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Agile Innovation Management

A Proposal for an Express Assessment Tool

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Abstract

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Presently, innovation has become a top priority for most companies and the need to innovate is greater than ever. Despite the obvious importance of innovation, there are very few tools available for individual companies to measure and benchmark their current state of innovativeness. The purpose of this Thesis is to propose a framework for a tool that would allow an express assessment and identification of the generic status and critical bottle necks in a company's innovation management process.

This Thesis uses action research method and is completed in four consequent research cycles. First, interviews with leading innovative companies were conducted for compiling an innovation funnel model to build up a conceptual framework for the Thesis. Second, the key elements of the process were identified during the literature analysis. Third, based on these findings, a questionnaire was devised. Next, the questionnaire was validated using several independent methods, including a well-validated innovation climate survey. Finally, the questionnaire was tested with seven pilot companies, representing the Finnish technology industry.

The received test results support the validity of the questionnaire and indicate that the proposed assessment tool can be used for express identification of the key development areas in the innovation process and innovation management practices for individual companies.

Key words	Invention, innovation, innovativeness, innovation climate, innovation funnel, innovation process, innovation management.

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Innovaatioiden tärkeys yritysten kilpailukyvylle on tunnistettu ja niiden merkitys on suurempi kuin koskaan. Tästä huolimatta yrityksille on tarjolla vain harvoja menetelmiä, joiden avulla ne voisivat helposti mitata ja vertailla innovaatiokyvykkyyttään. Tämän opinnäytteen tuloksena on tarkoitus esittää malli työkalulle, jonka avulla voidaan nopeasti arvioida yrityksen innovaatiokyvykkyys ja tunnistaa innovaatioprosessin tärkeimmät kehityskohteet.

Työssä käytetään action research metodia, ja se toteutetaan neljässä vaiheessa. Ensimmäisessä vaiheessa käsitteelliiseksi malliksi valittua innovaatiosuppiloa (innovation funnel) muokataan asiantuntijahaastettelujen tulosten pohjalla. Seuraavaksi innovaatioprosessin tärkeimmät elementit tunnistetaan kirjallisuusselvityksen avulla ja tunnistettujen avaintekijöiden pohjalla muodostetaan kyselylomake. Kolmannessa vaiheessa kyselyn testaamista varten kootaan vertailutietoja pilottiyrityksistä usealla toisistaan riippumattomalla menetelmällä. Eräänä menetelmistä käytetään laajasti testattua verkkokyselyä innovaatioilmapiirin mittaukseen. Neljännessä vaiheessa kysely pilotoidaan seitsemän suomalaisen teknologiayrityksen kanssa ja tulokset testataan em. vertailutietojen avulla.

Saadut tulokset tukevat kyselyn ja piloteissa käytetyn menetelmän soveltuvuutta ja käyttökelpoisuutta yrityksen innovaatiokyvykkyyden ja innovaatioprosessin tärkeimpien kehityskohteiden nopeaan tunnistamiseen.

Avainsanat	Invention, innovation, innovativeness, innovation climate, innovation funnel, innovation process, innovation management.

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1 Introduction

Presently, innovation is a top priority for most companies and the need to innovate is greater than ever *(Andrew et al. 2010, Prahalad et al. 2003)*. One of the key drivers for the awakening interest is linked to the perceived opportunity for improving financial performance. Modern research suggests that the most innovative companies outperform their industry peers on several key financial indicators *(Jaruzelski et al. 2010).* Some results indicate that successful innovation firms are more likely to generate growth rates of 20% or more, compared with less successful ones *(Kuczmarski 2002).* There is also evidence that the companies that manage innovation well do enjoy higher revenue growth than those that are less adept managers *(Cooper et al. 2002)*. Another driver is obviously an ever increasing competition and the need for renewal, as the life of any business is finite *(Garcia-Valderrama et al. 2004).* The only means by which companies can sustain a competitive advantage is the development of innovative capabilities *(Mueller et al. 2005)*. "If you don't innovate you will not survive" *(Brown 1998: 168)*.

The purpose of this Thesis is to propose a framework for a tool that allows fast assessment and identification of the generic status and critical bottle necks in a company's innovation management process. Before further consideration of the matter, we'll first take a look at some of the reasons why this topic should be of interest to the researcher of innovation.

1.1 Business Problem

> *"To innovate forever, <…>, is not an aspiration; it is a design specification. It is not a strategy; it is a requirement. "*
>
> (*Moore 2005*)

Innovation is a fundamental driver of wealth creation *(Mueller et al. 2005)*. Quantitative research results reveal that innovation is one of the key factors of corporate value creation *(Chen et al. 2002),* and this is true not only for large enterprises; the process of innovation has been identified as an important determinant of success also in small enterprises *(Romano 1990)*. The purpose of innovation is to drive sustained growth in

revenue and profits, and its ultimate financial goal is to create an innovation premium *(Koehler et al. 2007)*. Furthermore, modern research suggests that shareholders see far higher returns when companies can successfully innovate organically *(Mueller et al. 2005)*.

Innovation and innovativeness are topical issues also in Finland. The implementation guidelines for the national innovation strategy were published December 2010, after three years work and several rounds of assessment by various government and parliament bodies (Tutkimus- ja innovaationeuvosto, Tutkimus- ja innovaatiopoliittinen linjaus 2011–2015). The academic community and leading technology companies, especially those active at global markets, have worked with various elements of innovation and innovation management already earlier, but the public discussion around the national innovation strategy finally brought this issue to light on the corporate managers' agenda. Yet, it seems that the generic understanding of innovation as a phenomenon and resource is not very consistent and even the vocabulary is mixed and confusing. Given the importance of the topic, this is regrettable. On the other hand, this provides an opportunity for consultants with the proper product and set of services to offer to make their services worth looking into.

Innovation is one of the fundamental processes in all organizations *(Rogers 2003)*, as well as a necessary ingredient for sustained success, and an integral part of the business, and as such it has to be managed *(Davila et al. 2006: xviii)*. While innovation process is one of the main processes for the company *(Apilo et al. 2007: 36)*, modern research indicates that a large majority of managers also believe that innovation should be tracked as rigorously as other business operations *(Andrew et al. 2009)*. During the past couple of decades, the focus was more on developing the new product development (NPD) practices. As these processes are now better understood, the focus has been shifting towards earlier stages in the innovation process. This is well understandable because the activities and decisions comprising the early stages are the starting points for all NPD processes, which determine the direction of any new product path. It is clear that a better understanding of these activities and decisions, comprising this starting point, could ultimately lead to a better competitive advantage *(Reid et al. 2004)*. Various research results suggest that the origin of almost half of the valuable lifetime of a product or service can be placed at the front end and the ideation stages *(Kettunen et al. 2008: 150).* Furthermore, of all the actions the firms can take to im-

prove their NPD process, those taken at the fuzzy front end give the greatest time savings at the least expense *(Reid et al. 2004)*.

Some of the key concepts, that form the logical frame for this Thesis, will be introduced in the next subsection.

1.2 Key Concepts

The term innovation is often used in a rather incoherent and misleading way. This seems to be the case also in contemporary discussion in Finland, especially the recent discussion about the national innovation strategy. The public debate about the support system distortions reveals that the expression *innovation* has taken a lift-off from its solid contextual ground. For the purpose of synchronizing the vocabulary for innovation the terms and definitions related to innovation need to be defined.

In the context of this Thesis, *idea* is defined – and intentionally completely bypassing philosophy, e.g. the Platonic epistemology – as any insight, clue, or new thought that can have practical use for creating a new process, product, or service. In this Thesis ideas are perceived as the material that feed the funnel. Several of the leading thinkers on innovation *(e.g. Christensen 2002, Prahalad et al. 2003)* suggest that companies should actively expand their sources for ideas, look for new ways to combine ideas, and even actively let them collide. In most cases, the more is the better, especially when the process of capturing potentially valuable ones is somehow managed. This also seems to be the part where companies have most potential to improve their performance *(e.g. Reid et al. 2004)*.

Invention then adds concept to the idea. It is the outcome of discovering something new (*Kettunen et al. 2008: 33)*. In the U.S. Patent Law, invention is defined as the creation of a new, useful process, machine, or improvement that did not exist previously and that is recognized as the product of some unique intuition or genius, and is distinguished from ordinary mechanical skill or craftsmanship. This is the stage where many start-up companies begin their existence. This is also where the seed money and other early funding instruments are a vital mainstay. Unfortunately, many technology companies believe that, already at this stage, they have a product ready for the markets and enter into technology push mode. Real life soon forces them to learn the basics of innovation.

The word *innovation* comes from the Latin innovãtes; to renew. Thus innovation does not necessarily refer to introduction of something new, but relates rather to process that renews something that already exists. Innovation, therefore, is exploitation of invention; it turns the new concept into commercial success or widespread use. It can be defined as successfully commercialized invention (*Kettunen et al. 2008: 7)*. At the same time, innovation is not synonymous with technology, but rather with the realization of value from a new solution to a problem; potentially rewriting the rules of the game *(Chen et al. 2002)*. This leads to a typical way of splitting innovation into *incremental* and *radical*, where radical innovation forces the company to change its business logic, processes and structures *(e.g. Apilo et al. 2007: 23)*. Most successful companies have well defined and functioning processes for the innovation stage of the funnel. But if the process for feeding new ideas into the funnel is not well planned, as a part of the strategy process, the funnel runs idle and opportunities are missed. Based on this background and for the purpose of this paper, we hereafter attaches the <u>verb</u> *innovation* explicitly to the last stage of the funnel and the management of the overall funnel will be referred as *innovation process management* or *managing innovativeness*.

Innovation process is one of the key processes, and as such it has to be managed *(Davila et al. 2006: xviii)*. It is an iterative process initiated by the perception of a new market and/or new service opportunity (for a technology-based invention), which leads to development, production, and marketing tasks striving for the commercial success of the invention *(Garcia et al. 2002)*. The purpose of innovation is, therefore, to create business value. The method of innovation is to develop ideas, refine them into a useful form, and bring them to fruition the market, where they will hopefully achieve profitable sales, or in the operation of the business, where they will achieve increased effectiveness *(Morris 2008)*. Innovations are typically created in an environment where different people and complementary knowledge cultures interact with each other *(Kettunen et al. 2008: 8)*, but it has to be noticed that highly innovative product does not automatically imply highly innovative firms *(Garcia et al. 2002)*. The process is also defined as the successful generation, development and implementation of new and novel ideas, which introduce new products, processes and/or strategies to a company, or enhance current products, processes and/or strategies leading to commercial success, and possible market leadership, and creating value for stakeholders, driving economic growth and improving standards of living *(Essmann et al. 2009)*.

Innovation aptitude is defined, for the purposes of this Thesis, as the innate or developed ability of the organization to acquire and maintain the knowledge and skills that are required for managing a successful innovation process.

Innovation funnel is a concept that illustrates how innovation strategy, innovation resources, innovation process, innovation environment, and innovation results interact with each other. It is a practical way for conceptual modeling of innovation and innovation management. When Benkenstein introduced the innovation funnel model, he described a process that started from idea generation and continued through conception and testing to implementation [Figure 1.].

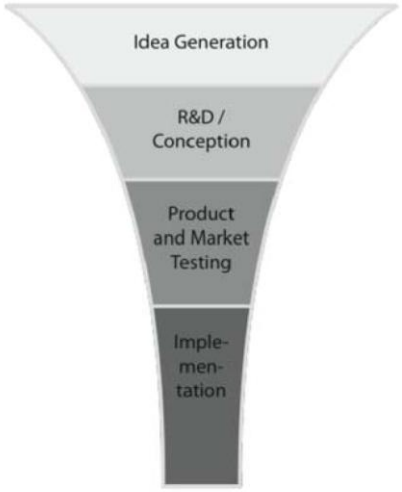


Figure 1. Innovation funnel model (Benkenstein 1998). [Reproduced from a presentation at Design Korea 2009 International Conference, December 2009, Incheon – Claudia Acklin, Design-Driven Innovation Process Model].

Figure 1 illustrates the original innovation funnel model that Benkenstein presented in the Handbuch Dienstleistungsmanagement manual in 1998. The funnel model itself has been criticized and various alternative concepts have been introduced during the past several years; for example Open Innovation (*e.g. Chesbrough 2003*), and user innovation (*e.g. von Hippel 2011*). It is also clear that, in a real life organization, applying the closed funnel model, as is, will most probably not lead to optimal results. Nevertheless, the funnel model can be considered to be a practical conceptual reference and a framework for synchronizing the vocabulary, especially when reinforced with elements from other models.

This funnel, often enhanced with some elements from the stage gate model introduced by Cooper and Kleinscmidt (1990), is the frame for the innovation management process at many companies. Now, when talking about innovation, people often refer to the funnel as a whole, or sometimes only to the early idea generation part, or mainly to the implementation part of it. When introducing innovation processes, companies often refer to their well structured R&D or engineering processes, which typically start (at best) from the conception and most often at the implementation stage. One practical way of trying to capture the complete picture is to split the funnel into three conceptual stages: ideation, invention, and innovation. These three stages are illustrated in Figure 2.

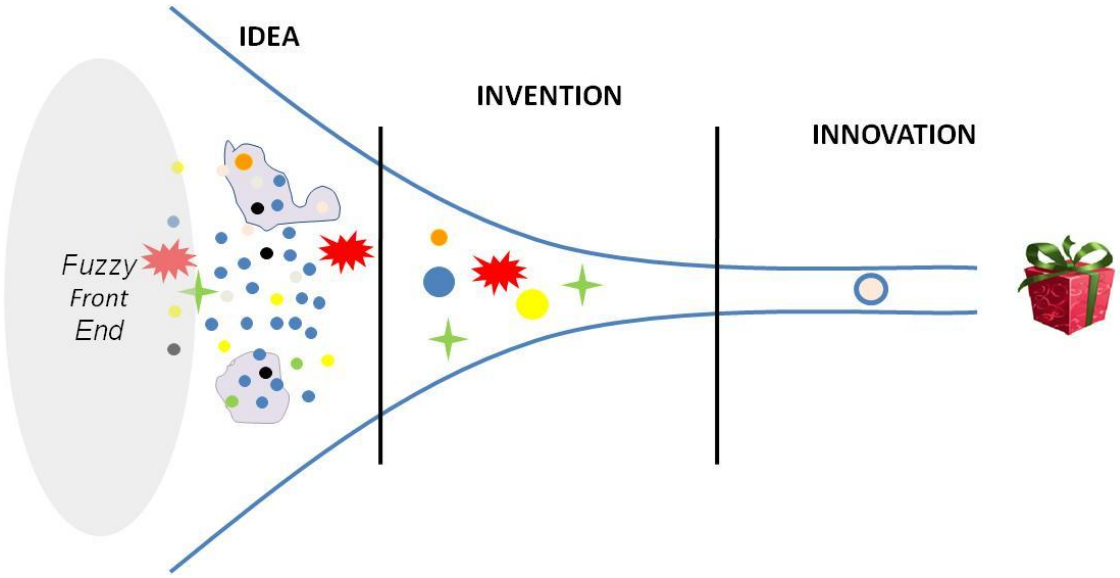


Figure 2. Innovation Funnel with three phases.

Figure 2 illustrates the traditional Innovation Funnel model with the three conceptual stages. Ideas are the material that feed the funnel. Invention then adds conception to the idea. Innovation is exploitation of invention and it turns the new concept into commercial success or widespread use. The funnel model can be used as a practical conceptual reference and a framework for synchronizing the vocabulary and for linking all innovation tools, practices, procedures, and platforms together into a meaningful and manageable process.

The fuzzy front end refers to the activities that typically take place before New Product Development; and the *idea* generation, enrichment, and concept development constitute the 'core' of it *(Kettunen et al. 2008: 90)*. The fuzzy front end, the time and activity prior to organization's first screen of a new product idea, is - especially for firms

involved with discontinuous new product innovation - the root of success, as well as the territory leading up to organizational-level absorption of the innovation process *(Reid et al. 2004: 171)*.

Together, all the above elements are referred to as *organizational innovativeness*; that is, the capability and readiness to combine technology and market needs in new ways *(Apilo et.alt 2007: 228)*. Organizational innovativeness is sometimes also referred to as the propensity for a firm to innovate or develop new products (or adopt innovation), and a measure of discontinuity in the status quo in marketing factors and/or technology factors *(Garcia et al. 2002)*.

For the purpose of this Thesis, the innovativeness of a company is hereafter defined as *the proven capability to systematically collect ideas, inventions, and other input from a broad range of versatile channels, and to exploit this information, together with the company internal/external competencies, in order to find a new solution to a problem, based on which, to bring up commercially viable new products and/or services, or other valuable gains with measurable impact, in a timely manner.*

After defining the key concepts, we will take a brief look at the case company working in this area.

1.3 Case Company Background

This Thesis was commissioned by a case company that is promoting innovativeness as an important organizational asset. Gearshift Group Oy (*Gearshift Group*) is an independent management consultancy company, founded in 2002. The case company focuses on consulting high technology companies as for their business strategies, innovation management, business development, internationalization, and mergers and acquisitions. Gearshift Group has served over four hundred companies, from young startups to publically listed companies, and it has accumulated an extensive bank of repository of the secondary market and industry information. The company, owned by its personnel, employs 14 consultants. The consultants at Gearshift Group have proven hands-on experience in the field of go-to-market strategies, operative planning, building strategies and business plans, as well as innovation management. All senior consultants have top management expertise in high technology companies. Managing the corporate innovation funnel is one of the company's core competencies.

During the past couple of years, the part of those projects that are directly linked to innovation and innovation management process has been increasing steadily. The company, in cooperation with a group of like-minded consulting companies, is also supporting the IMO-program (*Innovaatiojohtamisen koulutusohjelma*), with the primary aim to help grow competent innovation management officers into Finnish businesses. These activities, and lessons from various pilot projects, revealed a need for a tool that can be offered to companies for the fast assessment of the status of their innovation process, and for identifying the most critical bottle necks as the basis for further development projects. The company already decided to use the innovation funnel model as its conceptual framework and compiled other key concepts, tools, and its expertise into focused service packages. This assessment tool is one of the final missing pieces to build a comprehensive innovation management services offering.

The main business objective for this tool is to help the company to run fast prescreening of the customer, help identify its most urgent development areas, and to provide the basis on which the best approach for the next steps can be suggested. Besides the direct customer interface, a potential for broader public interest for collecting and compiling more data into a database has been identified. The collected information would then, for its part, help better understand the generic status with these topics in Finland. With this view of the landscape in sight, we now move on and take a closer look at the research objective and the scope of this Thesis.

1.4 Research Objective and Scope

The main purpose of this Thesis is to compile and pretest, in a form of a questionnaire, a set of topics and items that have been identified as the key elements for a successful innovation process and its management. As will be discussed later in Section 4, quantitative metrics seems to have little to no generic relevance when it comes to innovation. Furthermore, the practical value of the qualitative metrics that are often already intuitively linked to this topic depend in each specific case on the company internal and external circumstances. This process and key elements are not completely random, and several common nominators for a successful innovation process can be identified. Although any of the identified items, if taken alone, do not allow to predict success, together they do provide components for the platforms that help create competencies for safer navigation in the fast changing business environment.

The research question for this Thesis is thus:

How to devise an assessment tool for a quick diagnosis of a company's innovation aptitude?

In its scope, this Thesis is limited to a practical attempt to introduce a tool with which the innovativeness of a company can be briefly reviewed.

The first section of this Thesis provides some background for the project and introduces key concepts and the research objective. The second section introduces the research methods and the structure of the project, as well as a brief review of the reliability and validity aspects. The third section covers the definition of the initial status and the first review stages of the Thesis. The fourth section provides details of the analysis of the innovation process. The fifth section introduces the results of the literature analysis and the proposal for the innovation process assessment tool. The sixth section covers the validation and testing phases, and analysis of the results. The seventh and final section provides a brief summary and covers discussion and conclusions of the findings and final evaluation of the process.

Next section provides a more detailed picture of the research method and a closer look at the material used in this Thesis.

2 Research Method and Material

This Thesis applies qualitative research approach, although, in addition, for validation purposes some elements of quantitative research methods are also used. Action research method was chosen as a major research method for this Thesis. The next subsection provides background information about this method.

2.1 Action Research

Action research is often described as a problem-solving approach where the researcher, working together with the client aim at both solving a problem, as well as generating new knowledge. It is a reflective process of progressive and collaborative problem solving where individuals improve the way for addressing the issue. Action research involves a cyclical process of diagnosing a change situation or a problem, planning, gathering data, taking action, and then fact-finding about the results of that action in order to plan and take further action [Figure 3.] *(Coghlan and Brannick 2001)*.

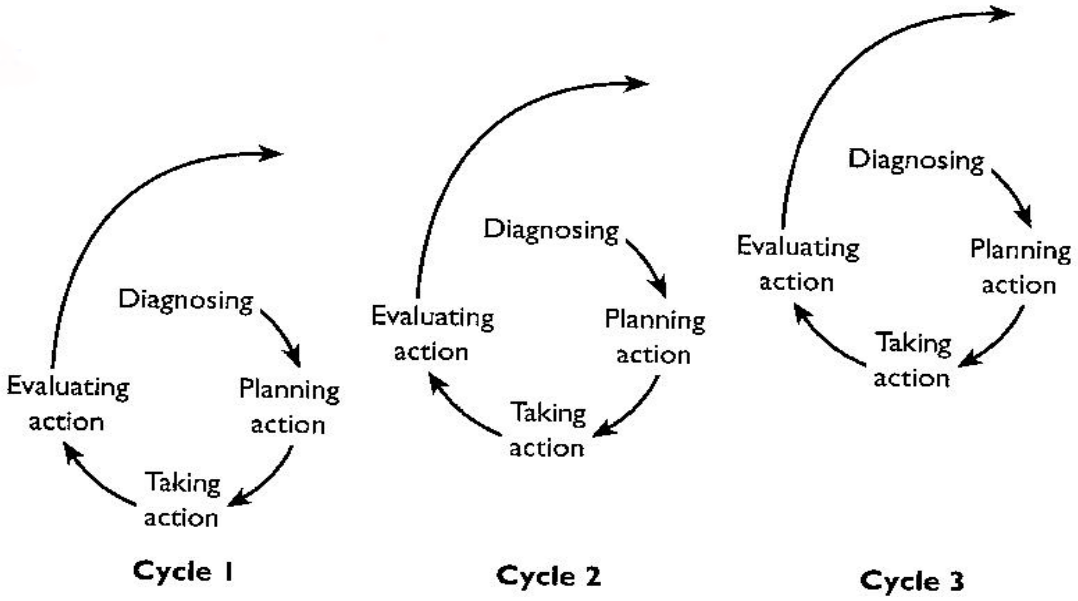


Figure 3. The spiral of action research cycles (*Coghlan and Brannick 2001*).

