rank variable including two categories: early development stage including pilot and testing stage, and later stage including introduced to market and consultancy). Whether a spin-off is involved in patenting (applied/granted) is also included as a measure for realized absorptive capacity.

Strength in social networks. We have selected two characteristics that represent aspects of support, i.e. tightness of the network (as amount of existing versus potential relations), and strength of relationships (as three variables: frequency of face-to-face contact, duration of the relationship and acquaintance level with partners).

Table 1- Absorptive capacity, dimensions and operationalization

Main category	Dimension	Operationalization in the literature	Operationalization in this study
Potential absorptive capacity	Knowledge acquisition	-Years of experience of the R&D department -R&D intensity (Zahra & George 2002; Murovec & Prodan 2009; Jong & Freel 2010)	- Amount of R&D investment - Number of R&D employees - Working experience of founders - Level of education of founders - Type of education of founders - Team versus single start -Number of team members at start
Potential absorptive capacity	Knowledge assimilation	-Number of cross-firm patent citation -Number of citations made in a firm's publication to research developed in other firms (Zara and George 2002)	Our database does not allow measuring this.
Realized absorptive capacity	Knowledge transformation	-Number of new product ideas -New research projects initiated (Zara and George 2002)	- Newness of innovation
Realized absorptive capacity	Knowledge exploitation	-Number of patents -New product announcements -Length of product development cycle (Zara and George 2002)	-Applied/granted patent - Development stage

3.2. Data description

The study draws on a given survey of spin-offs of the Technical University (TU) Delft, Delft, the Netherlands and the Norwegian University of Science and Technology (NTNU), Trondheim, Norway. The population of spin-offs from these universities was delineated on the basis of the following criteria. First, the firms needed to satisfy the condition of commercializing knowledge created at the university. Further, the firms had to satisfy the condition of "survived in 2006", not older than 10 years, and enjoy at least one type of support from the incubation organization/university. All firms in this population (150) were approached leading to an overall response rate of 66.7% (100 firms). Data were collected using a semi-structured questionnaire in personal face-to-face interviews with entrepreneurs. If necessary the information was supplemented by website analysis.

4. Absorptive Capacity among Spin-off Firms

As presented in table 2, spin-off firms in this study spend an average of 38% of their revenues on R&D related activities. On average, they employ four R&D employees. Both indicators show a relatively high standard deviation and a min-max range indicating quite some differentiation. The type of start shows that 21% of the spin-offs have started based on a single entrepreneur while 37% have started with two members and 41% with three or more members. With regard to team's knowledge composition, most spin-offs have just technical backgrounds in one field (65%) whereas 32% have a background in more than one technology or a combination of

technology with gamma/alpha. In addition, most spin-offs have no knowledge at the PhD level (62%), but 38% do have such knowledge.

With regard to development stage, most spin-offs (64%) are in the stage of having introduced their product/process into the market or supply consultancy services. A minority (37%) is still in an early development stage or stage of pilot production and various testing. In terms of newness of the products/processes, about 74% of the entrepreneurs qualify their invention as new (breakthrough and/or new to the sector) while 26% qualify their invention not as new in this sense. Also, nearly half of the spin-offs in the database has applied for or has been granted at least one patent, while patent application does not apply for 31% of firms (mainly active in software industry).

Table 2- Absorptive capacity

Variables	**Measure**	**Mean**	**S.D.**	**Min**	**Max**
R&D spending	Percentage of turnover or income*	38.59	21.22	0	100
R&D employees	Number of R&D employees	4.23	3.78	0	23
Previous working experience	Sum of years of working experience among first three founders grouped into two categories: low experience (<=3 yrs) and experienced (>3)†	Low experience (54.5%) Experienced (45.5%)			
Team-start	Two categories	Yes (78.8%) No (21.2%)			
Number of members in team		One member (21.2%) Two members (37.4%) Three or more members (41.4%)			
Type of education	Four categories: technology, multiple technology, management and technology/management/art/medicine**	Technology (64.6%) Multiple technologies (22.2%) Mixed (10.1%) Management (3.1%)			
Level of education	Three categories: no PhD, one PhD and more than one PhD in the entrepreneurial team	No PhD (61.6%) One PhD (24.2%) More than one PhD (14%)			
Development stage	Two categories	Early development stage or pilot and testing (36.5%) Introduction to market, including consultancy as main activity (63.5%)			
Newness	Two categories based on the entrepreneur's perception of the invention: a breakthrough and/or new to the sector or not	Yes (74%) No (26%)			
Granted or applied patent	Three categories	No applied/granted patent (18.2%) At least one applied or granted patent (50.5%) Not applicable* (31.3%)			

* Average in the last three years

† Experience has a mean of 7.5; S.D: 11.8, min:0, max: 62

5. International Learning among Spin-off Firms

As shown in table 3, a small majority of the spin-off firms in our database (61%) is internationalized in their learning activity. Among these firms, 16% have expanded their reach in learning merely in a neighboring country, while most of them (44%) have internationalized globally.

Table 3. Internationalization scale

Internationalization	Frequency	Percentage share
Not internationalized	39	39.4
Neighboring country (low)	16	16.2
Remaining Europe / World (high)	44	44.4
Total	99	100.0

Concerning the type of sources in international learning, we find that customers and exhibitions are the two most important ones for university spin-offs. Among the 60 firms engaged in international learning, customers account for 48%, whereas exhibitions account for 42%. Altogether, market-based sources (customers, suppliers, etc.) account for 28% of all international knowledge sources, whereas knowledge-based sources (universities, higher educational institutes, research institutes, etc.) account for 5%.

Among firms engaged in international learning, 75% have an international market orientation (selling/export). This finding could indicate links between product-market relations and knowledge collaboration and is in line with previous studies demonstrating links between knowledge relations, innovation collaboration and spatial reach to product-markets and exports (Arndt and Sternberg 2000; Roper and Love 2002).

6. Exploration of Influences on International Learning

In this section we broadly explore the relationship between internationalization of learning and the factors of influence as shown in figure 1. In this stage of the study we limit our self to absence or presence of international learning.

On the basis of cross-tabulation analysis, we find significant relationships between internationalization of learning and four characteristics of absorptive capacity: R&D spending, previous work experience of founder team, number of team members at start, and education level of the founder team. Looking for a significant cut-point in R&D spending, we observe that firms with higher spending in R&D (more than 20% of revenue) face a higher level of internationalization. In addition, years of working experience (founder team) tends to be positively associated with internationalization. The same holds for a higher education level of the founders. In contrast, a small starting team seems to be associated with internationalization of learning, not a large starting team. Except for the last result, the outcomes are in line with our hypothesis that prior knowledge accumulation within firms will increase their ability to search

for international learning and to coordinate it. The last, somewhat contradictory, result may be explained as follows: smaller teams need more external knowledge in increasing their innovativeness, including international learning. Further, we find a positive association between international market orientation of firms and international learning.

Table 4. Analysis of association between variables (cross tabulation analysis)*

Variables	Internationalization of learning
1. Firm age	N.S.
2. Firm size (5 employees as borderline)	N.S.
3. Character of technology	N.S.
4 Market uncertainty	N.S.
5. International market-orientation	**S.** † International market-orientation is positively associated with internationalization
6. Urban location (Delft versus Trondheim)	N.S.
7 R&D spending (20% of revenues as borderline)	**S.** †† R&D expenditure is positively associated with internationalization
8 R&D employees	N.S.
9 Working experience at start (3 years as borderline)	**S.**††† Working experience is positively associated with internationalization
10 Size of team at start (3 members as borderline)	**S.** ††† Number of team members is negatively associated with internationalization
11 Education level (PhD)	**S. ††** Number of PhDs in founder team is positively associated with internationalization
12 Education type (founder team)	N.S.
13 Newness of invention	N.S.
14 Granted or applied patent(s)	N.S.
15 Product development stage	N.S.
16 Frequency of network meetings	N.S.
17 Duration of relationships	N.S.
18 Acquaintance level in relationships	N.S.
19 Tightness	N.S.

*S.: significant, N.S.: not significant; significance level: †P<0.01, ††P<0.5, †††P<0.1; N (spin-offs): 99.

7. Explanatory model

In this section, we first describe the type of regression analysis used, i.e. logistic regression analysis, and then we examine the results of this analysis in identifying a model with the best fit.

Since the dependent variable - internationalization of learning- is a dichotomous variable we use logistic regression analysis. Accordingly, our regression model will predict the logit that is the (natural) log of the odds of having one or the other decision (here, internationalization of learning). Thus in a simple logistic regression with one predictor variable (X): Ln (ODDS) = Ln (Y/1-Y)= a+bX (Y, is the predicted probability of the event and X is a predictor variable).

With the aim to check for multicollinearity, correlation between the independent variables is presented in Appendix 3. The largest single correlation is between firm age and product development stage (0.66). The reported correlations (most are below 0.50) do not indicate serious concern for multicollinearity (Hair et al., 1998).

As a first step, in Model 1, we include all variables which are significantly associated with internationalization of learning according to the previous bivariate analysis (table 5). The results of this model show quite weak model parameters. To improve model parameters (pseudo R^2 and LR test); we add variables systematically into the model in order to have the maximum increase of model fitness at each step. Models 2 to 4 represent these steps. In Model 2, by adding 'newness' there is a significant improvement in model parameters, not only because its coefficient is significant but also the coefficient of R&D expenditure becomes significant, while the coefficient of international market orientation remains significant. In Model 3, by adding firm size we further improve the model fitness and the coefficients of international market orientation, R&D spending and newness remain significant. In Model 4, including eight variables and adding market (uncertainty) to the model, firm size becomes significant but newness becomes insignificant. In Model 5, by including nine variables we reach almost no better model by fitness. Adding more variables doesn't produce considerable improvements. Choosing the strongest model as a trade off between fitness and number of (significant) variables, Model 4 qualifies best. Firm size, international market orientation and R&D spending turn out to be important factors according to this model.

In more detail, the interpretation of Model 4 is as follows: for firms with a larger size (versus. firms with smaller size), the log odds of being internationalized increases by 0.89. For firms with international market orientation, the log odds of being internationalized increases by 1.04 and for firms with a larger amount of R&D spending, the log odds of being internationalized increases by 1.06. In addition, note that all signs in Model 4 are positive as expected, except for two. The size of the founding team and newness of the invention tend to have a negative impact on internationalization, but the coefficients are not significant. A negative impact of size of the founding team may be explained by the strategy of small teams to learn internationally to compensate for small size. Similarly, a negative impact of newness on internationalization may be due to a trend that firms facing a low level of newness are more eager to learn by internationalization and that firms facing a high level of newness feel hampered in international learning due a danger of loosing IP rights in sharing highly new knowledge abroad.

Table 5- Logistic regression analysis - dependent variable: internationalization of learning (yes/no)

Variables	1	2	3	4	5
	Logit coef.(s.e.)	Logit coef.(s.e.)	Logit coef.(s.e.)	Logit coef.(s.e.)	Logit coef.(s.e.)
Control variables					
Firm age	-	-	-		
Firm size	-	-	0.76 (0.49)	0.89 (0.51) ††	0.95 (0.52) ††
International market orientation	0.86 (0.47) ††	1.18 (0.52) †	1.02 (0.53)††	1.04 (0.55)††	1.08 (0.54) †
Location	-	-	-	-	-
Technology	-	-	-	-	-
Market (uncertainty)	-	-	-	0.65 (0.52)	0.61 (0.52)
Absorptive capacity					
R&D expenditure	0.72 (0.5)	1.08 (0.57)††	1.15 (0.58)††	1.06 (0.54)††	1.05 (0.59)††
R&D employees	-	-	-	-	-
Previous working experience	0.41 (0.48)	0.41 (0.49)	0.48 (0.5)	0.58 (0.51)	0.72 (0.53)
Size of founding team	-0.99 (0.67)	-1.00 (0.68)	-1.08 (0.7)	-1.12 (0.71)	-1.19 (0.73)
Education level (founding team)	0.59 (0.52)	0.67 (0.53)	0.83 (0.55)	0.86 (0.55)	0.84 (0.56)
Education type (founding team)	-	-	-	-	-
Newness of innovation	-	-1.12 (0.61) ††	-1.03 (0.62) ††	-0.89 (0.63)	-0.94 (0.63)
Granted or applied patent(s)	-	-	-	-	-
Product development stage	-	-	-	-	-
Social network					
Tightness	-	-	-	-	-
Frequency of network meetings	-	-	-	-	0.72 (0.72)
N	99	99	99	99	99
LR Chi-square	16.41*	20.06*	22.52*	24.12*	25.17*
Pseudo R Square	0.12	0.15	0.169	0.181	0.189
Log likelihood **	-58.17	-56.34	-55.11	-54.31	-53.79

*P<0.005, †P<0.01, ††P<0.05, †††P<0.1

Overall, the models remain rather weak, but two of the variables show consistently a significant coefficient: international market-orientation (all five models) and R&D expenditure (four models). With these rather robust results, our study confirms outcomes of some recent empirical studies (e.g. de Jong and Freel, 2010).

8. Conclusion

This paper is concerned with the first results of an exploratory study of the extent and causes of learning abroad among technology-based spin-off firms. The study is relevant because the high levels of specialization in technology inventions call for highly specialized knowledge, most probably not (all) available in the local environment of spin-off firms. However, as theory

indicates, spin-off firms have different capabilities for learning, depending on their absorptive capacity. The idea is that firms must first invest in their absorptive capacity before they are able to coordinate and learn from their knowledge partners abroad, potentially reflected in the amount of knowledge and experience in the founding team, as well as R&D expenditure. In addition, previous studies indicate that international learning goes along with an international market orientation. It appeared that most spin-offs in the current study (60%) are engaged in international learning, with customers as the most important category of partners.

The study included various steps: design of a causal model of international learning based on the literature, a broad exploration of the relation between the concomitant variables with presence of international learning (using bivariate analysis) and the exploration of a multiple regression model of international learning (using logistic regression). We included three types of factors in the causal model: firm-related factors (location, age, size and market-orientation, and market and technology features), absorptive capacity (based on R&D indicators and knowledge available at start, the latter both in level and richness) and strength of the social network. Bivariate analysis has revealed a significant relation of international learning with international market-orientation, R&D expenditure, working experience at start, number of team members at start and education level of the founding teams. We used these outcomes to construct a first model followed by the forward stepwise method (adding variables) in logistic regression analysis. The best model as a trade-off between the size of the model and model fitness remains rather weak, with three variables showing significant coefficients: firm size, international market orientation and R&D spending, the last as the only one representing absorptive capacity. Thus, larger firms, firms engaged in export and firms facing high R&D expenditure face a relatively large chance for international learning. The explored models are robust in the sense that two variables are consistently significant: international market orientation (all five models) and R&D expenditure (four models). The level of newness of the invention (significant in two models) shows surprisingly a negative relationship, possibly indicating that a low newness urges firms to learn internationally; but it could also mean that firms facing a high level of newness tend to avoid international learning because of danger of loss of intellectual property. All in all, we may conclude that so far absorptive capacity did not turn out to be a major influence in international learning, except for R&D expenditure and level of newness of innovations.

The relative weakness of the model outcomes has implications for further research. First, some of the variables could be examined in the model in more detail of measurement (refinement), in particular this holds for the variables on absorptive capacity, and secondly we could continue our research to identify some more not yet identified indicators of absorptive capacity.

Appendix 1

a. Tightness of network: refers to proportion of partners who are tied in a network measured as 2t / (n(n-1)) , where (t) is the total number of the network relations and (n) is the total number of partners (Borgatti et al. 1998). A high value indicates a relatively tight network; min:0, max:1. For example, if a spin-off has 5 partners but 3 three of them connect to each other, then the density of network would be (2*3)/(5*(5-1))=0.3

b. Strength of relationships: Granovetter (1973 pg. 1361) argued that the strength of a social tie is a function of its duration, emotional intensity, intimacy, and exchange of services. Accordingly, we measure the strength of relationship through three variables: *Duration of relationship* which presents the number of months/years two partners have been in contact with each other – *Frequency of face to face contacts* which represents the frequency of interactions between two partners in a specific period of time (e.g. how many times two partners may meet and have a face to face meeting?) – *Acquaintance level of relationship* which shows a person's assessment of closeness of the relationship.

Appendix 2

Variables and descriptive statistics (N=99)

Variables	Measure	Mean	S.D.	Min	Max
Firm age	# years since foundation	5.11	3.03	1	10
Firm size	#employees	7.43	7.06	0	51
Frequency of network meetings	# meeting per month	1.03	0.60	0.2	4
Duration of relationships	# years	4.25	2.13	1	13
Acquaintance level in relationships	three categories See Appendix 1	1.5	0.55	0.4	2.8
Tightness of networks	see Appendix 1	0.49	0.3	0.1	1
External orientation	see Appendix 1	-0.29	0.52	-1	1
Market orientation	two categories	International (63.5%) Non-international (36.5%)			
Firm market	two categories	Uncertain: 37% Not uncertain: 63%			
Firm technology	two categories	Science driven: 20% Market driven: 80%			
International learning	two categories	0: Not Internationalized (39.5%) 1: Internationalized (60%)			
Internationalization scale	three categories	0: Not Internationalized (39.4%) 1: Low scale of internationalization (16.2%) 2: High scale of internationalization (44.5%)			
Internationalization scope	three categories	0: Not Internationalized (39.4%) 1: Low scope of internationalization (50.5%) 2: High scope of internationalization (10.1%)			

Appendix 3- Correlation matrix (n=99) a)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1 Firm age	1	0.57**	-0.10	-0.18	-0.004	-0.13	** -0.32	0.24*	-0.03	-0.22	-0.11	0.04	** -0.30	-0.22*	0.66**	0.07	-0.25*
2 Firm size		1	0.13	-0.14	-0.07	-0.14	-0.05	0.50**	-0.09	-0.01	-0.16	0.33*	-0.12	-0.05	0.38**	0.23*	-0.08
3 International market-orientation			1	0.16	0.03	-0.11	0.24*	0.18	0.14	-0.14	0.29**	0.16	0.36**	0.4**	-0.09	0.07	-0.06
4 Urban location				1	0.06	0.11	0.14	-0.05	0.26**	0.03	0.09	0.12	0.22*	-0.005	-0.21*	-0.13	-0.009
5 Technology					1	-0.18	-0.03	-0.03	0.1	-0.02	0.03	0.02	0.27**	0.16	-0.01	-0.005	0.08
6 Market (uncertainty)						1	0.05	-0.03	-0.11	0.07	-0.09	0.04	-0.15	-0.12	-0.11	0.15	0.11
7 R&D expenditure							1	0.26**	0.14	0.17	0.2*	0.13	0.35**	0.40**	-0.32 **	0.10	0.02
8 R&D employees								1	-0.11	0.12	-0.10	0.41**	-0.04	-0.05	0.13	0.11	0.008
9 Previous working experience (founder team)									1	-0.11	0.36**	-0.06	0.08	0.23*	-0.02	-0.13	-0.23*
10 Size of team at start										1	-0.12	0.11	0.02	-0.04	-0.20*	-0.02	0.07
11 Education level (founder team)											1	-0.05	0.18	0.35**	-0.008	0.008	-0.06
12 Education type (founder team)												1	0.07	-0.02	0.11	0.26**	0.16
13 Newness of invention													1	0.43**	-0.21*	0.04	0.07
14 Granted or applied patent(s)														1	-0.23*	0.11	-0.13
15 Product development stage															1	0.16	0.04
16 Tightness of social networks																1	0.22*
17 Frequency of network meetings																	1

*P<0.05, **P<0.01,

a) Spearman correlation coefficients

References

Acs, Z. J. (2002). Innovation and Growth of Cities. Cheltenham, Edward Elgar.

Andersson, S. and I. Wictor (2003). "Innovative internationalisation in new firms – Born Globals-the Swedish case." Journal of International Entrepreneurship **1**(3): 249-276.

Arndt, O. and R. Sternberg (2000). "Do manufacturing firms profit from intraregional innovation linkages? An empirical based answer." European Planning Studies **8**: 465-485.

Asheim, B., L. Coenen, J. Moodysson, J. Vang. (2007). "Constructing knowledge-based regional advantage: implications for regional innovation policy." International Journal of Entrepreneurship and Innovation Management **7**: 140155.

Audretsch, D. and M. Feldman (1996). "R&D spillovers and the geography of innovation and production." American Economic Review **86**(3): 630-640.Autio, E. (1998). "Evaluation of RTD in Regional Systems of Innovation." European Planning Studies **6**: 131-140.

Bathelt, H., A. Malmberg, P. Maskell (2004). "Clusters and knowledge: local buzz, global pipelines and the process of knowledge creation." Progress in Human Geography **28**(1): 31-56.

Benneworth, P. S., Hospers, G. J. & Timmerman, P. (2009) "Who builds "science cities" and "knowledge parks"? High technology firms mobilising heterogeneous commercialisation networks" in R. Oakey, A. Groen, G. Cook and P v.d. Sijde (eds.) New technology based firms in the new millennium Vol 7, Bingley (UK): Emerald Group Publishing, pp. 147-163.

Borgatti, S. P., C. Jones, M.G. Everett (1998). "Network measures of social capital." Connections **21(2) - 36**.

Bosch, F. A. J. v. d., R. v. Wijk, H.W. Volberda (2003). Absorptive Capacity: Antecedents, Models and Outcomes. ERIM REPORT SERIES RESEARCH IN MANAGEMENT. ERIM. Rotterdam, Rotterdam School of Management.

Boschma, R. (2005). Proximity and innovation: acritical assessment. Regional Studies Vol 39 (1), pp.61-74

Braunerhjelm, P.,B. Carlsson, D. Cetindamar, D. Johansson (2000). "The old and the new: The evolution of polymer and biomedical clusters in Ohio and Sweden." Journal of Evolutionary Economics **10**(5): 471-488.

Cohen, W. M. and D. A. Levinthal (1990). "Absorptive capacity: A new perspective on learning and innovation." Administrative Science Quarterly **35**: 128-152.

Dodgson, M. (1993) Organizational learning: A Review of Some Literatures, Organizational Studies, 14 (3): 375-394.

Drejer, I. and A. Vinding (2005). "Location and collaboration: manufacturing firms'use of knowledge intensive services in product innovation." European Planning Studies **13**: 879-898.

Geenhuizen, M. van (2008) Knowledge Networks of Young Innovators in the Urban Economy: Biotechnology as a Case Study, Entrepreneurship and Regional Development, 20 (2): 161-183.

Geenhuizen, M. van, and Soetanto, Academic spin-offs at different ages: A case study in search of obstacles to growth, Technovation,, 29 (10), 671-681.

Gertler, M. S. (2008). Buzz without being there? Communities of practice in context Community, Economic Creativity, and Organization, Oxford Scholarship Online Monographs**:** 203-227.

Grant, R. M. (1997). "The Knowledge-based View of the Firm: Implications for Management Practice." Long Range Planning **30**(3).

Johannisson, B. (1998) Personal networks in emerging knowledge-based firms: spatial and functional patterns, Entrepreneurship and Regional Development, 10 (4): 297-312.

Jong, J. P. J. d. and M. Freel (2010). "Absorptive capacity and the reach of collaboration in high technology small firms." Research Policy **39**: 47-54.

Kafouros, M., P. Buckley,J. Sharp, C. Wang (2008). "The role of internationalization in explaining innovation behaviour." Technovation **28**: 63-74.

