UNIVERSITY OF VAASA
FACULTY OF TECHNOLOGY
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PERFORMANCE INDICATORS FOR THE FRONT END OF INNOVATION

Master's Thesis in
Industrial Management

VAASA 2011

FOREWORD

Knowledge management is an exciting challenge, especially when it comes to refining and sharing knowledge. While the corporate world is seeking out ways to squeeze out more innovations, it's important to keep all the involved knowledge in order. Contained between these covers is a spoonful of that which is - knowledge management as a whole – called idea management. It is a vast field of study and surely will provide researchers enough to argue over for countless studies.

This has been a really interesting thesis to write. I have personally learned much through the endeavour, in the course of which my view of what I want to become when I "grow up" has (finally!) started to gain focus.

I want to extend my heartfelt gratitude to my supervisor at Wärtsilä Finland, Mr. Antti Tuomainen. It has been a real pleasure working with you and to see the work we've done proving itself useful for those around us. Wärtsilä, its New Technologies & Innovations department and General Manager Ilari Kallio deserve my thanks for giving me a chance to develop both the company and my own competencies with this work. Also, I wish to thank Professors Josu Takala and Marja Naaranoja of the University of Vaasa for guidance and critique along the path.

The work-front could have panicked at some point without a solid home-front, so I wish to send thanks to my mom and to the rest of my family for their continuous support. Finally, a big "děkuji" to Jana for keeping my engine running all this time.

Arto Jyrälä

Vaasa, 17.05.2011

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LIST OF ABBREVIATIONS AND ACRONYMS

FEI	Front End of Innovation
FFE	Fuzzy Front End
KPI	Key Performance Indicator
KRI	Key Result Indicator
NBD	New Business Development
NPD	New Product Development
PI	Performance Indicator
RSP	Research Surplus Portfolio

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VAASAN YLIOPISTO
Teknillinen tiedekunta
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Tutkielman nimi: Suoritemittarit innovaation alkuvaiheessa
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Tutkinto: Kauppatieteiden maisteri
Oppiaine: Tuotantotalous
Opintojen aloitusvuosi: 2008
Tutkielman valmistumisvuosi: 2011 **Sivumäärä: 82**

TIIVISTELMÄ:

Tässä tutkielmassa haetaan vastauksia siihen, mitä suoritemittareita Wärtsilä Finland Oy:n tuotekehitysyksikköjen kannattaa käyttää innovaatioprosessin alkuvaiheen (Front End of Innovation, FEI) seuraamiseen. Innovaation alkuvaihe on epäselvä ja usein kaoottisena pidetty vaihe, jossa yrityksen tietopääomaa kasvatetaan uusilla ideoilla. Ideoiden arviointi ja oikean kehityssuunnan osoittaminen tässä vaiheessa nopeuttaa niiden kehitystä kaupallisesti hyödynnettäväksi innovaatioiksi, joten alkuvaiheen tarkasteluun kannattaa käyttää tarpeeksi resursseja.

Tutkielmassa on käyty läpi ideanhallinnan periaatteita ja tuotekehitys/innovaatioprosessia. Innovaatioprosessin alkuvaihe rajautuu yrityksessä valittujen strategisten tekijöiden mukaan. Näiden perusteella valitaan ideat, jotka sopivat yrityksen resursseihin ja tulevaisuudennäkymiin kullakin hetkellä.

Työssä on käytetty Balanced Critical Factor Index metodia, jolla selvitettiin yrityksen henkilöstön kokemuksia ja odotuksia ideanhallinnalta tulevaisuudessa. Tiedot tutkimusta varten kerättiin kyselyllä. Kriittisimmäksi tekijäksi kaikkien vastaajien keskuudessa nousee ideoiden kerääminen. Huomionarvoista on myös, että prosessin vaatima työmäärä oli epäselvä, mikä vaatii organisaatiolta selkeitä linjanvetoja ja ohjeistusta prosessiin osallistuville.

AVAINSANAT: Ideanhallinta, innovaatio, suoritusmittaus, innovaatioprosessin alkuvaihe

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Year of Completing the Master's Thesis: 2011 **Pages: 82**

ABSTRACT:

This study tries to answer the question of which performance indicators Wärtsilä Finland Oy should use to measure its Front End of Innovation (FEI) process. The FEI, where new ideas are introduced to the organization's knowledge base, is perceived unclear and at times chaotic. The evaluation of ideas and finding the right development path in this phase allows for faster development into commercially utilized innovation. Therefore, using enough resources for the front end evaluation pays off in the long run.

The theoretical framework for the thesis is built on the principles within idea management and the new product and business development process. The FEI is scoped by selected strategic factors in the organization. Based on these factors, the company screens ideas that correspond to the available resources and its future vision.

The used method is the Balanced Critical Factor Index method, which studies the experiences and future expectations of the company's employees. The data was collected by means of a survey. The 'idea collection method' surfaced as the most critical factor, according to the respondents. It is also worth noticing that the amount of work required by the idea evaluation process was found rather ambiguous, which will require the organization more specific instructions regarding the process.