Figure 3 illustrates the consequent action research cycles introduced by Coghlan and Brannick. Action research approach was developed by a German social psychologist Kurt Lewin, a seminal theorist who studied group dynamics and organizational development in the USA during 1940s. Lewin's work has since been carried on by several researchers and developed later into a bewildering array of activities and methods. A

significant feature of all action research is that the primary purpose is not only to develop theory or contribute to the fund of knowledge in a field, but rather to create a direct link between theory, intellectual knowledge, and action, so that each exercise contributes directly to the wealth and success of the focus company, or community and individuals involved in them. The process that is followed in this Thesis has elements of traditional action research, clinical inquiry, and action learning approaches.

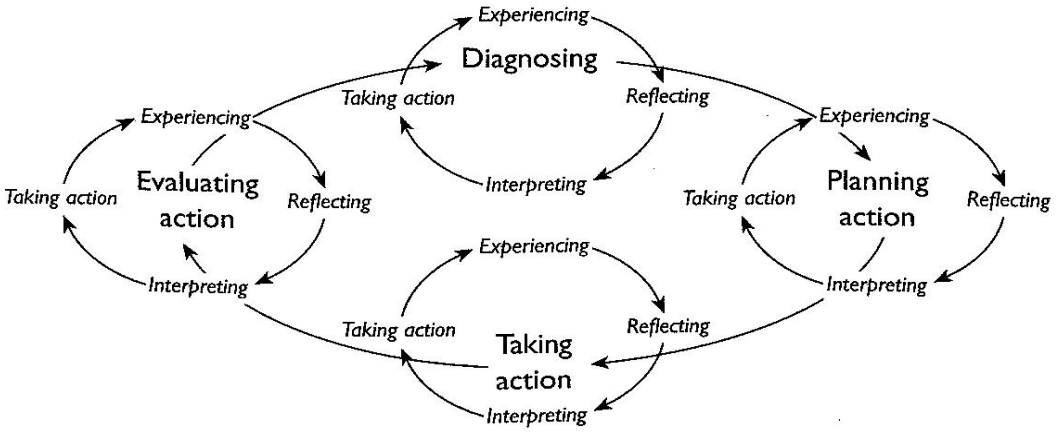


Figure 4. The experiential learning cycle in action research projects (*Coghlan and Brannick 2001*).

Figure 4 illustrates the experiential learning cycles that are an integral part of the process. Traditionally, in any action research project, there are two action research cycles operating in parallel. One is the main diagnose – plan – take action – evaluate cycle, and the second is a reflection cycle which is an action research cycle about the action research cycle. These experiential learning cycles, embedded into each of the action research cycles, are the core of the process and the true source of the value of the whole exercise *(Coghlan and Brannick 2001)*.

The traditional action research approach typically assumes that the researcher works inside the target organization, with the aim to solve a problem or improve the way how the organization addresses its issues. In this Thesis the commissioner and research focus companies are separate organizations. As the aim of the Thesis is to improve generic capabilities of fast assessing the status and identifying bottlenecks in a key organizational process, the action research is considered to be a reasonable framework

also in this case. With this conceptual background as the roadmap, we next take a look at the details of the structure of this study.

2.2 Action Research in This Study

This Thesis employs action research approach in four consequent cycles, which will be shown in this subsection. The first cycle, illustrated in Figure 5, starts from the original innovation funnel model that was used e.g. as the basis for the lectures at Innovation Managment Officer Program [Figure 9.].

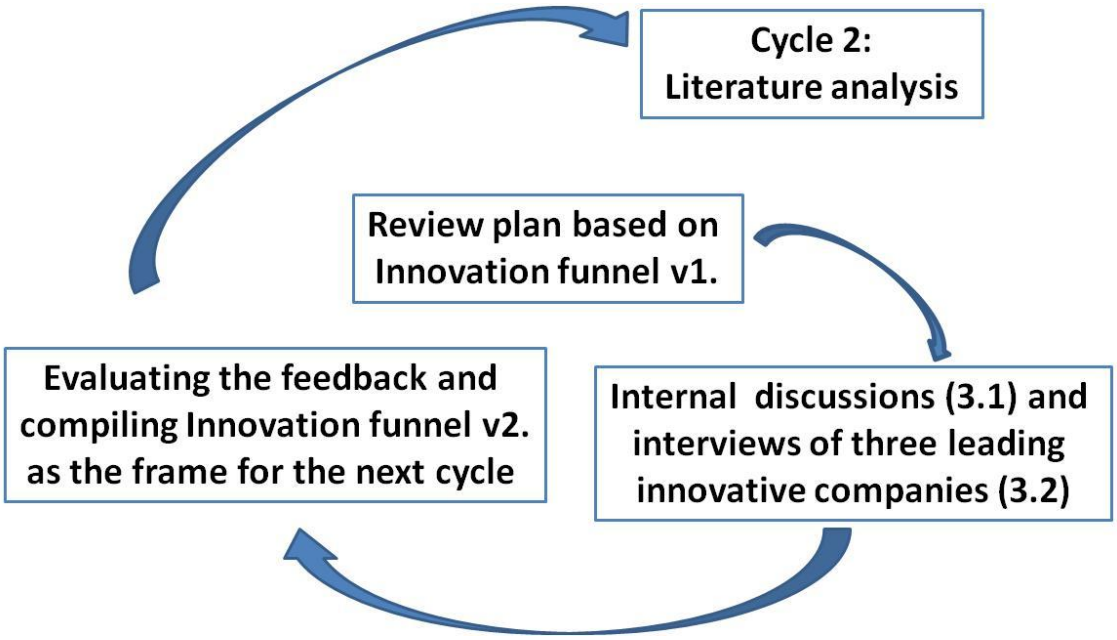


Figure 5. Action research, Cycle 1 – Reviewing and benchmarking the original funnel model.

Figure 5 illustrates the stages in the first action research cycle. Internal review process (Section 3.1) and the interviews of three leading innovative companies (Section 3.2) were conducted for reviewing and benchmarking the original innovation funnel model. The results were then used for modifying the funnel model and applying it to Cycle 2.

The second cycle consists of: a) planning and completing the literature review, b) analyzing the material for finding the key elements of a successful innovation management process, c) categorizing the findings, and d) developing the Innovation Management Process Questionnaire for piloting at the next cycle. Cycle 2 is shown in [Figure 6.].

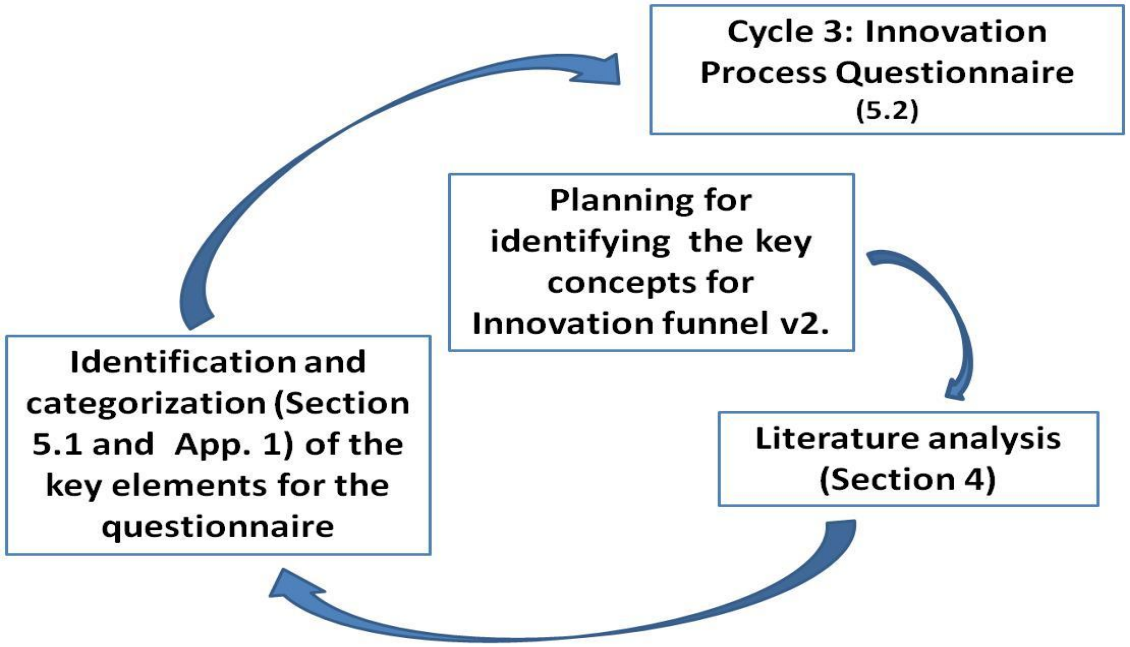


Figure 6. Action research, Cycle 2 – Literature review and developing the Questionnaire.

Figure 6 illustrates the second action research cycle. The selected innovation literature (*References*) was analyzed, and the key elements of the innovation management process were identified and categorized (Section 5.1 and Appendix 1). Based on these results, the proposal for the Innovation Process Questionnaire, shown in [Table 12.] on Appendix 1, was developed.

The third cycle covers planning and completing the validation of the Questionnaire and it is shown in Figure 7.

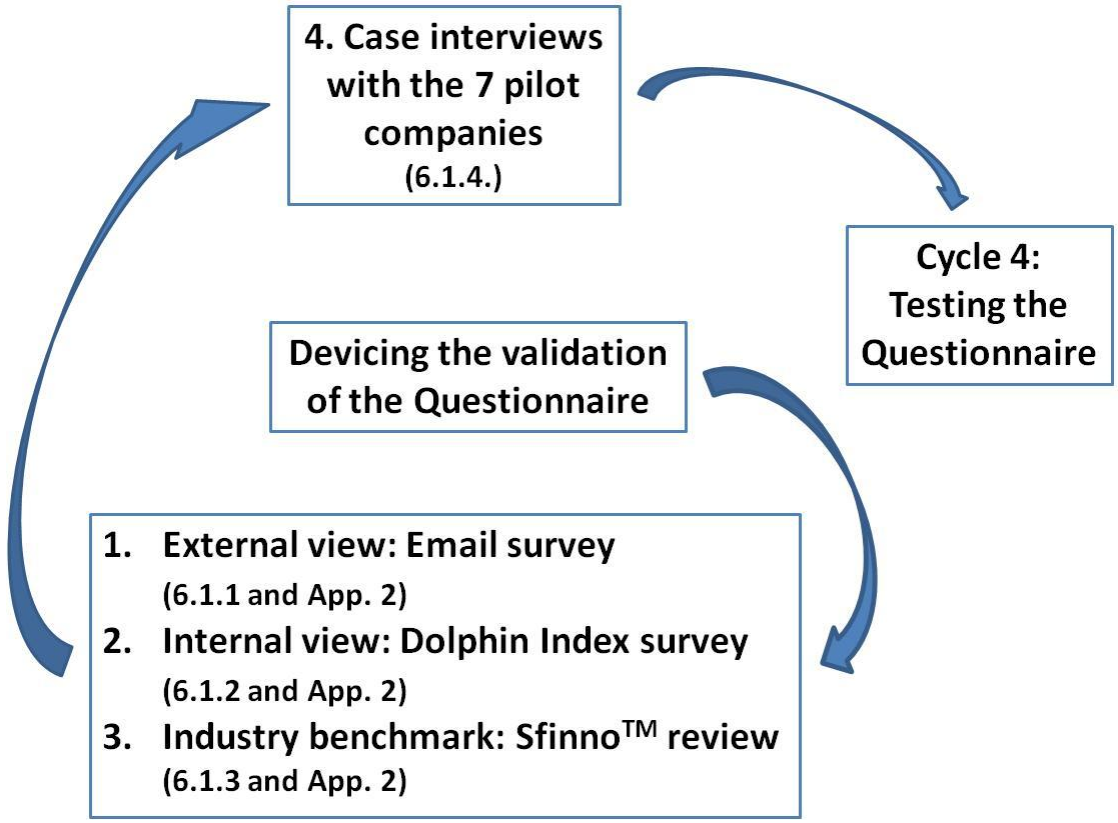


Figure 7. Action research, Cycle 3 – Piloting the Questionnaire.

Figure 7 illustrates the stages in the third action research cycle. To apply Cycle 3, seven pilot companies were selected (Section 6.1.1). This group of companies covers a broad and versatile range of organizations from different industries and of different size. Because of the sensitive nature of the research findings, the identity of the specific companies has been agreed to be kept anonymous, and companies will be referred to as Company A-F. The pilot phase consists of four partially parallel stages. The first stage represents an email survey which was conducted to formulate an external view about the innovativeness of the pilot companies. The second stage uses Dolphin Index survey to collect information about the innovation climate and internal views about the pilot companies' innovativeness. The third stage applies a separate questionnaire to compare some of the key parameters with an industry benchmark from VTT's Sfinno™ database. During the fourth stage the response for the Innovation Process Questionnaire, together with other qualitative data about the company specific circumstances and the innovation environment are finally collected. The questionnaire material was delivered to the pilot companies in advance, and the filled questionnaires were received before the interviews, or filled in during the meetings, and the response to them was discussed during the reporting and interview meetings.

The fourth cycle, shown in Figure 8, covers the testing of the Questionnaire.

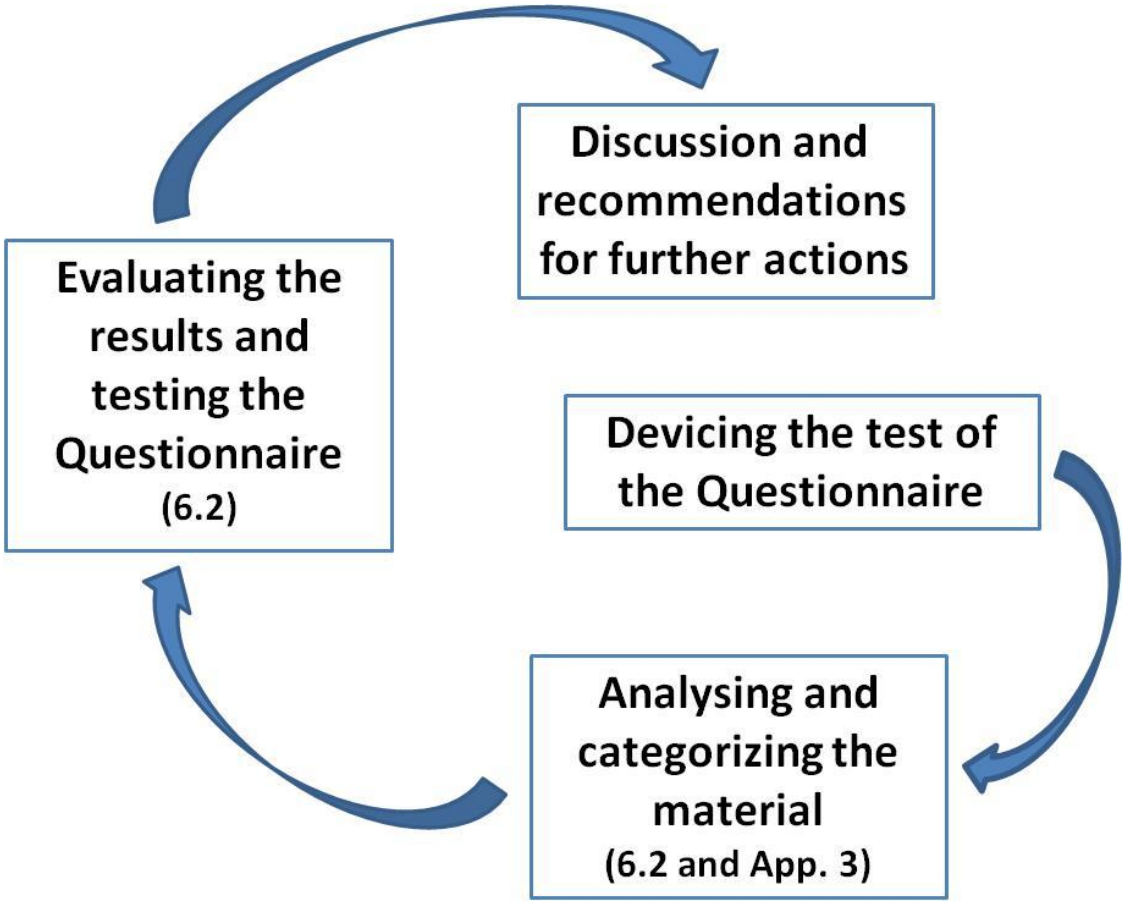


Figure 8. Action research, Cycle 4 – Analyzing the results and findings.

Figure 8 illustrates the stages in the fourth and final action research cycle. The results of the response to the Innovation Process Questionnaires, from each specific pilot company, were analyzed and categorized. These results were then compared with the findings from the validation stages and case interview in Cycle 3. The feasibility of the Questionnaire was then finally tested with these results. These final findings were then discussed and the conclusions based on the data are provided.

These four cycles of action research formed the research design utilized in this Thesis. Next subsection introduces the material that is used in this Thesis

2.3 Research Material

This section provides a summary of the research material that was used in each of the consequent action research cycles:

Cycle 1 used the results from Gearshift Group Oy internal discussions and findings from the interviews at three leading innovative companies. These materials were used for reviewing the original innovation funnel model and introducing a modified version of the model. The material is presented and discussed in more detail in Section 3.

Cycle 2 used selected innovation literature analysis for compiling a list of the key elements of a successful innovation process. The selected literature is listed in the References of this Thesis. The literature review process is described in Section 4, and the spreadsheets used for the analysis are shown in [Table 9.], [Table 10.], and [Table 11.], Appendix 1.

Cycle 3 used three independent methods and case interviews for validating the Innovation Process Questionnaire. The final Questionnaire is shown in Appendix 1, [Table 12.]. The validation process is described in Section 5.1, the results of the email survey at Appendix 2 on [Table 13.], the results of Dolphin Index innovation climate survey at Appendix 2 on [Table 14 (a)], and [Table 14 (b)], and the results of the comparisons with the industry benchmark based on the material from the Sfinno™ database at Appendix 2 on [Table 15.], and [Table 16.]. The results from the interviews with the pilot companies are reported in Section 6.1.4.

Cycle 4 used the response data to the Innovation Process Questionnaire collected from the pilot companies, and it also tested the results with the material from the previous cycles. The process is described in Section 6.2. The replies to the Questionnaire are presented in Appendix 3, [Table 17.]; the intermediate moderated results are presented in [Table 18.]; and the spreadsheet presenting the identified main Themes for categorizing the results of the material can be found in [Table 19.]. The moderated innovation questionnaire results for the main Themes are presented in [Table 20.]. The company specific graphs, presenting the final review results, are embedded into the text in the paragraphs where the company specific findings are discussed, in Section 6.2.

A summary of the various methods that were used for collecting the data for this Thesis is shown in Table 1.

	Task	nr/companies	time	format and topics	nr of participants	analysis/comments
1.	**Case company internal discussions**	n/a	ongoing	pilot projects	n/a	-
2.	**Innovation expert interviews**	3	Nov-Dec, 10	Semi-structured interviews	one key process owner/company	internal review
3.	**Literature analysis**	58 items	November 10 - April 11	-	-	-
4.	**External view: E-mail survey**	3 independent reviewer groups	Jan 11	E-mail survey	20 replies	statistical analysis
5.	**Internal view: Dolphin Index**	7 pilot companies	February-March 11	Web-survey	363 invited, 175 addressable replies	Dolphin Index scoring
6.	**Industry benchmark: Sfinno™**	7 pilot companies	February - March 11	Questionnaire	5 replies	statistical analysis
7.	**Innovation Process Questionnaire**	7 pilot companies	February - March 11	Questionnaire	7 replies	testing with the material from 4.-6. & 8.
8.	**Pilot company interviews**	7 pilot companies	March 3.-17. 2011	Semi-structured interviews	1 - 3 managers/ pilot company	summaries sent for comments

Table 1. A summary of the various methods used during this Thesis.

Table 1 illustrates the various methods; namely the semi-structured interviews, e-mail and web-surveys, and literature analysis, which have been used for collecting material for this Thesis. Next subsection provides a brief look at the aspects of reliability and validity.

2.4 Reliability and Validity

Quite often, the research in physical and even more so in social sciences depends on measuring the things that are hard to see. The measures do not always reflect the construct in the way they are intended to do it, and when planning the project the quality of measures must be carefully assessed. This is usually done by assessing separately both reliability and validity dimensions. Reliability refers to the degree of which the observed scores are free from errors of measurement, and it can be evaluated by the consistency of scores. Validity refers to the appropriateness, meaningfulness, and usefulness of the specific inferences made from the measures, and it belongs not just to a measure, but depends on the fit between the measure and its label (*Dooley 1995: 77-78*). Reliability assesses the extent to which a measure reflects, in a non-biased manner, some consistent aspects of the measured phenomena. The reliability measures include different types of correlations. Validity assesses the extent to which the measure reflects the theoretical concept it is supposed to measure, the extent to which it agrees with other known measures of the concept, and the extent to which the measure covers the requisite topics. The assessment includes e.g. construct, criterion, and content methods (*Dooley 1995: 95-96*). Due to the nature of this Thesis' subject

matter, the research strategy is build on qualitative research methods, with the selected quantitative research tools used mainly as supporting elements. Qualitative research here refers to social research based on the participants' field observations, semi-structured interviews, and non-statistical methods of analysis and reporting. By nature, the qualitative research is more concerned about the validity aspects, and the construct validity in particular, which refers to the question how well the test or measure actually reflects the target construct (*Dooley 1995: 93*).