Keeble, D., C. Lawson, H. Smith, B. Moore, F. Wilkinson (1998). "Internationalization processes, networking and local embeddedness in technology-intensive small firms." Small Business Economics **11**: 327-342.
Krackhardt, D. and R. N. Stern (1988). "Informal networks and organizational crises: An experimental simulation." Social Psychology Quarterly **51**(2): 123-140.
Lubatkin, M. and P. Lane (1998). "Relative Absorptive Capacity and Interorganizational Learning." Strategic Management Journal **19**(5): 461-478.
Madsen, T. K. and P. Servais (1997). "The Internationalization of Born Globals: an Evolutionary Process?" International Business Review **6**(6): 561-583.
Maskell, P. and A. Malmberg (1999). "Localised learning and industrial competitiveness " Cambridge Journal of Economics **23**: 167-185.
McQueen, D. H. and J. T. Wallmark (1982). "Spin-off Companies from Chalmers university of Technology." Technovation **1**(4): 305-315.
Murovec, N. and I. Prodan (2009). "Absorptive capacity, its determinants, and influence on innovation output:Cross cultural validation of the structural model." Technovation **29**: 859-872.
Norusis, M. J. (1992). SPSS for Windows: Base System User's Guide, Release 5.0, SPSS Inc.
Pittiglio, R., E. Sica, V. Villa (2009). "Innovation and internationalization: the case of Italy." Journal of Technological Transfer **34**: 588-602.
Renzulli, L. A., H. E. Aldrich, J. Moody (2000). "Family matters: Gender, networks and entrepreneurial outcomes." Social Forces **79**: 523-547.
Roper, S. and J. Love (2002). "Innovation and export performance: evidence from UK and German manufacturing plants." Research Policy **31**(1087-1102).
Sedoglavich, V., M. E. M. Akoorie, K. Pavlovich (2009). "Absorptive Capacity and the internationalisation process of high-tech companies." World Review of Entrepreneurship, Management and Sustainable Development **5**(2): 149-165.
Shane, S. (2004), Academic Entrepreneurship: University Spinoffs and Wealth Creation, Edward Elgar, Cheltenham.
Soetanto, D. and M. v. Geenhuizen (2008). Social Networks and Competitive Growth of University Spin-off Firms: A Tale of Two Contrasting Cities. Journal of Social and Economic Geography, 100 (2): 198-209..
Soetanto, D. P. (2009). Entrepreneurial networks of university spin-offs: How social networks affect the growth of firms. Delft: TU Delft, PhD-thesis.
Torre, A. (2008). "On the role played by temporary geographical proximity on knowledge transmission." Regional studies **42**(6): 869-889.
Zahra, S. A. and G. George (2002). "Absorptive capacity: A review, re-conceptualization, and extension." Academy of Management Review **27**(2): 185-203.

Managing the essential Strategic entrepreneurial Production resource for the 21st Century: Foundaries at the Interface

BY

Mr. Robert Tierney
tierneyr@att.net
&
Dr. Steven T. Walsh*
Black Professor of Entrepreneurship
University of New Mexico
Anderson School of Business
Walsh@unm.edu
&
Dr. Jonathan Linton
Power Corporation Professor for the Management of Technological Enterprises
Telfer School of Management
University of Ottawa

*Corresponding author

Abstract

Twenty first century economies are increasingly being fueled by regional entrepreneurial and intreprepreneurial solutions to global problems such as water purity, global warming, health care, energy, and nutrition. However, the tradition al single technology or "Silo" approach to solving one of these problems while negatively affecting others are increasingly being eschewed. Multi technology solution sets, often comprised of both emerging and more established technologies, are increasingly embraced. Many utilizing these types of solution bases seek to leverage the more established management practices centered on the established technologies in order to manage their entire production process. Yet is this approach appropriazte?

One such multi technology solution set is comprised of the more emergent technology basis of nanotechnology and micromachining (MEMS) combined with the more established semiconductor microfabrication. This "Small Tech" solution base is seen by many as theb next "Shumpeterian Wave" of economic development. Yet they require costly "Foundaries at the Interface" or Multi Technology, High Product Mix, Low Volume fabrication facilities (MT-HMLV). These fabrications facilities have adopted for the most part the more established management practices of High Volume Semiconductor Faciltiy (HVSF) management proacticeses. We show that the results practice have been less than optimum. Our case study effort shows that these facilities use of taditonbal HVSF managment practices do not convey the strategic value of a MT-HMLV, nor do they adequately assist in their operational management. These facilities often funded by governmental action are essential to regional and firm based economic growth are now at risk. If this is so there is cause for concern.

Abstract Keywords
(R&D, Technology, entrepreneurship, Innovation, Nanotechnology, Metrics, MEMS, economic development, technology transfer, Government)

I. Introduction

The complexity of 21st century problems have hastened 21st century entrepreneurs and intrepreneurs to embrace solutions based on complimetary technology sets rather than the traditonal technology "silo" approach. Many seek to address regional problems concerned with water, health care, nutition, energy, and global warming that have global implications. Thesecomplementary technology sets are comprised of established technologies as well as emergent ones. These entrepreneurs and regional production facilties often seek to leverage as much knowledge centered on the established technology based operations.

One such set of technologies that are forming the basis of a great number of 21st century innovations is "Small Technology." Small Technology based innovations are those created at the interface of; Semiconductor Micro-fabrication, Micromachining (MEMS) and Nanotechnologies. Many see innovations based small technology as the harbinger of the next Schumpeter's wave critical to 21st century firm and regional economic success.

Why? Firms and other entities based on these technologies are starting to solve commercial and governmental problems in a uniquely valuable manner and without contributing to other global problems as they persue their focused solutions [59], [36], [3], [60], [12]. While these innovations are being increasing valued. This valuen is being

developed b y new necessary competencies which for the basis of new industri2rfqfq es while creatively destroying others. The Schumpetarian Wave is building.

Yet the production facilities from which these innovations will spring, "Foundaries at the Interface" or more specifically in this case Multi Technology High Mix Low Volume fabrication facilities (MT-HMLV) [47], [48] are costly and under an increasing amount of operational and strategic scrutiny. The global answer to this scrutiny has been to utilize the "Best Practice" production facility management practice of the most established production base - semiconductor microfabrication. Multitechnology solution set managers often seek to leverage the most established technology basis managerial practice. Yet is this practice acceptable or do these existing practices lack managerial approaches that adequately address operation effectiveness or express value to their stakeholders?

There are factors that further complicate the use of semiconductor based managerial practices that rely heavily on a metrics management approach:

1) Semiconductor manufacturing facilities are moving from more the more developed economies of North America and Europe to the big emerging economies of Asia.
2) Money for these facilities once more freely flowing is being more harsley scruntinized during a period of recession.
3) These "Fondary at the interface" facilties are often too costly for any one firm to sustain and increasingly seeking support from various governmental bodies seeking to support economic development

4) The "Small Tech" foundaries of the future have often grown from purely research facilities with little or no operationa scrutiny.

5) The successful use of metrics management based on semiconductor microfabrication, especially those developed for the highly successful High Volume Semiconductor Fabrication (HVSF) has made the metrics management approach the methodology of choice, both operationally and strategically for any semiconductor like facility.

Many of these facilities are perceived as extensions of High Volume Semiconductor Facilities (HVSF). The "Defacto" standard for HVSF management, both operational and strategic is metrics. However, simply applying HVSF based metrics to this group of MT-HMLV facilities is proving ineffectual. MT-HMLV's are fraught with ineffective operations and strategic management practice. Current management practices for these incubation facilities are barrowed from the metric management approach endemic of single technology high volume production facilities. The result is that these "foundaries at the interface" are iin trouble. But do they suffer from an operational and strategic mangemt practice that while greatly suited for the semiconductor microfabrication industry is not well suited for a small tech "foundary at the interface?

We focus on a groups of "Foundations at the interface," or MT-HMLV's. They are liken by many to semiconductor fabrication facilities as far as processes are concerned.Yet, HVSF metrics unfettered use in MT-HMLV facilities have proved inadequate. We seek to ascertain why HVSF metrics management has failed. We start this by first investigating the literature.

We initiate our investigation through a literature review on three subjects. They are the nature of MT-HMLV's, the large base of operational metrics developed for HVSF and finally the operational and the strategic value of R&D metrics. First, we expand on earlier work of Myers [47] and Naughton [48] to provide a definition of MT-HMLV facilities that meets the current reality of these facilities. Then we review global and local HSVF metrics with an eye toward their use for MT-HMLV facilities. Finally, we address the lack of strategic value in currently applied HVSF metrics to MT-HMLV facilities through the inclusion of selected R&D metrics, which focus on innovation. This value is perhaps most succinctly put by Michelin and Berg [43] in their seminal piece "ROI is not enough." This is directly opposed to the nature of HVSF metrics, which imply that, not only is ROI an important consideration, but it is indeed the only consideration.

We utilize the case study method to ferret out both the differing natures of HVSF and MT-HMLV facilities and to define the state of operational and strategic metric use in MT-HMLV facilities. We found that metrics, meant to guide the efficiency of large volume foundries were not easily applied to MT-HMLV facilities. Further, we find that even through smaller than their HVSF cousins, semiconductor like MT-HMLV facilities are defined by greater complexity. Finally, that MT-HMLV's have a more arduous pathway to demonstrate value to stakeholders and posses less well defined operational characteristics.

MT-HMLV facilities metrics usage has meet with varied operational success. Indeed some are so frustrated with their initial spans that they use none at all. Even those MT-HMLV facilities that use some subset of the established metric base developed for

HVSF's use them reluctantly. This conundrum has provided an environment where managers of MT-HMLV faculties are not able to effectively use even a minimum common set of metrics. Managers making strategic decisions to invest or disinvest see this as problematic. They seek to operate their facilities effectively and to do so with a metrics management approach. We take knowledge from literature and case studies to develop a Metric Selection Model.

If we do not have a method for effective operational management tools nor a direct method for effectively communicating their strategic value compounded occurring in a time of recession and increased globalization, then these facilities are at risk. If they are truly the harbingers of the next economy and these facilities have ineffective management practice that dissuade many to invest in them then there is cause for concern.

In order to use the "Small Tech" solution set effectively one resource intensive asset is required – a fabrication facility. Many agree that innovations created at the interface of micro-technology semiconductor micro-fabrication and nanotechnologies are critical to 21st century firm and regional economic success. We provide the model, which is designed to meet the strategic and operational requirements of a MT-HMLV facility. This model allows a metrics approach designed to meet the needs of the diversified group that is MT-HMLV facilities stakeholder group. Finally, we suggest future research to test the findings to other MT-HMLV manufacturing facilities.

II. Literature Review

We developed a literature review to ascertain the state of knowledge of operational and strategic metrics for MT-HMLV facilities. Furthermore, we focus on metrics as a management tool. Finally, we find gaps in the literature and practices that need to be included in this investigation and form the basis for our model.

We initiate our literature review with a discussion of metrics categorization. Many researchers have noted the differences between product and process metrics [21]. Others have noted the differences between continuous processes (i.e. semiconductors) and more job shop like operations like Micro and nanotechnologies [13]. These two concepts provide great value to our discussion of effective metrics for MT-HMLV facilities and help build a connection to our metric selection model. MT-HMLV managerial practices suffer from the direct application of metrics developed for facilities with are intrinsically different in nature and provide radically different outcomes. We address this inequality with use of Hayes and Wheelwright [24] process product metrics approach, which helps to explain the correlation between product and processes. To date these ideas have not been applied to the MT-HMLV facility.

Metrics developed for commercial high volume semiconductor facilities are efficient centric whereas MT-HMLV's are job shop intensive. Using this model, we see MT-HMLV facilities are job shop intensive, whereas HSVF are categorized as commercial. Trying to apply metrics from one extreme, transferring to the other has not proved effective. For example in HSVF, research has shown that wafer starts and yield proves to be the universal metrics and added to that is the push towards automation [21].

MT-HMLV facilities are characterized by high product mix and low volume. Their products and processes are unique in nature. This creates the need of a more

flexible factory environment. Hence, high volume, low mix metrics cease to be an effective measure of operational and strategic success. Moreover, when innovation is emphasized in semiconductor like facilities, lot moves become the more defining metric [21]. No wonder the unfettered application of HVSF metrics to MT-HMLV facilities is so problematic.

Understanding the fundamental differences between MT-HMLV and HSVF provides a starting point for effective management. We focus on three literature streams to assist us in developing our model. We seek first to derive value from metrics developed for traditional MT-HMLV facilities, then continue with: HVSF metrics and finally analyze relevant R&D Metrics literature.

II.1 Multi Technology High Mix Low Volume Facilities (MT-HMLV)

Myers introduced the term Multi-Technology High Mix Low Volume in 2000 [47]. Others have expanded this semiconductor centric original use to include the research and development aspects of facilities that emphasize not only semiconductor micro fabrication, but also Nanotechnologies [48]. Still others suggest that MEMS and Nanotechnology facilities differ greatly in operation and strategic value to a firm when compared to HVSF facilities [64].

Here Naughton demonstrated the difference in tool alignment between HSVF and MT-HMLV facilities [48]. Naughton provides evidence that shows provides that that the nature of the MT-HMLV facility workflow differs from HVSF and these tools must mimic these needs. Naughton also suggested than any product produced in quantities of less than 1 million should be consider low volume. However in today's MT-HMLV facilities, even the LV portion of this acronym has changed greatly. Now LV or low

volume can mean tens of thousand of parts, but for the large majority of their MT-HMLV product efforts, they are more likely to be at the 1000 quantity range and for a R&D intensive environment an order of magnitude less than that [66].

This work together with Walsh's earlier effort, which focuses on the operational and strategic management problems firms endure when converting older semiconductor fabrication facilities for MEMS and Nanotechnology utility [66]. These efforts provide the confirmation for the inclusiveness of MEMS and Nanotechnology in MT-HMLV. Furthermore, the investigations illustrate even more greatly the differences between HVSF and MT-HMLV facilities.

Further, we use the High Mix (HM) portion of the acronym to mean not only many differing semiconductor products, but also tasks of product and process maturation, innovation, design validation and many other types of efforts that are not centered on a product production utilizing a matured process [51]. Is it any wonder that HVSF based metrics that did not fit the earlier form of MT-HMLV facilities would now even be further off the mark? Another basic difference in our uses of the term MT-HMLV is found in the MT portion of this acronym. Earlier works for the most part used the MT portion to mean differing semiconductor technologies, whereas we use this portion to mean three distinctly differing technology bases. They are semiconductor micro fabrication, nanotechnologies and MEMS. Here Nano and MEMS technologies are technology platform on their own and not necessarily simply extensions to semiconductor micro fabrication [29]. There is a much larger difference between these base technologies and differing forms of Semiconductor micro fabrication than just the material usage and processes.

.

II.2 HVSF Metrics

Metrics have become the "defacto" operations management performance standard for HVSF facilities. The era of metrics management in semiconductor micro fabrication was introduced during the semiconductor micro fabrication industry transition from grown junction semiconductor technology of the 1940's to semiconductor surface technologies in the late 1950's [55], [30], [44]. Today, most semiconductor chips are silicon based and fall into well-defined product areas. The ITRS roadmap has broadly categorized these into four categories: microprocessors/microcontrollers, memory devices (RAM, ROM EPROM), power and smart power [26]. The semiconductor industry produces well over $261.2 billion in commercial products and is found in nearly every aspect of our life [56]. Counterintuitive too many, despite this success, the number of semiconductor micro fabrication facilities worldwide is shrinking. This is due to processing convergence, the advent of huge facilities, the exceptionally large facility investments required to build modern fabrication facilities and the resultant volume requirements for its efficient production. These facilities are simply out of the resource scope and product quantity requirements of most firms.

These capital intensive, large diameter silicon based semiconductor micro fabrication facilities, are managed through metrics designed to maintain both cost effectiveness and yield efficiency. The modern production of semiconductors follows a two-step process: front end and back end and are customarily performed in separate facilities [26]. But even here, there is more influence of back end than front end processing for metrics. We will investigate the HVSF metrics usefulness to operation

and strategic management of MT-HMLV's. We then build on Sattlers' [52] and others semiconductor metrics classification schemes. We do this by bifurcating these metrics into those focused on an entire process or "global" metrics and those more focused on specific process steps or tools or "local" metrics [37].

II.2.1 HVSF Global Metrics

Many global HVSF metrics focus on productivity and yield, but not all. For example, Goldrat in "The Goal" discussed metrics dealing with throughput and lot moves [23]. Some measure of lot moves due to the high mix and low volume nature of MT-HMLV facilities are essential metric. We provide a selected list of global metrics in Table 1 below. First we will discuss the utility of HVSF yield and wafer start metrics in a MT-HMLV environment. Next, we will address the utility of Cycle Time (CT) and Work in Process (WIP) measures [52]. Finally, we discuss the information, simulation automation, clustering and facilities upgrade project targets in the landscape of MT-HMLV facilities.

One of the first set of metrics utilized by HVSF facilities leveraged the concept of benchmarking HVSF stated capacity versus actual wafer starts and focused their efforts by the year, month, week and day [7]. This was furthered investigated by Leachman, who linked yield to actual wafer starts as a facility approached capacity [34]. Sattler improved this concept by adding product mix and the required number of process steps [52]. In order for these types of measures to be useful in MT-HMLV facilities, the product mix effect would have to be modified with the addition of differing types of

efforts in the fab and differing types of technologies. This would lead to a greatly modify model that would recognize lower wafer capacity.

CT measures are essential to HVSF operation management and many of these focuses on traditional bottleneck processes. A common methodology for this type of global metrics is found in lithography layers per stepper per day [26]. Jacobs stated that by reducing bottleneck processes, stagnation time's leads to the reduction of cycle time [28]. Both Dietrich and Maynard further this concept by stating the solution of a bottleneck is not simply tool redundancy, but rather lies in tool and facility understanding [14], [38].

These metrics are based on a deep understanding of HVSF facilities and simply do not translate well to the realities of MT-HMLV facilities. The related WIP papers of first Sattler, Fallon and then Bonal are exceptional measures for very low mix facilities. The idea of streamlining processes for a singular product does not meet the realties of MT-HMLV facilities where flexible high mix and large process scope is essential [52], [17], [8].

We next discuss metrics developed around computer-aided efforts. Many of these applications hold promise for MT-HMLV facilities due to the nature of parameters or bound shifts. For example, modeling is used to define bottlenecks for HVSF and modifications to this process might make it applicable to MT-HMLV facilities [22]. Wu discussed the focus change in a re-facilitation effort. He described a transitioning from 300mm efforts to 450mm [68]. Tool clustering metrics must be developed along scope of process than one process. Many of the MT-HMLV facilities are older semiconductor facilities, which have been refocused. Given this fact, Goodall along similar lines

discussed tool re-clustering for high volume facilities [24]. If the switch from a narrow to a more open production environment, then in order to use this concept in MT-HMLV facilities, we must switch the discussion from a narrow to more open production environment. Finally, the exploration of limiting information flow in order to streamline efforts was accomplished and was shown to be effective for HVSF [27]. This type of metric is exceptional for HVSF, but proves less than useful on efforts that are not well defined.

Table 1. Global

Metrics

Author	Characteristic	Analytical technique
Sattler, Glassey and Saeed [53]	Yield and wafer starts vs. capacity	Ranking
Benson, Cunningham and Leachman [7]	Wafer starts versus stated wafer start capacity	Factory Performance
Leachman and Hodges [33], [34]	Product mix, Wafer starts vs. capacity	Benchmarking
Sattler and Schluter [52]	WIP and Wafer starts	Case Study
Fallon et al [17]	Work in Process	Case Study
Bonal et al [8]	Work in Process	Equipment Efficiency
Ishii and Watanabe [27]	Control Information	Case Study
Wu [68]	300/450 Fabs comparison	Case Study
Goodall and Fandel [24]	Fab tool cluster Setup	Manufacturing Costs
Maynard, Kerr and Whiteside [38]	Overall Yield	Project Costs
Jacobs et al [28]	Cycle Time Management	Case Study
Dietrich [14]	Cycle Time Management	Case Study
Wagner [61]	Failure Analysis	Case Analysis
Herrmann and Conaghan [22]	Simulation	Modeling
Guidi and Paradis [25]	Automation	Modeling
Mozumder and Lowenstien [46]	Simulation	Modeling

II.2.2 HVSF Local Metrics

Modern HVSF facilities produce products that routinely exceed 500 individual process steps. Yield and efficiency originate at the tool base or local metrics level. HVSF routinely achieve overall yields of over 90%. This means the process steps must yield perfectly [4], [5]. We provide a selected group of HVSF local metrics in Table 2 below.

We have provided four distinct groupings that are representative of the local metrics used in HVSF. The first group is focused on labor contribution. The second group's concentration is local tool temporal contribution to Work in Process and Cycle Time. The third group focal point is a group of metrics that focuses degree of tool base process's latitude over the diameter of a wafer or uniformity. Finally, the fourth group is a set of metrics that focus on a tools contribution to the capital structure of the fab based on reinvestment, tool lifetime measures and contribution to maintenance.

One of the labor contributions metrics is driven by automation versus a more labor-intensive fabrication and was discussed by Appleyard and Brown [4]. Even though less than 10% of the production cost of any fab based product is found in labor contribution, the cost is of concern for HVSF facilities [5]. The crossover point holds great significance for HVSF, but is not very attractive to the more labor-intensive MT-HMLV facilities. Croft furthers this discussion by suggesting that production facilities should all embrace automation at some level [11]. This again provides limits on insights for the production nature of the MT-HMLV facilities.

Another important local metric for HVSF's is for a given tool, temporal contribution to work in process cycle time. Meyersdorf and Taho [40] showed that individual tools temporal performance could be improved by use of the proper metrics. Carrying forward this notion was Konopka and Trybula [32] through the use of Work in Progress (WIP) based metrics. Finally, Foster and Nugent [18] linked individual tools temporal metrics to overall HVSF profitability. While these measures are exceptionally useful for a HVSF, the temporal performance measures must be modified to be applicable

to MT-HMV facilities. Here, the transference of wafer starts to lot moves would provide value to the MT-HMLV facility.

Next, metrics are used to provide overall wafer process uniformity often focusing on the process latitude of a particular tool over the diameter of the wafer. Mozumder, Saxena and Taylor [45] found process uniformity across the diameter of a wafer in a particular tool setting had profound overall yield implications. Smith [57] repeated the study on larger diameter wafers finding similar results. The scope of tool processes in MT-HMLV facilites creates problems for the user of this metric. Here we suggest a lot yield metric.

The final group of HVSF local metrics focuses on a tool contribution to the capital structure of the fab based on reinvestment, tool lifetime measures and contribution to maintenance. Hallas [19] discusses the tool contribution to overall cost of the fab while Miller [42] analyses tool performance and reinvestment. Limanond [35] and Kim [31] focus their investigations on specific tool processing such as etching, metallization and lithographic tools and then discuss the overall contribution to cost of a HVSF. However, HVSF tool selection is focused not on design performance factors such as flexibility of processing, but on their effectiveness of one single process or product platform. The result is a tool of limited with a process capability. Here again a tool for MT-HMLV should be chosen for scope capability. Unfortunately due to the extreme nature of MT-HMLV fabs these measures often lead to poor tool choices whereas flexibility of a particular tool is a critical dimension.

Table 2: HVSF Local Metrics

Author	Characteristic	Analytical Technique
Appleyard and Brown [4], [5]	Labor Usage	Case Study
Croft, Toente and Baker [11]	Labor	Case study
Meyersdorf and Taho [40]	Tool Usage	Temporal
Foster and Nugent [18]	Tool Usage	Temporal
Konopka and Trybula [32]	WIP	Temporal
Smith et.al. [57]	Wafer Uniformity	Yield
Mozumder, Saxena and Taylor [45]	Wafer Uniformity	Yield
Hallas, Kim and Mosier [19]	Tools	Manufacturing Cost
Miller [42]	Tool Utility	Cost
Liamnond et.al. [35]	Tool Utility	Cost
Kim and Lee [31]	Tool Utility	Cost

II.3 Research and Development Metrics

MT-HMLV facilities act as engines of innovation, centers of new product and process creation, developers of proof of concept and innovation and invention centers at the interface of converging technologies [65]. These tasks diverge greatly from the modern HVSF facility and are much more in line with the strategic and tactical roles found in R&D and commercialization organizations. HVSF facilities provide no metrics focused on this core aspect of MT-HMLV facilities. Here the authors investigate the plethora of R&D and innovation based metrics as to their potential application to these facilities.

We provide in Table 3 a review of potentially interesting innovation metrics. We categorize them by decision-making, product and applications, process focused and a discussion of metrics on metrics evaluation. We begin with the review of R&D metrics focused on decision-making. Secondly, metrics focused on products and the applications are examined. Thirdly, the R&D process and metrics is scrutinized. Next, R&D

performance versus value literature is reviewed and finally, the evaluation of metrics by using metrics in a R&D setting.

