

# SME Innovation and the Crucial Role of the Entrepreneur

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## Summary

In this paper we examine the perceptions of entrepreneurs and other concerned individuals: which factors do they consider critical for success in the innovation process? From the perspective of the respondents, the entrepreneur is the most important factor in the innovation process. Internal aspects dominate not only the list of success factors but **also** the top of the list. External aspects appear only in the third and even the fourth clusters.

A few aspects are believed to be **more** important for the manufacturing sector than for the service sector. These are unique product advantages, marketing activities, **pre**-development, competition and collaboration. The subgroups of responding entrepreneurs and non-entrepreneurs revealed hardly **any** differences. Nor were there **many** significant **scale** differences.

Statistically, we **may** conclude that the entrepreneurs do not consider external circumstances **very** important aspects of innovation success. They have a **rather** egocentric point of view, in that they **place** themselves and the internal process on top (which they are in a position to influence). External aspects follow **much** later. This attitude obviously entails a **considerable** risk of over-estimation.

## Introduction

Schumpeter views the entrepreneur as the **core** of the innovation process. Extensive research from recent decades has revealed **many** other factors of **importance** for the innovation process. In this paper we examine the perceptions of entrepreneurs and other concerned individuals: which factors do they consider critical for success in the innovation process? Do they correspond with the common knowledge derived from the literature, or does their **practice** differ from the theory?

The **first** question we asked our respondents was whether their business revolved mainly around generating **products** or services. A service was defined **here** as being intrinsically intangible and a product as being intrinsically tangible. Innovation is related to the development and marketing of **products** and services that are new from the perspective of the enterprise. New **can** be interpreted here as a totally new product or service, new utilization possibilities of existing **products/services** or improvement of **an** existing **product/service**.

## 2. Literature review

### 2.1 General success factors in innovation

Montoya-Weiss and Calantone (1994) gathered and synthesized the results of empirical research on the determinants of new product performance. They identified 18 factors that **capture** the essence of research on these determinants. The most frequently mentioned determinants are proficiency of technological activities, proficiency of marketing activities and product advantage. The factor proficiency of technological activities **indicates** proficiency of product development, in-house testing of the product or prototype, **trial/pilot** production, production start-up, and obtaining necessary technology. Proficiency of marketing activities **specifies** proficiency of marketing research, customer tests of prototypes or samples, test **markets/trial** selling, service, advertising, **distribution** and market **launch**. Product advantages refer to customer **perception** of the product's qualitative superiority, **cost-benefit** ratio, or performance with respect to the competition.

The findings of Zirger and Maidique (1990) have revealed that managerial **excellence** is critical: new product development **tends** to be more successful if the **process** is planned and implemented **well**. Management **commitment** is **also** essential in this context. They **further** stress that the new **products** should **provide real value** to the customer (in **terms** of technical performance, lower **costs**, unique features, superior quality, or reliability). **Strategic** focus is **also** important. The authors recommend that **firms** choose **projects** that complement their existing technological, marketing, and organizational **competencies**. The market **also contributes** to the success of new **products**. The advantages of **making** the **first** move and large **markets** are relevant in this context.

Cooper and Kleinschmidt (1987) have concluded that product superiority is the **chief** factor influencing commercial success, in terms of unique features for the customer, better quality, reduction of customers' **costs**, innovative **nature**, superiority over competing **products** and problem-solving features. Project definition and early predevelopment activities are the most **crucial** steps in developing new **products**. Project **definition can also** be described in terms of a protocol consisting of a clear **definition** of the target market prior to the product development stage. This **process may indicate** customer **needs**, desires and preferences, the product concept, and the product specifications and requirements. Proficiency in predevelopment activities reflects initial screening, preliminary market **assessment**, preliminary technical assessment, detailed market study (i.e. marketing research) and business and **financial** analysis. **Success** does **not result** simply from situational influences but requires both marketing and technical synergies.

Craig and Hart (1992) presented a general overview of the literature on research into the **dynamics** of new product development (a more marketing-oriented term) or innovation (a more **R&D-oriented** term) In their view, new product development is a necessity **rather** than a **strategic** option. There are different types or measures of product development, based on criteria **such** as present or new technology, existing or new product lines,

present or new marketing and current or new customer segments. The **main** themes in new product development research are:

- strategy: the need for new product development requires a guiding corporate strategy.
- management: successful new product development **receives considerable** support from top management.
- company characteristics: a decentralized, flexible **structure** that **encourages risk-taking** is the most conducive to success.
- process: the more complete the new product development process, the **more** successful the outcome.
- people: organizational design and project management are significant factors.
- information: dissemination of information and the extent of communication **within** the organization are important for the new development process.