In this Thesis the reliability and validity aspects will be considered in following ways. First, reliability with the quantitative methods is secured by using standardized and well-tested methods (6.1.2 Internal view, and 6.1.3 Industry benchmark) or by using sufficiently independent and separate reviewer groups (6.1.1 External view). Second, the construct validity of the main product of this Thesis – the Innovation Process Questionnaire – will be confirmed, given the absence of statistically sufficient amount of material that would justify factor analysis, by founding the design on broad and versatile literature references and by validating the concept using three independent validation methods and interviews (Section 6.1). Third, the issues with the content validity of the questionnaire will be addressed by reviewing the content and the results during the interviews, as well as by testing the validity of the product with the findings from the other validation methods. The design of the Thesis is based on a well-structured action research approach that enables sequential construction, validation, and testing of the final proposal of this Thesis. The construct will be build on solid basis of existing knowledge and the process, as well as the logic and data supporting decisions and conclusions documented in an appropriate manner.

With the information about the Thesis background, methods, and materials, that was provided in previous sections, we can now move on to the description of the actual research work.

3 Defining the Initial Status

The next subsections define the conceptual starting point for this Thesis. They also introduce the results from the internal review discussions and the first external interviews with the innovative companies selected for this analysis.

3.1 Internal Review Process

At Gearshift Group Oy, the funnel model was selected as the conceptual framework for the innovation management service packages. The origin of this decision is in the work done for Innovation Management Officer Training Program (*Innovaatiojohtamisen koulutusohjelma*) and, specifically, in the presentations prepared for the lectures that Gearshift Group partners delivered during spring 2009 [Figure 9.].

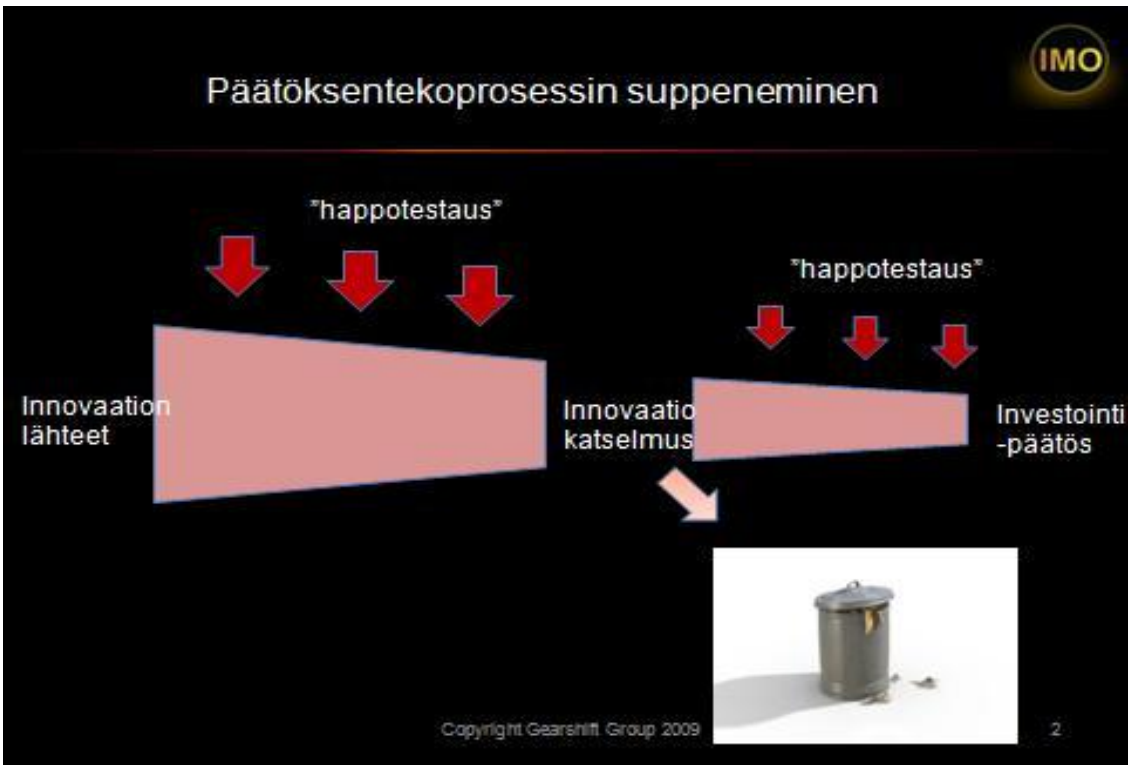


Figure 9. The original Innovation Funnel Model by Gearshift Group Oy. (A slide from the presentations given during the spring 2009 season of the IMO Program).

Figure 9 illustrates the original Innovation Funnel at Gearshift Group Oy. The model was used as the conceptual framework for illustrating the important decision and review stages in the innovation process. This frame and the key drivers and issues hindering efficient process were discussed internally at Gearshift Group Oy in several informal discussions and meetings during spring and summer 2010. This basic model

was further developed based on the results from earlier customer projects, the early pilots with the innovation management service package modules, as well as on the personal management experience that core team members have gathered from a broad and versatile range of industries.

The following topics were perceived to be important parameters of an improved funnel model. First, the amount of the ideas that are feeding the funnel is one of the key success parameters. Second, although innovation is more about people and culture, the process can still be defined. Third, as the cost of the idea increases rapidly on the way through the funnel, a managed process for fast identifying the failing ideas is another key success factor. Fourth, the exact timing of the market window cannot be controlled by any single company; therefore, the fast lane for disruptive ideas and inventions is important. Fifth, the message must be compact and over-engineering product or service functions are costly. In general, the funnel must also be permeable at key areas, so that the voice of the customer and the markets can be linked into the process fast and at the right time.

In parallel to internal discussions, the funnel model with the key performance indicators were benchmarked with three external companies that were identified as the leading innovators in their specific markets. It was done by conducting selected interviews described in the next subsection.

3.2 Selected Expert Interviews

Discussions with customers were a natural part of the development work with the overall innovation management service packages, and the funnel model was the main framework, or one of the discussion topics, in several meetings during early pilots. As an intentional and direct part of this Thesis, three meetings with companies that belong to the leading innovators in their specific markets were arranged. These companies represented a leading telecom operator; a leading ICT and hardware supplier; and a leading supplier for research and production equipment for advanced material technology. Their managers which either own the innovation process or otherwise play a focal role in the innovation management were interviewed. In these semi-structured interviews, the funnel model was used as a framework. The interviews were recorded following normal customer meeting practices, but because of the confidential nature of

the discussions, the detailed meeting minutes have been available only to the instructors of this Thesis.

As a general finding the funnel model was supported and its differences are mainly linked to the details of how the process is embedded into the company specific procedures and practices. As a result, the following common elements, or key success factors, can be identified. First, a basic prerequisite seems to be a *culture* that supports innovation, with the attitude towards failure as an important cultural parameter. One of the interviewees stated that, before even starting to develop innovation management processes, the culture must be identified and measured. Innovation *climate* was also mentioned as one of the few generic topics that should be included in the process performance metrics. Another prerequisite is a defined innovation *strategy* which is linked to the corporate strategy. Importantly, this innovation strategy must have consistent *management support* throughout all business cycles, and it should also cover alternative paths for ideas that have merits but do not fit the prevailing corporate strategy. Next, the *process* must be clearly defined and communicated. Furthermore, the process must have owners and coaches. Well-structured incentive plans are also an important element, if any longer lifetime and support for the process is desired; but careful planning is vital. Incentives are obviously linked to metrics, but these seem to be very company and time specific, and defining generally valid and useful metrics is not considered to be a relevant or even possible target. The third prerequisite seems to be the *process flexibility*. It should support high input volume and also manage the fuzzy-front-end. Some of the identified key process elements are the *breadth of the funnel* feeding end, feedback loops, and the capability to recycle ideas. Together, they are represented in Figure 10.

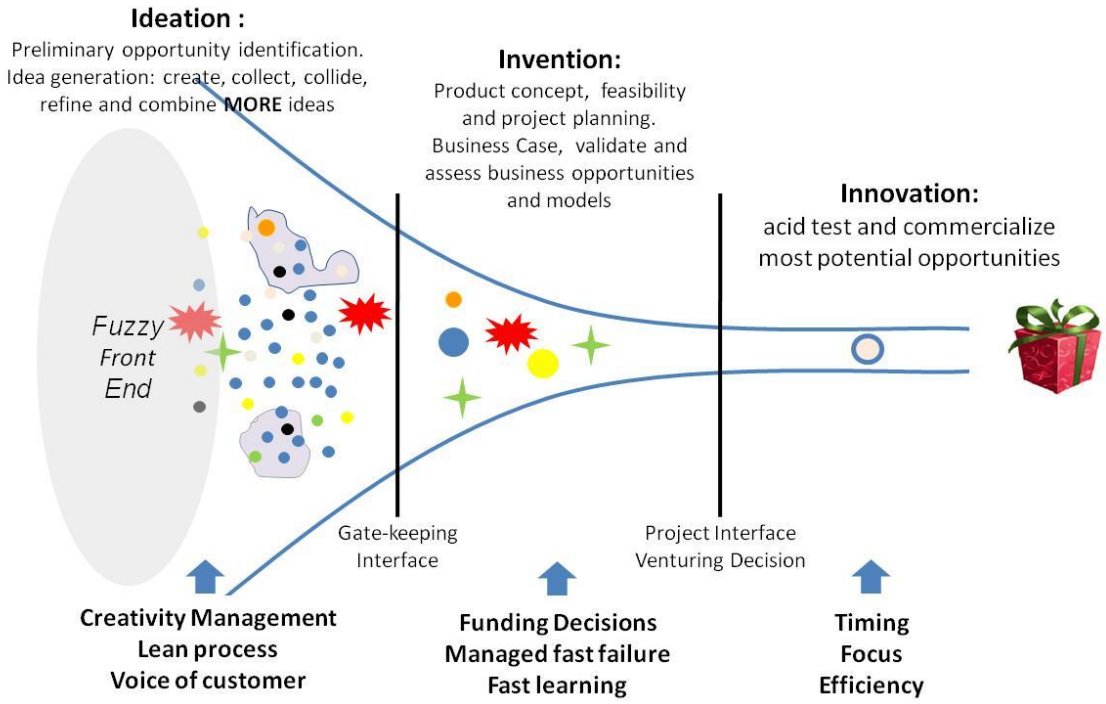


Figure 10. Modified Innovation Funnel model v2 (Gearshift Group Oy).

Figure 10 illustrates the innovation funnel model that was modified and updated as a result of the analysis of the internal and external feedback. Some of the key success factors are the amount of the ideas that are feeding the funnel (the more the better) and a managed fast failure process, i.e. a managed process for fast identifying the ideas which will fail because of the contents or wrong timing. Because the exact timing of the market window cannot be controlled by any single company fast learning and processes that enable fast reactions are important. Over-engineering product or service is costly and the funnel must be permeable at key areas so that the voice of the customer and markets can be linked into the process fast and at the right time. This model was then added with the background reference based on literature analysis, the subject of the next section.

4 Analysis of Innovation Process

The purpose of this section of the Thesis is to identify, based on the literature analysis, the key elements of a successful innovation management process, and categorize the findings using the modified innovation funnel model as the background reference. This material is then used as a basis for developing the Innovation Process questionnaire. The goal was to select reference material that provides a broad and versatile view of the innovation process, innovation process management, and innovation process metrics research, mainly from the past decade. Some of the findings were already introduced in the Introduction.

During past decades, academic research and practical work at organizations, has increased the awareness of the issues and also helped the development of robust processes and management practices for the last part of the innovation funnel, the new product development stage. However, this is not the case with the whole innovation funnel. Especially towards the feeding end the outline of the landscape often gets blurred. Towards the end of the funnel, the organization and efficient processes play a vital role but at the front end what finally matters more are the individual, and the culture and climate that either enable or hinder their aspirations. The investments required for moving ideas through the funnel increase fast the further we go and disciplined process with low friction help increase the overall efficiency. The final yield of the funnel depends on many parameters and quantitative benchmarks do not seem to have generic relevance. Anyhow, a 1/10 ratio through each of the gates in the proposed funnel model seems not to be unusual for companies that work with a broad strategic view, and consider true alternatives in their decisions. Best innovation strategy does not exist and there is no "one-size-fits-all" way to organize the process for innovation. Nevertheless, a best set-up for each company for a given time does exist, and organizations need to ensure that structures they create are appropriate given the innovation challenges they face *(Anthony et. al 2008: 226, Jaruzelski et. al 2007)*. It is essential to remember that innovativeness is an important but not sufficient metrics for predicting success; to be successful companies must also excel in the implementation. Furthermore, even well-performing foresight and idea generation are not enough; well performing and well managed innovation process is also required. One of the common nominators of winning strategies seems to be the insistence on managing the innovation process from start to finish as tightly as possible *(Jaruzelski et. al 2007, Jaruzelski*

et. al 2010). Strategic alignment and transparent communication are its other key elements, and the industry best performers often follow simple recipe: create purpose, provide process, allocate people, and learn quickly *(Kuczmarski 2000: 26-32, Govindarajan et al. 2004: 67-74)*.

The analysis suggests that the fundamental building blocks for a successful innovation process can be categorized under five leading themes. First, a *culture* and *climate* that support innovation; second, a *strategy* that facilitates the innovation process to serve a purpose; third, *resources* that enable the implementation of the plan; fourth, *networks* that link the internal and external realities; and fifth, the *process* that brings structure, measurability, and controllability into the system. Understanding and managing these conceptual assemblies in an appropriate way is vital through the whole innovation process, and this topic will be discussed more in Section 6.2. Now, we are interested in understanding the innovation process and the key elements at various steps throughout the funnel, based on the findings from the literature review.

During the literature analysis, the key elements of a successful innovation management were identified and listed in a separate spreadsheet. The innovation funnel model that was modified during the previous stages of this Thesis [Figure 10.], was used as the background reference and framework for categorizing the material. The most important ideas from the literature analysis were listed, with the links referring to the sources identified in the spreadsheet. The results are recorded and presented in Appendix 1, in [Table 9] and [Table 10]. The innovation funnel model and the results from the internal review discussions (Section 3.1) and the selected customer interviews (Section 3.2) were used as additional selection criteria. These results are presented in [Table 11], Appendix 1. For synchronizing the vocabulary and simplifying the communication with the pilot customers, these main themes topics are also presented in reference to the innovation funnel model stages [Figure 11.].

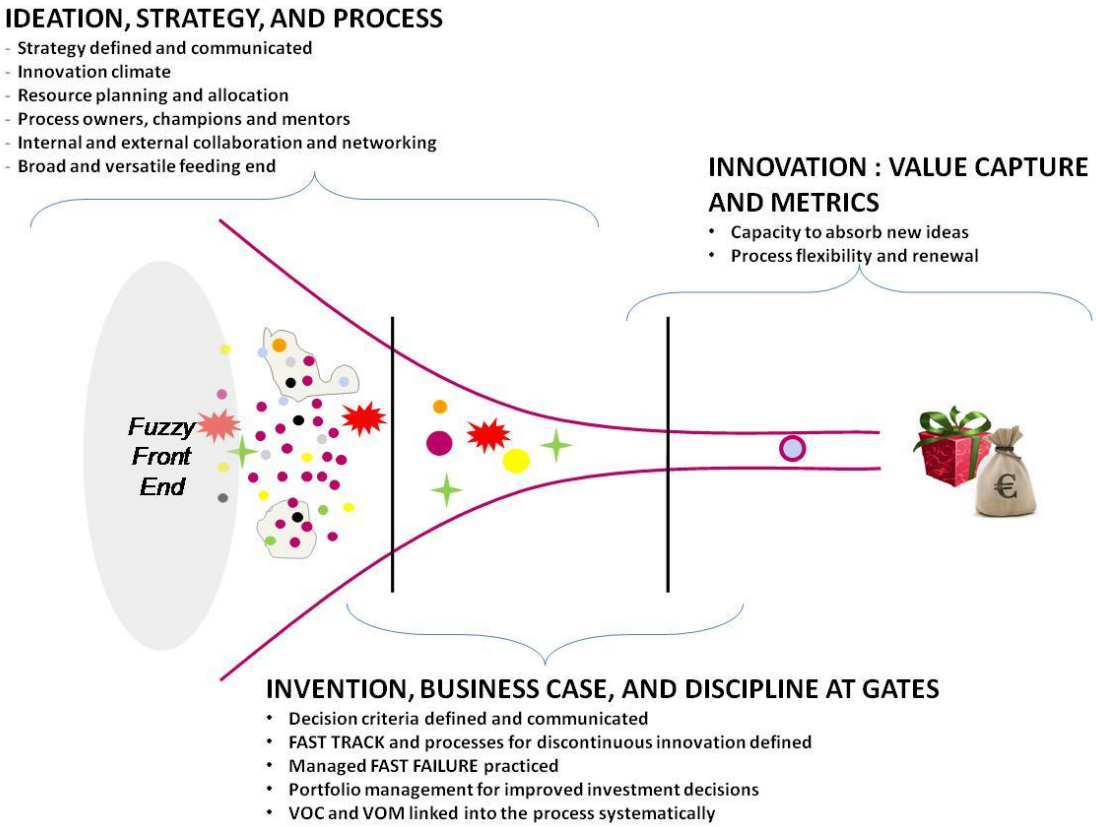


Figure 11. The most common themes from the literature analysis in reference to the innovation funnel stages.

Figure 11 illustrates the innovation funnel model with the key elements and the most common themes from the literature analysis, presented in reference to the innovation funnel model stages; ideation, invention, and innovation. The proposal for the Innovation Process Questionnaire will be developed on the basis of this material.

5 Results from the Innovation Literature Analysis

This section describes the results of the literature analysis and suggests a proposal for the Innovation Process Questionnaire. The proposed Questionnaire consists of 20 items that cover the key elements for various steps through the innovation funnel. These items are then grouped under the main funnel segments and introduced in the next subsection in the same order as they appear in the questionnaire.

5.1 Key Elements of Innovation Management

The first 12 items in the Questionnaire are grouped under the first segment of the funnel, namely the *idea*.

5.1.1 Idea: Ideation, Strategy, and Process

(1) *Innovation strategy is defined, aligned with corporate strategy, and senior management is committed.*

Strategy primarily concerns decisions concerning the company future direction, as well as management commitment to its practical implementation. Strategy, therefore, is an iterative and continuous cycle which builds on the company vision and key targets, and brings them together, in a disciplined process, with the analysis of the operational environment and customer value proposition (*Rohweder 2010*). The same principles are also relevant to describing the innovation strategy, and the obvious requirement here is that it should be defined and supported with committed management (*e.g. Utterback 1992*). In addition, one of the clear and leading themes coming up in the literature review is the requirement to align the innovation strategy and processes with the existing corporate strategy (*e.g. Davila et al. 2006*).

(2) *Innovation strategy is clearly communicated and understood, and organization is broadly committed and participates in the process.*

A vital element of strategy implementation is communication. This is especially important for innovation strategy, especially for synchronizing the vocabulary and for creating a common language. The vision and strategy has to be communicated, but it is also important to verify that they are understood and accepted in a consistent way. An organization that is broadly participating in the innovation process and decisions is one of the key elements *(e.g. Brophey et al. 2009)*.

(3) *Culture/Climate*

There seems to be broad consensus about the fact that innovation climate and in general corporate culture supporting innovation are the single most important factor in this formula. Organizational culture and leadership are the "glue" that ties other elements together *(Chen et al. 2002)*. Especially in the early stages of the funnel, the codes of value and corporate culture represent the main control lever, and it is important to spread a common innovation culture all over the organization in order to orient all the resources to the identification of innovative areas *(Chiesa et al. 2009)*. Former entrepreneurs in the company - also at the management level – help create the supporting leadership mentality. Innovation is eventually a learning process and the attitude towards innovation in general, and attitude about failure in particular, really matter for success *(von Oech 1998, Silvan 2006, Morris 2008)*. True innovation culture helps bring together people from the organization; it supports open communication, and improves internal collaboration in cross-disciplinary and cross-functional, and overlapping teams *(e.g. Beerens et al. 2005)*. "Necessity is the mother of innovation, and play is the father" *(von Oech 1998)*. Innovation climate measurement is embedded into the questionnaire as a separate survey and implemented using the Dolphin Index web survey.

(4) *Innovation process is clearly defined, communicated, and broadly understood.*

Organizational innovativeness is more a result of committed people and organizational learning than of distinguished tools and processes. At the front end especially it is the individual, together with the supportive culture and climate, that really matter; and a tight process can actually hinder innovativeness. A clearly defined process, however, is important as a frame for metrics and communication, and a key enabler for the management. Thus, a successful front end requires a culturally acceptable degree of structures and formality, supplemented by enough process-orientation and strategic awareness *(Khurana et al. 1998)*.

(5) *Appropriate resources are planned and allocated for supporting the innovation process (including the senior management commitment).*

It is obvious that innovation process must be supported with sufficient resources that drive innovative success, such as managers and money *(Christensen 2002)*. Modern research reveals that there is no statistically significant relationship between financial performance and innovation spending. It is not a question, therefore, of how much to

spend on innovation, but how to spend it – and how consistent the long-term strategy in this regard should be. Topics that matter even more are the innovation capabilities, talent, knowledge, team structure, tools, and processes, which directly affect the effectiveness of the innovation process *(Jaruzelski et al. 2010, Kandybin 2009, Skarzynski et al. 2008: 178)*.

(6) *Innovation champions and mentors are identified, recognized, and supported.*
When the landscape is still new and the organization is still in its early phases of creating innovation management practices, the internal champions, mentors, and the internal innovator networks are especially valuable. It has proved that they can significantly help in focusing attention and synchronizing actions, and accelerating the process *(e.g. Kettunen et al. 2008)*.