Innovation management has utilized metrics for decision making for many years [1]. The potential of metrics to condition data and information in a manner that provides knowledge in a very useful and compact nature was studied by Pich [50]. Pich stated that metrics proves easily assimilated knowledge, that easily provides assimilated knowledge, which is useful. Drongelen [15] further suggests that metric selection for maximum utility is paramount to their effective use. Adams introduced a framework for innovation based decision-making processes using metrics [2]. While this basic knowledge is important, the sufficiency of data and the correct application of information are essential to the managerial supervision of a MT-HMLV facility.

The focus of a R&D based innovation center is to transfer knowledge, re-invent the corporation, provide new technology product paradigm platforms and make existing technology product lines better faster and cheaper [65]. Yet all MT-HMLV facilities have differing focuses. Meyer suggests tailoring metric use to innovation and R&D facilities activities [39]. He suggests differing metrics for those facilities that revolve around basic research versus core technology exploration and finally applied market research. Chen and Chen evolved this concept by further investigation into the parallel use of metrics in both R&D and marketing efforts [10]. The multi-faceted nature of MT-HMLV facilities suggests a specialized set of metrics that encompasses their mission scope.

Metrics utility in managing a firm's innovation modus operadi has been extensively investigated. Szakonyi [58] proved the necessity of metrics for the effective

management of a R&D process. Schumann duplicated this work [54]. Multiple objective and subjective methods for applied metrics in R&D situations was explored by Werner and Souder [67] and directly correlates too many of the MT-HMLV facilities. Hauser [23] for example, suggested differing metrics sets for facilities focused on research, development or engineering. The efficacy of R&D activities by firm industrial leaders showed by increasing funding in R&D for these facilities increased their market dominance [49]. When there are different mixtures of R&D, primarily in the private sector, it is extremely difficult to choose one or a set of metrics for a MT-HMLV facility due the ever-evolving product lines. Projects may be shelved for a period of time or even extended, which makes the use of applied metrics that much more challenging.

The use of metrics can also be used to convey a performance attribute for a firm and Bagieri [6] surveyed this concept. Using stakeholders instead of shareholders the fundamental contribution of R&D in a firm was examined. While metrics are a necessary managerial decision-making tool to operate a facility efficiently, the use of metrics to provide a framework of information to stakeholders is extremely difficult at best. External stakeholders tend to lack the specific knowledge about MT-HMLV facilities to understand their importance. Internal stakeholders are predisposed to their prejudices, which affect the interpretation of those chosen metrics.

The last section that the authors investigated encompasses using metrics to examine the metrics of a firm. Mihm [41] investigated this idea by examining system design metrics and by using local metrics. He found by using local metrics as an integrated knowledge base, a complex system could be devised and improved. Another concept of looking at metrics was investigated by Chen [9]. Here, they used a data

framework, Data Evaluation Analysis (DEA), to evaluate R&D performance and found that a semiconductor R&D performance can be improved. Since the understanding of metrics and their applications are under investigation, the use of another metric upon a metric seems redundant. . The investigation of metrics based literature and the nature of MT-HMLV facilities, provides us with the foundation to build the Metric Selection Model (MSM)

Table 3: R&D Metrics

Author	Characteristic	Analytical Technique
Drongelen and Bilderbeek [15]	Choosing Metrics	Operational
Pich et. al. [50]	Decision making	Operational
Adams et. al. [2]	Metric Application	Operational
Abby and Dickson [1]	Metric Application	Operational
Hauser [23]	R&D and Engineering Metrics	Core Competence
Meyer et. al. [39]	R&D	Core Competence
Chen and Chen [10]	Parallel R&D Projects	Strategic
Szakonyi [58]	Metrics Evaluation	Process Evaluation
Schumann [54]	Metrics Evaluation	Process Evaluation
Werner et. al. [67]	Combining Metrics	Case study
Ofek and Sarvary [49]	R&D Investment	Cost Analysis
Bagliersi et. al. [6]	R&D performance	Stakeholder Value Creation
Mihm et. al. [41]	System Design	Manufacturing Throughput
Chen et. al. [9]	Data Envelopment Analysis	R&D Performance

III Methodology

We employ a case analysis methodology to generate an understanding of the differing imperatives, nature and metric utilization of MT-HMLV ad HVSF facilities. . We utilize the case method to investigate potentials of the case study depict differences not only between HVSF and MT xx but also between differing MTHMLV facilities. We

have utilized Yin [69] and Eisenhardt [15] case study techniques to interview and analyze our four MT-HMLV facilities and one HSVF facility.

We provide the finding from our case study analysis section table 4. IN figure we discuss the Section 3.1. We further our case study by administrating a structured survey to all five firms. The survey probes the firm's metric utilization and we provide results in table 5 Section 3.2 detailing

III.1 Initial Case study Results

Our case study analysis focused on 21 characteristics of fabrication facilities. The range of these characteristics range from basic technologies to more specific subjects such as the degree of automation in the facility. We segments our characteristics into four groups The first group is the number and nature of technologies in use in a particular fab The second group deal with the relative mix of products at high mix facilities. Included in this is measure is the number of products, processes developed, innovation efforts embraced and research efforts taken at a specific fab. The third group speaks directly to facility utilization and includes measures such as number of wafer starts and use of tool capacity. Finally the fourth group was developed during our case study data gather and is far more specific in nature and include measures such as metric usage, tool availability, engineering holds, changes in tool setup, tool scope and amount of automation in a particular facility..

We initial the discussion with group 1 found in Table 4. Here we focus on three technologies platforms; semiconductor fabrication, MEMS and Nanotechnology.
A fabrication facility is said to have a semiconductor micro fabrication capability if it has a Bipolar or CMOS front-end process. A foundry having MEMS capability has a full

front-end process for one of the three types of MEMS Process basis (sacrificial surface, bulk silicon micro-machining or high aspect ratio MEMS. A facility is said to have a nanotechnology capability if they have a bottom up or top down nanotechnology capability. We examined four MT-HMLV facilities and one HVSF in order to develop an understanding of their differing nature of HSVF and MT-HMLV. Further this allows us to illustrate the differences within MT-HMLV facility community and their respective differences. The results of our investigation are found in the first three rows of Table 4

Next we looked at the High Mix portion of the MT-xxx definition. We operationalized through the number of different products produced at a single facility , the amount of research versus product production lot starts, the number of processes run, the number projects completed, the inclusion of an innovation mission and the inclusion of a research mission. They are found in rows 4 through 9 in table 4. We also defined volume in rows ten and 11 by the categories of number of wafer starts and tool capacity. The final nine characteristics are in group 4 and are much more specific and found under in table 4.

There are major differences between our 5 case study facilities. When looking at group 1 characteristics, for example, all of the MT-HMLV facilities have three major technology platforms whereas HVSF's have only one product platform. When examining group 2 characteristics the difference between HVSF and MTHMLV facilities are stark. Yet the number of products produced by these facilities range from hundreds to 50. Further there exists a slight but significant difference in relative use of the facility for production versus research.

	MTHMLV1	MTHMLV2	MTHMLV3	MTHMLV4	HVSF1
Group 1					
Nanotechnology	Yes	Yes	Yes	Yes	No
Semiconductor	Yes	Yes	Yes	Yes	Yes
Microsystems	Yes	Yes	Yes	Yes	No
Group 2					
Number of Products	Hundreds	50-100	20-70	50	2
Research vs. Production lots	Unknown	30% to 70%	50%	40% to 60%	0%
Innovation Mission	High	High	High	High	Low
Research Mission	Yes	Yes	Yes	Yes	No
Processes	Yes	Yes	Yes	Yes	Yes
Project Completion	Yes	Yes	Yes	Yes	No
Group 3					
# of Wafer Starts/Yr.	<10000	<1000	<2000	<5000	>50000
Capacity use	Low	Low	Low	Low	High
Group 4					
Tool Availability	Yes	Yes	Yes	Yes	No
Engineering Holds	Yes	Yes	Yes	Yes	No
Metrics	Yes	Yes	Yes	Yes	Yes
Global Metrics	0 to 2	0 to 2	1	2	5+
Local Metrics	5	16	5	3	16 +
Lot Moves	Yes	Yes	Yes	Yes	No
Changes in Tool Setup	High	High	High	High	Low
Tool Redundancy	Low	Low	Low	Low	Yes
Tool Scope	High	High	High	High	Low
Automation	Low	Low	Low	Low	High

Table 4: Case Study Results

Again when we examine group three characteristics we see dramatic difference between HVSF and the MTHMLV facilities. Yet here again there are significant difference between the MTHMLV facilities. These facilities run from 10,000 to less than 1,000 wafer starts. Finally in group 4 we see again an extreme difference between MTHMLV facilities and the HVSF facility. Further there are significant differences within the MTHMLV community of facilities.

We see visually that multiple root technologies greatly increase production line complexity and generate huge tool compatibility and flexibility issues. This creates a work environment where tool scope rather than tool efficiency when used in any single technology process becomes the dominant characteristic for tool selection. Further, all HVSF firms use some form of metrics, including many that are tool based or local metrics. Moreover a recurring theme in all the MT-HMLV facilities was the view that a global wafer starts metric so important for HVSF facilities provided them no or little value. Finally, lot moves usually not seen as exceptionally important for HVSF facilities were seen as providing exceptional value to the operation of MTHMLV facilities.

The MT-HMLV facilities focused on flexibility, rather than standard product manufacturing efficiency like their HVSF counterparts. MT-HMLV individual processing steps are just as critical as those in HVSF but their integration measures take on new dimensions. For example, MEMS process times are often longer due to their use of silicon and other materials in both a structural and electrical manner rather than just electrically as in HVSF. Finally, the vary nature of structural material changes in bottom up nanotechnology provide process complexity issue never encountered in a HVSF facility.

The case study analysis showed us that the very nature of MTHMLV facilities were so far afield from HVSF that the simple transference of metrics utilized to operate HVSF were not going to be effective in MTHMLV facilities. More interestingly we found a great diversity of mission, scope and process activities within the MTHMLV facility. A characteristic we did not expect to find. We decided to further our understanding MTHMLV facilities through a directed questionnaire. We developed the

questionnaire using Fowler [CC] questionnaire protocol in order to more deeply understand their utilization of metrics.

III.2 Questionnaire development and results

We developed a metrics based questionnaire with 16 quires and sent them to selected individuals at all four pre screened MT-HMLV and one HVSF facilities. We sent them to the HVSF facility as a matter of completeness. All of the respondents remain anonymous due to the sensitivity of their work assignments. We provide our survey results in Table 5.

The first question acted as a general introductory inquiry into the subject of metrics in a MT-HMLV and HVSF facilities. Four out of the five interviewees responded that they strongly agree with the use of metrics is an enormous benefit to the management of the facility. The lone stand out was neutral in the subject area and came from a MTHMLV facility. The second question asked if MT-HMLV metrics are highly borrowed from the HSVF industry. All of the respondents agreed or strongly agreed to the question. The third question inquired into the percentage of HVSF metrics that apply to their particular situation. Two MTHMLV respondents stated that the percentage of useful to them HVSF metrics were from 0 to 25%. The other two MTHMLV respondents answered with 26% to 50% and 51% to 75% and 100% respectively.

The next question concerned actual metric use and their effectiveness for the efficient operation of their MT-HMLV and HVSF facilities. Three MTHMLV respondents stated that they strongly believed little value was gained from their use, one MTHMLV responded with a statement that any metrics were better than no metrics at all and of course the HVSF was quite pleased with their use.. The next question is a sidebar

of the previous in that it relates the application of metrics to establish value to the stakeholders of the facility. Again, the results mirrored the previous question with one disagree.

The next set of questions was designed to introduce the concept of global and local metrics. Question number six asked if HVSF metrics emphasized wafer movers. Four individuals strongly agreed with the statement, with one individual disagreeing. Question seven asked about lot moves and it was agreed and strongly agreed to that lot moves were used as a better performing metric than wafer moves in MT-HMLV facilities. Questions eight and nine dealt with HVSF's and the how the metrics stifle technology experimentation and how the HVSF's focus is metrics on single processes. In both cases, all five respondents agreed and strongly agreed to the proposed question.

The next two questions inquire about MT-HMLV's strategic intent and the need for new metrics when dealing with these facilities. All respondents agreed strongly to the strategic intent of a MT-HMLV are a multi-technology, multi-product, low wafer start facility. In respect to the need of new operational and strategic metrics, three out of the four agreed strongly to question, with the fourth individual also agreeing.

The next question was a departure from the previous style of inquiry. Each individual was asked to pick from a list or provide examples of their metrics that are non-traditional and used in their facility. Each respondent provided a different of answers to the question. The first individual reported that lot moves and the number of multi-technology based products were how their MT-HMLV measured performance. This is in correlation to the next respondent whom also mentioned lot moves, but added that process steps metrics were also important. The third respondent placed fab utility as a

metric, whereas fab utility is the percentage of the facility that is being utilized to full capacity. The fourth respondent answered that patents and the number of research papers produced was a principal metric for the organization. The HSVF response was that wafer starts and yield is the most important metric.

Table 5: Metrics Comparison

Metrics	Innovation	R&D	Prototyping	HVSF
Job Completion	X	X		
Wafer Starts			X	X
Line Yield				X
Die Yield				X
ROI				X
Cost/ function				X
Labor	X			
Queue	X	X		
Cycle Times			X	X
Lot Moves	X	X		
Tool Usage			X	X
Patents	X			
Tool Alignment			X	X
Bibliometrics	X			

The next array of questions asked for a numerical value for the global and local metrics that each MT-HMLV used. For global (integrated) metrics, one individual answered 0 to 2 metrics were used; one had a response of 3 to 5 metrics. Very few global or integrated process metrics are being used by those interviewed with the exception of the HVSF, yet they all state a necessity for one that is accurate. Most suggested a metric move from wafer starts to lot moves. All five stated once more that they employ local or tool based metrics. Two of the fabrication facilities stated they utilized 16 or greater local metrics.

One of the individuals interviewed, listed the number of papers that are published and the patents that are applied for as their global metric. Some facilities still use these metrics over local or global style metrics. It is apparent that some MT-HMLV facilities still prefer this method of a performance metric. With patent or bibliometrics style measures, they do count for global or local metric measures and are difficult to place a value on for stakeholders. This is in direct contrast to the last question of whether or not global metrics would benefit the MT-HMLV and the stakeholders.

We have shown that MT-HMLV's and HVSF's are different by nature and require different metrics to operate efficiently. Further, we have shown that a great variety of metrics exists in the nature of the MT-HMLV facilities. The leads us to the development of not the right set of metrics for an MTHMLV facility but rather a model where a set of metrics are presented to MT-HMLV facilities managers from which they can select the metrics the meet the mission an operational realities of their facility. A model we name the MTHMLV facility Metric Selection Model.

IV. Model Development

All of the MTHMLV respondents recognize the importance of a metrics based management system for their facilities but stressed the need for a new and fresh approach. A metrics approach designed to both assess the strategic and operational effectiveness of a MT-HMLV facility and convey that assessment to others. We start this approach with the knowledge that metrics follow the nature of a fabrication facility and that fabrication facilities can be thought of in terms of capacity and capabilities. It is

exactly in the capabilities and capacity realm that HVSF and MTHMLV facilities are so vastly different.

The misalignment of facilities based capacity and capabilities are at the crux of the problem of simply transferring HVSF metrics to MTHMLV facilities. MT-HMLV respondents recognize that direct application of HVSF to their facilities did not assist in improved operational effectiveness. Nor did they effectively convey their strategic value to their stakeholders. In fact, in many cases, the use of HVSF metrics at MTHMLV facilities actually hampered their ability to obtain resources from stakeholders as well as run their "shop" effectively. Further due to the wide variety in mission and operational capability in MTHMLV facilities it seemed doubtful that one set of metrics would be the varied needs of these facilities.

Indeed, MTHMLV success cannot be measured by the HVSF rubric of yield. Yet yield is always important in these facilities and often getting any yield might be considered a success. Yield must be seen in the light of the mission, capabilities and capacity of the facility. The value of MT-HMLV facilities lies in their ability to produce new products and processes, critical products, provide a facility that embraces iterative lot runs utilizing nontraditional process technologies and becoming the cradle of innovation at the convergence of technologies. Their ability to prove out product design through design iterations based on real manufacturing feedback and their ability to take an embryonic technological process and create a stable manufacturing platform. Indeed ROI is not enough.

Throughput measures are important for any manufacturing facility. Wafer starts are the "Defacto" throughput standard for HVSF yet the more effective throughput

measure for the vast majority of MTHMLV facilities is Lot moves. Lots are the true unit of analysis in the MTHMLV facility where each lot will require tool recalibration and differing WIP routing. Lots in these facilities can be comprised of a little as a single wafer fragment. Yet to say that wafer starts are not valuable to MTHMLV facilities would be in error.

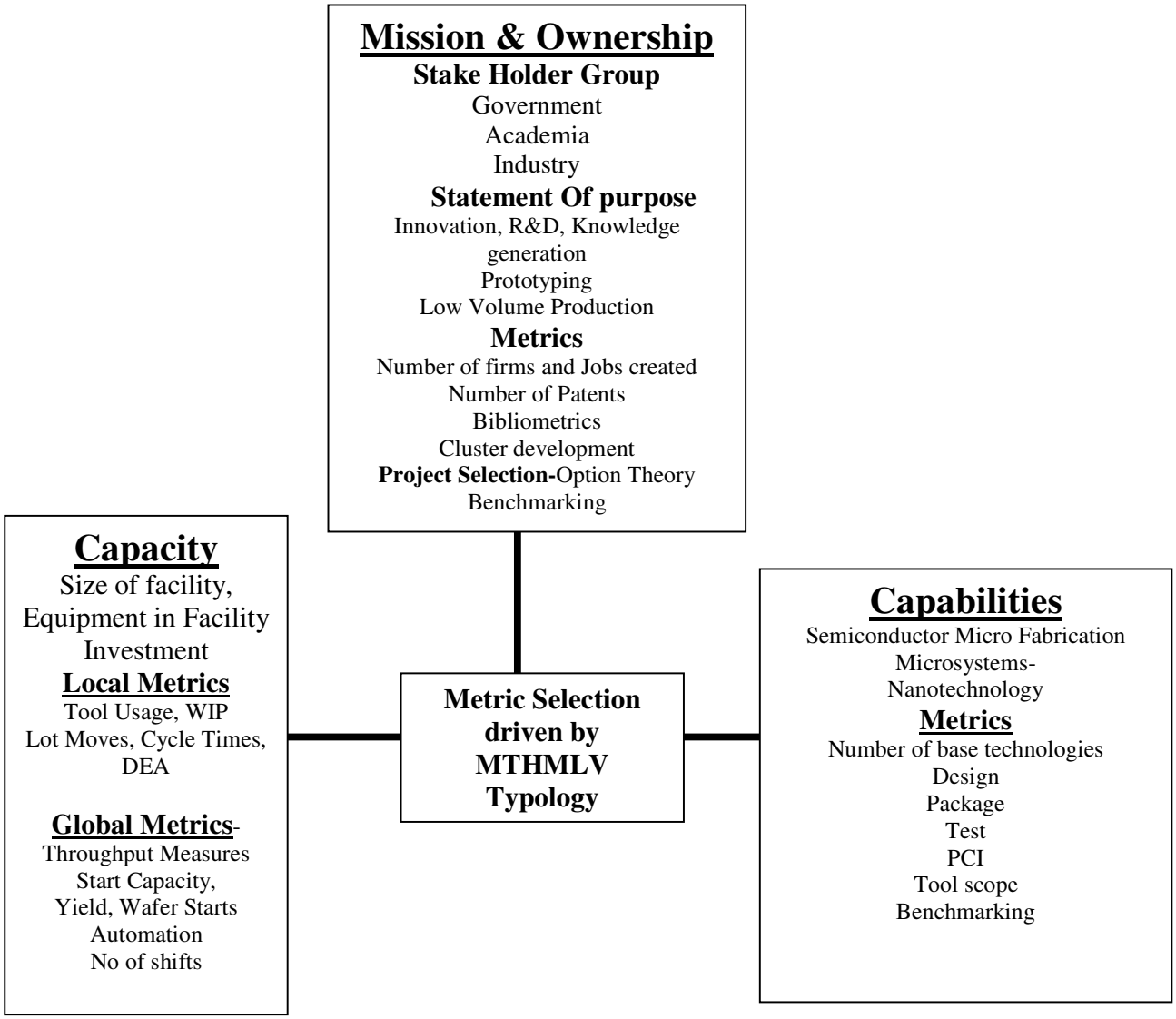
Indeed, MTHMLV success cannot be measures by the HVSF rubric of yield. Yet yield is always important in these facilities but often getting any yield might be considered a success in the MTHMLV facility. Yield must be seen in the light of the mission and capabilities of the facility. The value of MT-HMLV facilities lies in their ability to produce new products and processes, critical products, provide a facility that embraces iterative lot runs utilizing nontraditional process technologies and becoming the cradle of innovation at the convergence of technologies. Their ability to prove out product design through design iterations based on real manufacturing feedback and their ability to take an embryonic technological process and create a stable manufacturing platform. Indeed ROI is not enough.

These realities suggest the development of a number of metrics from which a subset can be utilized for the specific needs of a particular MTHMLV facility. MTHMLV specific metrics designed to directly support the managerial requirements generated by the desperate missions and capabilities of MTHMLV facilities. We have developed a model, the MTHMLV Metrics Selection Model, which is designed to assist these facilities to accurately assess their operational and strategic effectiveness and value based on the mission and capabilities inhering in their facility. Our model builds on Hayes and Wheelwright separation of manufacturing facilities into 4 distinct categories.

The realties in the MT-HMLV world is that these facilities are not distinctly in any of these categories. Rather MT-HMLV facilities occupy more of a continuum role where they provide value in all of these sectors. They require a metrics management approach that is flexible enough to meet the needs of all 4 types of facilities.

We have developed a 3 factor approach for a firm's investment and operation of a MT-HMLV facility. Those factors are mission focus, capability scope, and capacity. We operationalize each of the factors in accordance with the nature of MT-HMLV facilities.

Figure 6 MT-HMLV Metric Selection Model



We depict our HT-HMLV Metric Selection Model (HT-HMLV MSM) framework designed to be more relevant for MTHMLV metric selection. We began by developing a 3 factor derived from our literature review and case study analysis. These factors are (1) Mission and Purpose, (2) Capacity and (3) capabilities.

Mission and Ownership. We operationalized mission and ownership as follows. First we agree with Hayes and Wheelwright (***)_ that the nature of the firm dictates the type

of managerial metrics required Then, we define these facilities nature through its mission and ownership. Next we develop a set of metrics that might be selected to demonstrate strategic value of the facility through a variety of metrics that meet the stated mission and speaks to the ownership group.

Our MTHM:LV facility are tasked with a variety of mission including; increased innovation, job and regional wealth creation, R&D, Prototyping, and low volume production. We individually operationalize these factors. We use bibleometirc measures as the metric for R&D, knowledge generation and innovation. The bibleometric units are Innovation awards, journal articles, citation rates and licenses as their metrics. Further some MTHMLV facilities are tasked with the necessity to produce low volume products usually tied to a specific stakeholder group. Here we utilize capacity measures. Fineally most ownership is focused on regional development, jpob and wealth creation. Here metrics are numbers. Number of employees, firm attraction and spinouts.

Capacity

We considered and cataloged the different types of business units into three distinct, but separate groups in the model. The first group is industry partners. They include commercial, for- profit research and development labs. The group also includes R&D division of a firm. The focus of both entities is to create innovative products for the commercialization in a timely and cost effective manner. Next are governmental partnership faculties. These include federally fund national labs, NASA and Department of Defense Research Labs. Their ambition is to seek new approaches to challenging technical issues and produce a product using nonstandard methods in extremely low volumes. Last, are those labs, which are in academic situation. Each of these units

requires a distinct managerial style, which influences the outcome of the HT-HMLV MSM. The management approach of a federal funded national lab is quite different than a profit research and development MT-HMLV facility. Thus internal corresponding variables must be taken into consideration.