Yap and **Souder** (1994) submit that the small **entrepreneurial** high-technology firms they studied **need** to adopt strategies that **are very** different from the **ones** used by large organizations to maximize their chances of success with their new product introductions. These strategies include selecting **projects** with high synergies and developing **products** that **will** encounter little competition and high customer need, applying high quality resources, ensuring excellent interdepartmental communications, encouraging early involvement by top management, recruiting influential product champions, and avoiding **technologies** that require **dramatic** behavioral modification among customers. Generally, these **prescriptions** are fairly **conservative**: stick with your core **technologies**, seek **out niche** opportunities, and do not overextend your abilities.

Atuahene-Gima (1996) described the results of a study comparing the innovation activities of service firms and manufacturers. While service and manufacturing firms focus on similar factors for improving **innovation** performance, their relative **importance** depends on the type of **firm**. The critical factor for service firms is **the importance** they attribute to innovation in the firm's **human** resource strategy, as **well** as management support and teamwork. **Manufacturers** focus primarily on the advantage and quality of product innovation.

In introducing new **products, having** a unique and superior product, a strong market orientation, pre-development activities (i.e. homework), a sharp and early product definition and the right people **working** on the project **are key factors** for success (Cooper, 1990). The author concludes that execution quality becomes **crucial** at a **very** early stage in the new product project.

Rothwell et al. (1974) renewed the SAPPHO (Scientific Activity Predictor from Patterns with Heuristic Options) project, which was designed to identify differences between successful and **unsuccessful** technological innovations. The factors that proved the most important to success were the **ones** concerning **need** satisfaction. User **needs** must be determined and met and should be monitored throughout the course of the innovation, since they **very** rarely remain completely **static**. The **importance** of good communication and **efficient** market **intelligence** are highlighted as well. Moreover, integration of the

marketing and development functions are necessary throughout the innovation. Innovation is a multi-functional process, and success is neither attributable to nor **attainable** through a single or a few isolated **factors**.

Calantone, **Schmidt** and Song (1996) have provided managerial guidelines for new product success. They advise **building** appropriate new product development resources and expertise. Adequate marketing research, a decent sales force, distribution, advertising, and promotional resources and skills are among the conditions for conducting market assessment **studies**, testing products, and introducing products successfully. Their results have **also** indicated that greater proficiency in marketing and technical activities increases the likelihood of success for new products. Collecting and assessing information on the market and the competition **contribute** to a better understanding of these **areas**.

Cross-functional integration and **competitive** product advantage **are** two key determinants for new product success (Song and **Parry**, 1997). Cross-functional integration is a **collective** term for the integration between **R&D** and manufacturing, between marketing and **R&D** and between marketing and manufacturing. This integration **means** that an early understanding of market **needs**, desires, and behavior is essential for new product success.

Maidique and Zirger (1984) listed the following **areas** as being important for a new product's success: market knowledge **gained** through dealing with customers, planning of the new product process, marketing, management support, contribution margin of the product, early market entry, **and** compatibility of the new product **technologies** and **markets** with the developing organization's current strengths.

Dwyer (1990) investigated the impact of various elements of the firm's internal situation on the proficiency of product innovation management and outlined the systems for better management of product innovation.

Edgett, Shipley and Forbes (1992) compared the success of new product innovations at Japanese and British **firms**. They concluded that Japanese **firms** outperform British **ones** only marginally. The **main** reason for the outperformance is that the Japanese **firms place** greater emphasis on meeting **consumer needs** by ensuring reliable, quality products at **competitive prices**.

Song and Parry (1994) identified **six** dimensions as significant **correlates** of new product success: market potential and marketing proficiency, **competitive** intensity and relative **lack** of product advantage, production start-up proficiency, perceived risk, market determinateness, and technical synergy and proficiency. Market potential reflected the intensity of customer need for the product, market **size**, and the growth **rate**. The proficiency of marketing activities depended on the **firm's** understanding of customer **needs**, buyer behavior, and the **competitive** situation, as **well** as on whether the firm carried **out** the preliminary market assessment, the prototype test with customers, the test market, and the market **launch**. The **second** dimension indicated intense competition and

scarcity of advantages over existing **products**. Product start-up proficiency meant adequate financial resources, thorough preparation for the **launch** and production of **sufficient** volume to satisfy **demand**. Perceived **risk** was **interpreted** as accurate risk **perception**. Market determinateness reflected the degree to which the product was clearly **specified** by the marketplace. Finally, technical synergy and proficiency conveyed the firm's **engineering, R&D**, and managerial skills, as **well** as proficiency in preliminary technical assessment and prototype tests.

Dwyer and Mellor (1991) observed links between the **firm's** organizational characteristics on the one hand and new product process activities on the other hand and **also** between proficiency in activity and new product project outcomes. Of **all** organizational elements, skills have a particularly strong impact on proficiency in activity. The **second** outcome has important implications for management and supports the **importance** of pre-development activities in the new product process.

Heracleous (1998) **stressed** the **importance** of **human** resource development as a driving force behind innovation. The world's most admired **companies** consistently **invest** heavily in their **human** resources. Leadership is **crucial** in orchestrating both individual **career** development and the appropriate organizational architecture. People are thus the **crucial success** factor, with information technology as a supportive element.

