

Industrial Innovation in Transition

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Industrial Innovation in Transition**

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Publisher School of Business**Unit** Department of Management Studies**Series** Aalto University publication series BUSINESS + ECONOMY 4/2014**Field of research** Innovation research**Abstract**

In this study, the innovation management processes of Finnish companies in significantly changing business environment were examined. Data collection for this study draws on qualitative methods and interviews. Based on the analysis, it can be summarized that innovation activities are often characterized as processual and hierarchically structured with emphasis on the traditional stage-gate-model. As a contrast, in some interviews also highly informal and unsystematic origins and processes of innovation are described. Strategy processes are often characterized according to the established terminology emphasizing rationality and formal processes. However, business strategies are also perceived as a limiting and hindering factor for innovations.

Based on the analysis, there seems to be heavy emphasis on incremental innovation, which builds on advancing current competencies, businesses, and capabilities. Large foreign companies and "players" are described as trendsetters, which are followed. The majority of characterizations do not convey an exploration spirit or passion for radical, disruptive innovations and creation or transformation to entirely new businesses. Descriptions of developing new social innovations (eg. Facebook, Twitter), novel business models, intrapreneurship or start-up mentality as well as passionate visions of transformational ideas and business opportunities appear seldom. Activities for developing processes for open innovation are seen as a future possibility. Currently there is a lack of open innovation tools and processes. Many companies accumulate "big data" from their operations. However, developing its widespread analysis and utilization is seen to take place in the future. Descriptions of active development of ideas to transform businesses and business models based on "big data" analytics are rare.

Industrial innovations originate from networks involving customers, suppliers and public R&D organizations. The study raises also some suggestions how to reform the Finnish innovation system. Development is needed in company innovation management processes, TEKES activities, new funding instruments and university incentive system. On the Finnish societal level, an innovation gap emerges between small companies and large enterprises.

Keywords innovation management, innovation strategy, networks, ecosystems, innovation policy

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1. INTRODUCTION

A study on changing innovation processes in companies

International innovation networks, open collaboration in innovation, social media and free developer communities have significantly changed the innovation processes of companies. At the same time, it has become increasingly more important for companies to manage their innovation process in a way that serves the company's business strategy efficiently and which leads to products and services that can be brought to markets quickly. This development is a challenge to policies promoting innovations as well as to the roles of traditional actors, such as the interaction of universities and investors with economic life.

Aalto University conducted a study on changes in companies' innovation process management during March-June of 2014. The purpose of the study is to create knowledge about companies' innovation management practices in the changed operational environment in order to support management in their tasks. The study also creates knowledge on how to develop innovation policy measures so that they would best serve the changed needs of companies' innovation processes. The study was conducted with funding from TEKES (The Finnish Funding Agency for Innovation), EK (The Confederation of Finnish Industries), and Teknologiateollisuus (The Federation of Finnish Technology Industries).

Altogether 58 persons were interviewed for the study, representing 52 different organizations. The median duration of the interviews was about 60 minutes. The interviews were transcribed. The interviews were based on the interviewees participating actively in the discussion in a dialogue-like interviewing situation. The interviewees were therefore active knowledge providers, participating in a discussion about the topic in question and elaborating on their views through dialogue, simultaneously creating knowledge about the topic of the interview. (Holstein & Gubrium 1997)

The interviews were analysed by utilizing the principle of grounded theory where the interpretation of the data and conclusions drawn from it are based on the data. The data were coded into a table and categorised according to the interview structure, after which the researchers deepened their understanding of the data by linking logical and conceptual connections between interviews by comparing the data sets (interviews) against each other. The quality of the data analysis was confirmed by systematically harmonizing the different interpretations of the researchers.

All the companies that participated in this study were established businesses, so the study did not include newly established or start-up companies. Among

the background organizations of the interviewees who participated in the study, 50 % were manufacturing companies, 33% were information and communications companies, 12% were service companies and 5% were wholesale and retail trade companies. Of these, 45 (78%) were large companies and 13 (22%) were small to medium-sized businesses. The industries were coded according to the industry classification TOL 2008, with the exception of the construction industry, which was added to the manufacturing category.

The study results cannot be generalized into conclusions that would cover the whole company population in Finland. The data emphasizes especially the views of large companies and the manufacturing industry.

This study report discusses the results in terms of the themes that emerged from the data. The report is divided into presentations of study observations regarding the companies' innovation processes, innovation management processes and the Finnish innovation system function.

2. INNOVATION PROCESSES AND MANAGEMENT

Innovation activity can be considered as development activities taking place in a company that aim to improve the company's competitiveness. In a broad sense, innovation is any action that creates an advantage in relation to competitors: "Innovation is the generation, acceptance and implementation of new ideas, processes, products or services" (Thompson 1965, 2). Innovation can be a new kind of skill, applying of new knowledge, a new product or technology, a new service or a new kind of concept. In addition to development, a more limited definition of innovating is related to usability and commercialization.

Innovation is a process involving development, inventing and/or adaptation where existing knowledge meets new contexts and creates new solutions. From the point of view of society, innovations aim at company growth and internationalization and therefore at creating higher well-being, as well as social reformation and innovation. The goal is competitiveness gained through growth, enabling the success and growth of Finnish companies in international markets. For companies, innovation is about responding to market dynamics, a need to respond to changing client preferences and improvements brought to the market by competitors – renewing the company's own competitiveness. In Finland, the proportion of growth companies, especially rapidly growing companies, is smaller (about 6%) compared to Nordic countries (15%) or European countries (about 11%) (Yrittäjyyskatsaus 2008, 57).

Based on existing understanding, it can be said that the innovation process in modern companies cover and touch upon

four inter-related phases: 1) Anticipating the future business environment with the help of a strategy process, 2) linking the innovation strategy with the business strategy, 3) implementing the innovation strategy and 4) bringing innovations to the market and expanding the market. The following sections of this report follow this categorization.