(7) *Innovation process owners are defined, the process is managed, and the appropriate management processes are applied at various stages throughout the funnel.*
As in any other case, the organization's key processes, including its innovation processes, require owners with clearly defined links to decision making *(e.g. Kettunen et al. 2010)*.

(8) *Competence mapping and gap analysis are exercised, and the process supports development of a broad scope of talent and capabilities.*
Organization's innovativeness is predominantly development of committed people and organizational learning, and it relies on the competencies that are available. Thus, a structured competence mapping and gap analysis process are important elements of the overall innovation strategy. The best performers in the industry analyze their resources and deliberately develop new competencies as a part of their portfolio management processes (*e.g. Anthony et al. 2007, Apilo et al. 2007*).

(9) *Formal and informal practices for supporting internal collaboration and information sharing have been created, supported and adopted.*
Clear communication and the climate that is supporting internal and external collaboration and information sharing are important elements for a successful innovation process. Ideas feed the funnel but the ideas alone seldom have sufficient content and momentum. Typically they have to be refined through deliberate actions, where the material is collected, combined, and by exploiting constructive conflict also collided. At the front end, the individual acts as an important conduit for funneling environmental-

level changes into organizational-level processes, through their boundary-spanning and gate keeping roles *(Reid et al. 2004: Fig. 2 Innovation Funnel Model)* . But even the best insight is worthless unless it is broadly shared among all innovation stakeholders *(Goldbrunner et al. 2005)*.

(10) *Internal and external professional networking is encouraged and supported as an important source for new ideas and insights.*
Effective networking is one of the most important factors contributing to innovation *(Kettunen et al. 2008: 117)*. Cross-functional team structures *(Brophey et al. 2009),* and the strategy that supports global networking also through exhibitions, conferences, and professional associations, help in broadening the view and bringing in new insights.

(11) *Roles and expectations are clearly defined, and performance is measured and supported with well-aligned incentive schemes.*
People tend to give attention to those topics that are measured, and the required tasks are executed with priority, especially when supported with appropriate incentives. Innovation as one of the key performance indicators, the supporting incentive schemes, and clearly stated objectives that challenge the team are important elements for a successful innovation process *(e.g. Brophey et al. 2009).*

(12) *Strategy, culture and tools support idea collection from a broad and versatile range of sources (including structured foresight process, and customer, and supplier involvement)*
The importance of a broad and versatile range of sources feeding the front end of the funnel is supported broadly in the references. This is obviously important for increasing the volume of ideas, but also vital for broadening the diversity of the idea sources. The front-end at the funnel needs to be shaped for external market and customer factors *(Khurana et al. 1998)*, but it is important that broad view from multiple channels is maintained during the complete innovation process through a transparent funnel.

Five of the questionnaire items are grouped under the next funnel segment (*invention)*.

5.1.2 Invention: Business Case, and Discipline at Gates

(13) *Clear decision criteria at gates are defined, communicated, and applied with discipline.*

An innovation opportunity is a hypothesis that value can be created. Value creation requires selection mechanisms and management *(Terwiesch et al. 2009)*. Unstable product specifications and project scope creep are two of the biggest wasters of time in new product development *(Cooper R.G. 2008)*. Well-informed gate decisions are a critical success factor; and the key element supporting these decisions are well defined and clear criteria for gate filters that are used in a disciplined manner.

(14) *Distinct processes and practices have been defined for discontinuous innovation, and fast track processes are prepared.*

During the way through the funnel, the balance between the key elements of a successful innovation process changes. Thus, it is important to develop and apply distinct management processes and practices for various stages of the funnel. The importance of the key elements also changes over time because any individual company cannot control the exact timing for a market opportunity. This is especially important for discontinuous innovation, where consistently applied dedicated processes and protected resources are vital. When the proper market window is identified, a well-prepared fast track process is invaluable and can help the company to build strong competitive edge (*e.g. Davila et al. 2006*).

(15) *Alternative paths for IP/innovations (e.g. licensing, spin-off, selling) are part of the strategy and actions are planned.*

The cost of developing ideas further increases when moving through the funnel; therefore, venturing decisions at the gate, before finally moving over to innovation stage, are important. However, it is not automatically evident that all inventions at this stage fit well into the selected strategy. While various models of internal venturing options are needed *(Kettunen et al. 2008*), it is also important that alternative external paths are prepared. In fact, for many organizations selling and licensing IPR is their main *modus operandi*. The innovation forerunners develop generic competencies for managing these options and deliberately nurse and keep at close distance those spin-off inventions that can potentially fertilize and strengthen their eco-system.

(16) *Managed "fast failure" practices are defined and applied with discipline (including willingness to "kill" and recycle ideas that do not pass the gate filters).*

Innovation process relies on individual and organizational learning. As already discussed earlier, the cost linked to individual ideas increase through the funnel, so that learning fast is obviously beneficial. One of the ways to achieve this is to make iterative learning steps through the quick cheap trials *(Brophey et al. 2009)*. Clearly defined and prepared processes and practices for managed fast failure are important elements of the Invention part of the funnel. The organizational climate and attitude toward failure are, therefore, important factors supporting or hindering this process. Clearly communicated targets and practices that are exercised with in a disciplined manner at gates (see item 13. above) together with demonstrated willingness to discontinue and recycle projects that do not pass the filters, help align the climate and the actions.

(17) *Portfolio management is exercised as a part of the innovation management process and used for scenario planning and for improving investment decisions.*

One of the six clearly leading themes that come up in the references is the significance of innovation portfolio management. Although portfolios and processes differ from one company to another, and the industry benchmarks do not always work *(Kandybin 2009)*, portfolios are important for scenario planning and the growth gap analysis. A well-structured process helps improve investment decisions and makes long term planning and balancing the innovation portfolio possible *(Cooper et al. 2002)*. The platforms are required for understanding the relevance of various ideas, but portfolios are important for detecting innovation clusters that may be required for major technological advance *(Morris 2008, Rogers 2003)*.

(18) *The Voice of Customer and the Voice of Markets are systematically linked to the innovation process at all stages throughout the funnel.*

Another leading theme is the importance of linking the voice of customer to the innovation process. At the front end, this is part of a broader view; where bringing in the insight of experts and hobbyists can help identify emerging opportunities faster than the competition can do it. At the invention stage, the lead users, and pilots are a valuable part of the managed fast failure strategy (*e.g. von Hippel 1986*).

The remaining two blocks of the questionnaire are finally grouped under the third funnel segment (*innovation)*.

5.1.3 Innovation: Value Capture and Metrics

(19) *Capacity to absorb new ideas, learn quickly, and adjust the process and practices fast and flexibly exists, the process and practices are supported, and supporting behavior is encouraged.*

Today, after active research during the past couple of decades, the processes towards the end of the innovation funnel are better understood. For organizations, the speed of change in the operational environment is increasing. Thus, one of the key competencies for innovation management is the capability to observe the environment, learn quickly, and adjust the strategy and processes accordingly (*e.g. Utterback 1994*).

(20) *Innovation process is supported with a meaningful and actionable performance metrics, which are clearly defined, and communicated, and applied systematically.*

"What can be measured can be managed" is a familiar phrase from management literature. The activity where one spends time reflects one's priorities *(Anthony et al. 2008: 271)*. Measures and their associated targets describe the means to execute the strategy; and measures connect innovation objectives with specific innovation initiatives *(Koehler et al. 2007)*. While the metrics comes up as one of the leading themes in the references, modern research suggests that this is not yet reflected in real practice. One of the results reveal that only 32% of the respondents were satisfied with their company's innovation measurement practices *(Andrew et al. 2009: 6*). What matters most depends sharply on the company's circumstances, capabilities, and strategic objectives; therefore findings for one particular study cannot be directly compared to another study *(Anthony et al. 2008: 254, Garcia et al. 2002)*. The goals and targets of innovation vary by industry but the generic variables measured by the innovation metrics will always be quite similar across most fields *(Mueller et al. 2005)*. When designing the metrics it is important to identify those that are meaningful and actionable, align the metrics with the value of the innovation portfolio, and limit the number of measures to a manageable amount - maximum 20 *(Davila et al. 2006, Koehler et al. 2007)*. A proper use of innovation metrics provides the road map, the sign-posts and the goal, and enables both personal and professional dimensions of everybody involved. "Metrics make it happen" *(Kuczmarski 2000)*.

This section described the 20 items that were identified, during the literature analysis, as the key elements of a successful innovation process. These items were grouped

under the main innovation funnel segments and the Innovation Process Questionnaire was devised directly based on these results.

5.2 Innovation Process Questionnaire

In this subsection we'll take a closer look on the final Questionnaire. The proposal for the Innovation Process Questionnaire is based on the literature review and the results of the internal and external reviews introduced in previous sections. The questionnaire consists of 20 items that were introduced and listed in Section 5.1 and grouped under three headings that position the items into the innovation funnel model: First, Idea (Ideation, strategy, and process); second, Invention (Business case, and discipline at gates); and third, Innovation (Value capture and metrics). The final Questionnaire [Table 12.] was structured into a simple one-page document with two statements that pilot customers are asked to rate using the traditional Likert scale [Table 2.].

a) We are well prepared and practice this with good discipline
b) This is important parameter for our business
Please use following rating:
1 = Strongly disagree,
2 = Disagree,
3 = Neither agree nor disagree,
4 = Agree,
5 = Strongly agree

Table 2. Innovation Process Questionnaire rating instructions, as they were presented in the questionnaire.

Table 2 illustrates the two statements and the rating instructions that were used in the Innovation Process Questionnaire. The Questionnaire was sent in advance, together with the Industry Benchmark Questionnaire (Section 6.1.3) to each of the pilot companies, to the host of the project. The contact person, who also arranged the company specific part for the Dolphin Index survey (Section 6.1.2), and participated in the case interview and reporting session (Section 6.1.4), was typically the manager that owns the innovation process or otherwise plays a focal role in the innovation management at each specific pilot company. Final modified innovation funnel model was prepared to be used during the discussions with the pilot customers [Figure 12.]. This model, together with the conceptual model where the main themes and topics are presented in ref-

erence to the innovation funnel stages [Figure 11.], were used during the meetings for synchronizing the vocabulary and simplifying the communication with the pilot customers.

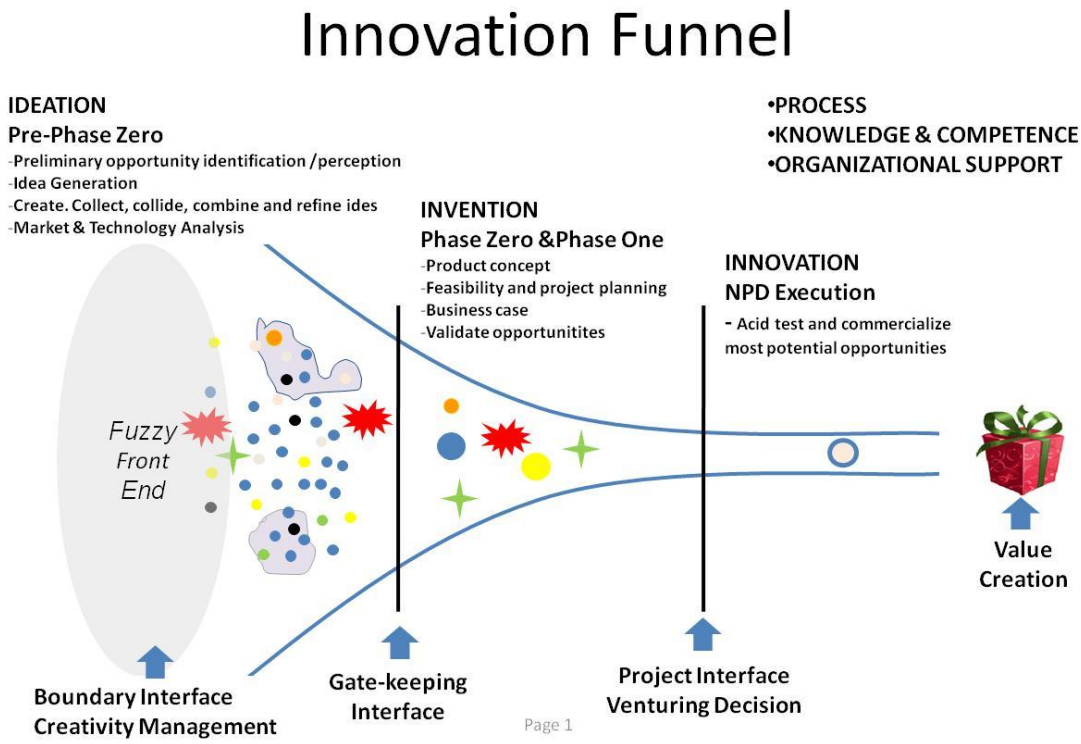


Figure 12. Innovation Funnel model for piloting.

Figure 12 illustrates the final innovation funnel model that was used for synchronizing the vocabulary during the discussions and interviews with the pilot customers. The model illustrates the ideation, invention, and innovation stages and the main gates in the funnel. Next section introduces the process for validating and testing the Questionnaire with real trials in the field.

6 Validating and Testing the Questionnaire

This section covers the four validation stages and the piloting test of the Questionnaire feasibility and validity. Next subsection introduces the four validation stages.

6.1 Validation of the Innovation Process Questionnaire

The main purpose of this Thesis stage is to collect information from seven pilot companies using the Innovation Process Questionnaire. The results and the questionnaire itself will be tested using three independent methods; by comparing the material with the external and internal view about the pilot company's innovativeness, and by comparing the company performance with an industry benchmark. Originally six and finally seven pilot companies were selected. Piloting consists of four partially parallel stages. Next section introduces the first stage, an email survey that is used for formulating a view about the external opinion of the pilot companies' innovativeness.

6.1.1 External View: Email Survey

The target of this stage is to formulate a draft of the external view of the pilot companies' innovativeness. The selected research method was email survey. The plan was to collect data separately from three independent review groups; board members of an association of telecom professionals, the personnel of Gearshift Group Oy, and fellow students at this Industrial Management Masters Degree program. Altogether 50 reviewers were invited to review the innovativeness of 12 selected companies. The companies on the list were selected based on accessibility through Gearshift Group Oy contacts. The survey questionnaire was sent to the review group via email where, in addition to the list of the review companies, innovativeness was defined [Table 3].

Innovativeness of a company is here defined as the proven capability to
• systematically collect ideas, inventions, and other input from a broad range of versatile channels, AND to • exploit the information together with company internal/external competencies for finding a new solution to a problem (new re: patents: "new", "useful", and "nonobvious"), AND based on this to • bring up commercially viable new products and/or services or valuable gains with measurable impact, in a timely manner.

Table 3. The innovativeness definition, as was presented in the e-mail survey questionnaire.

Table 3 illustrates the definition of innovativeness, as presented to the selected email survey reviewers. Review group was asked to rate two statements for each of the listed companies using traditional Likert scale [Table 4].

A. THIS COMPANY IS HIGHLY INNOVATIVE B: THE COMPANY HAS PROMISING GROWTH POTENTIAL	**1. Strongly disagree** **2. Disagree** **3. Neither agree nor disagree** **4. Agree** **5. Strongly agree**

Table 4. Email survey questions and review instructions, as presented in the questionnaire.

Table 4 illustrates the two questions and the rating instructions as presented to the selected email survey reviewers.

The response rate of the email survey was low; finally only 20 answers were received and of those only 14 covered all listed companies. As a result of research economic reasons the self-bias, missing data, and other validity and data quality related aspects will not be examined. The results of the email survey are not confidential but because some later parts of the Thesis contain sensitive information the full list of reviewed companies, together with the detailed survey results, have been available only for the instructors of this Thesis. Based on the generic accessibility and on the results of this survey six of the companies were selected as pilot companies for next Thesis stages. The attempt was to include companies with a versatile range of the external innovativeness view but the final results do not provide too much playroom with this aspect.
Despite the low response rate, the mean value and standard deviation of the collected data for question A was calculated for each of the listed companies, assuming the Likert scale that was used in the questionnaire linear. The statistical relevance of the results was tested applying Student's t-test and the generic level of innovativeness for each of the pilot companies was categorized [Table 5].

	N	**μ**	Std Dev.	Hypothesis	t	df	Innovative?
A	15	**4,25**	0,594	4	1,740	.104	**+++**
B	20	**3,35**	0,933	3	1,677	.110	**+**
C	15	**2,93**	0,961	3	0,269	.792	0
D	17	**3,06**	0,827	3	0,293	.773	0
E1	16	**3,00**	0,816	3	0,000	1.000	0
F	18	**2,56**	0,984	2,5	0,240	.813	**--**

Table 5. Email survey – results (Question A – company innovativeness).

Table 5 illustrates the final Email survey results. According to this survey, only companies A and F have a clearly distinctive external innovativeness profile. The results for company B can be interpreted as moderately positive but all others are neutral. Nevertheless, these results will be used as one of the test references when analyzing the results of the pilots with the Innovation Process Questionnaire. The process and the validity of the results will be discussed later in Section 7. Graphs and more details about the results for each of the pilot companies can be seen on Appendix 2 [Table 13].

The results of the second question (Question B) in the email survey questionnaire were reported to each of the pilot companies during the Case interview meetings (Section 6.1.4) but otherwise the data is not used in this Thesis. Now, after reviewing the external view of the pilot companies' innovativeness we move on and take a look on the internal view.

6.1.2 Internal View: Innovation Climate Review – Dolphin Index

As already discussed in previous sections, the thesis that innovation climate, and in general corporate culture supporting innovation, are the single most important factor behind a successful innovation process, seems to be broadly accepted *(e.g. Beerens et al. 2005, Brown 1998, Chen et al. 2002, Chiesa et al. 2009).* One of the research pioneers in this area is Professor Göran Ekvall, who assessed the creative climate in a large number of Swedish organizations some 20 years ago. The organizational *climate* refers to the enduring, although not unchangeable, patterns of behavior, attitudes and feelings that are experienced within an organization (*Ekvall 1996*). The climate stems from the interactions people have with one other in their organizational setting. Organizational *culture* refers to the values and belief systems that underpin an organization (Ekvall, 1996). Based on the pioneering work of Ekvall it is now possible to quantify the climate for innovation. He assessed the creative climate in a large number of Swedish organizations which were independently classified by Harry Nyström (Norwegian School of Management) as high, low, or average, in innovative development of products, services, or operational processes. High scorers are accordingly defined as 'innovative' and low scorers as 'stagnated'. Results showed that, on average, innovative organizations scored differently from "stagnated" organizations on some key climate dimensions [Table 6], (*Innovation Centre Europe 2011*).

Innovative	Stagnated
More open and trusting relationships	Fewer open and trusting relationships
Fewer personal conflicts	Higher frequency of personal conflicts
Higher frequency of debates and discussion about ideas	Fewer debates and less discussion
More likely to take risks (e.g. introducing new procedures)	Less likely to take risks
More personal freedom in doing the job	Close and conspicuous supervision
More time to spend in idea generation / evaluation	Less time to spend in idea generation / evaluation
New ideas received favourably by senior people and encouraged	New ideas ignored or discouraged
Committed people highly involved in their work	Less commitment and involvement
More fun	Less fun
Workplace more exciting / dynamic	Workplace less exciting / dynamic

Table 6. Climate characteristics of more and less innovative organization (*Innovation Centre Europe, 2011*).

Table 6 illustrates the different climate characteristics of more and less innovative organizations revealed by the work of Ekvall and Nyström. Ekvall's work included the development of the Creative Climate Questionnaire, which was then developed further at Innovation Centre Europe Ltd (ICE). Their Dolphin Index Questionnaire is a substantial development on from Ekvall's original questionnaire. The Dolphin Index Indicator (DII) has been developed to measure important features of team, departmental and organizational climate. Dolphin Index measures the organizational climate for innovation at both individual and organizational level. The survey is completed using a simple web-survey. To get a more accurate picture of the organizational climate all individual's scores are aggregated within an organization. This is a more accurate description of the shared perception of the organizational environment manifested in behaviors, attitudes, and feelings. The normative reference "UK norm" is based on information from ca 4000 participants from 50 organizations (*Innovation Centre Europe 2011*).

Those climate dimensions, that are measured using the Dolphin Index, are presented in Table 7. (*Innovation Centre Europe 2011*):

Dolphin Index Dimensions	
Commitment	**The extent to which people are committed to the organisation and work is viewed as stimulating and engaging.**
Freedom	**High freedom work environments are those in which people are empowered to make their own decisions, for example about prioritising their work. In low freedom environments there is close and conspicuous supervision.**
Idea support	**Refers to organisational support and encouragement for the development of new ideas and suggestions for improvements.**
Positive Relationships	**Refers to the extent to which there are positive, trusting, friendly, interpersonal relationships between people, rather than negative (e.g. hostile, conflicting) ones.**
Dynamism	**Refers to whether work is exciting and dynamic, or static and boring.**
Playfulness	**Refers to levels of light-heartedness and fun in the work place. Work environments low on playfulness may be seen as dour and humourless.**
Idea proliferation	**Refers to the extent to which other people in the work environment are perceived as having innovative ideas about, and varied perspectives towards, their work.**
Stress	**High stress work environments are defined as those in which other individuals are observed to be highly stressed and encountering heavy workloads.**
Risk taking	**High risk taking environments are thought to promote the speed at which new ideas are implemented. Low risk taking environments are likely to be characterised by excessive use of formal rules and procedures.**
Idea time	**Refers to the extent to which employees perceive that there is time for producing and developing new ideas.**
Shared view	**Refers to the extent to which there are open and adequate communications between more and less senior employees. Work environments where there is an 'us' culture rather than an 'us and them' culture.**
Work recognition	**Do people feel that they receive credit and praise for their achievements? Or do they feel undervalued?**
Pay recognition	**Refers to satisfaction with pay and conditions. Do people feel fairly remunerated for their work - or at worst, feel exploited?**

Table 7. The Dolphin Index innovation climate dimensions (*Innovation Centre Europe 2011*).