KEYWORDS: Idea management, innovation, performance measurement, front end of innovation

1. INTRODUCTION

In modern day business, new product and business development and innovation are among the most fertile sources of competitive advantage. Companies devote massive resources for bringing improved or completely new solutions out to the market to stay ahead of competition. Several studies have looked into traditional research & development, trying to break it down into manageable stages, to control and coordinate the flow of ideas from the minds of individuals towards innovations. There exists an excess of production and innovation management literature, but relatively few studies have yet concentrated on the specifics of the front end of innovation, i.e. the stage where ideas are generated and recorded into the organization's knowledge base.

The Boston Consulting Group has found out through one of their surveys, that even though organizations have been putting more effort in innovation activities, they are still too slow in their attempts to innovate, fragmented across too many projects, and that there is no common alignment that covers the entire organization (Boston Consulting Group, 2005). Their other surveys (for example Andrew, Haanæs, Michael, Sirkin & Taylor, 2008; 2009) display similar results, stating that a great deal of companies do not measure their innovation activities effectively by using the correct metrics throughout the innovation-to-cash chain. They even claim that there are companies whose executives do not believe that measuring innovation is useful (ibid, 2009).

1.1. Purpose of the study

This study was commissioned by the Wärtsilä Finland, an engine and power solutions manufacturer. The company's interest is to establish a defined and focused idea/innovation management system. This study serves to append the company's decision-making with knowledge about the processes in idea management, and specifically to clarify the front end of innovation. In order to establish this, ways and criteria to measure idea eligibility and strategic fit in the front end of innovation are studied by appropriate methods and material. The overall purpose is to find a set of

reliable performance indicators that yield the company management valid information about its idea management, and to find the criteria by which new ideas are assessed for further development.

1.2. Objectives of the study

The overall objective of this study is to find suitable criteria to assess and evaluate individual ideas generated in the company and the performance indicators for the front end of innovation. Other objectives include making suitable reporting models to support the idea management process as a whole. Statistics collected for separate stakeholder groups are used to enhance and develop the idea screening process and follow-up for it to move eligible ideas further down the development processes.

1.3. Scope of the study

This study will concentrate mostly to how the case company can improve its idea management and measuring the strategic value of ideas in the stages of idea recording and initial screening, often referred to as the Front End of Innovation (FEI). Since the FEI is a very narrow part of the process and as such would yield only partially useful results, this study will also inspect measurement and reporting options of the idea management process to selected stakeholders. The scope was defined and specified by the commissioner of the study. Therefore, it is not in the scope of this thesis to specify the ideation phase, i.e. how ideas originate. Ideas are considered to originate at this stage only from within the company, and the focus is in measuring them within the limited process.

In the field of innovation management, there are topics such as open innovation and crowdsourcing, which are not covered in this thesis. These are left out of the scope firstly because the case company has not wanted to include these in its idea management yet. The technologies the company uses are seen as overly complex, and some are

protected by patents. For disclosing such information to external sources, the legal side of matters needs to be specified. In addition, idea origination from customers is left out of the scope for the same reason. Without legal consultation and specification (which is the future intention of the case company), this thesis does not include these topics.

1.4. Research questions

In the light of the aforementioned scope and objectives, the following research questions will direct the study and provide a thread to follow throughout the study:

1. What criteria should the company use for the initial screening of individual ideas?
2. How can the idea management process be measured and reported for stakeholders?
3. What follow-up procedures should the company consider for evaluated ideas?
4. How are the toolset and reporting for idea management further developed to correspond to stakeholder requirements?

1.5. Structure of the thesis

Figure 1: Structure of the thesis

The thesis is divided into sections thematically. This introduction chapter presents the topic and the overall purpose of the thesis. The subject, idea management for new business development is presented in the second section. More background material for performance indicator measurement is introduced in the third section. The study method this thesis uses is elaborated in the fourth section.

Section 5 presents the case at hand, as it is commissioned by the case company, Wärtsilä. Section 6 presents and analyzes the study results yielded by the used Balanced Critical Factor Index method. Section seven further discusses the analyses and handles the causes for what the study shows, in light of the given results. Section 8 draws a conclusion for the thesis and makes recommendation for the case company. The section is followed by the bibliography and appendices, including a copy of the questionnaire used in the study, the corporate units of respondents and the BCFI values of different respondent groups. The next section will start the theoretical part of the thesis by introducing the themes around idea management.

2. IDEA MANAGEMENT

This section introduces the subject area of idea management and provides background knowledge about the theories therein. Idea and innovation management are important core topics that contain an enormous amount of information on their own. Furthermore, there are theories and solutions in the fields of project and (product) portfolio management, in addition to technology roadmapping, that supplement the material. This material is introduced as it fits the topics of the front end of innovation and idea management.

2.1. Idea management

Idea management is a key topic in new product and business development. It has a central focus because the strategic decisions about how to attract and collect new ideas, and what to do with them, can be vital to the company's success in the market. It is a common statement by companies that a leading driver for their business is specifically innovation. This process should be fed by well-constructed idea management.