3. STRATEGY PROCESS

The majority of the interviewees in the study (over 50% of the responses), characterize a company's strategy process in the generally accepted way where strategies and strategy processes are mainly the responsibility of senior management and the steering group. This characterization adheres to the commonly known view of a formal strategy process and its implementation. There were also occasional comments (fewer than 10% of responses) according to which the aim is towards more agile strategy processes, in accordance with current trends.

Less than one third of the responses expressed views that the strategy process in a company is not necessarily a formal process. In a few responses, the company was explained to have completely given up formal strategy processes because they were not seen to have practical significance for the company's operations. These kinds of descriptions were, however, a minority compared to the number of descriptions of formal strategy processes. A few responses emphasized the role of negotiation and dialogue when describing strategy processes.

According to the interviewees, strategic management builds a framework and creates opportunities for successful innovation activities. The process of innovation management includes the following components: filtering ideas, making choices, creating focus, and allocating resources. The components of a decision making process are: (1) monitoring and analysis of change signals in the operating environment and 2) management of change dynamics by iterating the company's short and long-term operations. Change management tools include institutional¹ and strategic management.² Both of these processes were linked directly or indirectly to the innovation management of companies.

¹ Institutional management refers to the act of influencing the operating requirements in the political arena: "it is the work that aims to secure and justify corporate existence and activity, and which aims to develop the societal requirements and conditions for the company's business operations. An important part of this job is to legitimize the needed forms of corporate change and growth." (Tainio et al. 1987, 103-104).

² Strategic management is understood to refer to the operations of the senior management to improve the company's performance in the external operating environment: "The field of strategic management deals with (a) the major intended and emergent initiatives (b) taken by general managers on behalf of owners, (c) involving utilization of resources (d) to enhance the performance (e) of firms (f) in their external environments." (Nag, Hambrick & Chen 2007, 942)

Regarding the strategy processes, the responses emphasized (in c. 30 % of the comments) the role of monitoring and following different trends. Companies aim to identify mega trends, for example, and follow them. It is noteworthy, however, that the interviewees mainly emphasized the following and monitoring of trends as well as observing global changes. In some individual comments, actively influencing the trends or having a "conquering the world" attitude was deemed to be more characteristic of Swedish companies than typical Finnish companies.

Regarding trends, the companies did not describe clear company-specific future evolution or transformation paths. In some interviews, when specifically asking about views on future competitors, the respondents most often mentioned the threat of new competitors coming to the market. Yet, despite changes in the operating environment, competitors were still seen to be mainly the same or being of similar type in the future as well. The company's strategic focus points in their operations were also seen to be mainly the same in the future, and therefore the competitors were seen to be the same or similar. Therefore, when asked separately, the idea of moving to entirely different business areas, and thus, to new competitive fields was seen mainly as something worth pondering on.

Especially in responses from interviewees working in an industry susceptible to regulation (c. 25% of the interviews), institutional management was emphasized as one aspect of following mega trends. Highly regulated industries were e.g. the energy industry and media/communications. Regulatory policies both determined the direction of development activities and influenced the development of business profitability. Institutional management was conducted through industry associations and participating directly in different forums and committees. Management's direct contacts to state officials and decision makers were also channels for exerting influence. The interviewees saw the direction of national industrial policy as one mega trend. Political alignments in order to follow this policy changed the focus of societal goals and affected the amounts of funds given and distributed to businesses, in accordance with the current societal view and government program.

Approximately 50% of the interviewees also emphasized the importance of monitoring the regulatory and political operating field and influencing it. According to the interviewees, signals from the operating environment were monitored and followed as part of the operating ecosystem. Future changes were monitored and identified by being involved in different company-specific operating networks (component manufacturers, subcontractors, consultants) and collaboration networks (authorities, research institutes, universities).

Regarding the monitoring of the operating environment, the strategy process emphasized frequently (c. 50% of the responses) technological anticipation, disruptions related to markets, monitoring of developments in client needs, and monitoring of competitors. Approximately 20% of the interviewees mentioned that they monitor the operating environment in order to compare their competitiveness with that of competitors. Often the monitoring was the responsibility of sales or key personnel.

When discussing processes that have led to individual innovations (in only a few interviews), the interviewees also emphasized views that it may be only afterwards that innovations can be perceived strategic. In addition, some descriptions pointed out that innovations can be strategy-based and still become non-strategic, and then later become an essential part of strategy again. In the same way, there were some views that innovations that are significant for individual companies can also be born regardless of mega trends. The innovation can emerge first, and only afterwards is a mega trend born, which the innovation is then seen to follow. This was also related to comments that innovations may have their sources and foundations in technological solutions or developments dating back decades.

Therefore, innovation processes themselves are temporally very long-term, which makes it difficult to identify their ‘strategic aspect’, or their links to the current strategy at current time. In contrast, the current strategy can also be seen to be a consequence of a development path started by an innovation. However, descriptions like these were a clear minority, as the majority of the interviews did not bring up individual innovations and innovation processes.

4. MERGING OF BUSINESS STRATEGY AND INNOVATION STRATEGY

The business strategy and the innovation strategy are ambiguously intertwined. The innovation strategy was generally seen as subordinate to the business strategy, in accordance to the traditional top-down model. On the other hand, the interviewees also gave the impression of bottom-up-operations where an organization’s ideas and innovations can affect the business strategy. In addition, when examining some individual innovations in more detail, notions about the link between strategy and innovation strategy were more complex.

The merging of business strategy and innovation strategy was emphasized in a large number of responses (n. 50%). In these cases, innovation activity and innovation projects are coordinated into existing businesses in conjunction with the company’s general strategy and strategic planning. As individual

examples of this kind of coordination of business strategy and innovation strategy, the interviewees mentioned frequent meetings between senior management and R&D. It is typical in the top-down model that innovation strategy or its components define the goals and projects of the company's development work by their market prospect and/or the revenue they create. However, innovation strategy was not always described explicitly alongside business strategy. In some individual cases the interviewees described innovation or technology strategy as a support strategy for business strategy.