Table 7 illustrates the 13 dimensions that the Dolphin Index survey measures. Additionally, to directly examine perceptions of innovation within an organization, and the dimensions of the innovation climate survey, ICE conducted an analysis, examining individual perceptions of their organizations as innovative, and their perceptions of the work climate. Respondents were divided into five groupings, depending on their scores on the innovative organization classification; very low, low, moderate, high, and very high level of innovation. Statistical analysis was conducted on each of the innovation climate questionnaire dimensions to examine whether the responses between the five groups were different. The analysis showed that the effect was statistically significant and for all 13 dimensions a more positive climate is associated with substantially higher levels of innovation *(Redford et al. 2010)*. Reference tables that have been used for analyzing the material for this Thesis are available on the research manual that ICE provided for this Thesis *(Redford et al. 2010)*. The relevant parts of the manual have been available for the instructors of this Thesis. More information about the reliability and validity of Dolphin Index survey can be requested from Innovation Centre Europe Ltd.

The innovation climate survey using Dolphin Index was completed, with the support of Innovation Centre Europe Ltd, at seven pilot companies; those six selected after the email survey and a seventh company, which joined the project as a result of ongoing company reorganizations at one of the other pilot companies. The group of companies covers a broad and versatile range of organizations from software industry, through material sciences, to civil engineering; a leading supplier for research and production equipment for advanced material technology, a leading ICT security company, a leading construction and civil engineering company, a leading supplier for product data management services, a leading provider for cash flow automation solutions, a management consulting and marketing service provider, and a provider for web and e-service solutions. The selected pilot companies cover also a broad range of organization size; the range of business volume is 10 – 350M€ and the range of personnel 25 – 2500. Finally, the pilot group covers companies from those that focus solely on domestic markets to fully global organizations, and depending on the company a significant portion of the replies to DII survey came from teams and offices abroad. Because of the confidential nature of the material a detailed list of the reviewed companies, together with the detailed survey results, information about the demographics, and sur-

vey reports have been available only for the instructors of this Thesis. The pilot companies will therefore below be referred to as companies A, B, C, D, E1, E2, and F. Depending on the company the sample that was selected for the DII survey was either the whole organization or a selected sample [Table 8].

Company	Sampling strategy	Sample size	Replied	reply %
A	**all**	65	45	69 %
B	selected sample	80	21	26 %
C	**all**	32	12	38 %
D	selected sample	80	34	43 %
E1	**all**	25	16	64 %
E2	**all**	35	16	46 %
F	selected sample	46	23	50 %
All		363	175	48 %
(of which non-addressable)			8	5 %

Table 8. Dolphin Index survey sampling and response rate

Table 8 illustrates the survey sampling strategies and response rates of the 7 pilot companies. Company B and company F defined their sampling strategies internally and company D was instructed to select a representative sample from each of their operational units in proportion to the personnel of the overall size of the company. As a result of research economic reasons the potential impact of sample selection, self-bias, missing data, or other validity and data quality related aspects will not be examined. The potential impact of these topics was discussed separately with each specific company during the case interview and reporting meetings. The process and the validity of the results will be discussed later in Section 7.

The web survey data was analyzed using the IBM® SPSS® Statistics 18 statistical software with the scoring information that ICE provided for this Thesis. The company specific results were then analyzed using the instructions and references in the Innovation Climate Questionnaire, Professional Manual (*Redford et al.*) that ICE provided for this

Thesis. Graphical illustration of the results and a table where the results are compared against the internal organizational innovativeness classification for each of the pilot companies can be seen on Appendix 2 [Table 14]. The Dolphin Index survey results were reported to each of the pilot companies during the case interview meetings (Section 6.1.4). The generic feedback about the DII survey process as well as the results was very positive. The findings were perceived as relevant, they could be linked to concrete organizational topics, and for the most part were also supported by parallel data from other recent surveys or issues that have been already otherwise identified and discussed at management level. The commercialization of DII service was also recommended and it seems that a localized version of the survey would be well justified. The results are the basis for the second independent method for validating the Innovation Process Questionnaire and will be discussed in more detail later in Section 6.2 and Section 7. Next subsection introduces the third and final concept that is used for validating the Questionnaire; the industry benchmark with Sfinno™ database.

6.1.3 Industry Benchmark: Sfinno™ Database

One of the three methods that were chosen for validating the proposed Innovation Process Questionnaire is comparison with quantitative references from Sfinno™ innovation database. The main target is to try to identify and compare specific behavior and procedures that are linked to the viscosity of the innovation funnel, and issues with and drivers behind the process in general. The detailed findings will be discussed later but as a general notice; this part did not provide much additional information that has obvious and generic value for this Thesis. With those pilot companies that responded to the Industry Benchmark-questionnaire the results did awake interesting and valuable discussion about company specific topics. These are mainly beyond the scope of this Thesis. Next we take a brief look into the VTT Sfinno™ database.

The innovation database Sfinno™ is developed, constructed and maintained by VTT Technical Research Centre of Finland. It has been designed to capture significant technological innovations developed by Finnish industry during the postwar period. Data collection follows the LBIO (Literature Based Innovation Output) method and is supported with a separate survey. The database includes a diverse set of data constructed on the basis of single innovations. Today, the innovation data covers years 1945-2009

and information about 4900 domestic innovations from 1900 innovative firms. VTT defines innovation in this context as an invention which has been commercialized by a firm or equivalent, and is a technologically new or significantly enhanced product, process, or service from the firm perspective (OECD Oslo Manual 1997).

The data in Sfinno™ database is delineated on roughly three levels; the innovation, the innovation process, and the innovating firm. The material covers a wide range of aspects relating to the different phases in the process, from idea to commercialized innovation and further. These topics include origin and drivers of the innovation, funding, collaboration, patenting, exporting and internationalization of the innovation, innovation diffusion, commercial success, timeliness of the process, novelty of the developed innovation, as well as challenges in and impacts of the innovation for the commercializing firm *(van der Have et al. 2009)*. The sample of the data used in this work covers material of a selected set of these topics [Appendix 2: Table 15. VTT Sfinno™ database questionnaire]. The sample was furthermore chosen to cover only technology innovations following OECD definition and TOL95 classification of industries *(Suomen virallinen tilasto).* The reference material for this Thesis is based on a set of data that VTT provided on 15.02.2011. For the final analysis the original material was further filtered down to cover only innovations where the basic idea was presented or development was started during 1995 or later.

The final material covers a list of 192 innovations, which is the basis of the references for this work. The Industry Benchmark-questionnaire that was distilled down from the full database material is organized under six headings. First heading covers data about Typical/average time that is required for various steps through the process, starting from the idea introduction to the beginning of the development of the next generation of the innovation. This information is used as a quantitative reference for the speed of the innovation process. Second heading is Mechanisms used for protecting the innovations; Third, Factors impacting the decision to commence innovation activities; Fourth, Other parties collaborating in the innovation activities; Fifth, Problems and challenges in innovation activity; and Sixth, Other benefits and impacts of innovations [Table 13]. Material from the five last groups was mainly used as qualitative background data about the innovation process of the pilot companies.

The Industry Benchmark-questionnaire was sent in advance, together with the Innovation Process Questionnaire (Section 5.2) to the host of the project at each of the pilot companies. The response was collected for the case interview and report meetings in advance and five of the seven pilot companies returned fully or partially completed questionnaire. For the analysis of the material the percentage proportion of yes/no answers (S-YES %, S-NO %) and the mean and standard deviation values of the quantitative data (S-mean, S-sd) in the selected Sfinno^{TM} reference data was calculated [Table 16]. The response from the pilot companies was compared with this material. Results of this stage of the Thesis are compiled together and presented on Appendix 2 [Table 16].

The company specific results were reported to each of the pilot companies during the case interview and reporting meetings (Section 6.1.4). This material, together with company specific conclusions and recommendations are presented in the detailed company reports. As the material is perceived to contain sensitive information the full list of replied companies together with the detailed results have been available only for the instructors of this Thesis. The results are the basis for the third independent method for validating the Innovation Process Questionnaire and will be discussed in more detail later in Section 6.2, as well as in Case interviews, the topic for the next subsection.

6.1.4 Case interviews with the Innovation Process Questionnaire

The case interviews serve two purposes. First, the response to the Innovation Process Questionnaire was collected from the completed questionnaires that were returned back before the meeting or completed in place, and verified during the meetings. Second target was to gather other qualitative information about the company specific circumstances that impact or may impact the environment for innovation. As already briefly introduced in Section 6.1.2 the pilot group comprises of a broad and versatile range of companies from software industry, through material sciences, to civil engineering, and marketing services. The sample also covers companies of different sizes, both when considering the extent of their organization and business volume as well as their focus markets. The pilot companies were selected based on accessibility and on the results of the email survey, aiming at a case group with a versatile range of their innovativeness view as seen by external reviewers.

The final version of the Innovation Process Questionnaire [Table 12] and Industry Benchmark-questionnaire [Table 15] documents were sent in advance to the host of the project at each of the pilot companies. Five Innovation Process Questionnaires were completed and returned back before the interview meetings and two were completed during the meetings. Five Industry Benchmark Questionnaires were completed and returned back before the meetings. The Dolphin Index survey was also completed and the results analyzed by the time of the interview meetings. Six of the final seven pilot companies were also reviewed during the email survey. A company specific report of the results of these external and internal reviews as well as findings from the comparison with the industry benchmark was prepared and presented during the interview meetings. Because of the confidential nature of the material, full reports have been available only for the instructors of this Thesis.

Personal interviews were completed during March 3rd to March 17th, 2011. The meeting at each of the pilot companies was arranged with the project host, who was in the smaller companies typically the CEO and in larger organizations the manager that owns the innovation process or otherwise plays a focal innovation management role. In two of the interviews other members of the management team or key members from the innovation management team also joined the meeting. During these semi-structured interviews the final modified funnel models that were developed during the previous Thesis stages were used as the framework [Figure 11], [Figure 12.]. Interviews were recorded in writing following normal customer meeting practices and the summaries, as recorded below in this Thesis, were sent for comments for each interviewee. Because of the confidential nature of the discussions the detailed meeting minutes have been available only for the instructors of this Thesis. Next we take a brief look on the main topics and lessons from these meetings.

Company A is one of those few pilot companies that had a clearly distinctive external innovativeness profile, and based on the results of this study the company can be interpreted to be seen as highly innovative by external viewers. The company is in a fast growth mode. Nevertheless, the Dolphin Index response rate was high and in general all activities linked to this project were managed and conducted through promptly and in every way in an exemplary manner. The DII results indicate that the climate and company environment in general is highly supportive and conductive to innovation. All innovation climate dimensions receive high rates and innovation climate should not be

a barrier for this company. Comparison with the Sfinno™ data reveals that the company has fast and well disciplined processes in place. The company is technology driven and the focus is clearly in global markets. Important elements of the innovation process and process management have clearly been identified and innovation is an elementary part of the company strategy. Based on observations at this level it seems that the process could be further enhanced by focusing on process ownership and discipline at gates, especially towards the front end. In general the Dolphin Index survey was considered to be useful and practical both when considering the process as well as the results. The overall results and recommendations in the report were confirmed and the potential issues that this material brought up have also been identified in other internal surveys.

Company B does not have very clear or distinctive external innovativeness profile but based on the results of this study, the picture that external viewers have can be interpreted as moderately positive. The company works in markets with fast product cycles and extremely hard global competition. Innovation strategy has been identified as an important element but has not been defined separately. The Dolphin Index response rate was the lowest in this survey and the completion of the activities linked to this project did not have high priority, mainly because of issues with busy time schedules. The sample was selected and selection criteria decided internally at the company and as the sample was supposed to cover to an important extent employees who are directly involved with the innovation process the results were considered to provide an indicative and meaningful picture of the status. The DII results indicate that the company environment in general is moderately supportive to innovation but the climate results suggest that feelings are somewhat mixed. Results suggest that the strategy and common goals have probably not been consistently understood or accepted and may also indicate that people perceive that there is disparity between expectations and resources. Comparison with the Sfinno™ data reveals that the company has really fast and disciplined processes in place. The company is technology and market driven and works with a tight niche focus for fully global markets. Key elements for a successful innovation process and management have been identified and innovation has been important element in internal communication already some time. Nevertheless the DII profile brings up some confusing signals, and the assumptions about the innovation strategy seem to be rather mixed. In general the Dolphin Index survey was considered to be helpful. The overall results and recommendations in the report were also con-

firmed at a general level during the interview and the potential issues that this material brought up could be linked to potential causes and other supporting findings.

Company C did not receive clear or distinctive external innovativeness profile and in fact some of the reviewers indicated that they did not know enough about the company to provide any comments. Company organization was changed to fit the new business strategy just months before this survey. The Dolphin Index response rate was rather low but the results were nevertheless considered to provide useful and correct indications about current status. The completion of the activities linked to this project was conducted in a proficient manner. The DII results indicate that the company environment is in general moderately supportive to innovation but the innovation climate seems to be somewhat mixed. Although the climate appears as rather relaxed the results indicate that company strategy and goals may not have been communicated clearly. Furthermore the results suggest that although the company supports innovation the expectations as well as the possibilities to contribute at individual level are not completely clear. Comparison with the Sfinno™ data and discussions during the interview reveal that the company has adopted really fast processes but the main focus is in incremental customer specific product adjustments rather than in completely new innovations. The company is customer driven and the focus is local and in a less price sensitive niche market. The Innovation Process Questionnaire was completed and returned before the interview and the discussions indicate that some part of the terminology was understood in a slightly different way than what was the intention. The key elements for a successful innovation process and management seem to be identified but DII profile does indicate that the strategy has not been clearly communicated or accepted. In general the Dolphin Index survey was considered to be useful. The overall results and recommendations in the report were confirmed and the potential issues that came out from this material have clearly, as a result of other internal discussions and activities, been identified already earlier.

Company D did not receive clear or distinctive external innovativeness profile either and also here some reviewers replied that they did not know the company sufficiently for meaningful comments. The company has recently gone through a fast turn-around process and the focus in the very basic elements of profitable business is still apparent. As a result of busy time schedules the launching of the survey required some extra effort but after the process was triggered the completion of the activities linked to this

project was conducted in a professional manner. The sampling for the Dolphin Index survey was done following the instructions to select a representative sample from each of the operational units in proportion to the personnel of the overall size of the company. Although the response rate was moderate the sample was interpreted to be sufficiently representative, and the results were considered to provide a correct and meaningful picture of the status. The DII results indicate that the company environment is supportive and conductive to innovation. All innovation climate dimensions receive moderate or high rates. The environment and climate seem to be relaxed and dynamic and employees are committed, although the results indicate that innovation strategy and goals are potentially not consistently understood or accepted. In general the innovation climate should not be a barrier to success for the company. Comparison with the Sfinno™ data and discussions during the interview reveal that the company is clearly a technology leader in a narrow niche area and the funnel viscosity benchmark does not have direct relevance in this case. The company is customer and technology driven and as a result of the technology leadership and narrow niche focus works at least currently in a less price sensitive area, on the way towards global markets. Important elements of the innovation process and process management have been identified. Strategic alignment, communication about the goals and targets, and disciplined process at gates – especially at the invention stage – seems to be an area with positive development potential. The Dolphin Index survey was considered to be useful and the potential issues that the results indicate could be linked to other supporting findings. The conclusions and recommendations in the report were also ratified.

The interviews with *Company E1* and *Company E2* were carried out together. Company E1 did not receive clear or distinctive external innovativeness profile and it is obvious that most of the respondents were not familiar with the company. Company E2 joined the survey after the data for the external view was collected. The merger of these two companies was starting at the time of this survey. Neither of these companies replied to the Innovation Benchmark-questionnaire. The Innovation Process Questionnaire was completed for both companies during the meeting. Both companies completed the Dolphin Index survey with a moderate or good response rate but the results were eminently different. The DII results for Company E1 suggest that the climate and the company environment in general are not highly conductive to innovation. The results suggest that the company is perceived to be capable of working with new ideas also fast but it seems that the strategy has not been understood or accepted in a consistent

way through the organization. Furthermore the findings suggest that there are potential issues with interpersonal relations. The innovation climate as is may become an obstacle to the success of the company and actions for synchronizing the perceptions and attitude about the strategy and common goals are recommended. The DII results for Company E2 indicate that the climate and company environment in general is highly and consistently supportive to innovation. Furthermore the climate seems to be very relaxed. Innovation climate should not be an obstacle for the success of this company. Based on the response to the Innovation Process Questionnaire and discussions during the interview it seems that all important elements of the innovation process and process management have clearly been identified. The reactions towards the concepts in the questionnaire as well as the detailed answers were almost identical for both companies, which may indicate that answers are at least partially synchronized and reflect the common view of the strategy and of the main issues after the merger, rather than the exact status of the processes at each specific company today. The results of the Dolphin Index survey and the conclusions and recommendations in the report were in general confirmed and the background factors influencing the results were identified. The Dolphin Index survey was considered to be clearly useful and the commercialization of the service locally was supported.

Company F is the second of the two pilot companies that had a clearly distinctive external innovativeness profile, and based on the results of this study the company can be considered as non-innovative by external viewers. As a reaction to the changes in the competitive situation, the company has recently been forced through heavy reorganization. The organization has been changed to support the new strategy. Innovation has a significant role in the new strategy and activities for improving competencies in this area are ongoing. All activities linked to this project were managed and conducted through promptly and in every way in a professional manner. The Dolphin Index response rate was moderate. The sample was selected and selection criteria decided internally at the company. The outcome was seen to be a sufficiently representative sample of those employees who are involved with the innovation process and the results were considered to provide an indicative and meaningful picture of the status. It was clearly understood that follow-up measurements are essential in order to be able to control the process on the path forward. The DII results indicate that the innovation climate and company environment in general is at best moderately supportive to innovation and several potential challenges can be identified starting from interperson-

al relations, employee commitment, and management practices, which may potentially be perceived limiting employee potential and possibilities to contribute. Clear communication about the innovation strategy as a key element of the corporate strategy is recommended. The Innovation climate as is may become an obstacle to the company success. Comparison with the Sfinno™ data and discussions during the interview reveal that the company has disciplined processes and has typically reacted fast at the early ideation stages but the process later is considerably slower. The company had local focus and the strong and secure market position supported processes and practices which can be harmful in the fast changing environment. Elements of productive innovation process have been identified but some key elements seem to be incomplete or not yet implemented or in real practice. The results from the Dolphin Index survey and conclusions and recommendations in the report were confirmed to be accurate, the findings could be linked to specific factors influencing at the background, and supported by similar results from other recent surveys. In general the Dolphin Index survey was considered to be useful and practical both when considering the process as well as the results and both the commercialization and localization of the service was supported.

We now have collected the response to the Innovation Process Questionnaire from all pilot companies, the information for validating the results using three independent methods, and the final interview results. Next section introduces the results and the analysis of this material.

6.2 Testing the Questionnaire with Seven Pilot Companies

The main purpose of this Thesis stage is to test the Innovation Process Questionnaire by comparing the results with the validation material introduced in Section 6.1. The response to the questionnaire from each pilot company is compared with the findings from the E-mail survey (Section 6.1.1), the Dolphin Index survey (Section 6.1.2), the industry benchmark (Section 6.1.3), and the company interviews (Section 6.1.4). Based on the results, the preliminary validity of the proposed Innovation Process Questionnaire is assessed.

The final version of the Innovation Process Questionnaire [Table 12] and Industry Benchmark-questionnaire [Table 15] were sent in advance to the host of the project at each of the pilot companies. Five of the questionnaires were completed and returned

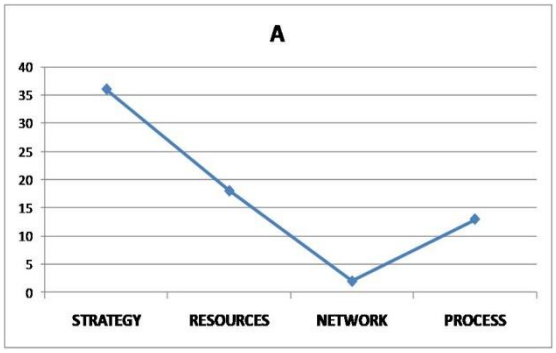
back before the interview meetings took place, and two were completed during the meetings. The results are shown in Appendix 3 [Table 17]. The sample size does not justify quantitative analysis methods. Furthermore, neither the questionnaire nor the Likert-scale that was used in the questionnaire has automatic scaling features. Thus, in order to be able to analyze the material further, the following strategy was chosen. The response for each of the items on the questionnaire was moderated by using the results for the parameter importance question as the moderating variable (company status x importance). The 20 items in the questionnaire were furthermore categorized under the five leading themes that were identified as main building blocks in Section 4. The first of these themes is innovation ***climate***, which is covered by the Dolphin Index survey (item 3 in the questionnaire). The second theme is ***strategy***, which refers to the overall alignment with the corporate strategy as well as to management and employee commitment (items 1, 2, 17, and 19 in the questionnaire). The third theme is ***resources***, which refers to the analysis and allocation of the appropriate resources and competencies as well as the measurement of the results (items 5, 8, and 20 in the questionnaire). The fourth theme is ***network***, referring to both internal and external networks and company policies and practices supporting networking (items 9, 10, 12, and 18 in the questionnaire). The fifth theme is ***process***, which refers to the roles, owners, gate definitions, and other innovation process specific topics (items 4, 6, 7, 11, 13, 14, 15, and 16 in the questionnaire). The detailed allocation of the questionnaire items under these topics is shown in Appendix 3 [Table 19]. The cumulative sum of the moderated results for the questionnaire items under each of these themes was calculated for each pilot company. The mean value for the team cumulative sum of all pilot companies was calculated as the base level and the deviation from this reference was calculated for pilot companies. These results, shown in [Table 20], were then used for testing the validity of the overall Innovation Process Questionnaire.