**Hatch** and Mowery (1998) have found that dedicated process development facilities, geographic proximity between development and manufacturing facilities, and the duplication of **equipment** between development and manufacturing facilities are **all** significant for improving performance in introducing new **technologies**. Improvement of **manufacturing** performance is influenced primarily by the **systematic** allocation of engineering labor to problem-solving activities. Furthermore, the characteristics of learning for new **processes** reflect significant **differences** between **the** environments within which new **processes** are developed. Individual performance in new process introduction is **also** amenable to managerial actions. Careful management of new process introductions is **very** important.

Individual capacity to transform circumstances as desired depends on the application of personal and organizational resources to negotiate appropriate meanings through **social** and political relations with relevant parties. This element is important in the framework for understanding the construction of innovation (Coopey, Keegan, and Emler 1998).

Pickard (1996) showed the **importance** of an innovative culture and environment in which people **feel** empowered to take risks. In this culture and environment, freedom, support for ideas, **time** for experimentation, trust, and dynamism are **very** important.

## 2.2 SMEs and Innovation

**SMEs provide** a surprising engine of innovative activity (Thurik, 1996). Nooteboom (1994) speaks of **dynamic** complementarity in innovation between small businesses and large ones. Small businesses are strong in inventions aimed at applications of **basic technologies**, in **ventures** intended to develop inventions and to implement and introduce the **results**, and satisfaction of **demand** in **small niches** or **residual markets**. Large businesses, **however**, are skilled at fundamental research and invention and **efficient** production and distribution, thereby benefiting from economies of scale and scope. The qualities of **small** businesses are related to their **core** characteristics: **independence** and personality. These characteristics are inevitably associated with the personality of the entrepreneur.

Huiban and Bouhsina (1998) stressed the **importance** of labor quality in the innovation **process**. Small firms appeared to be less innovative for two reasons. First, they lacked economies of scale. **Second**, quality of manpower is important in the innovation **process**, especially the internal job **structure** and the **lack** of formal **scholarly** capabilities. Not **every** phase of innovation entails the same job **categories**.

Karlsson and Olsson (1998) added the regional environment as a potential explanatory factor behind the **success** of innovation by **SMEs**. Their hypothesis, **however**, was **rejected**: **SMEs** are no more dependent on their regional surroundings than large **enterprises** are.

Heunks (1998) showed – in the context of innovation – that proper management of a business depends on taking advantage of opportunities **rather** than on the intrinsic **desire** to run a **firm**. Furthermore, a **certain** combination of order, flexibility and creativity fosters innovation. These are typical entrepreneurial **aspects**. **Size** correlated positively with innovation, whereas **firm** age did not.

Quinn (1985) mentioned that large **companies** stay innovative by **behaving** like **small** entrepreneurial ventures. Small **companies** are prolific innovators for various reasons. One reason is that innovation occurs in a probabilistic setting: a company never knows whether a certain **result will yield success** in the market. For **every** new solution that **succeeds**, **many** others fail. These risks **may** be intolerable for big **companies**, as they jeopardize employment. Quinn mentions the following entrepreneurial **factors** as being **crucial** to the **success** of innovative **small companies**:

1. Need orientations: clients should be involved in an early stage.
2. **Experts** and **fanatics**: **commitment** is an absolute requirement for **success**.
3. **Long-term** horizons: the obstacles and length of **time** required to succeed should not be underestimated.
4. Low early **costs**: if one approach fails, **little time** or money is lost.
5. Multiple **approaches**: technology **tends** to **advance** through a series of **random** insights that **can be** tolerated only by deeply committed **entrepreneurs**.



6. Flexibility and quickness: undeterred by **committees**, board approvals and other **bureaucratic** delays, the entrepreneur **can** experiment, test, **recycle**, and try again with little idle **time**.
7. Incentives: entrepreneurs **can** foresee personal rewards if they are successful.
8. Availability of **capital**: financing institutions focus on **aspects such as the people** requesting funding.

### 3. Research questions

Based on this literature review, we have identified 13 critical success **factors** for the innovation process in Table 1. The classification is questionable in some **respects, however**, since most items are not mutually **exclusive**. In **fact**, most are strongly interrelated. The product itself and the management by the **people** involved are most frequently mentioned as **crucial** for the innovation's success, followed by the relation to the market and the innovation project's organization. Then **come** the surrounding market, the relationship of the company concerned to the new product, the activities preceding the actual development, technology, competition, the entrepreneur (**both** references from the **section SMEs and Innovation**), and, finally, the approach to the innovation project, the innovation culture within the company, and the **financing** of the innovation process.