Similarly, the interviewees emphasized (c. 50 % of the responses) descriptions of the merging of business and innovation strategy as a bottom-up process. It was typical for these descriptions that the innovation activity took place in the activities and operations of business units or lines. In these cases, these activities affected the company's strategic operations and its strategic direction. According to this viewpoint, ideas and innovations are searched, created and collected from the company and they have a guiding effect on the organizational strategy. This was most often described to take place within the boundaries of the commonly known stage-gate process for innovations.

In the interviews, the majority of the responses were focused on generic description. Therefore descriptions of specific innovations or innovation processes were a clear minority in the data. However, when studying descriptions of some individual innovations or processes that had led to innovations, the notion of merging business strategy and innovation strategy became significantly more complex than the above-mentioned top-down and bottom-up views:

Innovations and innovation processes may be temporally very long. Descriptions of individual innovations brought up innovation processes covering long time spans and cases where innovations and the central focus of the company's operations were based on innovations made years earlier. Over long time periods, a company's strategy can be estimated to change several times. There were a few comments that the future perspectives of typical strategy processes are too short for innovation activity, covering only periods of 3–5 years, even though innovation processes may last longer. **Based on these descriptions, the link between a company's business strategy and an emergent³ innovation strategy is very ambiguous: business strategy and innovation strategy may live their own lives, and integration between them may remain loose.** Some individual responses mentioned that publicly listed companies need to generate an even

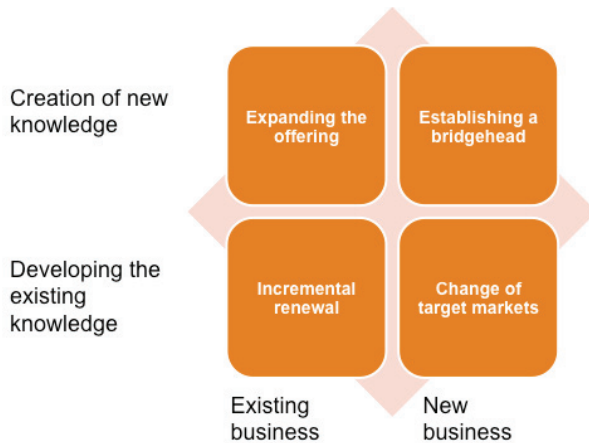
³ According to Professor Henry Mintzberg (1979), it is possible to detect a so-called emergent component in company strategies. According to this view, a path of sequential events following each other may become a strategy, and it is not planned, designed and aimed at beforehand. In contrast, there is the generally dominant strategy view that strategy/strategies are a result of anticipation and rational planning, implementation and management processes.

cash flow in quarters, and this was seen as preventing radical innovation experiments. In such cases, business strategy was also described as restricting innovation activities by being focused on a too short time period.

As sources of ideas and innovations within organizations, the interviewees mentioned different kinds of formal and informal systems for collecting, managing and analyzing ideas, visions by key persons, as well as following and building on the organization's own know-how and intuition. As external sources of ideas and innovations, the descriptions often emphasized clients and their needs, information acquired from partners and subcontractors, and competitors' activities. Some comments described how regular client meetings can be seen to have an influence on guiding the business strategy. There were also a few comments that strategy and innovation activities are affected by trends in client activity, and that weak signals have an indirect impact – for instance, through participating in EU research projects or monitoring the actions of several separate clients and integrating these observations. On the other hand, some interviewees mentioned the good relationships between key persons in business units and clients or partners, especially subcontractors. Here, the impact on innovation activity and business strategy was transmitted through these key persons' interactions.

In some interviews, there were descriptions about very informal and mundane starting points for significant innovations. These were, for example, thought experiments, 'half-serious' discussions, a shared feeling of 'need to do something', and aiming at cost savings. As long-term consequences of these starting points, innovations and strategic solutions could emerge which were very significant for the company's operations. These descriptions further added to the ambiguity of the cause-and-effect relationship between business strategy and emergent innovation strategy: an innovation may become an innovation strategy and a business strategy also when it is defined as such afterwards.

In the long term, a company's success depends on how it invests in developing existing knowledge and operations as well as in creating new knowledge and operations. This kind of setting that requires balancing on the part of management causes different types of innovation processes, can be categorized in the following way, based on the interviews: 1) incremental renewal, proceeding towards productivity with small steps and maintaining competitiveness in current business areas; 2) expanding the offering in current business areas; 3) changing the target market, re-defining the company's existing knowledge in order to encounter new business areas; and 4) 'establishing bridgeheads', which means creating entirely new product/service and business areas (see Figure 1). The basic question in business management is that of balancing with continuity, and whether the basic business activities can generate sufficient financial independency in order to make expansion to new territory profitable.



(Figure 1: adapted from Huolman et al. 1999)

Based on the interviews, when examined through this framework with regard to individual innovations and innovation processes, innovation activity is focused on the three first mentioned areas. **There were very few clear descriptions in the interviews of establishing bridgeheads or development of new products/services in order to move to entirely new business areas.** This reflects a challenging situation for companies, a situation that Levinthal and March (1993) call the ‘success trap’ and Christensen (1997) the ‘innovator’s dilemma’. These terms refer to an extremely common tendency in business where companies end up overemphasizing the development of their existing operations at the expense of creating completely new business – regardless of the fact that this kind of imbalance has been shown to be one central factor in decreasing competitiveness in the long term (e.g. Levinthal & March 1993).

Partly related to this, some responses described that some industries are naturally conservative and slow moving, so that the innovation model emphasizing the first three processes is a natural choice regarding the pace of change in the operating environment. In addition to these, the interviews yielded **only a few comments about radical, disruptive innovations and activity aimed at them. This kind of activity was described to happen especially outside business strategy, ‘under the radar’, or in terms that business strategy was seen to restrict this kind of innovation activity.** Individual comments also mentioned that radical innovations are tricky with respect to the functioning of a company because they do not fit with any existing strategy or business unit. Based on these descriptions, we can summarize that business strategies and organization according to business units/lines may become a limiting factor for innovation activity.