	Innovation process questionnaire moderated results Theme summary							
	A	B	C	D	E1	E2	F	Mean
STRATEGY	80	45	64	33	34	21	32	44
RESOURCES	52	39	44	32	20	21	28	34
NETWORK	52	37	77	53	42	37	51	50
PROCESS	85	98	117	77	35	26	66	72
	269	219	302	195	131	105	177	200
	Theme summary - deviation from the mean							
	A	B	C	D	E1	E2	F	
STRATEGY	36	1	20	-11	-10	-23	-12	
RESOURCES	18	5	10	-2	-14	-13	-6	
NETWORK	2	-13	27	3	-8	-13	1	
PROCESS	13	26	45	5	-37	-46	-6	

Table 20. Moderated innovation questionnaire results for the main themes.

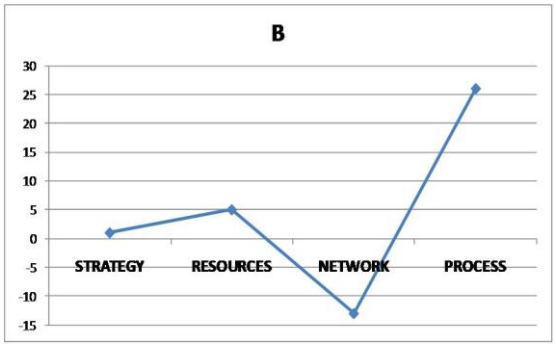
Table 20 illustrates the moderated Innovation Process Questionnaire results for the four main themes and the deviations from the mean for each of the seven pilot companies. The upper part of the table presents the summaries of the moderated Innovation Process Questionnaire results ([Table 17] and [Table 18, Appendix 3) for each of the identified main innovation process building blocks or themes for each of the pilot companies A – F. The mean value for each of the themes, which is used as the reference base line, is presented in the last column. The lower part of the table presents the deviation from the mean value for the four main themes for each of the pilot companies. As an example; Company B received for the *strategy* theme result 1, and for the *resources* theme 5 above the mean value, for the *network* theme result 13 below the mean value, and for the *process* theme result 26 above the mean value. These results indicate the status of each of these main blocks for the pilot companies in a relative order, and indicate where the investments should be primarily allocated. Next we study the results for each pilot company in more detail. A graph showing the company specific questionnaire analysis result is embedded, for clarity purposes, directly into the section where the findings for each company are discussed.

For Company A, the Innovation Process Questionnaire results suggest that, first, the items under the *network,* and, second, under the *process* theme are those where the



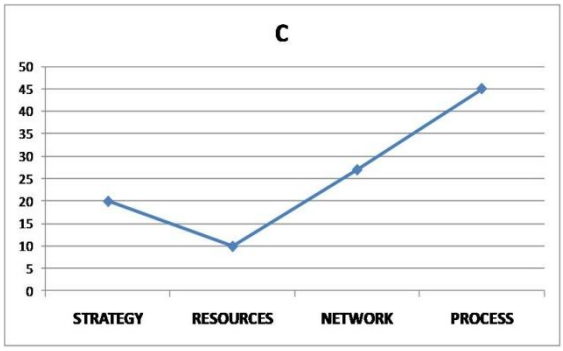
company should focus its process improvement activities. Company A has a clearly distinctive external innovativeness profile, and the survey results indicate that it is seen as highly innovative by external viewers. The industry benchmark comparison indicates that Company A has fast and well-disciplined processes in place. Innovation is a basic part of the company strategy. The Dolphin Index results indicate that the innovation climate and culture are also highly supportive and conductive of innovation. The results suggest that the *process* could be further improved by focusing on process ownership and discipline at gates, especially towards the front end. This is well backed up with the questionnaire findings, which also indicate that the *network* theme issues are linked to internal collaboration and practices of collecting ideas from a broad and versatile range of sources. The questionnaire results are supported with the other validation material.

For Company B, the Innovation Process Questionnaire results suggest that, first, the items under the *network,* and, second, under the *strategy* theme are those where the

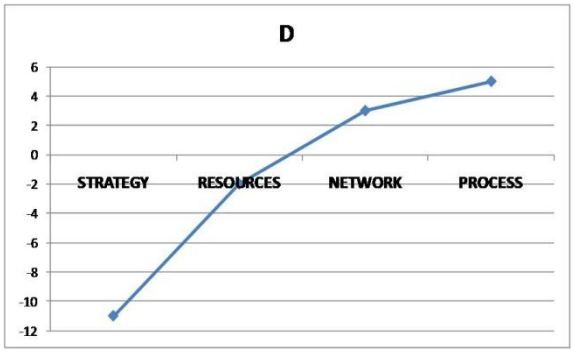


company should focus process improvement activities. This company does not have clearly distinctive external innovativeness profile, although the results can be interpreted as moderately positive. The industry benchmark comparison indicates that Company B works with a tight niche focus at fully global markets and also has fast and disciplined processes in place. The Dolphin Index results indicate that the innovation climate is moderately supportive and conductive of innovation but the results suggest that the *strategy* and common goals have probably not been consistently understood or accepted, and the assumptions about the innovation strategy seem to be rather mixed. This is well aligned with the questionnaire findings, which also indicate that the *network* theme issues are clearly linked to internal collaboration and practices of supporting external networking, especially at the front end of the process. The questionnaire results are supported with the other validation material.

For Company C, the Innovation Process Questionnaire results suggest that, first, the items under the *resources,* and, second, under the *strategy* theme are those where the company should focus process improvement activities. This survey indicates that the company does not have clearly distinctive external innovativeness profile. The industry benchmark comparison indicates that Company C has adopted really fast processes but the main focus is in incremental customer specific product adjustments rather than in completely new innovations. The Dolphin Index results indicate that the innovation climate is moderately supportive and conductive of innovation but the climate seems to be somewhat mixed and although the climate appears as rather relaxed the results indicate that company *strategy* and goals may not have been clearly communicated or accepted. Furthermore the results suggest that, although the company supports innovation, the expectations, as well as the possibilities to contribute at individual level, are not completely clear. This is well aligned with the questionnaire findings, which also indicate that the *resources* theme issues are linked to competence mapping and targeted competence development – a topic that has been already identified separately and corrective actions have been triggered. The questionnaire results are supported with the other validation material.

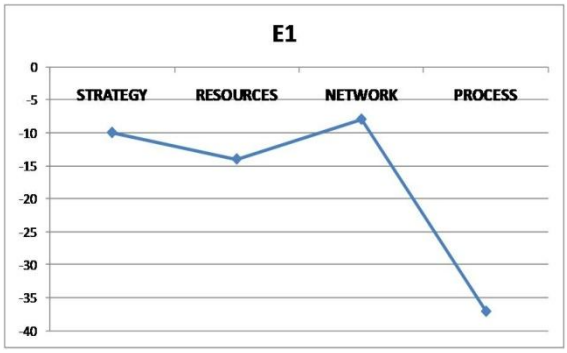


For Company D, the Innovation Questionnaire results suggest that, first, the items under the *strategy,* and, second, under the *resources* theme are those where the company should focus process improvement activities. This survey indicates that the company does not have clearly distinctive external innovativeness profile. The industry benchmark was considered not to have direct relevance in this case. The Dolphin Index results indicate that the company environment is supportive and conductive of innovation. The environment and climate seem to be relaxed and dynamic, and employees are committed, although the results indicate that innovation *strategy* and goals are potentially not consistently understood or accepted. Strategic alignment and communication about the goals and targets are important development areas for this company. This is aligned with the

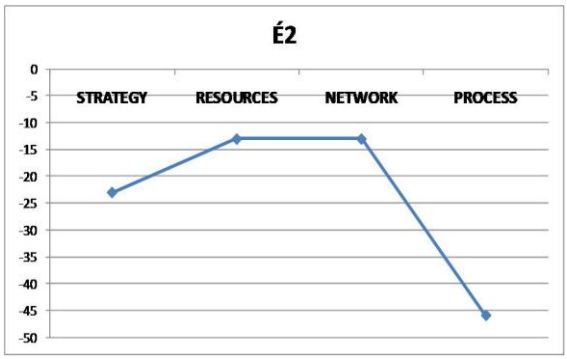


questionnaire findings, which also indicate that the *resources* theme issues are linked to performance metrics and similar details which understandably had lower priority during the recent fast turn-around process. The questionnaire results are supported with the other validation material.

For both Companies E1 and E2, the Innovation Questionnaire results suggest that, first, the items under the *process,* and, second, under the *strategy* theme are those



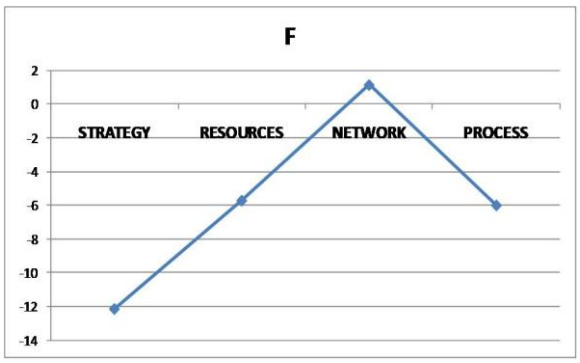
where the companies should focus process improvement activities. This survey indicates that company E1 does not have clearly distinctive external innovativeness profile. Company E2 joined the survey after the data for the external view was collected. Neither of these companies replied to the Industry Benchmark-questionnaire. The Dolphin Index results suggest that the prevailing climate in company E1 is non-supportive of innovation. The results suggest that the strategy has not been understood or accepted in a consistent way through the organization, and the findings suggest furthermore that there are potential issues with interpersonal relations. The innovation climate as is may become an obstacle to the success of the company and actions for synchronizing the perceptions and attitude about the strategy and common goals are of high importance. This is aligned with the questionnaire findings, which also indicate that the *process* theme issues are mainly linked to management and clear communication about the processes, roles, and expectations. The questionnaire results for Company E1 are supported with the other validation material. The Dolphin Index results for Company E2 indicate that the climate and company environment in general is highly and consistently supportive



to innovation and the climate seems to be very relaxed. It also seems that all important elements of the innovation process and process management have clearly been identified. The questionnaire results for Company E2 are not supported with the other validation material. This can be explained by other findings that were revealed during the interview. The merger of these two companies was starting at the time of the survey, and the questionnaire results, that are almost identical for both companies, may indicate that answers are at

least partially synchronized, and reflect the common view of the strategy and the perception of the main issues after the merger, rather than the exact status of the processes for Company E2 today.

For Company F, the Innovation Process Questionnaire results suggest that, first and foremost, the items under the *strategy* and, second, those under the *process* and *resources* themes are topics where the company should focus their process improvement activities. Company F has distinctive external innovativeness profile and the survey results indicate that it is seen as non-innovative by external viewers. The industry benchmark comparison indicates that the company has disciplined processes, and has typically reacted fast at the early ideation stages, but the process later is considerably slower. Furthermore, the strong and secure market position seems to have supported processes and practices, which can be detrimental in the fast changing environment. The Dolphin Index results indicate that the innovation climate and company environment in general are, at best, moderately supportive to innovation, and several potential challenges can be identified, starting from interpersonal relations, employee commitment, and management practices, which may potentially be perceived limiting employee potential and possibilities to contribute. Clear communication about the innovation *strategy* as a key element of the corporate strategy is of importance. Elements for a productive innovation *process* have been identified but some key elements seem to be incomplete or not yet implemented or in real practice. These findings are well aligned and the questionnaire results are supported with the other validation material.



The validation results clearly support the findings that the Innovation Process Questionnaire brought up with six of the pilot companies, and the conflicting results with one company can be explained by other case specific factors that were identified during the interview meeting. Next section provides the discussion and conclusions based on these results.

7 Discussion and Conclusions

The final section of the Thesis covers a brief summary of the Thesis and its results. The research implementation and its results, as well as the reliability and validity aspects, will be assessed in regard to the original targets and the research design plan. Finally, the recommendations and plans for future actions will be discussed.

7.1 Summary

This Thesis was scoped to develop a tool with which the innovativeness of a company can be briefly reviewed. Accordingly, the research objective for the Thesis was framed; How to devise an assessment tool for a quick diagnosis of a company's innovation aptitude! As a result of the company interviews and literature analysis, the primary proposal, the Innovation Process Questionnaire, was built, grounded on the existing knowledge. The tool was then validated using the material from several independent surveys and interviews, and tested with seven pilot companies. The results support the findings from six of the pilot cases; and the conflicting results with one of the companies can be explained by other factors that came up during the interviews. The results indicate that the proposed assessment tool can be used at a company level, for identifying the status with the key elements that are important to a successful innovation process. None of the findings for predicting company success should be used alone, but the results do help identify the major components for the platforms that help create competencies and capacity for a safer navigation in the fast changing business environment.

The key finding of this Thesis is that an express assessment tool for a quick assessment of a company's innovation aptitude is feasible. Presently, innovation is a top priority for most companies and the need to innovate is greater than ever. Despite the obvious importance there are very few tools available for individual companies to measure and benchmark their current state of innovativeness. This Thesis introduces a tool that helps companies assess fast their innovation aptitude and identify those areas in the innovation process where further investments would be most effective. Consequently, it can, for its part, help companies to shorten time to revenues; a topic that can have substantial economic importance also on the national level.

The following subsection discusses the implementation and the results of this Thesis in regard to the original targets and the research design plan.

7.2 Evaluation

This Thesis followed action research method and was completed in four consequent cycles. A summary of the contribution of each of these cycles is presented in Table 21.

Cycle	Stage	Contribution to the Thesis
Cycle 1	**Case company internal discussions**	The Thesis is linked to the case company activities and the results enhance the overall innovation process consulting services.
	Innovation expert interviews	Best practices view from the leading experts is supporting the structure of the Thesis.
Cycle 2	**Literature analysis**	The Innovation Process Questionnaire is grounded on existing knowledge and it covers the key elements of a well-functioning innovation process
Cycle 3	**E-mail survey**	External view of the pilot companies' innovativeness provides indicative background data that is supporting the questionnaire testing
	Dolphin Index survey	The survey supports the questionnaire testing. A compact, practical, convenient, and accurate process for measuring the innovation climate has been tested and localizing activities has been planned.
	Sfinno™ review	The comparison with the industry benchmark provides indicative background information for the testing of the questionnaire.
	7 pilot company interviews	The results provide insight to the company specific circumstances in a group that cover a broad and versatile sample of Finnish technology companies, enable validation material verification, and support the questionnaire testing.
Cycle 4	**Testing of the Questionaire**	Results support the validity of the tool and commercialization actions have been planned

Table 21. A summary of the contribution of the tasks in the action research cycles.

Table 21 illustrates the contribution of the various stages of the action research cycles.

In Cycle 1, results of the case company internal review process and leading innovation expert interviews were used for benchmarking and improving the original innovation funnel model. The results are then used as the conceptual framework during the literature analysis.

In Cycle 2, the Innovation Process Questionnaire was created, grounded on the findings from the literature analysis. The questionnaire covers the identified key elements of a successful innovation process. Nevertheless, the presented design and the detailed structure of the questionnaire are not perfect. Besides the grammatically inadequate expressions, some of the statements have unnecessarily complex sentence structures. For future use, the language as well as the design will be improved.

In Cycle 3, validation material for testing the questionnaire was collected in four stages.

A general view of the innovativeness of the pilot companies, as seen by a sample of external observers, was added by an e-mail survey. Given the small sample and the low response rate, the results are only indicative; but even as such the findings were of interest to most of the pilot companies.

The research suggests that innovation climate and corporate culture supporting innovation in general are the single most important factors behind a successful innovation process. Corporate culture development is a long term process, but some pictures of the prevailing climate can serve as a means for measuring and controlling the development. At the pilot companies the Dolphin Index survey was used for measuring the innovation climate, and it was proven to be a compact, practical, convenient, and accurate method for this purpose.

Material from the Sfinno^{TM} database was used for comparing the pilot companies' innovation processes with an industry benchmark. The original aspiration was to uncover the data that can be used for measuring the viscosity of the innovation process, e.g. by defining quantitative references for the speed of the various steps through the innovation process. As it can be concluded also from the literature analysis results, such references are largely very industry, time, and case specific, and this part did not finally provide much additional information that has any obvious or generic value for this Thesis. In any case, even though the results are only indicative, the company specific results, for those pilot companies that responded to the Industry Benchmark Questionnaire, did awake interesting and valuable discussion.

The results of the first three stages were discussed during the pilot company interviews. The pilot group covers a broad and versatile sample of Finnish technology companies, and the interviews provide additional insight to the company specific circumstances. The response to the Innovation Process Questionnaire was collected parallel to the four stages of Cycle 3.

In Cycle 4, the collected information was used for testing the Innovation Process Questionnaire. The testing was completed applying a strategy that was based on those main innovation process building blocks, which were identified during the analysis of innovation process.

Summing up, the project was completed based on the original research strategy and structure. The interviews were recorded in writing, following usual customer meeting practices and the summaries, as noted in this Thesis, were sent for comments to each of the interviewees. Although several parts of the specific reports of the pilot companies are considered as confidential, and the complete list of participating companies, as well as the full reports have been available only to the instructors of this Thesis, all stages of the research have been reported in such a way that the work can be repeated and verified independently. The Innovation Process Questionnaire is built on a basis of existing knowledge and the process, as well as the logic and data supporting decisions and conclusions, are documented in a reliable way.

In next subsection, the reliability and validity aspects will be revised and assessed as for how well the original plan and those targets that were set for this Thesis in Section 2.4, have been met.

7.3 Reliability and Validity

The plan for the reliability issues with the quantitative methods applied in this Thesis was to use standardized and well tested methods for the Internal View (6.1.2 – Dolphin Index survey) and Industry Benchmark (6.1.3 – Sfinno^{TM} database) stages.

The Dolphin Index survey is a standardized innovation climate survey and both, the reliability and validity of the construct are well-grounded and studied. The remaining issues are linked to the survey language, the sampling, and the response rate. An important portion of the survey response came from abroad, and only one of the companies indicated that the language had to be considered when defining the survey sample. Furthermore, the feedback regarding both the survey content and the questions was positive, and there are no indications of any difficulties that the language might have caused. The response rate for most of the pilot companies was, at best, moderate; and only Company A and E1 responses comply with strict statistical analysis requirements. As a result of research economic reasons, the potential impact of sample selection, self-bias, missing data, or other validity and data quality related aspects have not been examined; but the potential impact of these topics was discussed separately with each specific company during the interview meetings, and in all cases the results were considered to be representative and meaningful.

The Industry Benchmark Questionnaire did not provide much additional information that has any obvious or generic value for this Thesis, but the results did awake interesting and valuable discussion about the company specific topics. Eventually, the findings have been used as indicative background information for those pilot companies that replied to the questionnaire for this part of the project. The Sfinno™ database is a well structured and standardized source for reference information, and the reliability of the reference data can be considered to be well grounded.

The plan for the reliability issues with the e-mail survey was to use sufficiently independent and separate reviewer groups. As a result of the final response rate, this approach is not supported. Furthermore, a significant portion of the reviewers were not familiar with several of the selected pilot companies, and finally, only two of the companies have shown results that can be claimed to be somewhat distinctive. Therefore, the results from this part have been used mainly as indicative background data.

The design of the Innovation Process Questionnaire is based on the findings from the analysis of a broad and versatile selection of innovation literature sources; though the detailed list of the items on the reference list is a result of a subjective selection process. But since the sample covers more than 50 items, mainly from the past decade, holding articles from several of the most referred and recognized academic innovation think-tanks, it can be considered to be representative for the purposes of this Thesis. The method for selecting and categorizing the items for the Innovation Process Questionnaire is also clearly subjective. Furthermore, since the innovation funnel model was used as a generic benchmark reference during the analysis of the process it can also be argued to be prescriptive. The items were selected using defined selection criteria, and the content is well aligned with the results of the interviews with the innovation leaders (Section 3.2). The validation and testing of the results also suggest that the tool does reveal meaningful information. Thus, the construct of the study can be considered to be valid.

As for the testing procedures, the Innovation Process Questionnaire was sent to the pilot companies in advance, with the purpose of testing the language and the clarity of the message. In one of those cases, where the questionnaire was completed and returned in advance, the discussions during the interview meeting revealed that some part of the terminology was understood in a slightly different way than what was initially intended. The rest of the pilot cases did not bring up further indications of any

difficulties with the content. One of the pilot companies even adopted the questionnaire to be used as a check list for the company internal strategy processes. Finally, as the validation and testing of the results also, at least preliminary, indicate that the proposed tool is valid; therefore, validity can be considered to be supported.

The Innovation Process Questionnaire, which was developed during this Thesis, uses basic Likert scale for scoring. This decision was probably not optimal, as the tool does not have any features that help calibrate the response between different replies. The strategy that was chosen for analyzing the test results in this Thesis is based on categorizing the questionnaire items under common themes, and comparing the individual results with the mean values from all participating companies. This is a rather subjective method, taking into consideration that the calibration is largely based on qualitative data collected during the interviews. But for preliminary test of the validity of the construct, this method can be justified. With a significantly larger sample, statistical methods can be used for defining the benchmark standards and for tackling this issue. For further development of the questionnaire, and especially for the near future activities, this aspect should also be considered.

In next and final subsection, on the basis of all that has been above, the recommendations and plans for future actions will be discussed.

7.4 Further Prospects

The results of this Thesis indicate that the proposed Innovation Process Questionnaire is a valid and useful tool for fast assessing a company's innovation aptitude. The questionnaire, and especially the scale for rating the questionnaire items, requires some modifications; and features for automatic or forced scaling may be included. In general the proposed tool is useful, and the activities for its commercial launch have already started.

The Dolphin Index survey was also proven to be a practical method for fast reviewing the case companies' innovation climate, and the activities for the localization and commercialization of the tool has also been planned.