**Table 1. Critical Success Factors in the Innovation Process: Literature Review**

1. Unique Product Advantages	<p>Montoya-Weiss and Calantone (1994)  Zirger and Maidique (1990)  Cooper and Kleinschmidt (1987)  Atuahene-Gima (1996)  Cooper (1990)</p> <p>Rothwell <i>et al.</i> (1974)  song and Parry (1997)  Edgett, Shipley and Forbes (1992)</p>
2. Human Resource Management	<p>Craig and Hart (1992)  Atuahene-Gima (1996)  Cooper (1990)  Dwyer and Mellor (1991)  Heracleous (1998)  Hatch and Mowery (1998)  Coopey, Keegan and Emler (1998)  Huiban and Bousina (1998)</p>
3. Marketing Activities	<p>Montoya-Weiss and Calantone (1994)  Rothwell <i>et al.</i> (1974)  Calantone, khmidt and Song (1996)  Song and Parry (1997)  Maidique and Zirger (1984)  Edgett, Shipley and Forbes (1992)  Song and Parry (1994)</p>
4. Project Definition (advance)	<p>Cooper and Kleinschmidt (1987)  Craig and Hart (1992)  Cooper (1990)  Rothwell <i>et al.</i> (1974)  Maidique and Zirger (1984)  Song and Parry (1994)</p>
5. Market	<p>Zirger and Maidique (1990)  Yap and Souder (1994)  Calantone, Schmidt and Song (1996)  Song and Parry (1994)</p>

6. Product-Company Fit	Zirger and Maidique (1990) Yap and Souder (1994) Maidique and Zirger (1984) Song and Parry (1994)
7. Pre-Development	Cooper and Kleinschmidt (1987) Cooper (1990) Dwyer and Mellor (1991)
8. Technological Activities	Montoya-Weiss and Calantone (1994) Calantone, Schmidt and Song (1996)
9. Competition	Calantone, Schmidt and Song (1996) Song and Parry (1994)
10. Entrepreneur	Heunks (1998) Quinn (1985)
11. Project Approach	Zirger and Maidique (1990)
12. Innovation Culture	Pickard (1996)
13. Financial Means	Maidique and Zirger (1984)

Collaboration was an additional item. **Many** recent studies have highlighted the **importance** of collaboration for business success of **SMEs** from various perspectives. See e.g. Galbraith (1980) and Stem, El-Ansary, and Coughlan (1996).

These items were **all presented** to the respondents, together with the question as to whether they **agreed** that this factor was **crucial** in the innovation **process**. The **respective** values were measured for the different determinants. The other factors investigated included the **importance** of the product or **service's distinctive** quality, of the respondent's being an entrepreneur, and, **finally**, of the **scale** of the enterprise.

#### 4. Operationalization

Based on both the literature studied and the interviews with experts, the critical success factors were operationalized (see Table 2). The uniqueness of the product is related not only to its internal **aspects** but **also** to the market (i.e. **price**). Management of **human** resources is measured by the current knowledge and attitude and as an opportunity for knowledge cultivation. Relationship with the **client** is an important aspect of marketing, as is the strength of the distribution **channels** and the typical promotional activities. Project **definition** entails thinking about both the product and the **client** beforehand. The market characteristics are trivial. The product-company **fit** is determined in terms of input, throughput, and output. **Pre-development** is related to the **advance** project definition and is both output-related and input-related. The technological activities include obtaining the right knowledge and achieving the right organization. **Protection** is one particular aspect of competition, in addition to the more trivial degree of competition and the novelty of the product involved. The entrepreneurial qualities **encompass** both attitude and activities. The success of the project approach has to do with people and organization. Innovation culture justifies the support for new ideas and activities. Funding for the innovation project **may be** raised internally (e.g. through reserves) or externally (e.g. through **banks**). Finally, the collaboration issue **merits** consideration, in terms of other **companies**, knowledge centers and **consultants**.

**Table 2. Critical Success Factors in the Innovation Process: Operationalization**

1. Unique Product Advantages	Product Quality Product Functions Quality/Price Relation Design
2. Human Resource Management Technological Knowledge	Marketing Knowledge Customer Orientation Training and Development
3. Marketing Activities	Testing Prototype Provision of Additional Services Strength of Distribution Channels Advertising and Promotion Sales Department
4. Project Definition (advance)	Specification of Target Group Positioning Product Product Functions Technical Product Specifications
5. Market	Size Growth Potential
6. Product-Company Fit	Relation with Current Assortment Relation with Current Clients Relation with Current Technological Knowledge
7. Pre-Development	Determination Client Wishes and Demands Competition Analysis Technical Feasibility Financial Feasibility
8. Technological Activities	Assembling Technological Knowledge Development Prototype Internal Testing Prototype Organization Production Process
9. Competition	Degree Novelty of the New Product Possibility for Patents
10. Entrepreneur	Commitment and Determination Persistence in Problem Solving Creativity Team Spirit and Motivational Capacities
11. Project Approach	Strength of Project Leader Planning and Organization Progress Checking Multidisciplinary Composition of Project Team
12. Innovation Culture	Opportunity to Air Innovative Opinions Space to Elaborate Innovative Ideas Support for Innovative Ideas
13. Financial Means	Internal Disposability External Disposability
14. Collaboration	With Other Companies With Knowledge Centers Involvement of Consultants

## 5. Data Collection

Initially, 638 companies were selected from the Dutch **MarktSelect** CD-Rom (which comprised over 800,000 organizations). The sole criterion applied was being part of the small and medium-sized sector (i.e. less than 100 employees). The selection consisted of 388 companies in the service sector and 250 in the manufacturing sector. In addition to these 638 companies, 322 others **were** selected from a **rather** subjective database. These **latter** companies were known for their involvement in product development. Given the small **size** of the sample and its partially subjective **nature**, the selection **may** not have been **fully** representative. **Nevertheless**, the **process** occurred at **random**.