5. ORGANIZATION AND IMPLEMENTATION OF AN INNOVATION PROCESS

The innovation processes in the companies varied from the traditional stage-gate model to a customer-oriented, iterative innovation process. Among the respondents in the study, the most common (over 70% of the responses) organization and implementation model of the innovation process was by far the commonly known stage-gate model. In connection with the stage-gate model, the companies were mostly (over 50 %) characterized as divided into divisions, business units or business lines. If a company had a separate R&D unit, it was seen to generate innovations to business units or business lines. If a company did not have a separate R&D unit, innovation activity was described to be organized along business units or business lines. Gate evaluation was organized so that organizational management was mentioned as conducting gate evaluation, or the steering group evaluated the project portfolio of product development, or innovation activity was subordinate to expert groups gathered from business units or lines, e.g. subjected to evaluations by cross-functional teams.

Individual comments brought up development paths where a company had evolved from R&D activities being organized along business units or lines towards a separately organized R&D unit, as well as vice versa, from a separate R&D unit towards innovation activity being organized along business units/lines. A separate R&D unit was justified with views that innovation activity organized into business units or lines creates silos and short-sighted sub-optimizing. On the other hand, innovation activity organized into business units or lines was justified with views that a separate R&D unit would create innovations that are too separate or generic. **In sum, it can be said that descriptions based on the stage-gate model created a picture of business units or lines being strongly dominant over R&D units and innovation activity.**

As a contrast to the stage-gate model, the interviews also included descriptions of a way of organizing the innovation process iteratively and by involving clients early on. These kinds of descriptions appeared only occasionally compared to the previously mentioned descriptions (less than 30% of the responses). This model is significant in the sense that several interview responses emphasized a need to move more towards this kind of innovation activity.

When considering the iterative way of organizing the innovation process and involving the client in an early stage, this was seen as typical to have collaboration with the client at a very early stage, based on innovation ideas. In broad terms, the organizing of this innovation process proceeds in a reverse

order compared to the stage-gate model. The stage-gate model was seen to take innovations from ideas to the concepting phase and on to the business case and plan, which are then allocated to a specific business unit or line, and from there to the evaluation of possible client or profit potential.

In an iterative model with client collaboration, however, the process moves very quickly after the ideation stage to discussing about the joint development process of the innovation with the client. In this way, the client is committed to the innovating phase at an early stage, and therefore the client also becomes committed to the new product and service that is being created. According to the interview responses, the conceptualization phase therefore happens after the client has made his or her choice and in an iterative manner together with the client during the process. According to the descriptions, the innovation process in this model cannot be taken through business units or lines, because in the iterative model the conceptualization phase, business cases and business plans required by these units are formed only in a later stage. As a consequence, the innovations in the iterative model, which takes the client on board early on, might not pass the gate evaluations.

Several interviews discussed open innovation and its possibilities, and these were seen as important (in over 30 % of the responses). Even so, open innovation forms, such as open sourcing, crowdsourcing and crowdfunding, were mostly described as future opportunities and a possible direction where companies would be going. In most interviews, innovation in networks was seen to happen mostly with the most important subcontractors and clients. In a few comments, regardless of the industry, it was mentioned that in the future the innovation process should be significantly more open and transparent to subcontractors, and evolve towards better understanding the client. Some interviewees noted that involving clients more closely in development activities is more essential than crowdsourcing, for instance. Utilization of social media was also only seen as a possible future activity. In some interviews, it turned out that companies follow the most common social media channels or communicate through them, but these channels were not used in innovation activities in an organized manner.

In relation to open innovation, a few of the interviews gave a picture that companies involved in digital operations appear to be more advanced than other companies in the creation of open data and open interfaces. Based on a couple of responses, open innovation also seems to be related to certain industries, which have fast cycles, such as the communications and media industry. These industries were characterized by direct contact with consumers, the industry undergoing a critical period (digitalization), and fast-cycle product or service development. Open innovation is seen to enable especially rapid experiments, demos and mock-ups and to quicken innovation activities with the help of broader partnering and often free and already available platforms. Based on some interviews, this enables significantly more

extensive innovation processes than that which the organization's own know-how and capacity would enable. It also makes it possible for completely new business models and organizational forms to be created. Nevertheless, there were also views in the interviews that even companies involved in digital operations do not have appropriate tools and processes to analyze the vast amounts of data available through social media.

There were also views among the interviews about **the challenges of the stage-gate innovation model and process**. According to these views, the challenge in this model is firstly the gate evaluations, which are often carried out by business unit or business line representatives. Therefore, the innovations may be subjected to internal interest games in the company. Moreover, the persons nominated to gate evaluation groups may not be industry experts, or they may not be motivated enough to work in groups like these for some other reason. In addition, there is often a need at a very early stage to make evaluations about the concept, business potential and business plan of the innovation for the evaluation groups. The model was seen as bureaucratic and overly managerial, and it was also seen to subject the idea to the power abuse of business units or lines and to prevent quick experiments and experimental efforts in the markets. Here the dominance of business units or lines emerged again.

In some individual interviews, it was mentioned that **it is possible to make rapid new experiments with radical innovations outside the existing business strategy with the help of internal entrepreneurship or intrapreneurship**, remaining 'under the radar' and 'hidden' from the rest of the organization. In this connection, innovating taking place through internal entrepreneurship was also described with great passion and visionary ideas. In these descriptions of internal entrepreneurship, new forms of funding (e.g. crowdfunding, internal kick-starter programs), utilization of open innovations and crowdsourcing, and constructing new organizational forms were highlighted. These responses also described the organization's business strategy as a factor that restricts innovation activities. Therefore interviewees **emphasized a view that radical innovations can only be developed outside existing strategies**, or that the strategy restricts which ideas and innovations are taken forward.

As a summary, it can be said that in the creation of innovations – developing and filtering ideas and taking them forward and commercializing them – the most important resource are creative individuals. It is important that there are enthusiastic individual persons in organizations who have the desire and will to promote the creation of new things. Because client contacts were often seen as one important source of innovation, it is important for the people involved in development work to be in touch with real life, and they need to have time for development work and for working on initial ideas and prioritizing them. Innovation can be enhanced by investing in a positive atmosphere and in an

environment that is open to innovation. In the creation of productive innovation, the significance of the atmosphere as well as the management and guidance of innovation were seen to be equally important factors as the formal innovation process. On the other hand, excessive processing of innovation, developing the process into a too complex system, was described as a challenge because it wastes energy on maintaining the structure for the activity.