Innovation capability and continuous improvements are vital for maintaining Finnish competitive edge. There are a lot of expectations about ”innovation” and ”innovativeness” and yet, even the terms are ambiguous and not completely defined. The starting

point of the public discussion is largely concerned with the support instruments. These are essential elements and efficient ways of allocating the scarce resources, i.e. money, is of vital importance. Nevertheless, the focus should be more on the companies. Presently, there are little or no tools available for individual companies to measure and benchmark their current state of innovativeness. Furthermore, there is not enough data for supporting nation-wide innovation and innovativeness-related decision making. Thus, a 2-year project for collecting sufficient data and compiling a collection of best practices, with reference to Finnish companies, using the tools introduced in this Thesis, can be proposed as a next step in research.

The analysis with the Dolphin Index survey results has been done using the "UK-norm" as a reference. How relevant benchmark this finally is for Finland is an interesting topic for further academic research. A "Finnish-norm" backed with reliable statistical analysis is one of the targets for additional studies, given a sufficiently large data sample, which will become available e.g. as a results of the planned 2-year project.

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Metrics/paper	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	51	T	
INPUT: IDEATION AND PROCESS																																																				**QUESTIONNAIRE**
ALIGN INNOVATION STRATEGY WITH CORPORATE STRATEGY (fit w/ strategy)					1	1	1		1					1	1	1	1	1		1		1	1		1	1			1	1	1	1		1	1		1	1	1			1		1			1				**26**	Q1 & Q12
- innovation strategy defined (w/ senior mgmt commitment)						1														1					1					1		1			1			1				1		1			1				**10**	Q1
- strategy communicated and understood (verified) expectations						1	1		1					1						1					1	1						1		1													1				**10**	Q2
- competence mapping & gap analysis					1	1										1				1						1				1		1		1									1				1				**10**	Q8
- technology vs business model innovation - balance?																				1																											1				**2**	
- growth expectations from innovation defined																																						1													**1**	
INVESTMENTS IN INNOVATION - RESOURCE PLANNING			1	1	1	1	1				1					1	1			1		1		1	1	1				1	1	1		1	1		1	1	1			1	1	1			1				**25**	Q5
- effective and consistent incentive schemes - including non-financial							1													1					1							1					1		1											**6**	Q20
- Competence mapping, new competencies developed deliberately					1	1										1				1				1		1				1		1		1					1				1	1			1				**13**	Q8
- recruiting employees w/ broad scope of talents and training (complexity)					1	1																										1											1								**4**	
- technology/IT used to support innovation and innovation management																	1																														1				**2**	
- innovation and process training provided						1																																													**1**	
- resources						1																										1																			**2**	
- leadership commitment in terms of resources																				1																															**1**	
- dedicated and protected innovvation teams for radical innovations					1											1																					1					1	1								**5**	
- enabling platforms prepared for radical/discont inn at the front end																																										1									**1**	
PROCESS DEFINED		1			1	1	1									1				1				1					1	1		1	1	1			1					1	1						1		**16**	Q4
- FAST TRACK concept defined and prepared																1				1									1	1		1																		**5**	Q14
- process and dedicated/protected resources for radical innovations defined					1											1																					1					1	1								**5**	Q14
- performance measured against company internal objectives		1																						1																											**2**	
- industry average innovation economic value as benchmark																																																	1		**1**	
- standadization for improving cost efficiency and time-to-market							1																									1																			**2**	
- (holistic) process defined, communicated, and understood (incl roles!)						1																										1		1																	**3**	
- process covers systematic new idea screening, assesment and development						1																																													**1**	
FUNELL WIDTH - INCREASE THE NUMBER OF OPPORTUNITIES/IDEAS	1				1	1	1		1			1		1			1	1	1	1					1		1		1	1		1		1	1			1	1	1		1	1	1	1		1		1		**27**	Q12
- channell partners - idea source and/or outsourcing for cost benefits						1	1					1							1	1					1		1		1			1											1	1							**11**	Q12
- broad view from multiple channels and through transparent funnell	1				1		1					1													1							1		1				1				1					1		1		**11**	Q12
- constructive conflict - intl/extl informal discussions for colliding and combining ideas									1								1															1								1					1		1				**6**	Q9
- Lead users, pilot users, experts/hobbyists applied						1	1							1				1												1													1						1		**7**	Q18
- global networks, networking, extended networks, exhibitions, conferences						1						1								1					1							1			1							1			1						**8**	Q10
- open innovation/wisdom of crowds applied for maximising ideas												1						1												1											1				1						**5**	
- external experts used for invention/idea evaluation					1																																														**1**	
- a process to generate and renew ext/int insights exists																	1								1														1			1									**4**	
- increase opportunity/idea quality variance																																																	1		**1**	
- radical innovation = coincidence or even luck + passionate champion (41)GATEKEEPER						1																																				1									**2**	
- prepare for radical innovation - broad view																																1										1									**2**	
- RECYCLING (6-s146)						1																																													**1**	
- time spent on up-front activities >> improved new product performance																																										1									**1**	
- inteerfaces and individuals at the barrrier interfaces recognized and harnessed...																																										1									**1**	
CULTURE - CLIMATE (process fit w/ the culture)	1				1		1	1	1					1	1	1			1	1				1	1		1		1	1		1	1	1	1	1	1	1	1			1	1	1	1	1	1	1		1	**31**	Q3 - DII
- innovation climate (culture) development measured?																			1																																
- common culture shared and communicated						1								1																		1																			**3**	
- tolerance with risk and attitude with failure	1					1														1												1																			**4**	
- innovation a core part of activities - values						1										1																				1										1				**4**	
- continuosly challenge your opinions and frequently your attitudes																																													1		1				**2**	
- experimenting						1																										1															1				**3**	
- Breadth of organization participating in innovation (and decisions)	1								1																		1							1				1									1				**6**	Q2
- Former entrepreneurs in the company (also mgmnt level - leadership)																																1			1		1		1						1						**5**	Q3
- **information shared** at the organization level - essential part for building collective intuition																																										1									**1**	
CAPACITY TO ABSORB NEW IDEAS - LEARNING ORGANIZATION						1																		1								1												1		1					**5**	Q19
- NDA strategy successfull and defined																								1																											**1**	
- R&D personnell adaptability to technology changes																								1																											**1**	
- Increased knowledge acquired in R&D and venturing assessed?																								1																											**1**	
- felxibility - ability to respond rapidly to changes in requirements																																										1	1	1							**3**	
- seek extensive external insight - include 'outsiders' in the process					1																											1															1				**3**	
- networking, capabilities and incentives aligned																																1																			**1**	

Table 9. Literature review process ½.

Metrics/paper	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	51	T	
PROCESS MANAGED - LEADERSHIP and management	1		1	1	1	1		1			1			1	1	1	1	1		1		1					1		1	1	1	1		1	1	1	1	1	1			1		1	1		1	1	1		**31**	
- PORTFOLIO MANAGEMENT PRACTICED			1	1		1					1					1	1	1		1		1							1	1	1	1		1	1		1	1					1	1		1		1		**21**	Q17
- portfolios used for scenario planning & growth gap analysis				1	1	1			1														1				1			1	1				1							1		1		1		**12**	Q17
- investments in innovation of each type = balanced portfolio			1	1	1															1		1													1		1	1									1				**9**	Q17
- PLATFORM management/roadmaps for increasing the funnel yield						1												1	1		1										1		1		1																			**7**	
- Product management - well defined product definitons																																			1																			**1**	
- PIPELINE management for improving time-to-market						1											1																	1																					**3**	
- senior management aligned with and accountable of innovation strategy					1	1															1																	1																		**4**	
- innovation mentors in the organization - interanal innovators network					1																												1		1			1		1			1		1							**7**	Q6
- Innovation a key performance goal w/ supporting incentive schemes																		1																1					1		1													**4**	Q11
- cross-disciplinary/cross-functional and overlapping teams						1	1		1									1								1											1		1							1								**8**	Q3 - DII
- clear definiton for roles and expectations																																			1																			**1**	
- Total innovation = everyone is involved (also for diffusion)						1			1																																						1		1		1				**5**	Q3 - DII
- vision and strategy communicated - common language					1				1												1															1																		**4**	Q2
- process owner w/ clear link to decisions defined																					1									1			1	1	1														1	1			**7**	Q7
- clear communication supporting internal collaboration	1					1	1												1		1											1		1		1								1				1				**10**	Q9
- distinct styles/practices/ applied at different stages of the funnell				1	1	1																											1		1							1	1								**7**	Q14
- passionate champions role - people skills...																																1											1	1								**3**	
- measurable and actionable targets aligned with strategy						1																																															**1**	
- process and process improvement measured			1			1														1															1	1																		**5**	Q20
- Neutral/dispassionate portfolio management																															1																	1				**2**	
- flexible process incoporating best combination of old/new ideas											1																									1																	**2**	
- compared to competition																																						1															**1**	
- portfolio management improving investment decisions																	1																																					**1**	
- future trends tracked and included in scenarios																									1																		1			1						**3**	
- management commitment for metrics implementation															1																																							**1**	
- **gatekeepers and boundary spanners** recognized and empowered																																										1									**1**	
EXPLORATION: INVENTION AND BUSINESS CASE																																																				
DISCIPLINE AT GATES - PIPELINE MANAGEMENT			1						1								1	1													1	1	1	1		1			1	1	1			1									**13**	Q13
- FAIL FAST - prepare processes and practices fort this, managed failure!																	1	1																1															1				**4**	Q16
- willingness to kill projects that are not going to be successfull																	1																1					1	1													**4**	Q16
- apply absolute hurdles/value screens and relative comparisons																		1				1								1							1														1		**5**	Q13
- gate filters defined and clear - well informed gate decisions critical success factors					1				1																						1		1																		**4**	Q13
- selection must be efficient and accurate >> multiple rounds																																																	1		**1**	
- redirections																																								1											**1**	
- fast senior mgmt reactions to ideas offered					1			1																																											**2**	
- boundary interface decisions recognized and enabling tools exist																																										1									**1**	
VENTURING DECISIONS - ALTERNATIVE PATHS DEFINED					1	1						1					1			1				1								1						1			1									**9**	Q15
- steering and funding mechanisms																																1																			**1**	
- different funding sources exist/used for innovation						1																			1								1						1													**4**	Q14
- alternative paths prepared - licencing, spin-off, sell...					1							1					1		1	1											1																			**6**	Q15
- project interface decisions																																										1									**1**	
VOC(ustomers) - VOM(arkets)						1	1	1	1	1				1		1	1	1		1		1	1		1				1	1	1	1		1				1		1	1	1	1	1		1			1		**26**	Q18
- customer/market insight at all stages through the funnell																1						1			1				1	1						1		1		1				1							**9**	
- structured foresight process - emerging tech, changes in key attitudes																1						1							1	1		1						1														**6**	
- customers & suppliers involved in the innovation process																						1			1					1		1																			**4**	
- internal & external networking																				1		1						1																1							**4**	
- co-creation, experience innovation																																									1										**1**	
- business model innovations part of strategy																1																																			**1**	
- markets served accepts/demands innovation								1																																												**1**	
- marekting gatekeepers role. Technologu vice >>> market voice																																										1									**1**	
OUTPUT: VALUE CREATION																																																				
METRICS		1	1	1	1	1				1	1		1	1	1		1			1		1		1	1	1	1				1	1			1		1	1	1				1	1			1		1		**27**	Q20
- meaningful and actionable metrics						1														1						1								1												1				**5**	
- metrics clearly defined and communicated																				1					1	1																					1				**4**	
- balance between qualitative and quantitative															1					1						1																					1				**4**	
- metrics not too complex - KISS						1														1																1															**3**	
- volume/performance measured against competitive benchmark					1																		1		1																										**3**	
- flexible and tailored based on the business and type of R&D														1						1																														**2**	
- supported with appropriate incentives																																1																			**1**	

Table 10. Literature review process 2/2.

Literature review topic line	qty	%	QUESTIONNAIRE
ALIGN INNOVATION STRATEGY WITH CORPORATE STRATEGY (fit w/ strategy)	**26**	52 %	Q1
- innovation strategy defined (w/ senior mgmt commitment)	**10**	20 %	Q1
- strategy communicated and understood (verified) expectations	**10**	20 %	Q2
- Breadth of organization participating in innovation (and decisions)	**6**	12 %	Q2
- vision and strategy communicated - common language	**4**	8 %	Q2
- Former entrepreneurs in the company (also mgmnt level - leadership)	**5**	10 %	Q3 - DII
CULTURE - CLIMATE (process fit w/ the culture)	**31**	62 %	Q3 - DII
- cross-disciplinary/cross-functional and overlapping teams	**8**	16 %	Q3 - DII
- Total innovation = everyone is involved (also for diffusion)	**5**	10 %	Q3 - DII
PROCESS DEFINED	**16**	32 %	Q4
INVESTMENTS IN INNOVATION - RESOURCE PLANNING	**25**	50 %	Q5
- innovation mentors in the organization - interanal innovators network	**7**	14 %	Q6
- process owner w/ clear link to decisions defined	**7**	14 %	Q7
- competence mapping & gap analysis	**10**	20 %	Q8
- Competence mapping, new competencies developed deliberately	**13**	26 %	Q8
- constructive conflict - intl/extl informal discussions for colliding and combining ide	**6**	12 %	Q9
- clear communication supporting internal collaboration	**10**	20 %	Q9
- global networks, networking, extended networks, exhibitions, conferences	**8**	16 %	Q10
- Innovation a key performance goal w/ supporting incentive schemes	**4**	8 %	Q11
FUNELL WIDTH - INCREASE THE NUMBER OF OPPORTUNITIES/IDEAS	**27**	54 %	Q12
- channell partners - idea source and/or outsourcing for cost benefits	**11**	22 %	Q12
- broad view from multiple channels and through transparent funnell	**11**	22 %	Q12
- innovation strategy fit with corporate strategy	**26**	52 %	Q12
DISCIPLINE AT GATES - PIPELINE MANAGEMENT	**13**	26 %	Q13
- apply absolute hurdles/value screens and relative comparisons	**5**	10 %	Q13
- gate filters defined and clear - well informed gate decisions critical success factors	**4**	8 %	Q13
- FAST TRACK concept defined and prepared	**5**	10 %	Q14
- process and dedicated/protected resources for radical innovations defined	**5**	10 %	Q14
- distinct styles/practices/ applied at different stages of the funnell	**7**	14 %	Q14
- different funding sources exist/used for innovation	**4**	8 %	Q14
VENTURING DECISIONS - ALTERNATIVE PATHS DEFINED	**9**	18 %	Q15
- alternative paths prepared - licencing, spin-off, sell...	**6**	12 %	Q15
- FAIL FAST - prepare processes and practices fort this, managed failure!	**4**	8 %	Q16
- willingness to kill projects that are not going to be successfull	**4**	8 %	Q16
- PORTFOLIO MANAGEMENT PRACTICED	**21**	42 %	Q17
- portfolios used for scenario planning & growth gap analysis	**12**	24 %	Q17
- investments in innovation of each type = balanced portfolio	**9**	18 %	Q17
- Lead users, pilot users, experts/hobbyists applied	**7**	14 %	Q18
Voice of Customers - Voice of the Markets	**26**	52 %	Q18
CAPACITY TO ABSORB NEW IDEAS - LEARNING ORGANIZATION	**5**	10 %	Q19
- effective and consistent incentive schemes - including non-financial	**6**	12 %	Q20
- process and process improvement measured	**5**	10 %	Q20
METRICS	**27**	54 %	Q20

Table 11. Literature review process – identified common key topics (frequency of appearance in the reference literature indicated).

	PLEASE RATE THE STATUS AND IMPORTANCE OF FOLLOWING STATEMENTS IN YOUR ORGANIZATION		
	PLEASE USE FOLLOWING RATING: 1= Strongly disagree, 2=Disagree, 3= Neither agree nor disagree, 4=Agree, 5=Strongly agree		
	INNOVATION PROCESS INPUT: IDEATION, STRATEGY, AND PROCESS	**We are well prepared and practice this with good discipline**	**This is important parameter for our business**
1	Innovation strategy is defined, aligned with corporate strategy, and senior management is committed.		
2	Innovation strategy is clearly communicated and understood, and organization is broadly committed and participates in the process.		
3	Culture/climate - COVERED IN THE DII SURVEY	**COVERED IN THE DII SURVEY**	
4	Inovation process is clearly defined, communicated, and broadly understood.		
5	Appropriate resources are planned and allocated for supporting innovation process (including senior management commitment).		
6	Innovation champions and mentors are identified, recognized, and supported.		
7	Innovation process owners are defined, process is managed, and appropriate management processes are applied at various stages through the funnell.		
8	Competence mapping and gap analysisis exercised and process supports development of broad scope of talent and capabilities.		
9	Formal and informal practices for supporting internal collaboration and information sharing have been created, supported and adopted.		
10	Internal and external professional networking is encouraged and supported as an important source for new ideas and insight.		
11	Roles and expectations are clearly defined and performance is measured, and supported with well aligned incentive schemes.		
12	Strategy, culture and tools support idea collection from a broad and versatile range of sources (including structured forsight process, and customer, and supplier involvement).		
	INVENTION, BUSINESS CASE, AND DISCIPLINE AT GATES,		
13	Clear decision criteria at gates is defined, communicated, and applied with discipline.		
14	Distinct processes and practices have been defined for discontinuous innovation, and fast track processes are prepared.		
15	Alternative paths for IP/innovations (licencing, spin-off, selling...) are part of the strategy and actions are planned.		
16	Managed "fast failure" practices are defined and applied with discipline (including willingness to kill and recycle ideas that do not pass the gate filters).		
17	Portffolio management is exercised as a part of the innovation management process and used for scenario planning and for improving investment decisions.		
18	The Voice of Customer and the Voice of Markets are systematically linked into the innovation process at all stages through the funnell.		
	OUTPUT: VALUE CREATION AND METRICS		
19	Capacity to absorb new ideas, learn quickly, and adjust the process and practices fast and felxibly exist, process and practices are supported, and supporting behaviour encouraged.		
20	Innovation process is supported with a meaningful and actionable performance metrics that is clearly defined, communicated, and applied systematically.		

Table 12. The Innovation Process Questionnaire.

Appendix 2: Piloting the tool

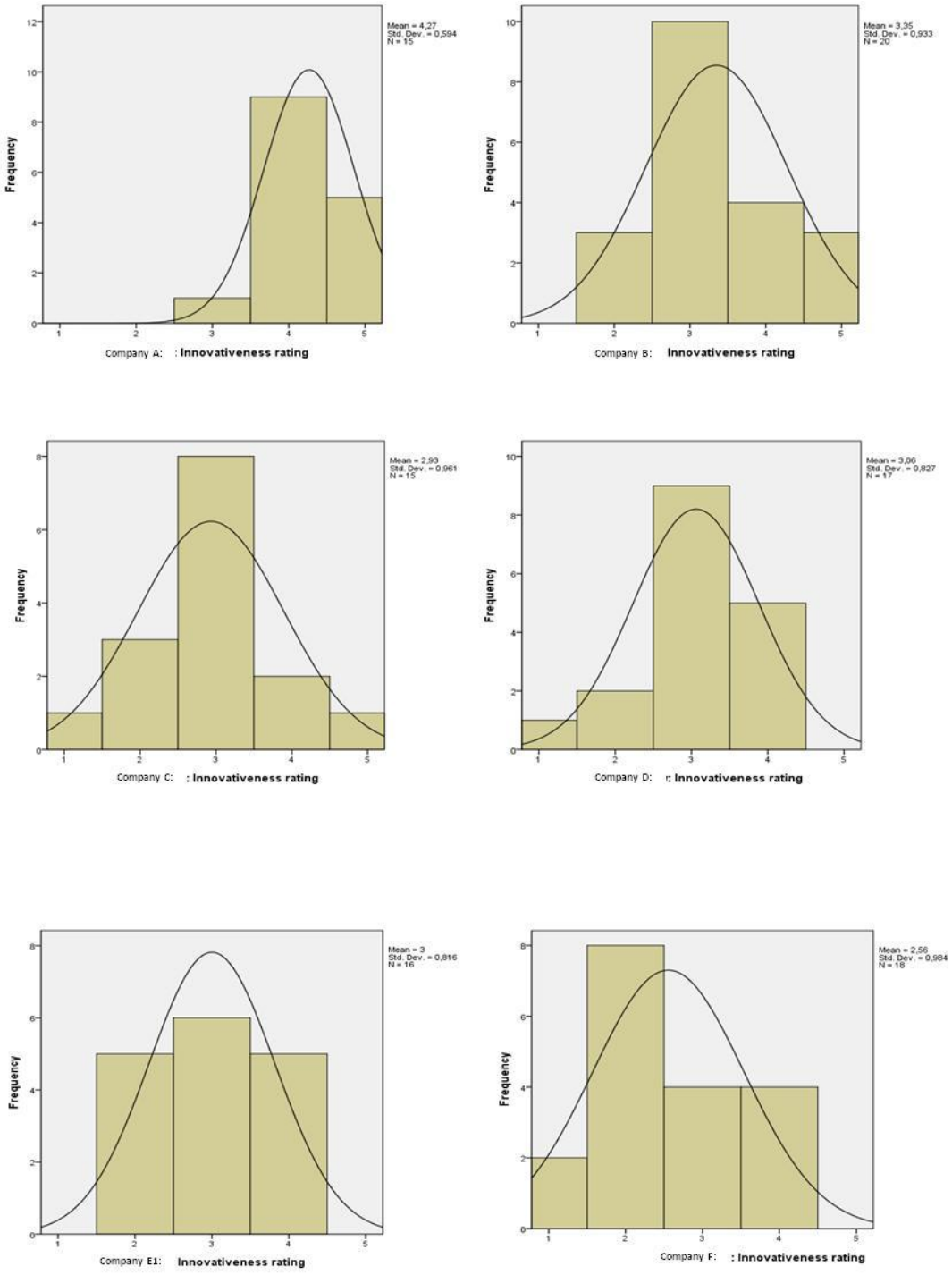
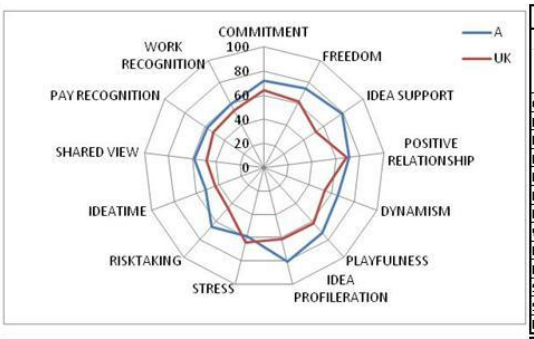


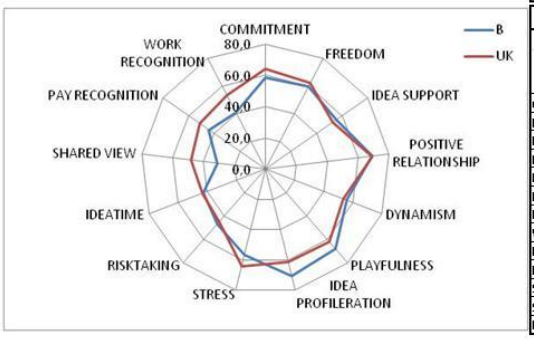
Table 13. External view – email survey results for the selected pilot companies.