Thus, 960 companies were **selected**. Within this group 167 (17.4 percent) returned the **completed** questionnaire on **time**. Among these companies, 43.8 percent employed not more than seven employees and 49.3 percent between seven and **100**; the workforce at the remaining 6.9 percent exceeded 100 people. Among the respondents, 68.3 percent consisted of the entrepreneurs themselves; the rest were mainly managers. Altogether, 47.3% of the respondents were **active** in the manufacturing sector, 27.5% in the service sector, and 25.2 % in other sectors.

An extensive **structured** questionnaire was drafted, containing **general** questions, questions about innovation and questions about critical **success factors**. The **first** cluster of questions conveyed the **profile** of the firms and the individual respondents. The questions concerned the respondent's position, the year the firm was established, the number of full-time and part-time employees, the **core** business and the firm's market.

The **second** cluster of questions addressed the type of experience of the companies with innovations. The companies indicated whether their innovations were product or service innovations, the **respective** numbers of product and service innovations, the market and **success** for the new product or service, and the extent to which the new product or service was innovative (totally new, an improved **version** of an existing product service or a new market for an existing product or service).

The **final** cluster of questions asked the respondents for their opinions about the **importance** of the fourteen different critical **success factors** mentioned in the previous **section**. **Each** critical **success** factor was **covered** by several operational questions. For instance, the critical **success** factor "uniqueness of **product/service**" can be measured by the operational questions about "uniqueness of quality", "**uniqueness** of product functions", "uniqueness of quality-price ratio", and "uniqueness of design" (see Table 2). The various operational questions corresponding to a **critical success** factor represented different **aspects** of that factor. This design of the questionnaire yielded a comprehensive impression of **each** critical factor.

The opinions of the respondents about the operational **aspects** were **all** measured on a five-point Likert **scale (five categories)**. Category 1 indicated total disagreement with a statement, whereas Category 5 corresponded with complete agreement, as answers to the

question of whether the success of a new product depended strongly on this operational aspect. The remaining answers were “disagree,” “no opinion,” and “agree.”

## 6. Testing

In order to **compare** the **importance** of the different critical success factors, we had to **define** a factor analysis model for **each** critical success factor (see Lewis-Beek, 1994). **Such** a model assumes that the **measured** variables (i.e. operational questions) **can** be generated and **represented** by just one unobserved common variable known as a factor. The measurements of the observed variables were believed to contain a margin of error. Thus, the factor models are basically measurement models for the unobserved common factors (i.e. the newly defined critical success factors).

SPSS software was used to obtain Maximum Likelihood estimates of the unknown factor analysis coefficients. The percentages ( $R^2$  values) of the operational variables, which are explained by the common factors, provided a good indication of the quality of the factor analysis models. The factor analysis models fit **well** in this study (nearly **all**  $R^2$  values are approximately 90%). This **means** that **each** common factor is a good representation of the corresponding group of measured operational variables.

The estimates for the unknown coefficients of the fourteen factor analysis models and the scores of **all** the operational questions enabled us to estimate **each** company's scores for the common factors of the fourteen separate factor analysis models (see Lewis-Beek, 1994). In **every** case, these estimates of the common factors are good indicators of the values of the critical success factors.

Next, we compared the values of the different critical success factors for **each** company. **Tables** 3 and 4 **depict** the **mean** values for the critical success factors for the complete set of data, the manufacturing sector and the service sector, respectively. The critical factors were ranked in decreasing order of **importance**. The top of the **tables** lists the factor with the highest **mean** score and the bottom of the **tables** the factor with the lowest **mean** score. Table 5 contains analogous **mean** scores for entrepreneurs and nonentrepreneurs. Furthermore, Table 6 presents the **mean** scores for the **real** innovative firms and the less innovative **firms**. Finally, Table 7 **indicates** the **mean** scores for firms of different **sizes** (large vs. small).