6. BRINGING TO MARKETS AND MARKET EXPANSION

The interview responses did not express many viewpoints about bringing innovations to markets and the execution of market expansion. The few comments related to these processes noted that bringing innovations to markets and expanding the market are mainly a problem or a challenge to companies. On the other hand, the interviews provided an impression that the companies participating in the research often proceeded with the innovation in the frontline, looking for potential clients and markets. This could be said to represent the phenomenon of ‘a solution looking for a problem’. The difficulties related to this phenomenon were described in some interviews as a balancing challenge in innovation activities where the company has to decide whether it will first create a ready product and find a market for it, or launch development and manufacturing only after the idea has been sold to a client and markets.

Regarding the bringing of innovations to markets, the interviews also brought up descriptions about process or operating model innovations that would enable innovating new products and/or services. However, these new products or services are not promoted or taken forward because they are not part of the company’s current activities and strategy – again the strategy was seen as a limiting factor for innovation activity. Comments such as these sometimes described that it would be possible to promote innovations outside the main business if a suitable partner was found. The challenge in these situations is value chain management and IPR questions, and in particular how to define the company’s share of the profit and income formation in these cases.

In relation to market expansions, in some interviews **the respondents described the company’s core operations as being capable of producing large amounts of ‘big data’ related to consumer behaviour and global logistic streams.** This means that a company’s products or services produce large quantities of information about the behaviour of consumer groups related to e.g. purchase quantities, targets of purchases, purchasing frequency, purchasing preferences, and lifestyles. Similarly companies delivering industrial products and services saw that the

'industrial internet/internet of things' already produces vast quantities of information, or will do so in the future, about the global logistic streams mentioned above. Questions related to these issues were separately asked in the interviews to gain views on different possibilities to build completely new business based on this kind of big data, in other words, develop the analyzing processes of this data and move to completely new business functions. At this point, the interviewees were also asked whether future competitors would differ from the current ones regarding their industries and types. In their responses, **the interviewees did not really describe opportunities to make radical business innovations in the future or leaps to new business areas with the help of analyzing 'big data'**. Therefore, the competitors were also seen to be similar and representative of the company's current industry in the future as well.

7. THE FINNISH INNOVATION SYSTEM AND INNOVATION POLICY

It emerged from the majority of the interview responses (over 80 %) that it was natural for the companies to use a broad innovation network when collecting solutions that bring additional value to the client. The innovation network included the company's contacts with universities, research institutes and authorities. Because the functioning of a significant number of the actors in the innovation network is based to a large extent on public funding, the management of the innovation network is part of the company's institutional management where management activity is targeted to public administration and societal actors.

Based on the interviews (over 50 % of the responses), one way to understand the structure of an innovation network (or ecosystem) is to see the state and the public sector as one entity where society produces the stable infrastructure necessary for business activity and creates conditions for societal welfare to which companies contribute. Companies generate tax revenue, create jobs and participate in the funding and maintenance of the administrative system. Companies also offer their own knowledge and know-how to help decision-making in the societal sector. For society, it is important that it has value-creating companies, tax revenue and know-how capital. Know-how capital is needed for competing in market competition and for creating new business. Competence capital is created by being at the frontline of knowledge and development activities, and this competence capital is built further with the research conducted in universities and research institutions as well as with the development and innovation activities in companies. The synergy between them is an important resource for both society and companies. When know-how accumulated in companies and the search for commercialization opportunities and creation of new business, which are

essential components of business and entrepreneurship, are joined into the most useful and applicable form of new knowledge, this creates national competitive advantage. In this sense, public support for product development or research in companies is one part of maintaining the national innovation ecosystem and infrastructure. When resources aimed to support innovation development in companies is partly channelled to universities and research institutions, it builds up-to-date know-how in research centres. This ensures that 1) the know-how stays in Finland 2) and that the quality of the know-how staying in Finland is high. On the other hand, the interviews also brought up views that when the company size grows, the company's know-how portfolio also grows. Broader know-how in the modern networked and globalized world is very difficult to create when working from only one geographical location.

7.1. Collaboration with universities in innovation activities

Overall, it can be said that collaboration with domestic universities was common among the participating companies (c. 75 % of the responses). There were also references to international collaboration with universities, but much more infrequently. Based on the responses, however, we cannot draw conclusions about differences in how much collaboration there is with domestic and foreign universities. It is possible that even though there were fewer mentions of foreign collaboration, it may have significantly more value than domestic university collaboration.

Related to collaboration with universities, the interviewees emphasized views that **the research done with universities is primarily applied research**. In some industries, there are some world-class know-how concentrations in their own area that have become centralized in domestic universities through a long historical development. From the point of view of companies, the core motive in these cases is to gain access to that know-how. The interviewees also expressed views that universities are at their best when they create new ideas and insights and experiment with them, whereas the primary task of the company is seen to be focusing on efficiency and streamlining activities. Universities were seen as generators of new ideas, in addition to representing the pinnacle of know-how in their specialization fields.

The interviewees also commented that **universities should improve their initiative towards companies** in launching innovation projects and collaboration. In some industries **in pioneering countries, universities and the industry work together more intensively**, so that universities can solve, for example, product problems at a theoretical level, and serve the industry that way. The collaboration between universities and the business world should be so close that it is possible to ensure that the work-force graduating from schools has relevant specialized know-how. A skilled workforce makes it possible for companies to keep innovation and product development activities in Finland. In this situation, expert know-how is

important – the workforce should have considerable knowledge about a specific, narrow field, and this know-how should be top quality.

It was mentioned in several responses that **research projects and the goals of research studies are often planned too much from the point of view of the research community**, blurring their connection and relevance to every-day business. Research plans are devised too much from the point of view of universities. Regarding collaboration with companies, some responses were also **very critical** towards the recently strengthened tendency in domestic universities to focus on **producing articles for academic top publications and paying excessive attention to the number of citations and publications**. Universities should be ‘bipolar’, with one half focusing on academic basic research and the other half working together with companies on projects developing business models, revenue models and logistical models.