The inclusive mission of each group is unique also. Government relies on the number of patents, job formation and strategically, a firm and stable foundation on which to base new applications of gain knowledge. Academia is different in the fact that it revolves around knowledge creation and education of future engineers and technologists. In this situation, patents are a primary metric for them, with economic outcomes being secondary. Industry is different from both previous entities in that fact that business units seek stable processes in order to generate products. Examples of such metrics would include project selection and lot moves.

Next is the block containing the term Statement of Purpose. The use of the expression Statement of Purpose is linked to the modified Hayes and Wheelwright model. The model shows the relationship between type of inquiry and the production of products or services. As the progression from pure research to applications to product takes place, there are divergent methodologies that are used in HT-HMLV facilities and thus differing metrics. For example, an applications element differs from a R&D unit. Moving diagonally down the line, a different approach is used in prototyping and entirely different tactic in low volume production. Each of the four steps in the modified Hayes/Wheelwright model requires an individual structure of metrics in order to achieve the desired outcome and success.

The area of Strategic Metrics is perhaps the best known and also the most studied. As MT-HMLV facilities act as engines of innovation centers of new product and process creation, these centers are at the forefront of cutting edge technology. To provide support for the decision making process that are occurring in these centers, the proper use of metrics are needed. We have identified three core metrics for the block. They are decision-making processes, application of metrics and metric evaluation. The first step here is the decision-making processes. Project selection permits both a macro view of the venture into manageable part quantities and a temporal value placed on the project. The use of option theory can be used to an advantage in R&D operations. Options provide not only a monetary value, but a temporal assignment to objectives, which must be meet or the project is terminated. If the objectives are met, then the project continues to the next phase. Using option theory also provides additional value since the approach attempts to provide a technological outlook for the future, thus projects can be accelerated or slowed to fit the outlook. Once a project is selected, specific global and local metrics can be chosen and adopted to fit the requirements of the each individual endeavor. Intertwined with project selection is the choice and evaluation of metrics. As the project evolves, the metrics must evolve also. Metric selection and evaluation should be consistent and diligent during the process.

The block adjacent to strategic metrics is Operational Metrics. These are the best known, but least understood classification of metrics. Operational metrics are bifurcated into the Global and Local metrics portions of the model. Starting with the Global portion, the approach for MT-HMLV is founded on the Lot Move concept rather than the Wafer Start Concept. Cycle times and the subset metric of Lot Moves are best used in MT-

HMLV faculties. These metrics best describe the performance nature of the project. Trying to predict a schedule in an unpredictable situation is difficult at best. With numerous incidences as engineering holds, hot lots and project termination accounts for temporal disturbances. Lot Moves provide information in numerous methods. Completion of a particular section of a project, time to complete and holds are all accounted for in lot moves, as well as tool breakdowns. Cycle times can be used, however they provided less information as they describe only the temporal added value input to an output to an individual process.

One of the universally used metrics in HVSF's is start capacity. Start capacity is the measurement of wafers that can be started in a particular time, usually at the beginning of a tool operation. This metrics helps locate bottlenecks in tool operation, while increasing throughput. However in HT-HMLV operations, nothing is standardized and each operation is different. The use of this metric is not suitable for HT-HMLV due to the lack of standardization of products, lack of automation and re-tooling after specific operations.

The Local Metrics portion of Operational Metrics is the management approach is based on tool scope rather that tool efficiency. We must trade efficiency for scope, which provides an efficient low volume production facility with metrics, whereas high volume foundries metrics are so inefficient. The difficult portion is not the identification of metrics, however the correct metric for the application. A common approach is the use of one single metric. One metric for the entire operation is not practical and provides information to operations. The single metric approach is by human nature the one that provides the greatest self-satisfaction with the least amount of input. Countering this is

the diligence use of numerous metrics, which tend to cloud the purpose of metrics and does not convey information in a distinct and clear way.

The Local Metric approach we have chosen for MT-HMLV's are founded on tool usage and tool capacity. The ability to use one tool for different operations is imperative to the operation. Flexibility is the underlying principle and effects key metrics. In MT-HMLV facilities the flexibility of tools is crucial to the operation stability. The ability to change or re-tool for explicit operation is a normal in day-to-day operations. The metric thus chosen here is tool usage. Even though tools have to be flexible in the environment, the operational throughput for each tool has to be recognized and account for. Tool Usage allows flexibility, but there still a need for whether or not a tool is operating at peak efficiency. Here the metric chosen is tool capacity. Tool capacity allows operations management to view if the processes that are required are meeting expectations

Yield is a critical dimension in HVSF's. The operations that are performed must achieve a particular yield in order for the HVSF to remain competitive in today's market place. With large capital investment and the decreasing price for standard semiconductors chips, the need for yield is critical in high volume situations. However, the use of yield is problematic in MT-HMLV facilities. With the design of new products, comes an engineering challenge that must be overcome. The use of yield in such a situation would be misleading to the stakeholders involved. Perhaps a better measurement of outcome is the application of a Process Capability Index. Process Capability Index (PCI). PCI is best described as using a sigma style process. Using the desired specifications as a norm, the project can be mapped using three or six sigma for

yield and/ or quality control. Once the mapping takes place, outliers can be identified and if the situation warrants, corrections made.

Both the operation and strategic metrics can make use simple statistics. Choosing of what works and what does not, is the foundation of metrics and their applications. However, there still is a requirement to compare individual processes and their outcomes. The Metric Selection Model is based on a Data Envelope Analysis methodology. The use of Data Envelope Analysis (DEA) was conceived for business applications, but can be adapted to other applications. The basic premise for DEA is to create a framework of Decision-Making Units that are benchmarked either internally or externally. In metrics and the use of statistics in those metrics, a statistical approach is characterized as a central tendency approach and it evaluates producers relative to an average producer. In contrast, DEA is an extreme point method and compares each producer with only the "best" producers. Those above the limit are efficient and those below the parameter line are losing efficiency.

The strengths of DEA include that it can handle a multitudes if inputs and outputs and doesn't require an assumption of functional form relating inputs to outputs. Also, with input and output variables, they do not have to be necessary related in function. This provides a simple weighted formula to measure parameters. In regard to MT-HMLV facilities, both internal and external practices can be examined and reviewed. The limitations of DEA are an extreme point technique and "noise" can cause fluctuations in measurement. DEA is able to estimate the relative efficiency of a DMU, but converges slowly to an absolute. Lastly large problems are difficult without specific software and statistical hypothesis tests are difficult.

With a DEA analysis, both the maximum and minimum performance parameters are identified and plotted. Once this is occurs, then that metric can be intergraded into a larger model for each process or tool use. The idea is to keep the system simple and clear. All three categories of metrics: Operational and Strategic metrics can be measured and placed into the framework of the model. Once each tier is measured they can be compared to others. The beauty of DEA is that it can be used internally or externally for measurement.

The HT-HMLV facilities block deal with three core areas: investment, size of the facility and number of personal involved or more specifically the number of shifts. The term investment deals with the amount of financial resources that were allocated. The more allocations that are made toward a facility usually means that more advanced processes that can be achieved. More importantly, than just square footage is the capital investment of the current lineage of tools and equipment to perform the needed work involve. As the search for technology advance, there must be a continuous investment in those tools. Size of facility was another factor that was considered. With larger facilities comes the convenience of more tools and the duplication of tools. This allows the practice of parallel procedures that reduce WIP times greatly. The last item involved is the number of personal that are employed at the MT-HMLV facility. As the number of personal grows, which include engineers and technicians, the capability of the business unit also grows.

Competencies are the principal areas in which the business unit is involved. We listed three areas' of which MT-HMLV facilities are involved with. Those areas are semiconductors fabrication, micro mechanical electrical systems (MEMS) manufacturing

and nano technology development. Each business unit requires a different approach to the subject of metrics. A semiconductor R&D facility and its process are going to be different that those that are involved with nano technology. Whereas, semiconductor and MEMS fabrication have similar attributes, although the MEMS creation takes multiple of steps that the semiconductor process does not have to perform.

Using the Metric Selection Model is simple and forward. By knowing the organization, how it operates and the mission of the institution, the model provides a foundation on which to build a managed approach to the problem of metrics in MT-HMLV facilities. For example, innovation and design centers are focused on creation of processes. By using advanced materials and techniques, these centers are attempting to solve tomorrow's problems. However, by holding these centers to the same metrics as HVSF or even prototyping MT-HMLV facilities are consistent with the model. Innovation and design centers require tool flexibility and the metric lot moves. Research and development overlays the innovation centers in the fact that lot moves and tool flexibility remains the chosen metrics. However, the search for a stable process is on going, which leads to prototyping. While lot moves is metric that is used here, consideration must be made to breath of capacity. Low production facilities are going to use lot moves and tool usage, since the transition has been made though innovation to production. Each stage of the process and facility, must realize their own managed approach to metrics.

VI. Conclusions

Building upon the current literature, we examined the differences in metrics for Multi Technology, High Mix, Low Volume (MT-HMLV) and High Volume Silicon Fab (HVSF) facilities. Most of the metrics in place now in MT-HMLV facilities are based upon those of their counterparts. While these metrics work well under the automated processes that are universally used in semiconductor facilities, they don't fit the essential needs for MT-HMLV facilities. Given the information that was proved by the questionnaire, MT-HMLV's prefer to use lot moves as the primary metric in their fabs. All respondents also mentioned that given the current set of metrics under use today that innovation is stifled and this subject is critical to the continuing improvement of technology.

Using the questionnaire as a foundation for our research, we constructed a framework of a managerial systemic approach to the use of metrics in MT-HMLV facilities. The model known as the Metric Selection Model (MSM) provides a framework for a systemic approach to metrics. By classifying the competencies, organizational type and purpose of each business unit, different metrics and their subsequent structure and methodology can be utilized. By separating the uses of metrics in three classifications: R&D, Local and Global, different metrics can be used for the situation. Option theory for project selection, tool usage and lot moves are considered the best metrics to use. With the use of DEA and PCI, individual operations can also be scrutinized. We also looked at the use of some common metrics for HVSF's such as wafer start and yield and showed the ineffectiveness in R&D settings. It is the hope of this report that further investigation is undertaken into the area of metrics for MT-HMLV facilities.

Bibliography

[1] Abby, Augustus and J. Dickson, "R&D Work Climate and Innovation in Semiconductors." *Academy of Management Journal* vol. 26-2, June 1983 pp.362-368.

[2] Adams, J.D., E.P. Chiang, and J.L. Jensen "The Influence of Federal Laboratory R&D on Industrial Research," *Review of Economics and Statistics,* vol.85, November 2003 pp.1003–1020.

[3] Anson, S., M Kautt, S.T. Walsh, K. Bittner, "Academic Infrastructure and Competence Centers for a potentially evolving Nano-manufacturing industry." *International Journal of Technology Transfer and Commercialization*, vol 7-4, 2008 pp. 436-455

[4] Appleyard, M. M. and C Brown, "The Influence of Employment Practices on Manufacturing Performance in the Semiconductor Industry." *Industrial Relations.* Summer 2001, pp. 1-43.

[5] Appleyard, M. M. and C. Brown, "Employment Practices and Semiconductor Manufacturing Performance." *Industrial Relations: A journal of Economy and Society.* December 2002, vol. 40-3. pp. 436-471.

[6] Baglieri, E., V. Chiesa, A. Grando, R. Manzini, "Evaluating Intangible Assets: The Measurement of R&D Performance." March 2001 Research Division Working Paper No. 01-49.

[7] Benson, R. F., S. P. Cunningham and R. C. Leachman, "Benchmarking Manufacturing Performance in the Semiconductor Industry" *Production and Operations Management,* vol. 4-3, Summer 1995, pp. 201-216.

[8] Bonal, J., C. Ortega, L. Rios, S. Aparico, M. Ferndndez, A. Sdnchez and S. Malvar, "Overall Fab Efficiency" *Advanced Semiconductor Manufacturing Conference IEEE* 1996, pp. 49-52

[9] Chen, C., L. M. Han "Using DEA to Evaluate R&D Performance in the Integrated Semiconductor Firm." *International Journal of the Computer, Internet and Management,* Sept/Dec. 2006, pp. 50-59.

[10] Chen, H., J. Chen, S. Li and Z. Wei, "Double Dimension Control Method for Performance Measure on R&D Process." *Wireless Communications, Network and Mobile Computering,* September 2007, pp. 6209-6214.

[11] Croft, T., H. Toeante and T. Baker, "Labor Modeling In Dynamic Environment." *IEEE.* 2001, pp. 513-515.

[12] Corbett, J., P.A.McKeown, G.N. Peggs and P. Whatmore, " Nanotechnology: International Developments and Emerging Products." *Manufacturing Technology* 49-2 (2000) pp. 523-545.

[13] Cordero, Rene S. Walsh, B. Kirchhoff, "Motivating Performance in Innovative Manufacturing Plants." *Journal of High Technology Management Research* vol. 16-1, September 2005, pp.88-89.

[14] Dietrich, J. M. "Life Cycle Process Management for Environmentally Sound and Cost Effective Semiconductor manufacturing." *IEE,* 2004 pp.168-172

[15] Drongelen K., C. Inge and J. Bilderbeek,. "R&D Performance pp. Measurement; More than choosing a set of Metrics." *R&D Management*, vol. 29-1 1999, 35-46.

[16] Eisenhardt, K. M. "Building Theories from Case Study Research." *The Academy of Management Review,* vol. 14-4 October 1989, pp. 532-550.

[17] Fallon, M., A.J. Walton, M.I. Newsam, V. Axelrad, and Y. Granik, "Integration of Costing, Yield and Performance Metrics into the TCAD Environment through the Combination OF DOE and RSM." *International Symposium On Semiconductor Manufacturing,* 1995, pp.266-270.

[18] Foster, J. and T. Nugent, "Implantation of Best Known Methods" *Advanced Semiconductor manufacturing Conference.* 2000 IEEE/SEMI pp.181-186

[19] Goldratt, E. M. and J. Cox, *The Goal* North River Press, 3rd ed. (November 2004)

[20] Goodall R., D. Fandel, A. Allan, P. Lander and H. Huff, "Long Term Productivity Mechanisms of the Semiconductor Industry." *American Electrochemical Society Semiconductor Silicon 20002,* 9th Ed. May 2002. pp. 125

[21] Guidi, R. L., D.E. Paradis, M.T. Whitfiel, F. D. Poag and D.P.Jenson, " Strategy and Metrics for Wafer handling Automation In Legacy Semiconductor Fab." *IEEE*

Transactions on Semiconductor Manufacturing, vol 12-1 February 1999, pp.102-108.

[22] Hallas, J. F., J.D. Kim and C.T. Mosier, "An investigation of operating Methods of 0.25 micron Semiconductor manufacturing." *Proceedings of the 1996 Winter Stimulation Conference,* pp. 1023-1030.

[23] Hauser, J.R. and F. Zettelmeyer, "Metrics to Evaluate R, D&E" *Research Technology Management*, vol.40-4, 1997, pp. 32-38.

[24] Hayes, R. H., S. C. Wheelwright, "Link Manufacturing Process and Product Life Cycles." *Harvard Business Review,* January-February 1979, pp.133-140.

[25] Herrmann, J. W., B.F. Conaghan, L.H.Lecordier, P. Mellacheruvu, M.Q. Nguyen, G.W. Rubloff, R.Z. Shi, " Understanding the impact and Process Changes with a Heterogeneous Semiconductor manufacturing Simulation Environment." *Proceedings of the 2000 Winter Simulation Conference,* pp. 1491-1498.

[26] International Technology Roadmap for Semiconductors, "2008 Update" pp. 79.

[27] Ishii, Y. and S. Watanabe, "Research and development of Production Control Information System Tool." *The Ninth International Symposium on Semiconductor Manufacturing*, pp. 351-354.

[28] Jacobs, J.H., L.F.P. Etman, J.E. Rooda and E.J. Van Campen, "Quantifying Operational Time Variability: the Missing Parameter for Cycle Time Reduction." *Advanced Manufacturing Conference.* IEEE/SEMI, 2001, pp. 1-10.

[29] Kautt, M. S. Walsh, K. Bittner, "Global distribution of micro–nano technology and fabrication centers: A portfolio analysis approach," *Technology Forecasting and Social Change,* vol. 74 2007, pp.1697-1717

[30] Kilby, J., "Turning Potential into Realities: The Invention of the Integrated Circuit" (Nobel Lecture) ChemPysChem 2-8/9 pp. 482 – 489

[31] Kim, J.H., T. E. Lee, "Schedule Stabilization and Robust Timing Control for Time-Constrained Cluster Tools." *International Conference on Robotics and Automation.* IEEE, 2003, pp. 1039-1044.

[32] Konopka, J. and W. Trybula, "Overall Equipment Effectiveness (OEE) and Cost Measurement." *International Electronics Manufacturing Technology Symposium* IEEE/CPMT, 1998, pp. 137-140.

[33] Leachman, R C. and D. A. Hodges, "Benchmarking Semiconductor Manufacturing" *Semiconductor Manufacturing, IEEE Transactions* vol. 9-2, May 1996, pp.158-169

[34] Leachman, R. C. and D.A. Hodges, "Benchmarking Semiconductor manufacturing." *IRW Final Report,* 1997.

[35] Limanond S., J. Si, K. Tsakalis, "Monitoring and Control of Semiconductor manufacturing Processes." *IEEE Control Systems,* 1998, pp.46-58.

[36] Linton, J. and S. Walsh, S. "A theory of innovation for process-based innovations such as nanotechnology." *Technological Forecasting and Social Change* vol.75-5, June 2008, pp. 583-594.

[37] Lockamy A. and J.F. Cox, " An Empirical study of Division and Plant Performance Measurement System in selected World Class Manufacturing Firms: Linkages for Competitive Advantage." *International Journal of Production Research,* vol. 33-1 1995, pp.221-226.

[38] Maynard, D. N., D. S. Kerr and C. Whiteside, "Cost of Yield." *Advanced manufacturing Conference* IEEE/SEMI (2003) pp. 165-170.

[39] Meyers, M.H., P. Tertzakian and J.M. Uttback, " Metrics for Managing Research and Development in the Context of the Product Family." *Management Science* vol. 43-1, January 1997, pp. 88-111.

[40] Meyersdorf, D. and T. Yang, "Cycle Time Reduction for Semiconductor wafer Fabrication Facilities. *Advanced Semiconductor manufacturing Conference.* 1997 IEEE/SEMI, pp. 418-423.

[41] Mihm, J. and C. Loch, "Problem Solving Oscillations in Complex Projects." *Management Science,* June 2003, pp. 733-750.

[42] Miller, D. "Semiconductor Capital Equipment Manufacturers." *Industry Report,* August 24, 2004, pp. 1-22.

[43] Michelin, G. and D. Berg, "Evaluating Research –ROI is not enough" *Harvard Business Review* 28-3 May/ June 1985, pp 15-22.

[44] Moore, G. "Lithography and the future of Moore's law" Proc. SPIE, vol. 24-39, 2 (1995); DOI: 10.1117/12.209195

[45] Mozumder, P.K., S. Saxena and K. Taylor, "Simultaneous Control for Multiple Nonuniformity Metrics Using Site Models and Monitor wafer Controls." *Advanced Manufacturing Conference.* IEEE/SEMI, 1994, pp. 205-208.

[46] Mozumder P.K. and L.M. Loewenstein, "Method for Semiconductor Process Optimization Using Functional Representations of Spatial Variation and Selectivity." *IEEE Transactions on Components, Hybrids and Manufacturing Technology,* vo1. 5-3, June 1992, pp. 311-316.

[47] Myers, D.R. "Implications of Intelligent Microsystems for Product Design and Development." *Engineering Management Society 2000,* pp. 325-330

[48] Naughton A. B. "Aligning Tool Set Metrics for Operation in a Multi Technology High Mix Low Volume Manufacturing Environment." MIT Thesis, June 2005.

[49] Ofek, E. and M. Sarvary, "R&D, Marketing and the Success of the Next Generation Products." *Marketing Science,* vol. 22-3, Summer 2003, pp.355-370.

[50] Pich, M. T., C. H. Loch and A. Meyer, "On uncertainty, Ambiguity and Complexity in Project Management." *Management Science,* vol. 48-8, August 2002, pp. 1008-1027.

[51] Romig, A., A. Baker, J. Johannes, T. Zipperian, K. Eijkel, B. Kirchhoff, H. S. Mani, C.N.R. Rao, and S. Walsh, "An introduction to nanotechnology policy: Opportunities and constraints for emerging and established economies" *Technological Forecasting and Social Change* vol. 74-9, 2007, pp.1634-1642

[52] Sattler, L and R. Schlueter, " Semiconductor metrics: conflicting goals or increasing Opportunities." IEEE/SEMI, 1998, pp.55-60.

[53] Sattler, L., R.C. Glassey and B.I. Saeed, " Benchmarking Semiconductor manufacturing Performance Using a Pairwise-Comparision Method." *IEEE Transactions on Semiconductor Manufacturing,* vol.10-2, May 1997, pp. 317-321.

[54] Schumann, P. A., D. L. Ransley and D. C. Prestwood, " Measuring R&D Performance," *Research Technology Management*, vol. 38-3 1995, pp.45-55

[55] Shockley, W. "The path to the Conception of the Junction Transistor" *Electron Devices, IEEE Transactions,* vol. 23-7, July 1976, pp. 597-620

[56] Silicon Industry Association (SIA) "Semiconductor Sales Slowing" November 19, 2008.

[57] Smith, T., D. Boning, S. Fang, F. Simon, G. Shinn and J. Stefani, "A Study of Within-Wafer Non-Uniformity Metrics." *International workshop on Statistical Metrology.* 4th Ed. 1999, pp. 46-49.

[58] Szakonyi, R. "Measuring R&D Effectiveness-I." *Research Technology Management* vol. 37-2*,* 1994, pp. 27.

[59] Thukral, I., J. Von Ehr, S. Walsh, A. Greon, P. Van de Sijd and A.K. Akmaliah Adham, (2008)**,** Entrepreneurship, Emerging Technologies, Emerging Markets, *International Small Business Journal***,** vol. 26, February 2008, pp.101 - 116.

[60] Tierney, R. and S. Walsh, "A strategic model for firms who seek to embrace nano—manufacturing" *International Journal of Technology Transfer and Commercialization*, Vol.7-2/3, 2008, pp 171-182.

[61] Wagner, L. C. "Failure Analysis Challenges." *IEEE.* 2001, pp. 36-41.

[62] Walsh, S. "Portfolio Management for the Commercialization of Advanced Technologies" *Engineering Management Journal,* vol.13-1, March 2001, pp.33-37.

[63] Walsh, S., J. Linton, R. Grace, S. Marshall and J. Knutt, "MEMS, Microsystems, Micro machines: Commercializing An Emergent Disruptive Technology", in MEMS and MOEMS Technology and Applications", *The International Society for Optical Engineering Development,* 2000, pp. 479 –514

[64] Walsh, S., R. Boylan, W. Carr, R.Warrington, and J. Elders, "The Strategic Development of HARM Manufacturing Technologies", *Microsystems Technologies*, vol. 43, 1996, pp. 11-26.

[65] Walsh, S., B. A. Kirchhoff, S. Newbert, " Differentiating market Strategies for Disruptive Technologies." *Transactions on Engineering Management, vol*. 49-4 November 2002, pp. 341-351.

[66] Walsh, S., et al (2003), "Ch. 2 Commercialization of Microsystems" International Roadmap on MEMS, Microsystems, Micromachining and Top Down Nanotechnology MANCEF, 2003, pp. 33-68.

[67] Werner, B.M. and W.E. Souder, "Measuring R&D Performance-State of the Art." *Research Technology Management,* May-June 1994, pp 44-56.

[68] Wu, B. P. F. "Innovations for Economical 300/450 IC Fabricators." *Advanced Manufacturing Conference.* IEEE/SEMI, 2002, pp. 150-154.

[69] Yin, Robert K. “Case Study Research: Design and Methods.” 3rd Ed. Sage Publishers, 2003.