**Table 3. Determinants of Innovation Success**

<i>Critical Success Factor</i>	<i>mean score</i>	<i>t-value for difference between current and next mean</i>	<i>probability level for difference between current and next mean</i>
Entrepreneur	4.34	4.59	0.000*
Unique Product Advantages	4.11	0.36	0.722
Innovation Culture	4.09	0.89	0.375
Project Approach	4.05	1.48	0.140

Technological Activities	3.99	0.12	0.907
Human Resource Management	3.99	0.80	0.424
Marketing Activities	3.95	0.25	0.800
Project Definition (advance)	3.94	0.05	<b>0.962</b>
Pre-Development	3.93	1.68	0.09% <sup>**</sup>
Market	3.82	1.43	0.153
Financial Means	3.71	3.53	<b>0.001</b> <sup>*</sup>
Competition	3.46	0.87	0.3%
Product-Company Fit	3.38	1.30	<b>0.197</b>
Collaboration	3.30		

<sup>\*</sup> significant on a 0.05 level

<sup>\*\*</sup> significant on a 0.10 level

**Table 4. Determinants of Innovation Success: Service Sector vs. Manufacturing Sector**

Critical Success Factor	mean score manu-facturing sector	mean score service sector	t-value for difference between sectors	probability level for difference between sectors
Entrepreneur	4.33	4.35	-0.20	0.839
Unique Product Advantages	4.19	4.00	2.26	0.025 <sup>*</sup>
Innovation Culture	4.13	4.01	1.05	0.2%
Project Approach	4.05	4.05	0.03	0.980
Technological Activities	4.04	3.88	1.39	0.167
Human Resource Management	3.99	3.98	0.11	0.917
Marketing Activities	4.05	3.53	2.21	0.029 <sup>*</sup>
Project Definition (advance)	3.99	3.84	1.51	<b>0.134</b>
Pre-Development	4.02	3.72	3.16	<b>0.002</b> <sup>*</sup>
Market	3.84	3.77	0.53	<b>0.594</b>
Financial Means	3.74	3.60	1.10	0.274
Competition	3.54	3.25	2.15	0.033 <sup>*</sup>
Product-Company Fit	3.41	3.38	0.26	<b>0.794</b>
Collaboration	3.38	3.08	2.22	0.028 <sup>*</sup>

<sup>\*</sup> significant on a 0.05 level

**Table 5. Determinants of Innovation Success: Entrepreneurs vs. Non-Entrepreneurs**

Critical Success Factor	mean score entrepreneurs	mean score non-entrepreneurs	t-value for difference between respondents	probability level for difference between respondents
Entrepreneur	4.35	4.30	0.56	0.577
Unique Product Advantages	4.12	4.13	-0.99	0.922
Innovation Culture	4.11	4.13	-0.24	0.812
Project Approach	4.01	4.01	-0.28	0.777
Technological Activities	4.05	<b>3.94</b>	0.93	0.355
Human Resource Management	4.00	4.00	0.05	0.963
Marketing Activities	3.93	4.07	-1.73	0.086
Project Definition (advance)	<b>3.97</b>	3.95	0.20	0.841
Pre-development	3.91	4.02	-1.18	0.241
Market	3.84	3.75	0.68	<b>0.499</b>
Financial Means	3.13	3.62	0.90	0.369
Competition	3.43	3.57	-1.05	<b>0.294</b>
Product-Company Fit	3.46	3.27	1.50	0.137
Collaboration	3.29	3.33	-0.321	0.749

<sup>\*</sup> significant on a 0.05 level

**Table 6. Determinants of Innovation Success: Real Innovative vs. Less Innovative Companies**

<i>Critical Success Factor</i>	<i>mean score real innovative companies</i>	<i>mean score less innovative companies</i>	<i>t-value for difference between real innovative and less innovative companies</i>	<i>probability level for difference between real innovative and less innovative companies</i>
Entrepreneur	4.34	<b>4.34</b>	<b>0.10</b>	0.493
Unique Product Advantages	4.14	<b>4.08</b>	<b>1.20</b>	0.186
Innovation Culture	4.08	<b>4.10</b>	<b>-0.44</b>	0.563
Project Approach	4.06	<b>4.04</b>	<b>1.00</b>	0.210
Technological Activities	3.99	<b>4.00</b>	<b>-0.25</b>	<b>0.537</b>
Human Resource Management	3.99	3.99	<b>0.07</b>	0.49
Marketing Activities	4.10	<b>3.91</b>	2.30	0.039
Project Definition (advance)	3.94	3.95	-0.87	0.593
Pre-Development	4.08	3.88	2.80	0.027
Market	3.84	<b>3.80</b>	0.93	0.364
Financial Means	3.71	3.72	<b>-0.55</b>	0.584
Competition	3.46	3.46	0.27	0.46
Product-Company Fit	3.31	3.39	-0.97	0.693
Collaboration	3.30	3.30	-0.12	0.505