Some responses also stated that the education system should be developed towards more internationality in general. Especially since knowledge from the rest of the world is needed in Finland, **the language skills and cultural knowledge of Finns should be developed to a higher level**.

The responses **also saw a need to develop the business orientation of domestic research**. According to individual views, Finland is far behind the United States in this regard. The respondents saw that the chasm between academic basic research and applied research as well as bringing innovations to markets is too wide. The respondents called for the sharpening of university activities by increasing entrepreneurship and innovativeness. Some interviewees thought that Finnish universities should form teams that take research to markets.

7.2. Experiences about Tekes’ activity

Tekes was seen as a central catalyst for innovations. The interviewees mentioned that it is possible to do more influential work with support from Tekes. Tekes is useful for companies in that companies can better and more extensively utilize their external know-how network, such as consultants and small to medium-sized companies, to conduct some development projects. This method provides companies with more know-how and know-how capital. The Tekes funding model drives companies to network and innovate together, which was seen as a good thing.

It also emerged from several responses that **with funding from Tekes, companies are able to fund more risky projects which would bring more lasting competitive advantage if successful**. In other words, Tekes funding was described as useful in decreasing funding risks in innovation activity. These kinds of projects, which ‘require courage’ and have a

long-term focus, would not otherwise be carried out, and the funding guarantees for its part that companies keep up with long-term development and that they remain competitive. As an example, some responses pointed out that the way Tekes supports new companies in finding new things was first-class quality.

Tekes has also made it possible that parties conducting research receive ample funding for their research without additional binding criteria. Tekes projects were seen to increase synergy between different companies. Networking increases information exchange and thereby the diffusion of knowledge to businesses. In the majority of the responses, it was said that Tekes projects allow things to be done faster and to have closer collaboration between Finnish companies than in EU projects. Know-how was not seen as a problem either – the respondents felt that the know-how gained from Tekes projects was as good as that gained from EU projects.

For some interviewees (c. 30 %), collaboration with Tekes also highlighted development targets. **Such development targets were e.g. decreasing bureaucracy and developing a holistic approach.** Tekes' goals were seen as abstract to some extent: with some projects, it can be difficult to see the justifications for funding. Some comments also brought up the issue that sometimes Tekes' rules have made it more difficult to bring the client closer to the research. This should be improved so that the client could be involved in innovation activity from the beginning of a research project, as described earlier. Some responses also noted that in some Tekes projects the different parties may 'go their own ways' after a joint project launch. As a result, the collaboration during the project cannot be developed further and the results do not meet the expectations regarding their relevance.

To some extent, there was also a need to develop Tekes' activities separately in specific industries. If one's own line of business is narrow, Tekes' requirement of having a domestic subcontracting network can make it more difficult to participate in the program. On the other hand, some responses mentioned that Tekes' choices for fields of business to be supported may depend on politics and the national economy.

Generally speaking, **commercial concepting was mentioned as one development target for Tekes.** The interviewees also wanted to direct innovation funding to the export industry and for supporting commercialization and growth. This does not necessarily mean subvention, which is prohibited within the EU, but rather the intellectual know-how called for by companies: networks, best practices, exchange of experiences and consultation support.

7.3. Experiences of activities with VTT Technical Research Centre of Finland

Collaboration with VTT was characterized as being very important in over 50 % of the responses, and VTT was seen as a significant partner for companies. VTT was seen as a party that has brought Finnish actors together. It was characterized as an initiator in technology projects, and VTT was seen to possess good basic research know-how and systematic skills in studying and advancing study topics. VTT has created technological breakthroughs in particular.

In some responses, **collaboration with VTT was described as significant especially at the beginning of product development projects.** It is easy to make demos and prototypes of new ideas with VTT. Ideation sessions in order to come up with new projects were also seen as important.

On the other hand, there were some comments that **it would be beneficial for VTT to bridge their distance to universities.** VTT was partly seen to be in the position of a competitor with respect to some companies, and partly as a competitor to universities. Regarding the organization of VTT, decreasing silo mentality was also seen as one development target.

A few responses also noted that **there is a need to develop more genuine collaboration and team spirit with VTT.** The planning of some research projects was seen to have been too much in VTT's hands, which can make it more difficult to connect the research to every-day business activity.

7.4. Experiences of EU projects

As a whole, the interview data gave the impression that **companies do not participate often in EU projects** (c. 70% of the responses). When asked for reasons for this lack of interest towards EU projects, the responses brought up the following viewpoints:

The process of looking for partnerships for EU projects should be improved. In addition, it can be challenging for a single company to participate in EU project applications because their resources may not be sufficient for EU projects. Companies should form a consortium in order to participate, but it may be difficult to find a common interest within a project. It was also noted that it is possible to do things faster between Finnish companies in a Tekes project when compared to an EU project. EU projects were seen as challenging from the point of view of coordination as well. This view was repeated in several responses. The funding is good in EU projects, but the heavy bureaucracy was seen to be a change target.

Some responses also mentioned that **a company may have had to give up on EU programs because the research goals were seen as somewhat outdated from the company's point of view.** Respondents also felt that there is a need in EU projects to listen more actively to the viewpoints of the industry when defining development targets. This would make the goals of the research and development activity more harmonious with the development goals of companies.

7.5. Innovation in Finnish society

Finland was seen to have a high level of know-how (c. 20% of the responses), which is likely to remain in the future. Finnish companies' ability to innovate was also seen as good, but there was a desire to improve it to some extent with networked operating models and funding systems. Some responses mentioned that efficiency, closeness and compactness were at a good level in Finnish collaboration networks. There were some comments where Finnish society was also seen as a good environment for piloting. The current funding system for innovations was seen to function well, although several improvement targets were identified.