ENTREPRENEURIAL EXPERIENCE AND ENTREPRENEURIAL STRATEGY

Empirical Analysis of the Influence of Entrepreneurial Teams with Academic and Surrogate Entrepreneurs on Entrepreneurial Strategy of Research-based Spin-off Companies in Europe

(Research in Progress)

PhD-Student: Rigo Tietz (3rd year)
University of Technology Dresden
01062 Dresden (Germany)
Phone: +49 351 463 32342
Email: rigo.tietz@tu-dresden.de
Supervisor: Prof. Dr. Michael Schefczyk
Phone: +49 351 463 36882
Email: michael.schefczyk@mailbox.tu-dresden.de

Keywords: Research-based Spin-offs, Strategic Entrepreneurship, Surrogate Entrepreneurship

Abstract

This study analyses the influence of entrepreneurial experience in research-based spin-off companies (RBSOs) on entrepreneurial strategy, venture development, and firm performance and uses different sources of information. Besides desktop-research a quantitative empirical analysis addressing RBSOs in Europe will be conducted. The first step was a survey asking technology transfer officers at universities and non-university research institutes about RBSOs at their organisations. In cooperation with the University of Antwerp 1.011 institutes in 24 European countries have been contacted leading to a database with 8,505 companies. In the next step an appropriate sample of RBSOs will be selected and asked for the characteristics of the entrepreneurial team and the strategy of the company. Finally, it will include different sources to measure RBSOs´ performance. This research-in-progress paper gives an overview about the current status quo of the study. It includes a brief review of the existing literature, introduces the research questions, and discusses a subset of hypotheses as well as the theoretical background and proposed methodology.

Introduction

The commercialisation of research-based technology has become an intensively discussed topic in politics and business as well as in academic networks. Spin-off companies from universities and research institutes are claimed to be important opportunities for commercialising technologies. Beside the conventional route for scientific discoveries to reach the market, through licensing, research-based spin-offs (RBSOs) have become an increasingly popular aspect, especially in the technology transfer process (Di Gregorio & Shane, 2003; Wright, Birley, & Mosey, 2004). In this context an initial question is whether the RBSO has entrepreneurs with appropriate commercial skills to establish profitable ventures if they were engaged in academia before. On the one hand, scientists are typically

the founders of high technology companies, but on the other hand, they often lack managerial and entrepreneurial skills. The entrepreneurship literature discusses the impact of habitual and novice entrepreneurs on new venture performance. Within the field of RBSOs two different approaches can be outlined: (1.) the academic/inventor or (2.) an external/surrogate as entrepreneur of the spin-off (Radosevich, 1995). The academic entrepreneur was usually in the research team developing the technology the RBSO is based on, whereas the surrogate entrepreneur did not belong to the research institute before joining the spin-off (Franklin, Wright, & Lockett, 2001). Most research has paid attention to the academic entrepreneur, but there are only a few studies in the literature which focus on the external entrepreneur. This study contributes to previous research by examining more closely the role of the surrogate entrepreneur in enabling RBSOs to become sustainable, rent generating firms.

Literature review and research questions

In prior studies, RBSOs are defined as new ventures based on the transfer of technology or academic knowledge developed by public research organisations with focus on the commercialisation of research results. In this context RBSOs can be discussed from different perspectives. Despite the increasing attention on the spin-off process and activities (e.g. Smilor, Gibson, & Dietrich, 1990; Roberts & Malone, 1996; Carayannis, Rogers, Kurihara, & Allbritton, 1998) most authors do not give a strict and clear definition of a research-based spin-off.

Pirnay et al. (2003) propose a typology on the basis of two key discriminatory factors. These factors are (1.) the academic status of the individuals which are involved in the new venture and (2.) the kind of knowledge that is transferred. Concerning the academic status a differentiation is made between entrepreneurs with a scientific background like professors or researchers (Mustar, 1997; Clarysse, Wright, Lockett, Van de Velde, & Vohora, 2005) and founders without substantial research experience like students. Spin-offs with a scientific background typically try to commercialise research findings with promising prospects of success. Therefore, in this type of spin-off usually researchers and rarely students are engaged. With regard to the kinds of knowledge on the one hand codified knowledge and on the other hand tacit knowledge can be transferred to the spin-off company. Codified knowledge is usually distinct from the researcher who developed it. Because it relies on formal information like publications or research reports it is easily accessible and can be used or reproduced by other individuals. Tacit knowledge such as experiences or technical expertise, is generally related to the researcher who acquired this kind of knowledge within his academic career.

Mustar et al. (2006) conceptualise a multi-dimensional taxonomy of research-based spin-offs and identify several common characteristics they have with new technology based ventures (NTBFs). On the basis of a literature review of articles on NTBFs published since 1990 they identify three main theoretical research traditions. The first category examines the “institutional perspective” which focuses on the relationship between RBSOs and their parent organisations. Most of this research analyses the influence that the parent institute might have with their decisions, e.g. on the business model of the RBSO (Clarysse et al., 2005; Löfsten & Lindelöf, 2005). The second category of articles pays attention to sectoral differences, technological frameworks, and product market combinations. In this context the term “business model perspective” seems to be appropriate. These papers are mostly more theoretical and descriptive (Chiesa & Piccaluga, 2000), they describe the business activities

developed by NTBFs and in particular by RBSOs. The third group can be labelled as the "resource-based-perspective" (Brush, Greene, & Hart, 2001). This kind of studies focuses on organisational resources and capabilities of a firm as predictors of performance and competitive advantage.

Previous research mostly agrees about the relevance of entrepreneurs and owner-managers as the key resource asset and influence factor for the growth and performance of small companies and new ventures in particular (Bruno, Leidecker, & Harder, 1987; Shane, 2000; Watson, 1995). In this context studies have analysed the characteristics of founders or owner-managers with the entrepreneur as unit of analysis (Davidsson & Wiklund, 2001). According to the literature that examines the human resources of new ventures, primary competencies of RBSOs depend on competencies of the entrepreneurial team (Cooper & Bruno, 1977). For this reason growth and performance of spin-offs are linked very closely to the characteristics of their founders and owner-managers. Particularly, the effect of their previous entrepreneurial experience is attracting more and more interest among entrepreneurship scholars (Chandler & Jansen, 1992; Dyke, Fischer, & Reuber, 1992; Westhead, Ucbasaran, & Wright, 2005). In this discussion an essential differentiation is made between "habitual entrepreneurs" who have previous business-ownership experience and "novice entrepreneurs" who are running their business without any prior entrepreneurial experience (Ucbasaran, Alsos, Westhead, & Wright, 2008).

There is a lack of research addressing the extent of habitual entrepreneurship in companies which emerged from academia (Mosey & Wright, 2007). The university environment implies a couple of constraints for establishing sustainable companies (Vohora, Wright, & Lockett, 2004). On the one hand new technology-based ventures are often challenged by several liabilities such as newness (Stinchcombe, 1965), size (Aldrich & Auster, 1986), adolescence (Brüderl & Schüssler, 1990), uncertainty (Schröder, 2008), and owner dependence (Shane & Stuart, 2002). On the other hand the entrepreneurial team often lacks managerial and entrepreneurial skills to establish profitable ventures since the scientists themselves are typically the founders of high technology companies emerging from academia. Within the field of RBSOs Radosevich (1995) outlines two different approaches: (1.) the academic entrepreneur approach (inventor approach) and (2.) the surrogate entrepreneur approach.

1. An academic entrepreneur is an individual who developed the technology. Although his primary role was that of a lecturer or researcher he takes the role of the entrepreneur in the new venture (Franklin, Wright, & Lockett, 2001).
2. Surrogate entrepreneurship involves an independent and external entrepreneur. This could be either an individual or organisation from outside the research institute that initiated the company. The originator of the technology keeps his position in the research institute (Franklin, Wright, & Lockett, 2001).

There are a few studies examining surrogate entrepreneurship on a theoretical approach that refers to the resource endowments. Radosevich (1995) points out that surrogate entrepreneurs may play an important role in transferring technology. In a theoretical paper he argues that inadequate incentives and support mechanisms for scientists in research institutes may change the focus of the scientist's activities. He argues that previous entrepreneurial experience and accumulated business knowledge including professional networks, easier access to risk capital, and strategic alliances are advantages of the surrogate-entrepreneur model. Corresponding to a survey of 57 universities in the UK Franklin et al. (2001) figure out that surrogate entrepreneurs could be an important source of commercial knowledge and

skills. Therefore they may increase the chances of success. Shane & Stuart (2002) analysed 134 spin-off companies from the MIT (US). Their main findings are that new ventures with founders who have direct and indirect relationships with venture investors are most likely to receive venture funding. Additionally, they are less likely to fail. They argue that receiving funding is one of the most influential determinants of the likelihood of an IPO. For this reason social capital assets which might be added by external entrepreneurs have a significant impact on fund-raising. Wright et al. (2004) used case-studies of 4 spin-offs in the UK to examine joint ventures with a company from the industry as a kind of external partner. The conclusion of this research is that creating a spin-off as a joint venture could be a helpful way for overcoming resource constraints.

Most attention in prior research concerning the entrepreneurial team in spin-off companies from research institutes has been paid to the inventor as an entrepreneur. The effects of surrogate or habitual entrepreneurs on research-based spin-offs´ development and performance has mainly been analysed qualitatively so further quantitative empirical studies are needed. Furthermore, findings in previous research concerning the relationship between prior entrepreneurial and business-ownership experience on firm performance are not consistent (Stuart & Abetti, 1990; Westhead & Wright, 1998). Habitual entrepreneurs do not by default perform better than novice entrepreneurs (Ucbasaran, Westhead, & Wright, 2006), because they may be able to enlarge their knowledge and capabilities, but they can also adopt routines and mindsets which limit the identification of opportunities and the development of the emerging business in a new and changed environment (Starr & Bygrave, 1991). In view of this inconclusive or just weak support for a positive impact of previous entrepreneurial experience on firm performance the point of view of this debate has to be broadened. Hambrick & Mason (1984) discuss the relationship between top management characteristics and the strategic decisions of the company as well as its´ organisational outcomes. Although this framework, called “Upper Echelons Theory”, was introduced more in the context of large corporations, applying it in an entrepreneurial setting may add an interesting perspective, because it outlines a mediating effect of the characteristics of the management team on firm performance through their strategic choices.

The relationship between strategic planning and firm performance has been extensively discussed within the scope of large corporations, predominantly indicating a positive influence of strategic planning activities (Bracker, Keats, & Pearson, 1988; Schwenk & Shrader, 1993). However, there are not many empirically based quantitative studies which focus on small companies (Kraus, Harms, & Schwarz, 2006). The existing debate about strategic planning in small firms does not agree about the value of planning activities, especially in the context of new emerging ventures. The so called “Planning School” argues that companies generally benefit from formal, systematic planning activities in stable as well as in unstable environments (Ansoff, 1991), so they support the development process and increase survival rates of established and emerging ventures. On the contrary, the “Learning School” states that companies perform better if they remain flexible and keep on learning, especially in unstable environments (Mintzberg, 1991).

In summary, there are not many studies analysing how habitual or surrogate entrepreneurs influence the performance and development of research-based spin-off companies. Previous research indicates inconsistent findings or only weak support for a positive impact of entrepreneurial experience on new venture performance. Furthermore, there are diverging opinions whether formal planning is beneficial for established and emerging small ventures. In the first instance, this study focuses on the relationship between prior entrepreneurial

experience and the intensity of strategic planning activities in research-based spin-off companies. Beyond that it looks at the mediating effect of strategic planning on firm performance. In this context the following research questions are addressed:

1. How do entrepreneurial teams in research-based spin-off companies influence the entrepreneurial strategy?
2. How does the entrepreneurial strategy mediate the effect of entrepreneurial experience on venture performance?

Theoretical background and hypotheses

Within this study the impact of entrepreneurial teams in research-based spin-off companies on entrepreneurial strategy, venture development, and firm performance will be analysed through different theoretical lenses. Firstly, it draws on the resource-based view and human capital theory to explain how initial resources may influence organisational outcomes (Barney, 1991; Wernerfelt, 1984; Becker, 1964). Secondly, effectuation and causation theory is used to explain why ventures emphasize strategic planning activities differently (Sarasvathy, 2001; Read & Sarasvathy, 2005; Wiltbank, Dew, Read, & Sarasvathy, 2006). Finally, this study refers to life-cycle models to outline RBSOs development (Miller & Friesen, 1984; Vohora et al., 2004).

The analysis of predictors of new venture performance has become an important field of entrepreneurship research. A number of studies has pointed out that initial resource stocks may have subsequent influence on organisational performance (Baron & Ensley, 2006). The resource-based view (RBV) considers firms as a set of resources which influence performance and competitive advantage (Barney, 2001). The RBV refers to several different theories of the firm and goes back to Edith Penrose and her work on “The Theory of the Growth of the Firm” (Penrose, 1959). Retrospectively, influential literature in the field of strategic management, e.g. Barnard (1938), Selznick (1957), Chandler (1962), and Rumelt (1974), has discussed the contribution of internal competencies to the performance of a firm. Therefore, these studies already incorporate a resource-based perspective (Conner, 1991). As one of the first authors, Wernerfelt (1984) outlines the theory of the resource-based view of the firm with a coherent description and notes, “For the firm, resources and products are two sides of the same coin” (pp. 171). In this context, the ability of a venture to keep its competitive position in a market depends on important resources rather than on a specific product market combination.

A resource-based approach places emphasis on attributes of the venture which are costly-to-copy and reside within the organisation. Barney (1991) suggests that this set of resources is significantly responsible for economic rents and therefore affects performance and competitive advantage. In a resource-based view it is generally accepted that companies try to obtain above-normal returns. According to Peteraf (1993) durable competitive advantage with above-normal returns needs resources which are valuable, rare, imperfectly imitable, and not substitutable. Nowadays, the resource-based view is one of the most influential frameworks in strategic management research. Resource categories are: (1.) technological resources, (2.) social resources, (3.) financial resources and (4.) human resources (Barney, 1991; Brush et al., 2001). Borch et al. (1999) use the term “technological resources” to refer to the firm-specific products and technology. RBSOs differ in their degree of innovativeness or scope of technology, they may also vary in their R&D quality and their position in the

product-development cycle. “Social resources” of a company can be defined as its industry and financial contacts (Brush et al., 2001). These social resources may also take into account the network or the social capital of the company (Elfring & Hulsink, 2003; Lee, Lee, & Pennings, 2001). The category “financial resources” includes the amount and type of financing with a distinction made between capital, loans, subsidies, and profits. “Human resources” refer to attributes of the founding team and the personnel, as well as the management team of the venture. Human resources can be measured as: size of the founding team, background of the founders, professional management experience, and organisational size.

Corresponding to the resource-based view literature, idiosyncratic internal resources implicate a sustainable competitive advantage. In the context of RBSO companies the question is, which resources are mainly responsible for these relationships? In the entrepreneurship field a series of articles identify the founders and their characteristics having an essential impact on RBSO performance and competitive advantage (e.g. Brüderl, Preisendörfer, & Ziegler, 1992; Brüderl & Preisendörfer, 2000; Chandler & Jansen, 1992). Although the discussions about the contributions of individual attributes comprise different arguments and opinions, a number of prior studies (e.g. Wernerfelt, 1984; Barney, 1991; Dierickx & Cool, 1989; Peteraf, 1993; Collis, 1994; Teece, Pisano, & Shuen, 1997) emphasize the role of the management team in identifying and exploiting profitable opportunities. Already Penrose (1959) perceived the weight of “unique managerial talent that is inimitable” (Rugman & Verbeke, 2002, p. 770) and distinguishes between entrepreneurial and managerial competences.

This study will explore the effects of initial resource endowments on the performance of RBSOs. It will concentrate on the human capital argument – especially the contribution of entrepreneurial teams with surrogate and academic entrepreneurs. The emergence of human capital theory was driven by the intention to analyse how individual investments of employees in training, education, knowledge, and experience improve their personal incomes (Becker, 1964). Scholars from the entrepreneurship field have used human capital theory in order to explain varying performance levels of new emerging ventures, e.g. compared to more mature companies which are already established in the market. Meanwhile, a substantial number and variety of different measures have been established such as formal qualification, work experience, and other kinds of knowledge and capabilities. In the context of young enterprises task-related variables like entrepreneurial, industry or ownership-experience have been discussed as being key assets for new venture performance and development (e.g. Florin, Lubatkin, & Schulze, 2003; Sexton & Bowman, 1985). According to human capital theory individuals can develop their capabilities leading to higher efficiency and productiveness if they acquire a wide range of human capital resources (Becker, 1975).

Based on a meta-analysis of 70 different studies Unger et al. (forthcoming) identify a significant positive correlation between human capital and entrepreneurial success. Although only a weak impact could be found the effect size is comparable to the relationship between formal planning and success in small companies (Brinckmann, Grichnik, & Kapsa, 2010). There might be several reasons why the link between human capital and entrepreneurial success is not as strong as the considerable amount of articles in the entrepreneurship literature may suggest. On the one hand contingency theory claims that the environmental situation of a company has to be taken into consideration and that so called “contingency factors” may also influence the relationship between human capital variables and performance measures (Lawrence & Lorsch, 1967). An external factor can be the situation of

the industry sector the company operates in. Human capital has been discussed to be more important in high-tech than in low-tech industries, because special knowledge and research expertise are crucial factors for developing new technologies (Khandwalla, 1976). As an internal factor the maturity of the company has to be mentioned, because emerging ventures have to cope with the liability of newness (Stinchcombe, 1965), thus superior human capital assets are supposed to be essentially beneficial for new companies (Davidsson & Honig, 2003). On the other hand human capital may have only in the long run a significant influence on venture performance, because this relationship is mediated by other factors such as company strategy (Baum, Locke, & Smith, 2001).

In principal, the literature differentiates between general and specific human capital (Becker, 1975). Whereas general human capital can be useful in a broader sense specific human capital refers to competences and skills which are connected to a specific context. Education and managerial work experience are important indicators of general human capital (Cooper, Gimeno-Gascon, & Woo, 1994; Castanias & Helfat, 2001), but not necessarily related to entrepreneurial knowledge and skills. Business ownership experience as a form of explicit entrepreneurial experience can certainly add to specific human capital in the entrepreneurship-context (Gimeno, Folta, Cooper, & Woo, 1997; Stuart & Abetti, 1990). Habitual entrepreneurs with previous business ownership experience are argued to have acquired specific entrepreneurial human capital which influences their behaviour and performance (Ucbasaran et al., 2008). In contrast to novice entrepreneurs they can link their strategic and operational decisions to prior experiences like experts in a certain field. Therefore, they are more likely to rely on intuitive reasoning, to apply heuristic-based logic, or to gather information in a more flexible and selective approach, especially in a dynamic and uncertain environment (Spence & Brucks, 1997; Mitchell et al., 2007). Furthermore, experienced entrepreneurs tend to make faster decisions (Forbes, 2005). On the contrary, novice entrepreneurs without any prior entrepreneurial experience do not have these kind of reference points, thus they act and search for information more systematically and analytically (Gustaffson, 2006).

These arguments are supported by effectuation and causation theory which helps to explain why entrepreneurial teams in RBSOs may apply different strategies in order to achieve competitive advantage. On the basis of recent literature in strategic management Wiltbank et al. (2006) frame strategy making in the categories of prediction and control and also differentiate between positioning and construction strategies. While positioning strategies focus on an exogenous environment where business opportunities are given construction strategies view companies within an endogenous environment where opportunities are partly created by the entrepreneur. Rational strategies focus on prediction as central issue in the decision process and try to achieve ex ante defined objectives by influencing and changing present circumstances. On the contrary, adaptive strategies follow a control-oriented logic which might be non-predictive and use available resources in a given setting in order to induce new goals and also new environments. This perspective emphasises events in the future which can be controlled instead of those which can be predicted.

Causation is based on the approach of prediction and effectuation on the approach of control. In this context (Sarasvathy, 2001, p. 245) provides the following definition: “Causation processes take a particular effect as given and focus on selecting between means to create that effect. Effectuation processes take a set of means as given and focus on selecting between possible effects that can be created with that set of means.” If the level of analysis is the firm these means are – according to the resource-based view – equivalent with the physical,

human and organisational resources of the company. These different strategy approaches do not exclude each other, in fact they can be applied simultaneously depending on the specific situation. Read & Sarasvathy (2005) state that an effectual approach concerning strategic decisions of a company may have a positive influence on the performance of new ventures. But further empirical analyses are needed in order to examine precisely in which situations whether the causation or the effectuation approach for strategic decision making is beneficial or unfavourable for companies. Both perspectives are extremely relevant for RBSOs. In contrast to typical start-up firms spin-off companies from universities and research institutes on the one hand rely on high sophisticated research results and cutting edge technology and on the other hand they often start in a very early stage without having placed successfully any products or services on the market or having any experience with customers or suppliers. Dew et al. (2009) conclude that habitual entrepreneurs use more likely effectual logic than novice entrepreneurs.

According to the previous discussion the following hypothesis is formulated:

Hypothesis 1: Entrepreneurial teams with previous entrepreneurial experience emphasize strategic planning activities less than teams without entrepreneurial experience.

The relationship between entrepreneurial experience and strategic planning might be moderated by several other variables. Presumably, the influence of previous entrepreneurial experience is different for established and emerging ventures. New companies are confronted with a higher degree of uncertainty and a lower level of predictability, because they have to build up their businesses so there is no information about the past development and the influence of the environmental situation available (McMullen & Shepherd, 2006). Establishing a new company requires estimations about market, competitors and demand which cannot be proved in advance. Therefore, new firms are more obliged to enforce learning than established companies (Shepherd, Zacharakis, & Baron, 2003). Previous research has figured out that especially in the early phases of venture development successful entrepreneurs emphasize less formal planning activities (Bhide, 2000).

These findings are underpinned by life-cycle or stage model theories which have been discussed extensively in previous research. Studies in this field analyse which changes are required for a company to evolve successfully over a period of time (e.g. Miller & Friesen, 1984; Van de Ven, Hudson, & Schroder, 1984). The success of a new venture depends in a crucial way on the ability of its entrepreneurs to cope with new and different challenges they meet when their business evolves, especially within the scope of research-based high-technology companies. In this context new ventures can grow from start-up with a specific marketable product to a complex organisational system in just a few years. In contrast to more predictable environments growth-related transitions and crises must be handled earlier and faster (Greiner, 1972).

The life-cycle theory suggests that ventures need significant changes in the managerial capabilities of their leaderships as the organisations grow and evolve through different life-cycle stages (Hanks, Watson, Jansen, & Chandler, 1993; Covin & Slevin, 1990). Entrepreneurs who have successfully set up an innovative venture may be not perfectly qualified to lead a company through further phases (Galbraith & Vesper, 1982). Because these stages of evolution differ basically from the founding process entrepreneurs may lack the necessary skills and experiences. The main challenge managing the venture becomes less

entrepreneurial with focus on viability and survival but more administrative with regard to larger organisational systems and even more complex business processes. Scholars have used life-cycle, respectively stage-based models to describe the development of new firms. The literature in this field of research states that organisations face a couple of very similar problems when they grow and become more mature. Concerning this matter entrepreneurs have to change considerably the management as well as structural configurations of their organisations. According to most life-cycle models new ventures develop in a coherent and predictable way through different phases of growth. Within each stage of development there are differing organisational characteristics which imply a number of new challenges and the necessity for different managerial and entrepreneurial qualities (Chandler, 1962; Greiner, 1972; Kazanjian, 1988; Miller & Friesen, 1984).

The life cycle models introduced in prior studies correspond to each other in reference to their basic idea that the growth of new ventures takes place in predictable patterns and distinguishable time periods. These models vary in the number of stages they point out, e. g. three- and four-stage models, up to models with five or even more stages. Greiner (1972) proposed one of the first stage-based models and states that ventures move through five discrete phases. Therefore, firms have to put through significant changes within their organisations before they can successfully manage the following stage. Vohora et al. (2004) point out five phases of development especially spin-off companies are faced with: (1.) research phase, (2.) opportunity framing phase, (3.) preorganisation phase, (4.) reorientation phase, and (5.) sustainable returns phase. Additionally, they identify four critical junctures between these different stages spin-off companies must accomplish to reach the next phase: opportunity recognition, entrepreneurial commitment, credibility, and sustainability.

Life-cycle theorists bring forward the argument that the continuing involvement of the original entrepreneurs in general management activities may be disadvantageous to the success of a venture as it grows. Because the skills of the founding team may not be well suited to manage larger and more established companies, new ventures may need to get professional managers involved in the team to match the required transitions. Hambrick & Crozier (1985) empirically observe that successful ventures are more likely to include experienced managers in the growth phase. On the contrary less successful start-ups are more likely to keep the original founding and managing team.