<sup>1</sup> significant on a 0.05 level

**Table 7. Determinants of Innovation Success: Large vs. Small Companies**

<i>Critical Success Factor</i>	<i>mean score large companies</i>	<i>mean score small companies</i>	<i>t-value for difference between large and small companies</i>	<i>probability level for difference between large and small companies</i>
Entrepreneur	4.31	4.38	-0.83	0.407
Unique Product Advantages	4.07	4.10	-0.37	0.711
Innovation Culture	3.99	4.24	-2.58	0.011 <sup>1</sup>
Project Approach	4.04	4.00	0.48	0.631
Technological Activities	3.99	4.02	-0.25	0.803
Human Resource Management	4.02	3.91	1.32	0.189
Marketing Activities	3.85	4.14	-3.31	0.001 <sup>1</sup>
Project Definition (advance)	3.99	3.89	1.11	0.269
Pre-Development	3.91	3.91	0.02	0.983
Market	3.81	3.75	0.43	0.665
Financial Means	<b>3.75</b>	3.68	0.55	<b>0.582</b>
Competition	3.48	3.41	0.52	0.602
Product-Company Fit	3.52	3.24	2.03	0.021 <sup>1</sup>
Collaboration	3.23	3.37	-1.12	0.266

<sup>1</sup> significant on a 0.05 level

## 7. Discussion

First we will discuss the results for the complete set of data (see Table 3). Clearly, the entrepreneur is the most important factor in the innovation process. The unique product advantages, presence of an innovation culture, project approach, technological activities, human resource management, marketing activities, advance project definition and pre-development are more important than the market and financial means. The potential determinants competition, product-company fit, and collaboration are of very little influence.

Using a t-test for paired samples (see Moore and McCabe, 1993), we tested whether the mean scores for two critical success factors differ significantly. The last column of Table 3 shows which different critical success factors do indeed have different mean scores statistically on a five or ten percent significance level.

A lot of differences are apparent with respect to the sequence we observed from the literature survey. Entrepreneurs attribute remarkable importance to innovation culture and project approach. As the classification based on the literature review is rather flexible, we did not consider the differences from the perception of the respondents any further.

Next, we compared the results for the manufacturing and service sectors (see Table 4). Running a t-test for independent samples reveals that unique product advantages, marketing activities, pre-development, competition and collaboration have statistically higher preferences for products than for services (on a five percent level). In both cases the entrepreneur is the most important, while collaboration seems to have the lowest priority. This conclusion agrees with the results for the complete set of data and partially confirms Atuahene-Gima (1996).

Table 5 gives the results for the entrepreneurs and the non-entrepreneurs. Their opinions hardly deviate, which means that the entrepreneurs do not have a special bias for themselves. In both cases the entrepreneur is mentioned as the most critical success factor. The only significant difference is that the questionnaires of the non-entrepreneurs indicate a more crucial role for marketing activities than the questionnaires of the entrepreneurs (significantly higher means with a probability of 0.086 on a t-test for independent samples).

44 firms show ten or more innovations, while their innovations are qualified as successful. Table 6 presents the results for this group of firms. On top of the table we see for the real innovative firms, apart from the entrepreneur and the unique product advantages, the critical success factors marketing activities and pre-development. Again, with a t-test for independent samples we can show that these two critical success factors are more important for real innovative firms than for the other firms.

Finally the data set was divided according to companies with up to seven employees and companies with more than seven employees. This number of workers was chosen



**because** it is the maximum that one individual **can** usually manage. A larger staff necessitates additional management and organizational **changes**. Marketing activities and innovation culture are more crucial for **small** firms than for large **ones**. The product-company fit has the opposite role (significant at the **five** percent level). See Table 7. These outcomes partially **confirm** Yap and **Souder** (1994) and Nooteboom (1994).

## 8. Conclusions

From the perspective of the **respondents**, the entrepreneur is the most important factor in the innovation process. Internal aspects dominate not **only** the list of success factors but **also** the top of the list. A cluster of internal aspects **follows** the entrepreneur: unique product advantages, innovation culture, project approach, technological activities, **human** resource management, marketing activities, project definition and pre-development. Market, financial **means**, competition, **product/company** fit and collaboration appear only in the third and even the fourth clusters. Financial **means, however**, entail both internal and external **aspects**.

A few aspects are believed to be more important for the manufacturing sector than for the service sector. These are unique product **advantages**, marketing activities, **pre**-development, competition and collaboration. The question of intangibility of services might be crucial in **this** respect. The novelty of **an** innovative service must be considered carefully and communicated to the potential **client**. Otherwise, competitors **may** win the prize. Collaboration **can** be an important **asset** in **fighting** this competition.

The **real** successful innovative firms think unique product advantages, marketing activities and pre-development are **very** important. These three factors **can all** be **controlled** by firms.

The subgroups of responding entrepreneurs and non-entrepreneurs revealed hardly **any** differences. Nor were there **many** significant **scale** differences. Marketing is **less** important for the entrepreneurs involved, which might be attributable to product-blindness. **Economies of scale** and bureaucracy might be explanatory factors for the differences between large and small **companies**.

Statistically, we **may** conclude that the entrepreneurs do not consider external circumstances **very** important aspects of innovation success. They have a **rather** egocentric point of view, in that they **place** themselves and the internal process on top (which they are in a **position** to influence). External aspects follow **much** later. This attitude obviously entails a **considerable** risk of over-estimation.