A large majority of the interviewees (over 70 %) commented on societal challenges. Some interviews brought up the following views and wishes among others:

- **The pace of innovation activity in Finnish society** should be improved. A few comments brought up the need to increase the efficiency, flexibility and mobility of the workforce and the pace of innovation activity.
- In Finnish society, **failures should be allowed and learning from failures should be improved.** This cultural challenge makes it difficult to promote radical innovations, for instance. The interviewees called for a change in the cultural mind-set, allowing an entrepreneurial attitude, which includes an ability to get over the fear of failure and courage for risk-taking.
- It should be ensured that **the manufacturing industry stays in Finland** in order to keep product development and innovation activities in the country. Innovation activities need to be connected to manufacturing. Industry is also needed in order to give the youth of the country a view into the future and to maintain a high level of skills and motivation.
- The interviewees saw **overlap, rigidity and corporatism** as the challenges in Finnish society. Finland needs vanguards of the future in R&D who would get other actors involved in developing new

business and innovations. There should also be more small agile companies developing innovations.

- **Society's systemic and holistic perspective** should be developed, and regarding innovation activity this means that collaboration with universities, Tekes and VTT needs to be managed and directed with vision and strategic planning. The different sectors in society need to play together – to develop team spirit.
- **The impact on employment** receives too much focus. Because the labour code is the same in large and small companies, it creates significant obstacles to recruiting in small to medium-sized companies.
- **Start-up funding** should be developed. Furthermore, in addition to having the capital, there are not that many investors in Finland who would also possess know-how related to the industry, client, network, competitor or technology, which is important for growth of entrepreneurship and innovation activity. The piloting of products or service concepts was also seen as challenging because it is difficult to find a foundation for building a client base and references in Finland.
- The challenge for the Finnish funding model is described to be, **how to direct funding mechanisms so that they do not support international forms of network activities** where the benefits might go outside of Finland. The funding does not support the formation of international development ecosystems or projects with foreign partners. It would nevertheless be important because even if the benefits go abroad, Finnish know-how and networking and development skills would still grow.
- **Open innovation processes and the mind-set and skills related to them** should be promoted. The missing methods for creating and managing open innovation and open organization should also be developed.

8. CONCLUSIONS

8.1. The innovation processes of Finnish companies in a changing innovation environment

Based on the interviews, the central observations in the study can be summarized into concepts in the following way. In the balance between improving existing innovation activity and creating new activity in companies, companies emphasize the improving of existing activity as well as innovations that reform products or services and markets incrementally. Therefore radical innovations or “blue seas” are not often born in the innovation activity of Finnish companies. Some interviewees described that the core activity of companies produces large amounts of big data related to consumer behaviour and global logistics flows. Yet when this issue was asked about separately, the interviewees described fairly few future possibilities for making radical business innovations or leaps to new business areas by analysing big data.

In the management of the innovation process of companies, the challenges for R&D and business development can be conceptually divided into two groups where each has separate actors, individual requirements and their own logic. These challenges are represented on two different levels: the product/technology level and the company level.

Challenges to innovation activity on the level of products/technology are to increase the quantity, general efficiency and time-to-market in the development of a new product or service. Based on the interviews, the following observations can be made related to this challenge:

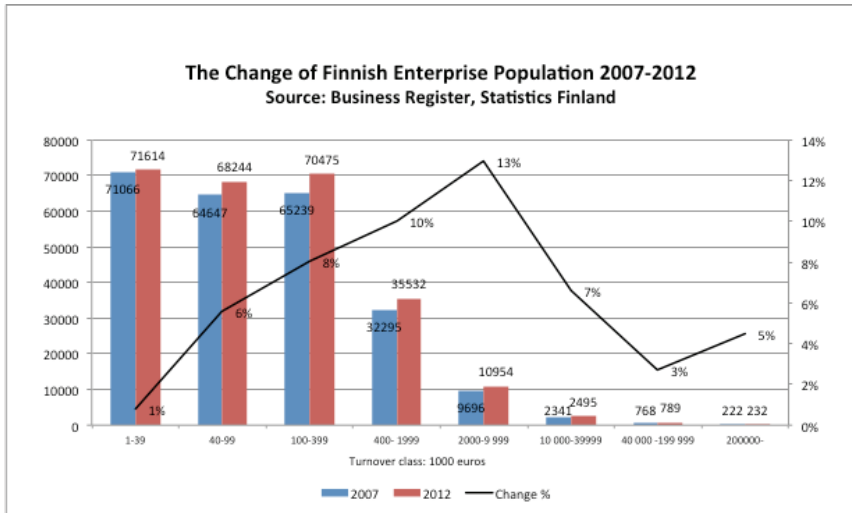
- Ownership of innovations/ideas seems to disperse among business units.
- In the stage-gate model, there is internal bureaucracy and reflections of more and less dominant positions.
- The stage-gate model seems to serve short-sighted innovation activities.
- Innovations requiring risk and courage, about which it is difficult to evaluate the anticipated revenue accurately, are often discarded when defining final development programs.

Innovation activity at the company level refers to ensuring the company’s viability and development of successful new business. Based on the interviews, the following observations can be made:

- The interviewees emphasized control and planning in innovation management. However, they saw a need for more creativity, experimenting and entrepreneurship in order to create breakthrough

innovations. As spheres of management these are very different, and this should be reflected in management education as well. Technological know-how alone is not enough.

- The focus of management is on ensuring a continuous ability to create results, which on the company level leads to development work emphasizing incremental development of existing activities. In other words, 'more of the same, but more efficiently'. This may lead to rigidity and risk aversion.
- New initiatives and actively changing the business environment were not emphasized in the interviews, even if changes in the business environment were actively monitored in the strategy process. The competition is seen to be very similar in the future.
- Business strategy is often seen as a limitation. The interviewees thought that it is possible to promote new openings and radical innovations only outside the current organizational structure and the existing strategy. Innovation-driven entrepreneurship – Innopreneurship – highlights the fact that independent thinking is needed in companies in order to create innovations. Entrepreneurship, in which independency is innate as a concept, was seen as the solution to this challenge.
- The development logic followed by companies causes an innovation gap at the level of society. Large companies (with a turnover of over 100 million €) seem to avoid innovations where the growth potential does not exceed the development efforts and their calculated payback time sufficiently in proportion to the company's size. On the other hand, new growth companies can rarely reach the size category of a turnover of over 10 million euro in near future growth predictions. When examining the change in Finnish company population, growth is relatively smaller in companies with a turnover of over 10 million euro per annum (Figure 2). Therefore, between large companies and small growth companies and start-ups there are a lot of innovation opportunities that are not utilized and that are lost from the point of view of society, as well as their growth and employment effects. We can assume that growth in the number of companies in the size category of over 10 million euro (measured by turnover) would have significant positive effects in society. This is why it is important to focus the impact of innovation-related measures on medium-sized companies.