Concerning the moderating effects on the relationship between entrepreneurial experience and the intensity of strategic planning activities the following hypotheses are stated.

Hypothesis 2a: The relationship between previous entrepreneurial experience and strategic planning activities is positively moderated by the maturity of the company.

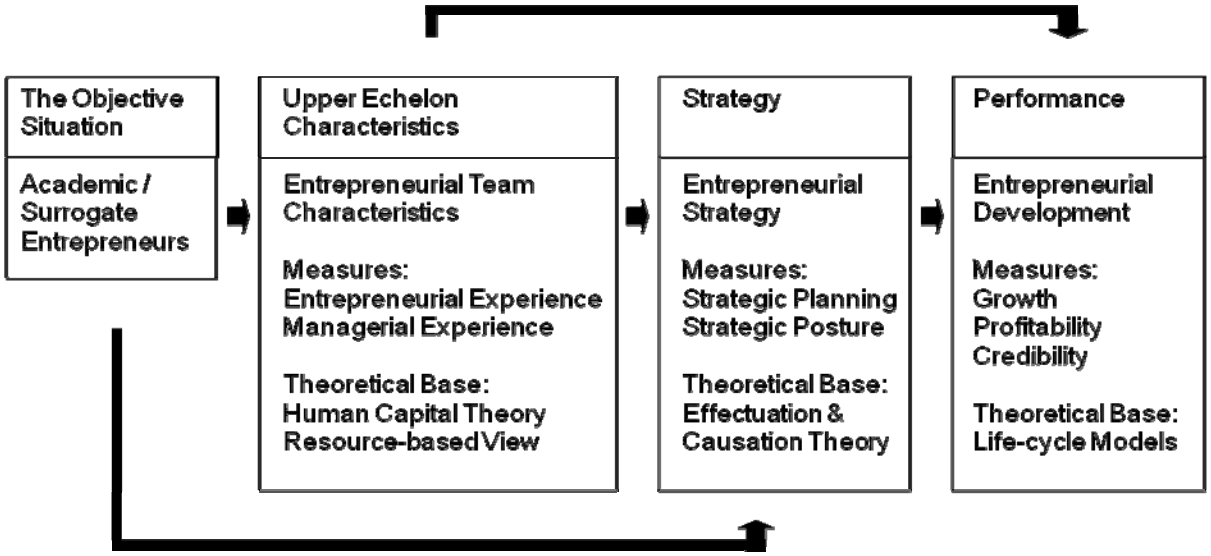
Hypothesis 2b: The relationship between previous entrepreneurial experience and strategic planning activities is positively moderated by the degree of environmental uncertainty.

Proposed Methodology

The upper echelons theory (Hambrick & Mason, 1984) states that the characteristics of top managers have an essential influence on the strategic decisions of a company and furthermore partly affect the organisational outcomes. This study will use this approach as conceptual framework, but apply it on the analysis of the attributes of entrepreneurial teams with

academic and surrogate entrepreneurs. It examines spin-off companies from universities and research institutes in different life-cycle stages and therefore also includes new and small ventures as well as established companies.

Figure 1 Conceptual framework (Hambrick & Mason, 1984)



The target group of this study are research-based spin-off companies from academic organisations across Europe. In order to enable comparability with other studies the main concepts of an academic organisation and a research-based spin-off company need to be clearly specified. On the basis of Pirnay et al. (2003), Clarysse et al. (2005), and Klofsten & Jones-Evans (1996) the following definition is used: “RBSO are new ventures created to exploit commercial knowledge, technology, or research results developed within a research institution." According to this specification, (1.) the RBSO has the legal structure of a new firm in contrast to an extension or a subsidiary of the research institute, (2.) commercialises scientific knowledge including technological innovations or patents, as well as individual know-how, generated within an academic career, and (3.) has the objective of generating profits with the business idea. This definition includes universities as well as non-university research institutes. Secondly, within this study an academic organisation has been specified as a research institute which is mainly financed by public money. This definition includes predominantly universities, but covers also universities for applied science as well as colleges as long as they are engaged in research activities. Furthermore, the study considers non-university research organisations such as the Max-Planck Gesellschaft in Germany or the Inter-university Micro-Electronics Centre (IMEC) in Belgium.

Because there is no existing public database about spin-offs in Europe available this study needs to look at the overall spin-off population at first. Therefore, a survey has been conducted in cooperation with the University of Antwerp (Prof. Dr. Johan Braet and PhD-Candidate Sven De Cleyn) and has addressed the question how many spin-off ventures originated from universities and non-university research organisations from 1985 till 2008. Intensive desktop-research on websites and databases has gathered information about 1,011 academic organisations and collected contact details of potential respondents – either directors or technology transfer officers. In sum, 809 academic organisations in 24 European countries have been contacted via an email survey and have been asked for the names of their

spin-offs as well as the corresponding date of foundation, activity status, academic field, industry sector, and the involvement of their parent organisations in the ventures such as equity stake, patent licenses or infrastructure. With an effective response rate of 41.1 % in total 8,505 spin-off companies in 24 European countries have been identified. 86 % of the sample are still active or established whereas 10 % are inactive, deceased or failed. Around 4 % of the ventures are already merged, acquired or sold. A very high percentage of spin-offs were founded in technology based industries (72 %).

After the validation process that proves whether the spin-offs fulfil the necessary requirements according to the used definition in the next step an appropriate sample of RBSOs will be selected and asked for the characteristics of the entrepreneurial team and the strategy of the company. Finally, it will include different sources to measure RBSOs´ performance. The empirical analysis of the study will use different sources of information and apply multivariate analyses to test the prepositions underlying the research model. The conceptual framework has been presented on several doctoral workshops and summer schools. Based on the received feedback multiple revisions have been made until now. In the next step a questionnaire has been designed addressing variables and constructs about surrogate and academic entrepreneurship respectively, entrepreneurial experience as well as company strategy, venture development and firm performance. Discussions with experts in the entrepreneurship field and a pre-test with 20 German and Belgium spin-off companies using the key informant approach by addressing a member of the management team has lead to several modifications of the questions and the intended procedure. The main survey will be conducted and preliminary results available in the first half of the year 2010. The study will contribute to existing literature in several ways. First, it will contribute to the entrepreneurship literature by focussing on the entrepreneurial teams and their impact on new venture strategy, development, and performance. Second, it will apply human capital theory with regard to different life-cycle stages. Third, it will broaden the upper echelons perspective by analysing especially small and new ventures. Finally, it will empirically test effectuation and causation theory by comparing venture strategies in early and later stages.

References

Aldrich, H., & Auster, E. R. (1986). Even dwarfs started small: Liabilities of age and size and their strategic implications. *Research in Organizational Behavior, 8*, 165-198.

Ansoff, H. I. (1991). Critique of henry mintzberg's 'the design school: Reconsidering the basic premises of strategic management'. *Strategic Management Journal, 12*(6), 449-461.

Barnard, C. (1938). *The functions of the executives* Harvard University Press.

Barney, J. (1991). Firm resources and sustained competitive advantage. *Journal of Management, 17*(1), 99-120.

Barney, J. B. (2001). Is the resource-based 'view' a useful perspective for strategic management research? yes. *Academy of Management Review, 26*(1), 41.

Baron, R. A., & Ensley, M. D. (2006). Opportunity recognition as the detection of meaningful patterns: Evidence from comparisons of novice and experienced entrepreneurs. *Management Science, 52*(9), 1331-1344.

Baum, J. R., Locke, E. A., & Smith, K. G. (2001). A multidimensional model of venture growth. *The Academy of Management Journal, 44*(2), 292-303.

Becker, G. S. (1964). *Human capital*. New York: Columbia University Press.

Becker, G. S. (1975). *Human capital*. New York: National Bureau of Economic Research.

Bhide, A. V. (2000). *The origin and evolution of new businesses.* New York, NY: Oxford University Press.
Borch, O. J., Huse, M., & Senneseth, K. (1999). Resource configuration, competitive strategies, and corporate entrepreneurship: An empirical.. *Entrepreneurship: Theory & Practice, 24*(1), 51-72.
Boyd, B. K., & Reuning-Elliott, E. (1998). A measurement model of strategic planning. *Strategic Management Journal, 19*(2), 181.
Bracker, J. S., Keats, B. W., & Pearson, J. N. (1988). Planning and financial performance among small firms in a growth industry. *Strategic Management Journal, 9*(6), 591-603.
Brinckmann, J., Grichnik, D., & Kapsa, D. (2010). Should entrepreneurs plan or just storm the castle? A meta-analysis on contextual factors impacting the business planning–performance relationship in small firms. *Journal of Business Venturing, 25*(1), 24-40.
Brüderl, J., & Preisendörfer, P. (2000). Fast-growing businesses. *International Journal of Sociology, 30*, 45-70.
Brüderl, J., Preisendörfer, P., & Ziegler, R. (1992). Survival chances of newly funded business organizations. *American Sociological Review*, (57), 227-242.
Brüderl, J., & Schüssler, R. (1990). Organizational mortality: The liabilities of newness and adolescence. *Administrative Science Quarterly, 35*(3), 530-547.
Bruno, A. V., Leidecker, J. K., & Harder, J. W. (1987). Why firms fail. *Business Horizons, 30*(2), 50.
Brush, C. G., Greene, P. G., & Hart, M. M. (2001). From initial idea to unique advantage: The entrepreneurial challenge of constructing a resource base. *Academy of Management Executive, 15*(1), 64-78.
Carayannis, E. G., Rogers, E. M., Kurihara, K., & Allbritton, M. M. (1998). High-technology spin-offs from government R&D laboratories and research universities. *Technovation, 18*(1), 1-11.
Castanias, R. P., & Helfat, C. E. (2001). The managerial rents model: Theory and empirical analysis. *Journal of Management, 27*(6), 661-678.
Chandler, A. D. (1962). *Strategy and structure*. Cambridge: The MIT Press.
Chandler, G. N., DeTienne, D. R., McKelvie, A., & Mumford, T. V. Causation and effectuation processes: A validation study. *Journal of Business Venturing,*
Chandler, G. N., & Hanks, S. H. (1993). Measuring the performance of emerging businesses: A validation study. *Journal of Business Venturing, 8*(5), 391-408.
Chandler, G. N., & Jansen, E. (1992). The founder's self-assessed competence and venture performance. *Journal of Business Venturing, 7*(3), 223-236.
Chiesa, V., & Piccaluga, A. (2000). Exploitation and diffusion of public research: The case of academic spin-off companies in italy. *R&D Management, 30*(4), 329.
Clarysse, B., Wright, M., Lockett, A., Van de Velde, E., & Vohora, A. (2005). Spinning out new ventures: A typology of incubation strategies from european research institutions. *Journal of Business Venturing, 20*(2), 183-216.
Collis, D. J. (1994). Research note: How valuable are organizational capabilities? *Strategic Management Journal, 15*(8), 143-152.
Conner, K. R. (1991). A historical comparison of resource-based theory and five schools of thought within industrial organization economics: Do we have a new theory of the firm? *Journal of Management, 17*(1), 121-154.
Cooper, A. C., & Bruno, A. V. (1977). Success among high-technology firms. *Business Horizons, 20*(2), 16.
Cooper, A. C., Gimeno-Gascon, F. J., & Woo, C. Y. (1994). Initial human and financial capital as predictors of new venture performance. *Journal of Business Venturing, 9*(5), 371-395.

Covin, J. G., & Slevin, D. P. (1990). New venture strategic posture, structure, and performance: An industry life cycle analysis. *Journal of Business Venturing, 5*(2), 123-135.
Davidsson, P., & Honig, B. (2003). The role of social and human capital among nascent entrepreneurs. *Journal of Business Venturing, 18*(3), 301-331.
Davidsson, P., & Wiklund, J. (2001). Levels of analysis in entrepreneurship research: Current research practice and suggestions for the future. *Entrepreneurship: Theory & Practice, 25*(4), 81.
Dew, N., Read, S., Sarasvathy, S. D., & Wiltbank, R. (2009). Effectual versus predictive logics in entrepreneurial decision-making: Differences between experts and novices. *Journal of Business Venturing, 24*(4), 287-309.
Di Gregorio, D., & Shane, S. (2003). Why do some universities generate more start-ups than others? *Research Policy, 32*(2), 209-227.
Dierickx, I., & Cool, K. (1989). Asset stock accumulation and sustainability of competitive advantage. *Management Science, 35*(12), 1504-1511.
Dyke, L. S., Fischer, E. M., & Reuber, R. (1992). An inter-industry examination of the impact of owner experience on firm performance. *Journal of Small Business Management, 30*(4), 72-87.
Elfring, T., & Hulsink, W. (2003). Networks in entrepreneurship: The case of high-technology firms. *Small Business Economics, 21*(4), 409-422.
Florin, J., Lubatkin, M., & Schulze, W. (2003). A social capital model of high-growth ventures. *Academy of Management Journal, 46*(3), 374-384.
Forbes, D. P. (2005). Are some entrepreneurs more overconfident than others? *Journal of Business Venturing, 20*(5), 623-640.
Franklin, S. J., Wright, M., & Lockett, A. (2001). Academic and surrogate entrepreneurs in university spin-out companies. *Journal of Technology Transfer, 26*(1-2), 127-141.
Galbraith, J., & Vesper, K. (1982). The stages of growth. *Journal of Business Strategy, 3*(1), 70.
Gimeno, J., Folta, T. B., Cooper, A. C., & Woo, C. Y. (1997). Survival of the fittest? entrepreneurial human capital and the persistence of underperforming firms. *Administrative Science Quarterly, 42*(4), 750-783.
Greiner, L. E. (1972). Evolution and revolution as organizations grow. *Harvard Business Review, 50*(4), 37-46.
Gustaffson, V. (2006). *Entrepreneurial decision-making: Individuals, tasks and cognitions.* Northampton, MA and Cheltenham: Edward Elgar.
Hambrick, D. C., & Crozier, L. M. (1985). Stumblers and stars in the management of rapid growth. *Journal of Business Venturing, 1*(1), 31-45.
Hambrick, D. C., & Mason, P. A. (1984). Upper echelons: The organization as a reflection of its top managers. *Academy of Management Review, 9*(2), 193-206.
Hanks, S. H., Watson, C. J., Jansen, E., & Chandler, G. N. (1993). Tightening the life-cycle construct: A taxonomic study of growth stage configurations in high-technology organizations. *Entrepreneurship: Theory & Practice, 18*(2), 5-30.
Kazanjian, R. K. (1988). Relation of dominant problems to stages growth in technology-based new ventures. *Academy of Management Journal, 31*(2), 257-279.
Khandwalla, P. N. (1976). Some top management styles, their context and performance. *Organization and Administrative Sciences, 7*(4), 21-51.
Klofsten, M., & Jones-Evans, D. (1996). Stimulation of technology-based small firms—A case study of university-industry cooperation. *Technovation, 16*(4), 187-193.

Knight, D., Pearce, C. L., Smith, K. G., Olian, J. D., Sims, H. P., Smith, K. A., et al. (1999). Top management team diversity, group process, and strategic consensus. *Strategic Management Journal, 20*(5), 445.
Kraus, S., Harms, R., & Schwarz, E. J. (2006). Strategic planning in smaller enterprises - new empirical findings. *Management Research News, 29*(6), 334-344.
Lawrence, P., & Lorsch, J. (1967). *Organization and environment*. Cambridge, MA: Harvard University Press.
Lee, C., Lee, K., & Pennings, J. M. (2001). Internal capabilities, external networks, and performance: A study on technology-based ventures. *Strategic Management Journal, 22*(6), 615.
Löfsten, H., & Lindelöf, P. (2005). R&D networks and product innovation patterns—academic and non-academic new technology-based firms on science parks. *Technovation, 25*(9), 1025-1037.
McMullen, J. S., & Shepherd, D. A. (2006). Entrepreneurial action and the role of uncertainty in the theory of the entrepreneur. *Academy of Management Review, 31*(1), 132-152.
Miller, D., & Friesen, P. H. (1984). A longitudinal study of the corporate life cycle. *Management Science, 30*(10), 1161-1183.
Mintzberg, H. (1991). Learning 1, planning 0 reply to igor ansoff. *Strategic Management Journal, 12*(6), 463-466.
Mitchell, R. K., Busenitz, L. W., Bird, B., Marie Gaglio, C., McMullen, J. S., Morse, E. A., et al. (2007). The central question in entrepreneurial cognition research 2007. *Entrepreneurship: Theory & Practice, 31*(1), 1-27.
Mosey, S., & Wright, M. (2007). From human capital to social capital: A longitudinal study of technology-based academic entrepreneurs. *Entrepreneurship: Theory & Practice, 31*(6), 909-935.
Mustar, P. (1997). How french academics create hi-tech companies: The conditions for success or failure. *Science and Public Policy, 24*(1), 37-43.
Mustar, P., Renault, M., Colombo, M. G., Piva, E., Fontes, M., Lockett, A., et al. (2006). Conceptualising the heterogeneity of research-based spin-offs: A multi-dimensional taxonomy. *Research Policy, 35*(2), 289-308.
Patzelt, H., zu Knyphausen-Aufseß, D., & Fischer, H. T. (2009). Upper echelons and portfolio strategies of venture capital firms. *Journal of Business Venturing, 24*(6), 558-572.
Penrose, E. G. (1959). *The theory of the growth of the firm*. New York: Wiley.
Peteraf, M. A. (1993). The cornerstones of competitive advantage: A resource-based view. *Strategic Management Journal, 14*(3), 179-191.
Pirnay, F., Surlemont, B., & Nlemvo, F. (2003). Toward a typology of university spin-offs. *Small Business Economics, 21*(4), 355-369.
Radosevich, R. (1995). A model for entrepreneurial spin-offs from public technology sources. *International Journal of Technology Management, 10*(7/8), 879-893.
Read, S., & Sarasvathy, S. D. (2005). Knowing what to do and doing what you know: Effectuation as a form of entrepreneurial expertise. *Journal of Private Equity, 9*(1), 45-62.
Roberts, E. B., & Malone, D. E. (1996). Policies and structures for spinning off new companies from research and development organizations. *R and D Management, 26*(1), 17-48.
Rugman, A. M., & Verbeke, A. (2002). Edith penrose's contribution to the resource-based view of strategic management. *Strategic Management Journal, 23*(8), 769.
Rumelt, R. P. (1974). *Strategy, structure and economic performance*. Cambridge: Harvard University Press.

Sarasvathy, S. D. (2001). Causation and effectuation: Toward a theoretical shift from economic inevitability to entrepreneurial contingency. *Academy of Management Review, 26*(2), 243-263.
Schwenk, C. B., & Shrader, C. B. (1993). Effects of formal strategic planning on financial performance in small firms: A meta-analysis. *Entrepreneurship: Theory & Practice, 17*(3), 53-64.
Selznick, P. (1957). *Leadership in administration*. New York: Harper & Row.
Sexton, D. L., & Bowman, N. (1985). The entrepreneur: A capable executive and more. *Journal of Business Venturing, 1*(1), 129-140.
Shane, S. (2000). Prior knowledge and the discovery of entrepreneurial opportunities. *Organization Science, 11*(4), 448.
Shane, S., & Stuart, T. (2002). Organizational endowments and the performance of university start-ups. *Management Science, 48*(1), 154-170.
Shepherd, D. A., Zacharakis, A., & Baron, R. A. (2003). VCs' decision processes: Evidence suggesting more experience may not always be better. *Journal of Business Venturing, 18*(3), 381-401.
Shrader, R., & Siegel, D. S. (2007). Assessing the relationship between human capital and firm performance: Evidence from technology-based new ventures. *Entrepreneurship: Theory & Practice, 31*(6), 893-908.
Smilor, R. W., Gibson, D. V., & Dietrich, G. B. (1990). University spin-out companies: Technology start-ups from UT-austin. *Journal of Business Venturing, 5*(1), 63-76.
Spence, M. T., & Brucks, M. (1997). The moderating effects of problem characteristics on experts' and novices' judgments. *Journal of Marketing Research (JMR), 34*(2), 233-247.
Starr, J., & Bygrave, W. D. (1991). The assets and liabilities of prior start-up experience: An exploratory study of multiple venture entrepreneurs. In N. C. Churchill, et al. (Eds.), *Frontiers of entrepreneurship research 1991* (pp. 213-227). Wellesley, MA: Babson College.
Stinchcombe, A. L. (1965). Social structures and organizations. In James G. March (Ed.), *Handbook of organizations* (pp. 142-193). Chicago: Rand-McNally.
Stuart, R. W., & Abetti, P. A. (1990). Impact of entrepreneurial and management experience on early performance. *Journal of Business Venturing, 5*(3), 151-162.
Teece, D. J., Pisano, G., & Shuen, A. (1997). Dynamic capabilities and strategic management. *Strategic Management Journal, 18*(7), 509-533.
Ucbasaran, D., Westhead, P., & Wright, M. (2006). *Habitual entrepreneurs*. Aldershot, UK: Edward Elgar.
Ucbasaran, D., Alsos, G. A., Westhead, P., & Wright, M. (2008). *Habitual entrepreneurs*. Boston - Delft:
Unger, J. M., Rauch, A., Frese, M., & Rosenbusch, N. Human capital and entrepreneurial success: A meta-analytical review. *Journal of Business Venturing, In Press, Corrected Proof*
Van de Ven, A. H., Hudson, R., & Schroder, D. M. (1984). Designing new business start-Up's entrepreneurial, organizational, and ecological considerations. *Journal of Management, 10*, 87-107.
Vohora, A., Wright, M., & Lockett, A. (2004). Critical junctures in the development of university high-tech spinout companies. *Research Policy, 33*(1), 147-175.
Watson, T. J. (1995). Entrepreneurship and professional management: A fatal distinction. *International Small Business Journal, 13*(2), 34-46.
Wernerfelt, B. (1984). A resource-based view of the firm. *Strategic Management Journal, 5*(2), 171-180.

Westhead, P., Ucbasaran, D., & Wright, M. (2005). Decisions, actions, and performance: Do novice, serial, and portfolio entrepreneurs differ? *Journal of Small Business Management, 43*(4), 393-417.

Westhead, P., & Wright, M. (1998). Novice, portfolio, and serial founders: Are they different? *Journal of Business Venturing, 13*(3), 173-204.

Wiltbank, R., Dew, N., Read, S., & Sarasvathy, S. D. (2006). What to do next? the case for non-predictive strategy. *Strategic Management Journal, 27*(10), 981-998.

Wright, M., Birley, S., & Mosey, S. (2004). Entrepreneurship and university technology transfer. *Journal of Technology Transfer, 29*(3-4), 235-246.

Wright, M., Vohora, A., & Lockett, A. (2004). The formation of high-tech university spinouts: The role of joint ventures and venture capital investors. *Journal of Technology Transfer, 29*(3-4), 287-310.

Conference paper for:

18th Annual High Technology Small Firms Conference (HTSF)

May 27 & 28, 2010, University of Twente

Enhancing effectiveness in early stages of technology transfer and entrepreneurship: the case of a new Alzheimer's disease treatment

Oliver Uecke[1], Lawrence Rajendran[2], Sven Schellin[3], Kai Simons[4]

BACKGROUND AND OBJECTIVE

Biotechnology is considered as one of the key technologies for the 21th century (European Commission 2007). Biotechnology is the "application of science and technology to living organisms, as well as parts, [...] for the production of knowledge, goods and services" (OECD 2005). The global biotechnology industry is still a young industry and has some unique characteristics compared to other industries. Those characteristics are, among others: increasing cost of R&D and global competition, high uncertainty and rapid change, heavy research costs, long product development cycles and the level of innovativeness of products is higher than in other industries (Khilji, Mroczkowski & Bernstein 2006 p.529; Cockburn and Henderson 1998 p.180). The biotechnology industry is dependent on academic research and therefore there is an increasing number of technology transfer and entrepreneurial activities within research institutes and universities (Kim and Marschke 2005; Branstetter and Ogura 2005). Effective and efficient technology transfer is a must today (Fontes 2001).