### References

- Atuahene-Gima K. (1996). 'Differential Potency of Factors Affecting Innovation Performance in Manufacturing and Services Firms in Australia'. *Journal of Innovation Management*, 13, 35-52.
- Calantone, R.I., L.B. Schmidt, and X.M. Song (1996). 'Controllable Factors of New Product Success: A Cross-National Comparison'. *Marketing Science*, 15, 4, 341-358.
- Cooper, R.G., and E.J. Kleinschmidt (1987). 'New Products: What Separates Winners from Losers'. *Journal of Product Innovation Management*, 4, 169-184.

- Cooper, R.G. (1990). 'New Products: What Distinguishes the Winners?'. *Research & Technology Management*, 33, 6, 27-31.
- Cooney, J., O. Keegan and N. Emler (1998). 'Managers' Innovations and the Structuration of Organization'. *Journal Management Studies*, 35, 3, May, 263-284.
- Craig, A. and S. Hart (1992). 'Where To Now in New Product Development Research'. *European Journal of Marketing*, 26, 11, 1-47.
- Dwyer, L.M. (1990). 'Factors Affecting the Proficient Management of Product Innovation'. *International Journal of Technology Management*, 5, 6, 721-730.
- Dwyer, L., and R. Mellor (1991). 'Organizational Environment, New Product Process Activities, and Project Outcomes'. *Journal of Product Innovation Management*, 8, 39-48.
- Edgett, S., D. Shipley and G. Forbes (1992). 'Japanese and British Companies Compared: Contributing Factors to Success and Failure in NPD'. *Journal of Product Innovation Management*, 9, 3-10.
- Galbraith, J.K. (1980). *American Capitalism*. White Plains: M.E. Sharpe.
- Hatch, N.W., and D.C. Mowery (1998). 'Process Innovation and Learning by Doing in Semiconductor Manufacturing'. *Management Science*, 44, 11, Part 1 of 2, November, 1461-1477.
- Heracleous, L. (1998). 'Better than the Rest: Making Europe the Leader in the Next Wave of Innovation and Performance'. *Long Range Planning*, 31, 1, 154-158.
- Heunks, P.J. (1998). 'Innovation, Creativity and Success'. *Small Business Economics*, 10, 263-272.
- Huiban, J.-P., and Z. Bouhsina (1998). 'Innovation and the Quality of Labour Factor: An Empirical Investigation in the French Food Industry'. *Small Business Economics*, 10, 389-400.
- Karlsson, C., and O. Olsson (1998). 'Product Innovation in Small and Large Enterprises'. *Small Business Economics*, 10, 3146.
- Lewis-Beck, M.S. (editor). (1994). *Factor Analysis and Related Techniques*. London: SAGE Publications.
- Maidique, M.A., and B.J. Zirger (1984). 'A Study of Success and Failure in Product Innovation: The Case of the U.S. Electronics Industry'. *IEEE Transaction Engineering Management*, EM-31, 4, 192-203.
- Montoya, M.M. and R. Calantone (1994). 'Determinants of New Product Performance'. *Journal of Product Innovation Management*, 11, 397-417.
- Moore, D.S. and McCabe, G.P. (1993). *Introduction to the Practice of Statistics*, second edition, New York: Freeman and Company.
- Nooteboom, B. (1994). 'Innovation and Diffusion in Small Firms: Theory and Evidence'. *Small Business Economics*, 6, 327-347.
- Pickard, J. (1996). 'A Fertile Grounding'. *People Management*, 24 October, 28-35.
- Rothwell, R., C. Freeman, A. Horsey, V.T.P. Jervis, A.B. Robertson and J. Townsend (1974). 'SAPHO updated - project SAPHO phase II'. *Research Policy*, 3, 259-291.
- Quinn, J.B. (1985). 'Managing Innovation: Controlled Chaos'. *Harvard Business Review*, May-June, 73-84.
- Schumpeter, J.A. (1912). *Theorie der wirtschaftlichen Entwicklung*. Leipzig: Duncker und Humboldt.
- Song, X.M., and M.B. Parry (1994). 'The Dimensions of Industrial New Product Success and Failure in State Enterprises in the People's Republic of China'. *Journal of Product Innovation Management*, 11, 105-118.
- Song, X.M., and U.B. Parry (1997). 'The Determinants of Japanese New Product Successes'. *Journal of Marketing Research*, XXXIV, February, 64-76.
- Stern, L.W., A.I. El-Ansary and A.T. Coughlan (1996). *Marketing Channels*, Englewood Cliffs: Prentice Hall International.
- Thurik, A.R. (1996). 'Introduction: Innovation and Small Business'. *Small Business Economics*, 8, 175-176.
- Yap, C.M., and W.E. Souder (1994). 'Factors Influencing New Product Success and Failure in Small Entrepreneurial High-Technology Electronic Firm'. *Journal of Product Innovation Management*, 11, 418-432.
- Zirger, B.J., and M.A. Maidique (1990). 'A Model of New Product Development: An Empirical Test'. *Management Science*, 36, 7, 867-883.