(Figure 2: Changes in Finnish company population 2007 – 2012)

In Figure 2, the horizontal axis shows the size categories of companies (turnover: thousand euros). The left vertical axis shows the number of companies. The change from 2007 to 2012 has been calculated in percentages in the form of a line graph, and its values are on the right side vertical axis.

8.2. Research and innovation policy in a crossroads

The observations raised by this study give reason to discuss whether the current research and innovation policy instruments are up to date. Without going through each observation individually, in the following we focus on the most important observations and discuss their effects on research and innovation policy as a whole.

According to the study results, innovation processes in companies are going through changes, but a significant number of companies, regardless of expressing broad interest, have not yet managed to combine new innovation instruments (open innovation, public/private partnership, crowdsourcing, demand-based innovation, social media, etc.) into a natural part of their own innovation process. Innovation processes still reflect the old stage-gate model, which easily leads to leaving out more ambitious, novel business ideas. **When devising innovation policy, focus should be placed on education and developing learning materials that would make the natural integration of these new instruments into the innovation processes in companies easier and faster.**

Current mega trends were identified in the innovation processes of companies, but in only a few cases had companies tried to find new business areas based on the identified trends that could form a growth platform for the next-generation product or service. The majority of research and development

projects in companies are directed towards boosting existing business activities. Companies believe that the activity will continue in the current markets and with products or services similar to current ones. The competitors are believed to remain the same or similar, and companies do not see big opportunities to break into new business areas. Projects aiming at new business or to new markets were only a fraction of all innovation projects in the companies. On the other hand, considering the development of international markets, it is known that new markets and value chains are born with an increasing pace, replacing the existing activity and creating significant new growth opportunities.

According to the research data, there are few growth companies in Finland. Market prospects falling between 10 and 100 million euro were few among the research and development projects of the companies included in the study. Yet this is the critical range for growth, where international growth companies aim.

The interviewees expressed concern over how innovation activity can be conducted in Finland in a scenario where all production is transferred to foreign countries. This internationally widely discussed phenomenon requires research where the dependencies between production and innovation activity should be identified, along with how value formation can take place in a situation where all manufacturing takes place abroad.

In Finland, the instruments of innovation policy are broadly targeted towards implementing incremental projects and projects that improve existing business. **In Finland, the most important issue in reforming the research and innovation policy is to strengthen the part of the innovation system that genuinely supports the development of new and internationally competitive business.** In this regard, the interviewees expressed a need for better integration of research and new ideas and projects in order to develop new business. It is necessary to create better understanding and know-how of business models, international ecosystems and value networks and to find out how Finnish companies can acquire relative competitive advantage and control points in these new operational conditions. TEKES, Sitra, SHOKs (Strategic Centres for Science, Technology and Innovation) and industry organizations are in a key position in building these new integration forums. In addition to better integration, better risk distribution instruments and funding solutions are needed that would enable investments of 10-20 million euro in increasingly international business activities.

Based on this study, we can estimate that significantly more new ideas that lead to innovations are born in companies than what the companies actually take to follow-up development on their own. This observation raises the question of whether we should develop operating models in innovation policy that would better utilize this so-called spin-off opportunity. Based on

international experiences, technology centres and company incubators can have a significant role in this kind of activity.

The companies emphasized strongly the importance of collaboration with universities. They saw that it is possible to succeed in international markets only with the best know-how, produced in universities and created by people who have been educated in universities. Companies representing traditional industries emphasized the importance of maintaining the acquired international top level in know-how. Companies in new fields of business were concerned about whether international top-level know-how and experts exist in Finland in the first place. Discussions about university collaboration expressed a concern about how the incentive and result measurement practices in universities are increasingly geared towards emphasizing scientific merits, while collaboration with companies and problem-based research are left in a marginal role. During the next funding period of universities, changes to the current incentive system should be considered. **Good collaboration between universities and the business world has traditionally been one of the strengths of the Finnish innovation system. Its strengthening and development are the core tasks of the innovation system in the future.**

SHOK centres were generally seen as useful in companies that were involved in the current SHOKs. SHOKs have improved integration and networking in research. On the other hand, the interviewees emphasized that some SHOKs have succeeded well, while others have not really launched their activities that well. Several companies that were not involved in SHOKs saw that SHOKs are too inward-looking. In order to develop SHOKs, companies wished that they improve their openness, raise their level of internationalization, and strengthen collaboration with companies currently not involved and other SHOK centres. **The task of the innovation policy should be to renew the concept of SHOKs and plan next generation solutions.**

Overall, the innovation potential of the companies is not the best it could be. The current world economy is arguably creating more new markets and value chains than ever before, which provides an opportunity for economic growth and better employment. Finland needs stronger collaboration, greater courage in risk taking, new funding opportunities and world-class know-how in new growth industries. These actions are necessary in order to reverse the current negative economic development towards a positive growth trajectory.

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International innovation networks, open collaboration in innovation, social media and free developer communities have significantly changed the innovation processes of companies. At the same time, it has become increasingly more important for companies to manage their innovation process in a way that serves the company's business strategy efficiently and which leads to rapid product and service launches. This development is a challenge to policies promoting innovations as well as to the roles of traditional actors, such as the interaction of universities and investors with economic life.

Aalto University School of Business conducted a study on changes in companies' innovation process management during March-June of 2014. The purpose of the study is to create knowledge about companies' innovation management practices in the changed operational environment. The study also creates knowledge for developing innovation policy measures.

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