However several barriers exist in the innovation process. One of the main hindering factors is the difficulty of translating basic research into clinical application. New approaches are needed to bridge the gap between basic research and translation. Private Venture Capital funding or funding through a licensing deal with pharmaceutical companies are important

[1] Oliver Uecke, Entrepreneurship Initiative Dresden exists / University of Technology Dresden and Max Planck Institute of Molecular Cell Biology and Genetics, Dresden – Email: oliver.uecke@tu-dresden.de
[2] Prof. Dr. Lawrence Rajendran, Systems and Cell Biology of Neurodegeneration/ Division of Psychiatry Research, University of Zurich
[3] Sven Schellin, Entrepreneurship Initiative Dresden exists / University of Technology Dresden and Max Planck Institute of Molecular Cell Biology and Genetics, Dresden
[4] Prof. Dr. Kai Simons, Max Planck Institute of Molecular Cell Biology and Genetics, Dresden

means but they are not functioning at thus early stage. This study will discuss a public support program (commercialization grant) which is aimed at funding basic research into this stage of commercialization (see figure 1). This public funding program has been planned to provide a framework to enhance the effectiveness of the early stage of the technology transfer process. We are using our model case study of a technology transfer project aimed at developing novel therapeutic strategy for Alzheimer's Disease to identify factors which enhance effectiveness.

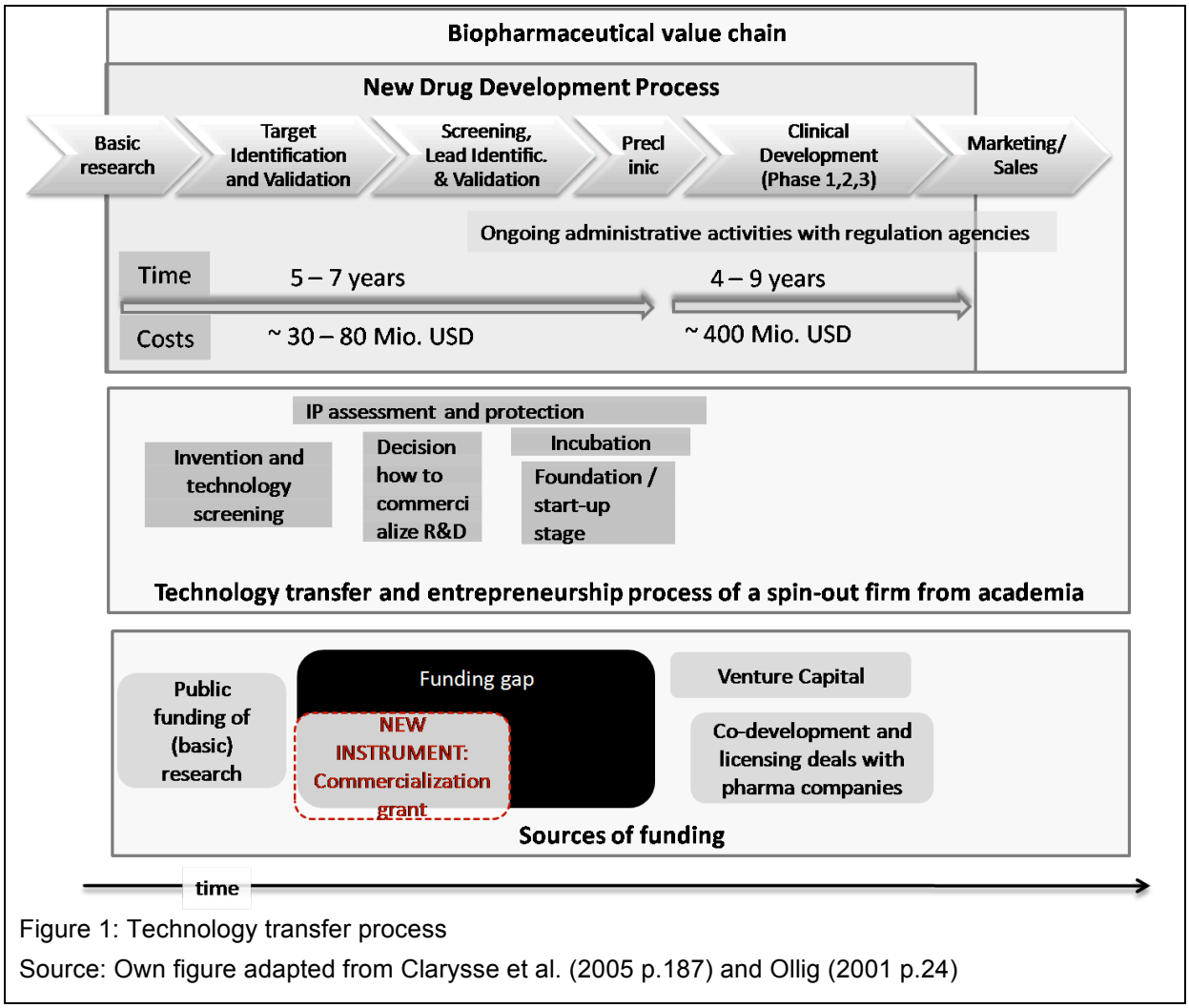


Figure 1: Technology transfer process

Source: Own figure adapted from Clarysse et al. (2005 p.187) and Ollig (2001 p.24)

CONCEPTUAL AND METHODOLOGICAL BACKGROUND

New commercialization grant

Recently the German federal ministry for education and research started a new program called “ForMaT – Research within a Team for the Market” to foster knowledge and technology transfer. The commercialization grant focuses specifically on early stages of the technology transfer process to identify and evaluate technologies for application in new products and services as well as to prepare the actual transfer of technology and knowledge. Within one project scientists from various disciplines are supported by business developers who are working as a “transfer team”. The program is designed to have two phases. Initially, in the first stage (6 month) researchers and business developer collaborate to identify new technologies or scientific results with commercial potential. The academic researchers present the scientific idea and the business experts evaluate its commercialization potential. The developers also evaluate the potential concerning scientific (e.g. proof-of concept) and economic parameters (e.g. market, competition, intellectual property protection). The funding for this first stage is 100.000 Euro. The second stage of the program (2 years) has the objective to develop the technology until it can be commercialized and to prepare the transfer of the technology (e.g. starting a spin-off, license patent). The total budget for the second stage is up to 2 million Euro to fund staff (nine researcher and one business development position), equipment, external services, conferences, etc.

The MIGRATA case study

A case study approach was chosen for the present research. To conduct explorative research the author Yin describes the case study as a research strategy when investigators want to “retain the holistic and meaningful characteristics of real-life events- such as individual life cycles, organizational and managerial process, […]” (Yin 2003 p.2). Case study research should be applied when a contemporary phenomenon is analyzed within its real-life context and especially when the boundaries between phenomenon and context are not evident. Data collection and analysis has been performed according to Yin (2003).

Within the ForMaT program the following biotechnology project has been funded which is used as a case study for further explanation of the characteristics of the program. The case study is a project based with a high level of innovativeness (radical innovation) in the early stage of the biopharmaceutical innovation process. The project is located at the Max-Planck-Institute of Molecular Cell Biology and Genetics in Dresden and is named MIGRATA

("Membrane Intervention and Genomewide RNAi Approaches Towards Alzheimer's Disease therapy"). It aims at the development of an innovative treatment for Alzheimer's disease based on research findings of Kai Simons and his research team. These findings were patented and also published (e.g. in SCIENCE: Rajendran et al. 2008). The current stage in the biopharmaceutical value chain is at the end of basic research (see Figure 2). The extension of the proof-of-concept project to preclinical trials required further research. The MIGRATA project is funded by the ForMaT grant to enhance the technology transfer process and to prepare for commercialization. Within the first stage an interdisciplinary team (two biotechnology researchers and two business- and innovation manager) did a technology screening and evaluation to prepare a concept for commercialization. The team analyzed aspects such as customer segments, the market and competition as well as patents and the freedom-to-operate with additional expert interviews and workshops to discuss the feasibility, the challenges in the development process. The next steps for the MIGRATA project are further R&D and the decision for a commercialization strategy (spin-off, license, etc.). Based on this decision a business plan will be conceived.

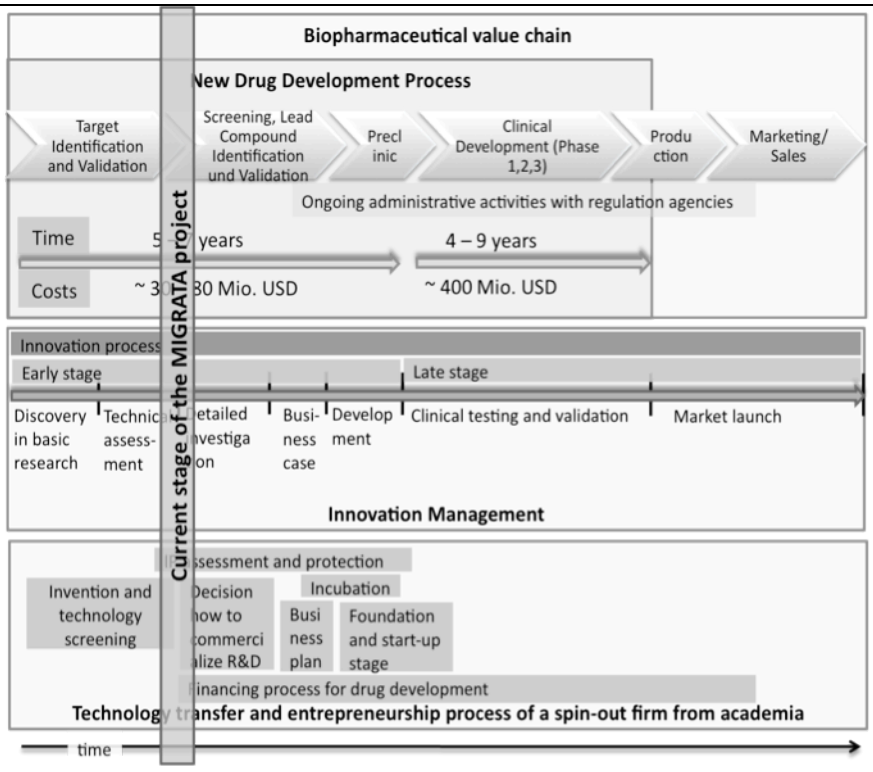


Figure 2. Current stage of the MIGRATA project in the biopharmaceutical value chain, innovation and technology transfer process

Source: Own figure

Performance measure of present study

Performance measures for technology transfer are generally number of patents, revenue based on licenses and number of spin-offs (Bozeman 2000). However, for the present case study the output criterion is related to early stages of the transfer and innovation process. Characteristics of early stages of the innovation process are (Klink 2008): (a.) high degree of fuzziness relating to the idea for a new product or technology, (b.) a high degree of uncertainty for the product and project, (c.) a low level for standardization within the process, (d.) resources utilized are relatively small compared to late stages of the innovation process and (e.) activities are performed by an individual person or a small project team employing experimental, trial and error approach rather than structured, well planed and very detailed strategy.

Therefore, the performance measure of early stages is an effectiveness measure (to achieve an aim) rather than an efficiency (input/output relation). For this study, effectiveness of early stages of the technology transfer process relates to: (1.) writing of a project proposal with preliminary market/ competitor/ IP analysis and a positive internal (e.g. by administration of institute, TTO) or external evaluation (e.g. a public authority which decides about a pre-seed spin-off grant) to receive further support to continue developing in early stages of the innovation process and (2.) generation of a product concept (containing the commercialization strategy, e.g. in form of a business plan for a future spin-off) as the result of the early stage of the innovation process, its positive internal or external evaluation (e.g. licensee, VC investors) and the subsequent technology transfer (e.g. new spin-off, license patents behind innovation).

FINDINGS AND IMPLICATIONS

The ForMaT program provides a framework for enhancing effectiveness in early stages of the technology transfer process for the MIGRATA project. The main determinants enhancing the effectiveness of the early stage are as follows (structured according to the level where they can be mainly influenced):

Level of support program (ForMaT):

- The commercialization grant (ForMaT) partly bridges the finance gap and provides funding for the transfer project to achieve a stage in development where

commercialization is possible. The grant provides the necessary amount of funding of staff costs (researchers and business people), consumables, equipment, etc.

- To enhance effectiveness there should be a flexible, situation- adapted use of resources with possibilities to change plans as well as a continued access to obtain sustainability. The commercialization grant should have the flexibility to collaborate with third parties and companies without any budget limitations. The ForMaT grant had the disadvantage that only 10% of the total sum could be used for expenditures to third parties.
- The structure of the program ensures interdisciplinary teams. Business developers are integrated early in the team who perform economic evaluations and prepare commercialization
- A continuous team contributes to effectiveness, but it is necessary to integrate and exchange people when skills and knowledge are needed to meet requirements of the innovation process. The commercialization grant should always give enough time to search for suitable team members. In addition, there is also a need to close the funding gap between phase 1 and 2 of the ForMaT program to ensure the continuity of the transfer team.

Organizational level:

- Access to research infrastructure of the institute (e.g. High-Throughput-Screening facility) is a crucial resource for transfer teams
- When researchers see technology transfer rather as “additional job” than as part of their job that hinders effectiveness. Therefore, technology transfer should be part of institute/university objectives (independent of whether the institute is a basic or an applied research institute) and then objectives should be implemented.

Team level:

- Transparency in the team and effective communication when being involved in search and evaluation of information to produce a commercialization concept (innovations with a high level of innovativeness such as the MIGRATA project have large information gaps in the early stage of the innovation and transfer process). There was a potential for principal-agent problems between researcher and business developer because there are differences in objectives. The principal investigator who could have

the aim at funding research and his lab and the business developer tries to push for commercialization.

- Information source: Researchers should be utilized by business developers as an important information source to understand the ecosystem of the innovation
- Guidance of project should be pragmatic based on current project-specific aims. There should be an external influence to guide the project when resources are overused or milestones are not met.
- Funding should be a means, not as the end of the technology transfer process. The team should utilize multiple financing sources, beside the key source, the commercialization grant.

Individual level:

- Requirement of predefined roles for team members that are suited to the task is crucial for effectiveness. When defining roles it is important to differentiate elaboration and decision making tasks. Each team member should be assigned a specific task or sub-project to distribute responsibility in an efficient matter.
- Researchers should focus on the transfer project and be willing to commercialize. The presence of a project "champion" ensures sustainability which enhances effectiveness.
- In a research team building and sustaining individual absorptive capacity is no challenge for researchers. However, one issue was a lack of knowledge of later more applied R&D activities (e.g. lack of knowledge about the steps of the new drug development process).

Across Europe and in the US, several programs similar to the German ForMaT grant are on the rise focusing on early stages of technology transfer (screening, evaluation and concept generation). In Switzerland, the Confederation's innovation promotion agency (CTI) promotes early stage inventions and commercialization. The Tuli program of Finland and the VINN program of Sweden are similar programs. These programs enable accelerated drug discovery in the academic setting and such funding measures ensure that adequate pre-clinical research could be done. By fostering collaboration between researchers and business developers, the grant promotes a fruitful interdisciplinary program and provides training for both sides of the innovation process. Criticisms to such translational research is

also on the rise. One issue is whether academia should concentrate on the basic aspects of science and should be free of the clutches of commercialization. Indeed, commercialising a product, let alone the long way to bring an idea to preclinical stages, is a long- winding and an expensive path. Most pre-clinical innovations do not reach the market and not all marketed products are successful. However, to realize or evaluate at an early stage (initial research stages) whether an idea/concept has the potential to reach the market is a wise approach. Whenever, a novel strategy or technology is developed, a common path is to patent the findings and patenting demands resources and this is a costly process. Programs such as ForMaT provide a framework for enhancing effectiveness of early stages of the technology transfer and innovation process and provide means to evaluate the potential early enough to boost the innovation process. Both sides, science and business will unite forces to evaluate and realize the commercial potential.

References

Bozeman, B. 2000. Technology transfer and public policy: A review of research and theory. ***Research Policy***, 29(4-5): 627-655.

Branstetter, L., & Ogura, Y. 2005. ***Is academic science driving a surge in industrial innovation? evidence from patent citations.*** SSRN.

Clarysse, B., Wright, M., Lockett, A., Van de Velde, E., & Vohora, A. 2005. Spinning out new ventures: A typology of incubation strategies from european research institutions. ***Journal of Business Venturing***, 20(2): 183-216.

Cockburn, I. M., & Henderson, R. M. 1998. Absorptive capacity, coauthoring behavior, and the organization of research in drug discovery. ***The Journal of Industrial Economics***, 46(2, Inside the Pin-Factory: Empirical Studies Augmented by Manager Interviews: A Symposium): 157-182.

European Commission. 2007. ***Analysis report: Contributions of modern biotechnology to european policy objectives***.

Fontes, M. 2001. Biotechnology entrepreneurs and technology transfer in an intermediate economy. ***Technological Forecasting and Social Change***, 66(1): 59-74.

Khilji, S. E., Mroczkowski, T., & Bernstein, B. 2006. From invention to innovation: Toward developing an integrated innovation model for biotech firms. ***Journal of Product Innovation Management***, 23(6): 528-540.

Kim, J., & Marschke, G. R. 2005. ***The influence of university research on industrial innovation***SSRN.

Ollig, W. 2001. ***Strategiekonzepte für Biotechnologieunternehmen. Gründung, Entwicklungspfade, Geschäftsmodelle*** (1st ed.). Wiesbaden: Deutscher Universitäts-Verlag.

Yin, R. K. 2003. ***Case study research: Design and method***s (3rd ed.). Sage Publications Inc.

PROSPERING OUTSIDE THE REGION?

Spatial patterns of spin offs universities of applied science
Case: Saxion University of applied sciences

Working paper

Rosalien van der Meer, Han van der Meer & Paul Bijleveld

Saxion Universities of Applied Sciences
Saxion Center for innovation and entrepreneurship
Saxion Center for urban and environmental studies

P.O box 70.000
7500 KB Enschede
Telefoon: 053 - 487 1674
Fax: 053 - 435 7116
E-mail: skio@saxion.nl

Abstract
Saxion is part of the Dutch system of universities for higher vocational training and applied sciences. In this paper a case study is presented to gain more insight in spin offs of these types of universities, and their effect on the regional economy. For this purpose a database of 152 spin offs has been developed and a first survey was analysed. Most spin offs are active in the ICT and business services sectors. We have compared the results with the spin offs University of Twente. We observed that the percentage of spin offs, which was located outside the surrounding region of Saxion (33%) was significantly higher, than the percentage of spin off of the University of Twente (22%). The spin offs outside the region also have employees than Saxion spin off in the region. There is however no difference in the way the spin off perceive the business climate of their location. Stimulating entrepreneurship at universities of applied seems a good strategy to support the development of the promising knowledge intensive service sector in the eastern part of the \Netherlands. On the other hand this strategy should be accompanied with policy instruments aiming at convincing alumni entrepreneurs to stay in the region.

Introduction

In the Netherlands higher vocational education is the responsibility of 'Hogescholen', the universities of applied science. They can be compared with the German Fachhochshulen or the English Polytechnics, but there is a major difference. The Dutch government has only recently given the universities of applied science the task and budget to start programs for applied research, and to stimulate regional innovation and entrepreneurship. Saxion University of applied sciences has set up a dedicated knowledge center on innovation and entrepreneurship. There is strong co-operation with the University of Twente in this respect. A major challenge for the knowledge center was to set up a monitoring system and database for researching the behavior of Saxion alumni entrepreneurs, and their effect on the regional economy. Before this study such a database of spin off did not yet exist, and had to be developed by searching and approaching alumni entrepreneurs. This process was complicated by the fact that Saxion was established as a merger of different 'Hogescholen' in the eastern part of the Netherlands. Saxion has three locations Enschede, Deventer, and Apeldoorn. Enschede is the largest city of the region of Twente. Deventer and Apeldoorn belong to the region Stedendriehoek.

In these regions there is great interest among policy makers on the spatial patters of Saxion alumni and entrepreneurs. The average level of education in Twente is lower than the Dutch average, and young highly educated professionals tend to move to the west of the country. Almost half of the Saxion alumni leave the region. That is much lower than the percentage of alumni of the University of Twente (78%), but has still a considerable effect, because of the total number of students of Saxion (22.000). Encouraging entrepreneurship is regarded as an effective instrument to counter brain drain. Secondly, alumni of universities tend to set up knowledge intensive and innovative companies both in the service sector as in high tech industries. Studies have confirmed this for the University of Twente. No studies yet exist on the spatial patterns of Dutch universities of applied sciences.

The research on the spin off of Saxion alumni entrepreneurs is still in progress. The first empirical results are however remarkable and sometimes seem contradictory to

what we would expect on the basis of spin off theory. The purpose of this paper is to publish and share our preliminary findings, and to increase the academic attention for studying entrepreneurship spinning out from universities of applied sciences.

Theoretical Background

There are wide and narrow definitions of university spin offs. According to Roberts university spin offs are companies founded by anyone who has studied of worked at a university (Roberts, 1991). Shane defines university spin offs as a new company founded to exploit a piece of intellectual property created in an academic institution (Shane 2004). In his view this is a subset of all start-up companies created by students and employees of academic institutions. In this paper we use the wide definition of Roberts, because of two reasons. Firstly, we are interested in the overall effect of the presence of a university of applied sciences on regional entrepreneurship. Secondly, Saxion and other Dutch universities of applied science are still in the phase of developing a policy and structure for technology transfer and protection of intellectual property.

The empirical evidence (Karnebeek, 2001; Wallmark, 1997) on university spin offs shows that they tend to locate very close to the universities that spawn them. Roberts (1991) argues that spin offs not only tend to be founded in the same city and state from which they emerged, but are often established in locations geographically very proximate to the laboratories in which they were born.

What are the spatial patterns and regional impact of spin off companies? Most scholars have a resource based perspective on the topic and try find the influence of the geographic location of the knowledge institution (like universities) on the tendency to found spin offs. Building on the work of Wright et al. (2002) DiGregorio and Shane (2003) argue that the geographic location of academic institutions influence spin off activity. Shane (2004) distinguishes four factors influencing the variation in the level of spin off activity across locations: access to capital, locus of property rights, rigidity of the academic labor market, and the industrial composition of the area. Looking at the latter factor it has been argued (Gompers & Lerner, 1999; Sorenson & Stuart, 2001) that geographic proximity facilitates the creation of social ties that allow investors to gain access to private information as well as reducing the costs of monitoring new ventures.

In an attempt to systemize the resource based view on spin off companies and also to provide a framework for stimulating spin offs Groen (2005) postulates four types of capital based on Parson's (1964, pp. 5-6 in Groen, 2005) definition of a social system: strategic, economic, cultural (human) and social capital. Other scholars do not take the resource perspective (what kinds of environments stimulate spin offs) on the spatial effects but take the perspective of the fruits (what kind of benefits bring the spin offs to their environment). Shane (2004) shows in his work spin offs are high performing companies in terms of growth (both value and jobs) and enhance local economic development.

Based on empirical studies we expected the following results of our research:

- There is a strong incentive for Saxion spin offs to stay in the region. We expected this effect to be even stronger than among spin offs of the University of Twente, because more Saxion students come from the region, and have stronger private ties.
- The regional economy in the region, where Saxion is located, is relatively small compared to other Dutch regions. It was therefore expected, that the spin off companies outside the region would be bigger and more successful.
- Policy makers and entrepreneurs complain that the region suffers from a bad image. We therefore expected companies outside the region to have a more positive view on the region where they are located.

To test the expected results three hypotheses were formulated:

- The number of Saxion spin offs, that stay in the region is larger, than the number of spin offs of the University of Twente, which stay in the region.
- The spin off companies that go outside the region of Saxion[1] are bigger en more successful than those who stay in the region;
- Spin off companies outside the region have a better image of the regional business climate than spin offs located in the region.

Research Method

As mentioned in the introduction a spin off database did not yet exist within Saxion, and had to be developed retrospectively. The research team has actively searched for alumni entrepreneurs within professional and alumni networks, contacted the Chamber of Commerce, and searched social networks on the internet. This resulted initially in 220 'leads' of alumni that started their own company after or during their study period at Saxion. After checking the leads a database of 152 companies was the starting point of our research. The process of developing and extending the database still continues. By using the abstracts of the Chamber of Commerce this database gives already interesting information on the characteristics and spatial patterns of spin off companies. A small number of leads were foreign based companies. These are not yet included in the database.