Pilot company A

Climate survey means by ratings of inniovative organization classification

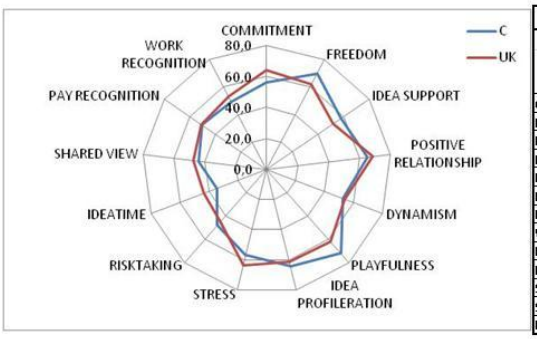
GROUP M EAN	Very low →	Low →	Moderate →	High →	Very High →	> Very High means
COMMITMENT					√	
FREEDOM				√		
DYNAMISM					√	
PLAYFULNESS					√	
IDEA PROFILERATION						√
RISKTAKING						√
IDEATIME					√	
WORK RECOGNITION				√		
IDEA SUPPORT						√
POSITIVE RELATIONSHIP				√		
STRESS					√	
SHARED VIEW					√	
PAY RECOGNITION					√	



Pilot company B

Climate survey means by ratings of inniovative organization classification

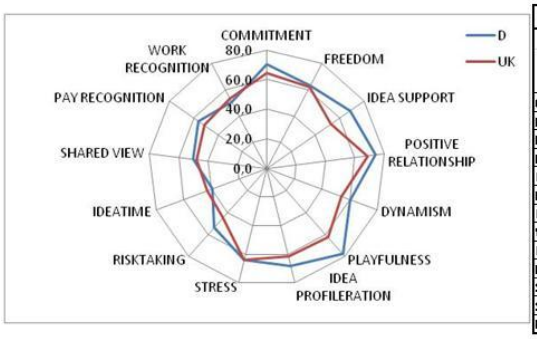
GROUP M EAN	Very low →	Low →	Moderate →	High →	Very High →	> Very High means
COMMITMENT			√			
FREEDOM			√			
DYNAMISM				√		
PLAYFULNESS					√	
IDEA PROFILERATION					√	
RISKTAKING				√		
IDEATIME				√		
WORK RECOGNITION		√				
IDEA SUPPORT					√	
POSITIVE RELATIONSHIP				√		
STRESS						√
SHARED VIEW	√					
PAY RECOGNITION	√					



Pilot company C

Climate survey means by ratings of inniovative organization classification

GROUP M EAN	Very low →	Low →	Moderate →	High →	Very High →	> Very High means
COMMITMENT		√				
FREEDOM					√	
DYNAMISM				√		
PLAYFULNESS					√	
IDEA PROFILERATION				√		
RISKTAKING				√		
IDEATIME		√				
WORK RECOGNITION			√			
IDEA SUPPORT						√
POSITIVE RELATIONSHIP		√				
STRESS						√
SHARED VIEW			√			
PAY RECOGNITION			√			

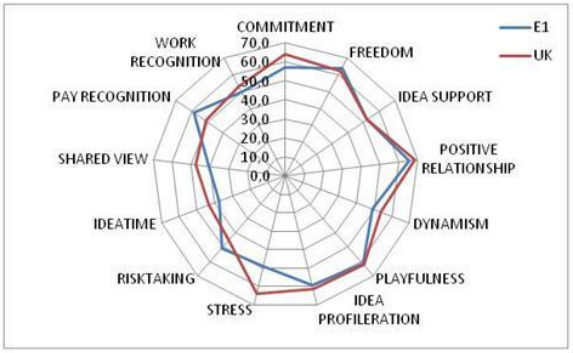


Pilot company D

Climate survey means by ratings of inniovative organization classification

GROUP M EAN	Very low →	Low →	Moderate →	High →	Very High →	> Very High means
COMMITMENT					√	
FREEDOM				√		
DYNAMISM					√	
PLAYFULNESS						√
IDEA PROFILERATION					√	
RISKTAKING						√
IDEATIME			√			
WORK RECOGNITION			√			
IDEA SUPPORT						√
POSITIVE RELATIONSHIP					√	
STRESS				√		
SHARED VIEW				√		
PAY RECOGNITION				√		

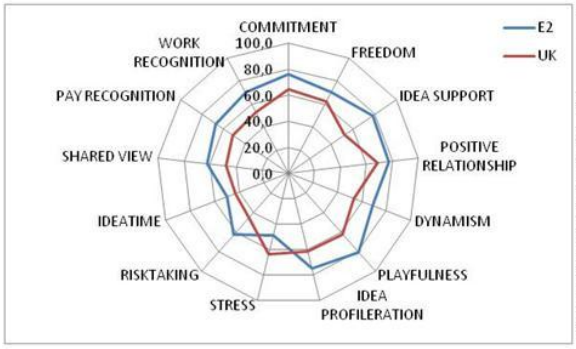
Table 14 (a). Dolphin index survey results – companies A – D.



Pilot company E1

Climate survey means by ratings of inniovative organization classification

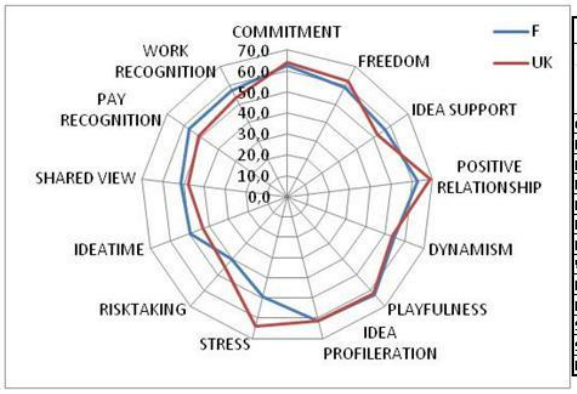
GROUP MEAN	Very low	Low	Moderate	High	Very High	> Very high means
COMMITMENT		√				
FREEDOM				√		
DYNAMISM			√			
PLAYFULNESS			√			
IDEA PROFILERATION			√			
RISKTAKING				√		
IDEATIME		√				
WORK RECOGNITION			√			
IDEA SUPPORT			√			
POSITIVE RELATIONSHIP		√				
STRESS						√
SHARED VIEW		√				
PAY RECOGNITION					√	



Pilot company E1

Climate survey means by ratings of inniovative organization classification

GROUP MEAN	Very low	Low	Moderate	High	Very High	> Very high means
COMMITMENT					√	
FREEDOM					√	
DYNAMISM					√	
PLAYFULNESS						√
IDEA PROFILERATION					√	
RISKTAKING						√
IDEATIME					√	
WORK RECOGNITION					√	
IDEA SUPPORT						√
POSITIVE RELATIONSHIP					√	
STRESS						√
SHARED VIEW					√	
PAY RECOGNITION					√	



Pilot company F

Climate survey means by ratings of inniovative organization classification

GROUP MEAN	Very low	Low	Moderate	High	Very High	> Very high means
COMMITMENT			√			
FREEDOM			√			
DYNAMISM				√		
PLAYFULNESS			√			
IDEA PROFILERATION			√			
RISKTAKING			√			
IDEATIME					√	
WORK RECOGNITION				√		
IDEA SUPPORT				√		
POSITIVE RELATIONSHIP		√				
STRESS						√
SHARED VIEW				√		
PAY RECOGNITION				√		

Table 14 (b). Dolphin index survey results – companies E1 – F.

	TYPICAL/AVERAGE TIME IN OUR ORGANIZATION FOR	time (m/a)
A9_1 a	Idea introduction - the start of development project	
A9_2 a	The start of development project - first prototype	
A9_3 a	The start of development project - the start of commercialization of the innovation	
A9_4 a	The start of development project - the start of export of the innovation	
A9_5 a	The start of development project - the breakeven point of the innovation	
A9_6 a	The start of development project - the development of the next generation of the innovation	
A9_7 a	A competitor commercialised a similar product in year	

	MECHANISMS USED FOR PROTECTING INNOVATIONS	YES	NO
A7	Patents		
A8_1	Trade marks		
A8_2	Other protection mechanisms, please specify:_____		

	PUBLIC FINANCING INSTRUMENTS USED FOR THE DEVELOPMENT OF INNOVATIONS?	YES	NO
A12_1	Technology Development Centre - TEKES		
A12_2	Ministry of Trade and Industry, other than Tekes		
A12_3	The Finnish National Fund - SITRA		
A12_5a	The Foundation of Finnish Inventions - Keksintösäätiö		
A12_6	European Union		
A12_8	Finnvera		
A12_9	TEkeskus - ELY-Keskus		
A12_7	Some other public organisation		

	FACTORS IMPACTING THE DECISION TO COMMENCE INNOVATION ACTIVITIES	0 = No significance	1 = Minor significance	2: Significant	3 = Great significance
A10	The intensification of price competition				
A10_1	The threat posed by rival innovation				
A10_2	The realisation of a market niche				
A10_3	The role of the customers				
A10_4	Public procurement				
A10_5	New scientific breakthroughs				
A10_6	New technologies				
A10_7	Public research or a technology programme				
A10_8	Environmental factors				
A10_9	Official regulations,legislation, standards				
A10_10	The availability of a licence				
A10_11	Other factors - which:_____				

	OTHER PARTIES COLLABORATING IN THE INNOVATION ACTIVITIES	0 = No significance	1 = Minor significance	2: Significant	3 = Great significance
A13_1	Other firms in the same concern				
A13_2	Domestic customers				
A13_3	Foreign customers				
A13_4	Domestic consults				
A13_5	Foreign consults				
A13_6	Domestic subcontractors				
A13_7	Foreign subcontractors				
A13_8	Domestic universities				
A13_9	Foreign universities				
A13_10	The Technical Research Centre of Finland - VTT				
A13_11	Other domestic research institutes				
A13_12	Foreign research institutes				
A13_13	Domestic competing company				
A13_14	Foreign competing company				
A13_16	Domestic supplier				
A13_17	Foreign supplier				
A13_15	Other, please specify:_____				

	PROBLEMS AND CHALLENGES IN INNOVATION ACTIVITY	0 = No significance	1 = Minor significance	2: Significant	3 = Great significance
A18_1	Financial factors				
A18_2	Factors related to knowhow				
A18_3	Market factors				
A18_4	Riskin the innovation activity				
A18_5	Other factors				

	OTHER BENEFITS AND IMPACTS OF INNOVATION	0 = No significance	1 = Minor significance	2: Significant	3 = Great significance
A19_1	Access to new markets & increased market share				
A19_2	Increased competitiveness and profitability				
A19_3	Improved way of action/methods and new patents				
A19_4	Strengthening of R&D				
A19_5	New contacts and cooperation + increased recognition				

Table 15. Industry Benchmark Questionnaire.

	TYPICAL/AVERAGE TIME (months) IN OUR ORGANIZATION FOR	A	B	C	F	S-mean	S-sd
A9_1a	Idea introduction - the start of development project	3	2-4	2	4	11	28
A9_2a	The start of development project - first prototype	6	3	1	2	10	17
A9_3a	The start of development project - the start of commercialization of the innovation	12	12		24	23	28
A9_4a	The start of development project - the start of export of the innovation	18	N/A		48	29	28
A9_5a	The start of development project - the breakeven point of the innovation	24	?		36	36	33
A9_6a	The start of development project - the development of the next generation of the innovation	24	12		60	49	40
A9_7a	The start of development project - a competitor commercialized a similar product	18	6		36	28	34

	MECHANISMS USED FOR PROTECTING INNOVATIONS	YES	NO	S-YES%	S-NO%
A7	Patents	A,B,F	C,D	44,6	52,8
A8_1	Trade marks	A,B,C,D	F	19,7	23,8
A8_2	Other protection mechanisms, please specify: (A: Trade Secrets, F: Protection of designs)	A,F	B,D	28,5	10,9

	RELEVANT CONTRIBUTORS/PARTIES INVOLVED IN THE DEVELOPMENT OF THE INNOVATIONS	YES	NO	S-YES%	S-NO%
A11	Inhouse R&D activity	A,B,C,D,F		48,1	1
A12	Public financing instruments used for the development of innovations	A,C,D	F	59,6	37,8
A13-a	Collaboration with other domestic partners	A,B,C,D,F		46,1	
A13-b	Collaboration with other foreign partners	A,B,D	C,F	6,2	
A14	Tekes technology programme	A,B,C,D,F		8,8	40,4
A15	Another public technology programme	B,C,D,F	A	2,1	44,6

	FACTORS IMPACTING THE DECISION TO COMMENCE INNOVATION ACTIVITIES	0 = No significance	1 = Minor significance	2 significant	3 = Great significance	S-mean	S-sd
A10	The intensification of price competition	C	B,D	A	F	1,31	961
A10_1	The threat posed by rival innovation		C,D	A,B	F	1,14	810
A10_2	The realisation of a market niche		C	D,F	A,B	2,27	743
A10_3	The role of the customers			B,C,D,F	A	2,23	791
A10_4	Public procurement	A,B,C	D		F	0,47	731
A10_5	New scientific breakthroughs	B,C,D,F		A		0,72	965
A10_6	New technologies		C	A,D,F	B	0,98	1176
A10_7	Public research or a technology programme	D	A,B	C,F		0,77	,886
A10_8	Environmental factors		A,B,C,D,F			1,18	1096
A10_9	Official regulations, legislation, standards		A,B,C	F	D	1,04	,942
A10_10	The availability of a licence	C	A,B,D,F			0,16	862
A10_11	Other factors - which: (F: Work safety)			F		0,45	,964

Table 16 (a). VTT Sfinno™ database results ½.

	OTHER PARTIES COLABORATING IN THE INNOVATION ACTIVITIES	0 = No significance	1 = Minor significance	2 = Significant	3 = Great significance	S-mean	S-sd
A8_1	Other firms in the same concern	A,C,D	F	B		0,75	.986
A8_2	Domestic customers		B	A,D	C,F	1,84	869
A8_3	Foreign customers			B,C,D,F	A	1,49	1029
A8_4	Domestic consults	D	A,B,F	C		0,65	.876
A8_5	Foreign consults	B,D	C,F	A		0,32	.864
A8_6	Domestic subcontractors		A,D	B,C,F		1,16	943
A8_7	Foreign subcontractors	A,C,F	D	B		0,87	992
A8_8	Domestic universities	D	B,C	A,F		1,01	1057
A8_9	Foreign universities	C,D,F	A,B			0,39	.722
A8_10	The Technical Research Centre of Finland - VTT	D	A,B,C,F			0,76	994
A8_11	Other domestic research institutes	B	A,C,D,F			0,57	.811
A8_12	Foreign research institutes	B,C,F	A,D			0,38	.881
A8_13	Domestic competing company	B	C,D,F	A		0,41	.818
A8_14	Foreign competing company		B,D,F	A,C		0,48	.737
A8_15	Domestic supplier	A,C,D	B,F			1,26	.811
A8_16	Foreign supplier	A,C,D,F		B		1,47	.879
A8_17	Other, please specify:____________			A			

	PROBLEMS AND CHALLENGES IN INNOVATION ACTIVITY	0 = No significance	1 = Minor significance	2 = Significant	3 = Great significance	S-mean	S-sd
A9_1	Financial factors		B,F	A,C,D		2,53	1004
A9_2	Factors related to knowhow			A,B,C,D,F		2,55	.798
A9_3	Market factors		B	C,D,F	A	2,71	.761
A9_4	Risk in the innovation activity		B,D	A,C,F		2,48	.713
A9_5	Other factors : (F: Participants workload)			A	F		

	OTHER BENEFITS AND IMPACTS OF INNOVATION	0 = No significance	1 = Minor significance	2 = Significant	3 = Great significance	S-mean	S-sd
A9_1	Access to new markets & increased market share			C,D	A,B,F	2,78	804
A9_2	Increased competitiveness and profitability			B,C	A,D,F	2,81	.866
A9_3	Improved way of action/methods and new patents			A,B,C,D,F		2,44	.911
A9_4	Strengthening of R&D		B,C	A,D,F		2,65	.743
A9_5	New contacts and cooperation + increased recognition		D,F	A,C	B	2,89	.771

Table 16 (b). VTT Sfinno™ database results 2/2.

Company status								Importance							
Q	A	B	C	D	E1	E2	F	Q	A	B	C	D	E1	E2	F
1	4	3	4	1	2	2	2	1	5	4	4	4	4	3	4
2	4	4	4	1	2	1	1	2	5	5	4	4	4	3	4
4	3	5	4	3	1	1	2	4	5	3	4	4	3	2	4
5	4	2	4	3	2	2	2	5	5	4	4	4	4	3	4
6	2	5	4	3	1	1	2	6	4	5	5	3	4	3	4
7	2	5	4	3	1	1	3	7	5	4	4	4	3	3	4
8	3	2	3	4	2	3	3	8	4	3	4	4	4	4	4
9	4	3	5	4	3	3	3	9	4	3	5	4	4	5	4
10	4	2	4	3	4	2	3	10	4	4	4	3	5	4	4
11	3	3	3	5	2	1	3	11	4	3	4	4	3	3	4
12	2	2	4	3	2	2	3	12	4	4	4	4	3	3	4
13	2	2	3	2	1	1	2	13	4	2	4	3	4	3	3
14	3	3	4	2	1	1	2	14	4	3	4	3	4	3	3
15	4	4	3	2	2	2	2	15	3	3	3	3	4	3	3
16	2	2	4	2	1	1	2	16	4	2	4	3	3	3	4
17	4	3	4	4	1	2	2	17	5	3	4	4	3	3	4
18	3	3	4	4	1	2	3	18	4	4	5	4	4	4	5
19	4	2	4	3	3	2	3	19	5	2	4	3	5	3	4
20	4	5	4	2	1	1	2	20	5	5	4	2	4	3	4

Table 17. Innovation Process Questionnaire results.

Q	A	B	C	D	E1	E2	F
1	20	12	16	4	8	6	8
2	20	20	16	4	8	3	4
4	15	15	16	12	3	2	8
5	20	8	16	12	8	6	8
6	8	25	20	9	4	3	8
7	10	20	16	12	3	3	12
8	12	6	12	16	8	12	12
9	16	9	25	16	12	15	12
10	16	8	16	9	20	8	12
11	12	9	12	20	6	3	12
12	8	8	16	12	6	6	12
13	8	4	12	6	4	3	6
14	12	9	16	6	4	3	6
15	12	12	9	6	8	6	6
16	8	4	16	6	3	3	8
17	20	9	16	16	3	6	8
18	12	12	20	16	4	8	15
19	20	4	16	9	15	6	12
20	20	25	16	4	4	3	8

Table 18. Moderated innovation questionnaire results.

	Questionnaire - reqrouping for analysis	MAIN THEMES
1	Innovation strategy is defined, aligned with corporate strategy, and senior management is committed.	STRATEGY
2	Innovation strategy is clearly communicated and understood, and organization is broadly committed and participates in the process.	STRATEGY
3	Culture/climate - COVERED IN THE DII SURVEY	DII SURVEY
4	Inovation process is clearly defined, communicated, and broadly understood.	PROCESS
5	Appropriate resources are planned and allocated for supporting innovation process (including senior management commitment).	RESOURCES
6	Innovation champions and mentors are identified, recognized, and supported.	PROCESS
7	Innovation process owners are defined, process is managed, and appropriate management processes are applied at various stages through the funnell.	PROCESS
8	Competence mapping and gap analysisis exercised and process supports development of broad scope of talent and capabilities.	RESOURCES
9	Formal and informal practices for supporting internal collaboration and information sharing have been created, supported and adopted.	NETWORK
10	Internal and external professional networking is encouraged and supported as an important source for new ideas and insight.	NETWORK
11	Roles and expectations are clearly defined and performance is measured, and supported with well aligned incentive schemes.	PROCESS
12	Strategy, culture and tools support idea collection from a broad and versatile range of sources (including structured forsight process, and customer, and supplier involvement).	NETWORK
14	Clear decision criteria at gates is defined, communicated, and applied with discipline.	PROCESS
15	Distinct processes and practices have been defined for discontinuous innovation, and fast track processes are prepared.	PROCESS
13	Alternative paths for IP/innovations (licencing, spin-off, selling...) are part of the strategy and actions are planned.	PROCESS
16	Managed "fast failure" practices are defined and applied with discipline (including willingness to kill and recycle ideas that do not pass the gate filters).	PROCESS
17	Portffolio management is exercised as a part of the innovation management process and used for scenario planning and for improving investment decisions.	STRATEGY
18	The Voice of Customer and the Voice of Markets are systematically linked into the innovation process at all stages through the funnell.	NETWORK
19	Capacity to absorb new ideas, learn quickly, and adjust the process and practices fast and felxibly exist, process and practices are supported, and supporting behaviour encouraged.	STRATEGY
20	Innovation process is supported with a meaningful and actionable performance metrics that is clearly defined, communicated, and applied systematically.	RESOURCES

Table 19. Innovation Process Questionnaire – the identified main Themes.