To retrieve more detailed information a questionnaire was sent to the companies in the database. The questionnaire contained questions on general characteristics of the company, the ambition of the entrepreneur before starting, the image of the region, where the company is located, and the present relation with Saxion. From all the entrepreneurs approached, 107 started filling in the questionnaire. Finally, 81 respondents completed the questionnaire, which is a response of 52%. In the case of minor differences with the abstracts of the Chamber of Commerce the answers in the questionnaire were taken as the actual data. In the case of strong mismatch the company was not used for the purpose of this study. The database lists not only entrepreneurs with personnel, but also entrepreneurs who work independent on the basis of long term contracts for large companies and organizations. We observed that these entrepreneurs without personnel may fill in the information on the large company, and do not give the details of their own company. This was corrected using the abstracts of the Chamber of Commerce.

[1] By the region of Saxion the regions 'Twente' and 'Stedendriehoek' are meant.

In the present database there is probably some bias with respect to the total population of Saxion spin offs. The list has a disproportioned number of young entrepreneurs and relative new companies. This might have the following effects on our data. Based on research of the University of Twente (Karnebeek, 2001), we expect that older companies that survive are on average larger than new companies. Secondly, the percentage of women that start companies has gradually increased in the Netherlands in the last decades. So, we would expect more female entrepreneurs in companies that were recently established.

Size and sectors of Saxion spin off companies

The 155 spin off companies employ 1537 people, including the entrepreneurs. This is almost an average of 10 persons per company. This average is comparable with spin off companies of the University of Twente. The percentage of female entrepreneurs is surprisingly low (11,6%). Saxion has a wide offer of subjects and courses, and is not a specialised technical university. Female students outnumber even male students, and score better results. The average size of the company of a female entrepreneur is also much smaller (5 employees). Saxion spin off companies are concentrated in specific economic sectors. The division according to sector is presented in table 1. We use here the standard sector classification of the Dutch Bureau of Statistics (CBS). The two most important sectors are 'Information and communication (31,58%)' and 'Consultancy, research and specialized business services (30,26%)'. The number of companies active in 'Industry (5,92%)' is surprisingly low compared to the spin off of the University of Twente (28%). Besides the strong concentration Saxion spin off companies can be found in almost all sectors.

Table 1: *Division of Saxion spin off according to business sector*

Sector (sbi index)	**No of companies**	**Share of total**
C. Industry	9	5,92%
F. Construction	4	2,63%
G. Retail and wholesale	10	6,58%
H. Transport	1	0,66%
J. Information and communication	48	31,58%
K. Finance	9	5,92%
L. Real estate	1	0,66%
M. Consultancy, research and specialised business services	46	30,26%
N. Leasing and other business services	15	9,87%
P. Education	2	1,32%
Q. Health	3	1,97%
R. Culture, recreation and sports	2	1,32%
S. Other services	2	1,32%
Total	**152**	**100%**

Regional pattern

From the spin off companies in the database 71 are located in the region of Twente (45,8%). 30 in the region Stedendriehoek (19,4%), and 54 are based outside the Saxion regions (34,8%). So, more spin off companies from Saxion are located outside the region, than spin off companies of the University of Twente (22%). The average size of companies outside the region (13) is larger than the size of companies within the region (8). This supports the second hypothesis.

In the questionnaire questions were asked on turnover development and expectations. We do present here figures on average turnover, because especially large companies from outside the region did not respond to the questionnaire. The average turnover development in the last year does not differ significantly between the region of Saxion and outside. Expectations with respect to the turnovers for the coming two years are however significantly higher outside the region than within the region of Saxion (t=-2.097, p=0.039). Both turnover development in the past and turnover expectations for the coming years are measured on a 5-point Likert scale (1= strong decline, 5= strong increase).

Table 2: *Spin off turnover compared to region*

	Region	N	Mean	Std. Deviation	Sig. (p)
Turnover development past year	Saxion	64	3.31	1.552	0.504
	Other	30	3.53	1.332	
Expectation turnover for coming two years	Saxion	64	3.14	1.592	0.039
	Other	30	3.87	1.502	

Region and removal wishes

From the 80 companies for which the questions about potential removal wishes were answered, 71% have their seats in the region of Saxion and 29% in another region (a more detailed spread of these spin off companies is presented in figure 1). From this total of 80 companies, 26% (n=21) wants to move to another location within three years. From the companies in the region of Saxion 23% wants to move within three years. From the companies in other regions that percentage is 35. From the respondents who answered that they want to move their company, 13 filled in where they would like to go. The results from this, per region, are presented in table 3.

Figure 1: Spread of Saxion spin offs

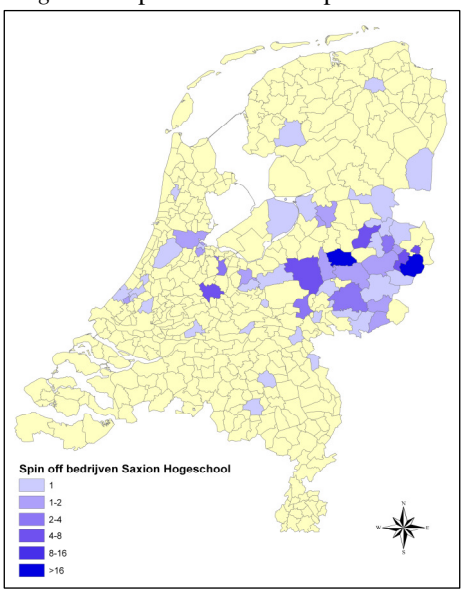


Table 3: *Removal wishes*

Region		Frequency	Percent
Saxion	Wants to move within the region of Saxion	4	57
	Want to move away from the region of Saxion	3	43
Other	Wants to move to the region of Saxion	1	17
	Wants to move to or within another region	5	83

Annual turnover and company size in relation to the removal wishes

Thus, within 21 companies a wish exists to move the company to another location within three years. And from these 21 companies, as mentioned above, 13 respondents filled in to where they want to move. Now we will go further into the characteristics of these companies with respect to their success (annual turnover and amount of FTE for which workers are employed).

- The four companies that want to move within the region of Saxion have seen, on average, a slight increase in their annual turnover over the past year (*m*=3.50, *SD*=1.73) and expect a substantial increase in turnover for the coming two years (*m*=4.50, *SD*=1.00). These companies have employees for on average 1.1 FTE.
- The three companies that want to move away from the region of Saxion have seen, on average, a slight increase in their annual turnover over the past year (*m*=3.33, *SD*=1.53), but they expect a strong decline in the turnovers for the coming two years (*m*=1.00, *SD*=0.00). These companies have employees for on average 1.0 FTE.
- One company wants to move from another region to the region of Saxion. The annual turnover of the past year showed neither increase nor decline (*m*=3.00). The expectation for the coming two years with respect to the turnovers is a strong increase (*m*=5.00). This company has employees for 3.0 FTE.
- The five companies that want to move to or within another region have seen, on average, a substantial increase in turnover over the past year (m=4.60, SD=0.89) and they expect a slight increase in turnovers for the coming two years (m=3.80, SD=1.79). These companies have employees for on average 1.6 FTE. We know from studies from the Dutch Planbureau voor de Leefomgeving, that only small numbers of companies actually move between regions (Van Oort, F., et al, 2007). This is supported by our findings. We were however surprised, that especially entrepreneurs with an expected decline in turnover, wanted to move to another region.

Spin off ambitions

In the questionnaire a question was included on the ambition of the entrepreneur before starting the company. These ambitions are measured by means of questions about the ´dreams´ the respondents had before they actually started their companies. We consider these questions as relevant, because the mental blueprint the entrepreneur has of the future company greatly influences later success and growth. The following questions were formulated:

- In my dream my company worked mainly: (regionally, nationally, internationally);
- I dreamed of a company with an annual turnover of: (less than one million, 1-10 million, 10-100 million, more than 100 million);
- With respect to innovativeness I dreamed of a company that is: (normal, above-average, market leader, unique in the world);
- In my dream my company was financed with: (mainly own property, about as much from own as from foreign property, through an own stock market quotation);

- I dreamed of an organisation that can be best described with the term: (one-man business, family concern, I am the boss, a tightly directed professional organisation, group of specialists in the field, an elite group);
- I dreamed of a company with headquarters in: ('Twente' or the 'Stedendriehoek', elsewhere in eastern Holland, elsewhere in the Netherlands, outside the Netherlands);
- In your dream, how many people would work for your company five years after the start up?

With respect to one of these questions one statistically significant relation was found with being seated in the region of Saxion or not, namely with question number six about the location of the company's headquarters (χ^2=28.137, p=0.000). See table 4 for the corresponding crosstabs.

Table 4: *Ambition compared to region*

			Region		
			Saxion	**Other**	**Total**
I dreamed of a company with headquarters in:	'Twente' or 'Stedendriehoek'	n	41	3	44
		%	93%	7%	100%
	Elsewhere in eastern Netherlands	n	6	8	14
		%	43%	57%	100%
	Elsewhere in the Netherlands	n	12	17	29
		%	41%	59%	100%
	Outside the Netherlands	n	3	0	3
		%	100%	0%	100%
Total		n	62	28	90
		%	69%	31%	100%

Ambition and removal wishes

Looking at the relation between ambition and removal wishes a relation can be observed with respect to question 2 about the turnover-ambition (χ^2=11.411, p=0.076), question 6 about the ambition with respect to the location of headquarters (χ^2=17.680, p=0.039) and the ambition with respect to question 7 about the amount of people who work for the company (χ^2=15.441, p=0.080). But since the small number of respondents for whom we have information on their removal wishes the reliability of these relations could be questioned. The corresponding crosstabs are presented in table 5, 7 and 8. Table 6 shows the frequencies with respect to the headquarters ambition for the total group of respondents.

Table 5: *Turnover ambitions compared to removal wish*

		Move within region of Saxion	Move away from region of Saxion	Move to region of Saxion	Move to or within other region	Total
I dreamed of a company with an annual turnover of:	Less than 1 million	4	1	0	3	8
	1 - 10 million	0	2	0	1	3
	10 - 100 million	0	0	1	1	2
Total		4	3	1	5	13

Table 6: *Headquarters ambitions*

		Frequency	Percentage
I dreamed of a company with headquarters in:	'Twente' or the 'Stedendriehoek '	44	48,9
	Elswhere in Eastern part of the Netherlands	14	15,6
	Elsewhere in the Netherlands	29	32,2
	Outside the Netherlands	3	3,3
	Total	90	100,0

Table 7: *Headquarter ambitions compared to removal wish*

		Move within region of Saxion	Move away from region of Saxion	Move to region of Saxion	Move to or within other region	Total
I dreamed of a company with headquarters in:	'Twente' or the 'Stedendriehoek'	4	0	1	0	5
	Elsewhere in Eastern part of the Netherlands	0	0	0	2	2
	Elsewhere in the Netherlands	0	2	0	3	5
	Outside the Netherlands	0	1	0	0	1
Total		4	3	1	5	13

Table 8: *Personnel ambitions compared to removal wish*

		Move within region of Saxion	Move away from region of Saxion	Move to region of Saxion	Move to or within other region	Total
In your dream, how many people would work for your company five years after the start up?	None	2	1	0	1	4
	1-9	2	1	0	2	5
	9-20	0	1	0	2	3
	20-50	0	0	1	0	1
Total		4	3	1	5	13

Regional image

The questionnaire included two questions on the perception of the strengths and weaknesses of the region in which the spin off is located. The first question measured the degree of importance for the entrepreneur of a specific characteristic of the region. Secondly, the entrepreneur was asked to give a score on his perception of the characteristic of the region. Asking both questions is important for the development of regional policy. Entrepreneurs can give a high score to for example the presence of

cultural institutions in the region. If they regard the cultural institutions not as an important aspect, than the high score is less relevant as a factor for regional competitiveness.

On a five-point Likertscale the respondents could indicate to what extent they found these aspects important for the region in which their company is seated. For all location factors the value 1 had a very negative meaning (little, bad, small, unfavourable) and the value 5 a very positive meaning (much, good, big, favourable). Respondents were asked to give their score to the following factors: the availability of space for companies, accessibility, image, entrepreneurial networks, presence of knowledge institutions, supply of labour, work ethos, living climate, cultural facilities, recreational and sports facilities, vivid environment, safety, location in the Netherlands and location in Europe. All average scores are presented in table 9.

The scores do not differ much between the different factors. The highest mean is 3,59 and the lowest mean is 2,60. The mean scores for the region of Saxion were compared to those for other regions by means of a t-test. We found no significant differences between the region of Saxion and other regions. The highest score for statistical significance difference was with respect to the work ethos (t=1.730, p=0.087). Respondents with a company in the region of Saxion valued the importance of work ethos averagely with a value of 3.59 and those in other regions valued it with an average of 3.04. If we look however to the ranking of factors we see some interesting scores. In other studies on regional image entrepreneurs normally stress the importance of accessibility and labour market issues. We discovered that Saxion entrepreneurs gave a high ranking to work ethoss and a vivid environment. There are also interesting differences between spin offs within and outside the region. Only entrepreneurs outside the region gave a high rank to the presence of knowledge institutions, cultural facilities, and the image of the region.

To measure the degree of appreciation with respect to the various regional characteristics, questions with respect to the same regional characteristics are put to the respondents. Here too they could give answers on a five-point Likertscale, but now the question was to what extent they found the various aspects present of applicable to the region in which their company is seated. Again the value 1 had a very negative meaning and the value 5 was associated with a very positive meaning. The general business climate in the region of Saxion is valued with a mean score of 3.61 (SD=0.894) on a five-point scale. In the other regions the mean score is 3.54 (SD=0.922). These mean scores don't differ significantly from each other (t=0.371, p=0.712).

The mean scores for the region of Saxion were again compared to those for other regions by means of a t-test. There appeared to be a significant difference with respect to the appreciation of the work ethos in de region (t=-3.041, p=0.003). The respondents with a company seated in the region of Saxion appreciated the work ethos in their region with a mean value of 3.58 and those with companies in other regions appreciated it with a mean value of 4.08. But if the region of Saxion is split in two more specific regions, namely 'Twente' and the 'Stedendriehoek', then the scores on work ethos only differ significantly between the region 'Stedendriehoek' (M=3.44, SD=0.511) and the 'other regions' (excl. the region 'Twente') (p=0.0200). The region 'Twente' scores with a mean of 3.66 (SD=0.781). The response of the entrepreneurs is

again remarkable. Policy makers in the eastern part of the Netherlands general share the view that their region performs relatively high on 'work ethos', 'safety', 'living climate', and 'sports and recreational facilities'. This view is not supported by the results of this study. On the other hand is the image of entrepreneurs on vividness and cultural activities not as bad as policy makers might think. So, we reject here the third hypothesis, which stated that: *Spin-off companies outside the region have a better image of the regional business climate than spin located in the region.*

Table 9: *Location factors ranked to importance to spin off entrepreneur*

Importance of factor	**Region where company is located**	**N**	**Mean**	**Std. Deviation**
Availibility of space				
rank: 8	Region Twente/Stedendriehoek	59	3,02	1,239
rank: 14	Other region	25	2,60	1,155
Accessibility				
rank: 4	Region Twente/Stedendriehoek	59	3,25	1,372
rank: 10/11	Other region	25	2,80	1,258
Image of the region				
rank: 13	Region Twente/Stedendriehoek	59	2,88	1,190
rank: 5/6/7/8	Other region	25	2,96	1,306
Entrepreneurial networks				
rank: 5	Region Twente/Stedendriehoek	59	3,22	1,146
rank: 12/13	Other region	25	2,76	1,234
Presence of knowledge institutions				
rank: 11	Region Twente/Stedendriehoek	59	2,95	1,121
rank: 2	Other region	25	3,20	1,190
Labour market				
rank: 6	Region Twente/Stedendriehoek	59	3,10	1,213
rank: 4	Other region	25	3,00	1,258
Work ethos				
rank: 1	Region Twente/Stedendriehoek	59	3,59	1,328
rank: 3	Other region	25	3,04	1,369
Living climate				
rank: 9/10	Region Twente/Stedendriehoek	57	2,96	1,322
rank: 9	Other region	25	2,92	1,222
Cultural facilities				
rank: 14	Region Twente/Stedendriehoek	57	2,86	1,093
rank: 5/6/7/8	Other region	25	2,96	1,098
Recreational and sports facilities				
rank: 9/10	Region Twente/Stedendriehoek	57	2,96	1,101
rank: 10/11	Other region	25	2,80	,957
Vivid environment				
rank: 3	Region Twente/Stedendriehoek	57	3,25	1,090
rank: 1	Other region	25	3,44	1,158
Safety				
rank: 12	Region Twente/Stedendriehoek	57	2,93	1,178
rank: 5/6/7/8	Other region	25	2,96	,889
Location in the Netherlands				
rank: 2	Region Twente/Stedendriehoek	57	3,37	1,080
rank: 5/6/7/8	Other region	25	2,96	1,207
Location in Europe				
rank: 7	Region Twente/Stedendriehoek	57	3,09	1,286
rank: 12/13	Other region	25	2,76	1,012

Table 10: *Regional score on location factors by spin off entrepreneurs*

Factors	**Region where company is located**	**N**	**Mean**	**Std. Deviation**
Availibility of space				
rank: 5/6	Region Twente/Stedendriehoek	57	3,54	,983
rank: 4	Other region	25	3,84	,688
Accessibility				
rank: 5/6	Region Twente/Stedendriehoek	57	3,54	,946
rank: 9	Other region	25	3,44	,870
Image of the region				
rank: 12/13	Region Twente/Stedendriehoek	57	3,21	,901
rank: 6	Other region	25	3,56	,870
Entrepreneurial networks				
rank: 9/10	Region Twente/Stedendriehoek	57	3,35	,916
rank: 11	Other region	25	3,32	,945
Presence of knowledge institutions				
rank: 7	Region Twente/Stedendriehoek	57	3,49	,947
rank: 12/13	Other region	25	3,24	1,128
Labour market				
rank: 9/10	Region Twente/Stedendriehoek	57	3,35	,876
rank: 12/13	Other region	25	3,24	,663
Work ethos				
rank: 3	Region Twente/Stedendriehoek	57	3,58	,706
rank: 1	Other region	25	4,08	,640
Living climate				
rank: 1	Region Twente/Stedendriehoek	57	3,91	,830
rank: 2	Other region	23	4,00	,739
Cultural facilities				
rank: 8	Region Twente/Stedendriehoek	57	3,47	,947
rank: 8	Other region	23	3,48	,846
Recreational and sports facilities				
rank: 2	Region Twente/Stedendriehoek	57	3,58	1,034
rank: 5	Other region	23	3,65	,647
Vivid environment				
rank: 12/13	Region Twente/Stedendriehoek	57	3,21	1,081
rank: 14	Other region	23	3,09	1,276
Safety				
rank: 4	Region Twente/Stedendriehoek	57	3,68	,783
rank: 3	Other region	23	3,87	,626
Location in the Netherlands				
rank: 14	Region Twente/Stedendriehoek	57	3,14	1,060
rank: 7	Other region	23	3,52	,994
Location in Europe				
rank: 11	Region Twente/Stedendriehoek	57	3,32	,890
rank: 10	Other region	23	3,35	,714

Conclusions and policy recommendations

The spin off companies of alumni of the Saxion University of applied sciences play an important role in specific sectors of the regional economy. The fast majority of the companies are active in the knowledge intensive service sectors, especially ICT and business services. The average size is 10 employees. The majority of the spin off stay in the regions, where Saxion is located. Approximately one third of the spin off is located outside the region. This was an unexpected high number compared to the number of spin offs of the University of Twente, which leave the region (22%). Saxion alumni in general tend to stay more in the region (50%) than students of the university (20%). Here we see a reversed effect between alumni and spin off. An explanation might be the difference in sectors in which the Saxion and University of Twente spin offs are active. The more production oriented spin offs of the university may be dependent on the use of laboratories of the alma mater. More research and in depth interviews are needed to learn more about the locational choices of Saxion spin offs. Even in our relatively small sample there is significant difference in size between spin offs located inside or outside the Saxion regions. The spin offs outside Twente and the Stedendriehoek have a higher average of employees. Explanations might be, that entrepreneurs that leave to set up a business are more ambitious or that they benefit from the proximity to large cities and agglomerations. Spin offs located in the region are active in the same sectors as companies that stay closer to Saxion.

There are no location factors, which are of specific importance to Saxion spin offs. The factors, which receive relatively high scores are however remarkable and distinct from entrepreneurs in general. We would have expected high scores on accessibility and labour market, but a vivid environment and work ethos ranked highest. This is probably related to the knowledge intensive service sectors, in which the spin offs are active. It is also remarkable that only spin offs outside the Eastern part of the Netherlands see the presence of knowledge institutions as an important factor. We have not yet an explanation for this. All spin off companies have approximately the same relatively positive judgement of the business climate in the region, where they are located. There is no factor, which receives a negative score (below 2,5). We did however expect higher scores on safety, recreational facilities, work ethos from spin offs located in the eastern part of the Netherlands. This was not the case. The location factor of utmost importance, vivid environment, received the lowest regional scores. This should be a worrying fact for policy makers. Saxion entrepreneurs are on the contrary highly satisfied with the work ethos of their employees and the living climate, especially the companies outside the region. We must stress that is not possible to conclude here, that regional image is not a factor for leaving the region. This is because the expected positive business climate of another region can still be an important factor for leaving. This higher expectancy is later included in the score, because of a more critical judgement of the new location. Interviews are needed to get more detailed information on location factors, mobility, and regional image.

The presented figures should be cautiously interpreted, because of the relative small size of the database. There are however results that should be of interest to regional policy makers. Somehow a relatively large part of the alumni leaves the region to start a company compared to the spin offs of the University of Twente. This cannot only be explained by sectoral differences. The university has been able for a long period to bind spin offs to the region by strongly promoting an entrepreneurial atmosphere, by

stimulating spin off networks, and developing the TOP programme. Saxion is now at the start of this process. There are good opportunities for developing instruments, which could also stimulate and convince Saxion entrepreneurs to start their company or open a branch office in the eastern part of the Netherlands. An import reason to encourage entrepreneurs to stay in the region is related to the structure of the regional economy. The business services sector is relatively small compared to other Dutch regions. It is however forecasted that this sector (and healthcare) will have the strongest employment growth in the coming years. Saxion entrepreneurs could therefore play a major role in regional job growth.

One important element for city policy makers is the fact that Saxion entrepreneurs mention a vivid and bustling environment as most important location factor. To accommodate these starting entrepreneurs it is important to offer affordable inner city locations that are accessible for the clients of the service oriented companies.

References

Di Gregorio, D., & Shane, S. (2003). Why do some universities generate more start-ups than others? *Research Policy, 32*(2), 209-227.

Gompers, P., & Lerner, J. (1999). *The Venture Capital Cycle.* MIT Press, Cambridge, MA.

Groen, A.J. (2005). Knowledge intensive entrepreneurship in networks: Towards a multi-level/multi dimensional approach. *Journal of Enterprising Culture, 13*(1), 69-88.

Karnebeek, A.J. (2001). *Spin-offs and the University of Twente: Sixteen years of experience in incubating start-ups.* Twente University Press, Enschede, Netherlands.

Roberts, E. (1991). *Entrepreneurs in High Technology.* Oxford University Press, New York.

Shane, S. (2004). *Academic Entrepreneurship, University Spin offs and Wealth Creation.* Edward Elgar, Cheltenham,UK.

Sorenson, O., & Stuart, T.E. (2001). Syndication networks and the spatial distribution of venture capital investment. *The American Journal of Sociology, 106*(6), 1546-1588.

Van Oort, F., et al, (2007), *Verhuizingen van bedrijven en groei van werkgelegenheid*, Ruimtelijk Planbureau, NAI Uitgevers, Rotterdam.

Wallmark, J. (1997). Inventions and patents at universities: The case of Chalmers University of Technology. *Technovation, 17*(3), 127-139.