Idea management can be seen as the function that controls and directs the information flow between idea originators and idea recipients. It works as a mediator and attempts to push viable ideas through the development chain while also screening out less attractive ideas. The management of ideas should be pervasive throughout the new product and business development path. The ultimate objective of idea management is to support and facilitate processes to reach the goals derived from corporate strategy, related to new product and business development.

Idea, invention, innovation

In order to specify the subject, it is necessary to make a distinction between the associated terms within idea management. The terms "idea", "invention", and "innovation" are sometimes used interchangeably, which may cause confusion and

ambiguity. Especially “innovation” or “innovative” have become hype words whose meaning tends to differ from context to context.

Defining innovation unambiguously is a tricky task. Authors throughout the field have their own views on how to make a distinction between ideas, inventions and innovations. Trott (2008) claims that innovation is the combination of theoretical conception, technical invention and commercial exploitation. Theoretical conception means generating and recording new ideas. Technical invention is the application of ideas and thoughts to form new products or concepts. Ultimately, what is still needed for innovation is commercial exploitation, which means that the new product or concept has to produce commercial value for the corporation (Trott, 2008). In this perspective, innovation should be considered a long-term activity, in contrast to ideas or inventions that may be spontaneous and quickly developed, while possibly never producing commercial success.

In accordance with the stated requirement of commercial exploitation, this thesis will handle front end of innovation in terms of idea management. The matter is approached with the presumption that idea generation and recording are instantaneous. These provide the basic structure upon where the elements that make up innovations are built, through development processes (and which produce commercial value in the long run).

The overall purpose of idea management is to bring new information into the organization and to upgrade existing knowledge both qualitatively and quantitatively. When the organization has access to new knowledge, it can allegedly find competitive advantages to improve its business.

Idea and innovation management are strongly connected to the new product development (NPD) process. NPD is fed with new ideas, and the processes within idea and innovation management direct the flow of ideas according to a set categorization. Poskela (2009) unambiguously states that managing the front end is “extremely challenging”. However, he claims that control is necessary in reaching the company’s long-term goals.

Idea generation and capture

Idea generation is a phase where ideas are created. Codification of the knowledge embedded in the ideas takes place as idea capture and recording. The recording can be done for example, with an “idea box” type of initiative system, usually in the form of computer software or web application.

Dr. Robert G. Cooper, a highly cited author in the field of project management, introduced the Stage-Gate model for new product development in 1986. According to the model, a project starts as an idea and passes through development stages where the idea is refined into a (product) concept. It then passes through later stages until it becomes a finalized product or service. Between the stages, there are assessment gates through which the concept may only pass if it fulfills the required criteria.

Cooper (2002) has later added a discovery stage in the beginning of the process is meant for collecting ideas centrally from contributors to a formal idea management system (Cooper, 1986, 2002). Figure 2 illustrates the Stage-Gate model:

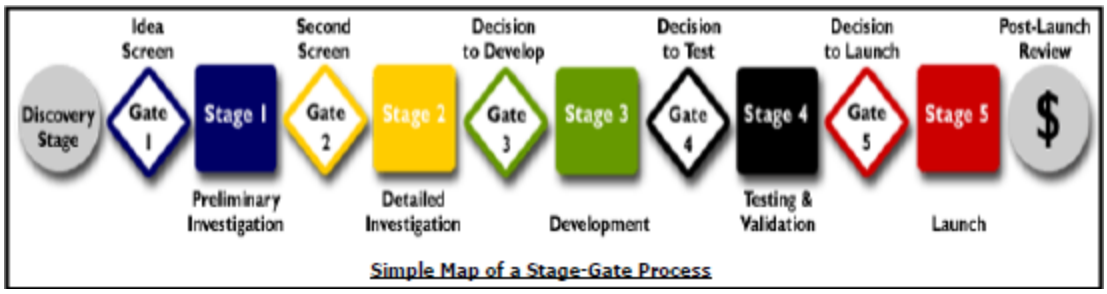

Figure 2: The Stage-Gate model (Cooper, 2002)

The Stage-Gate model has been developed as a management tool that examines and directs the progress of new product development. It also integrates the process with company strategy, and directs new ideas and projects to their correct strategic categories according to development roadmaps and other strategic guidelines. This approach attempts to define the NPD process clearly in terms of criteria for passing each gate.

The criteria are usually on a general level in the beginning, and become more specific in later gates as the process goes on (Cooper, 2000; Cooper, Edgett & Kleinschmidt, 2002).

The idea content passes through a focal person usually in a managerial or expert role within the subject area. The person in question will review the idea before gate 1, and assess its strategic value to the company. The first gate is an initial screening, where the idea eligibility is assessed based on a general level, and its accordance to company strategy and available resources. As this gate is the initial checkpoint for new ideas, all possible ideas are brought here. The eligible ones continue along the process, whereas the ones screened out will be archived for later examination and review (Cooper, 2002).

The discovery phase and Gate 1 are further broken down to phases by Cooper according to the following figure:

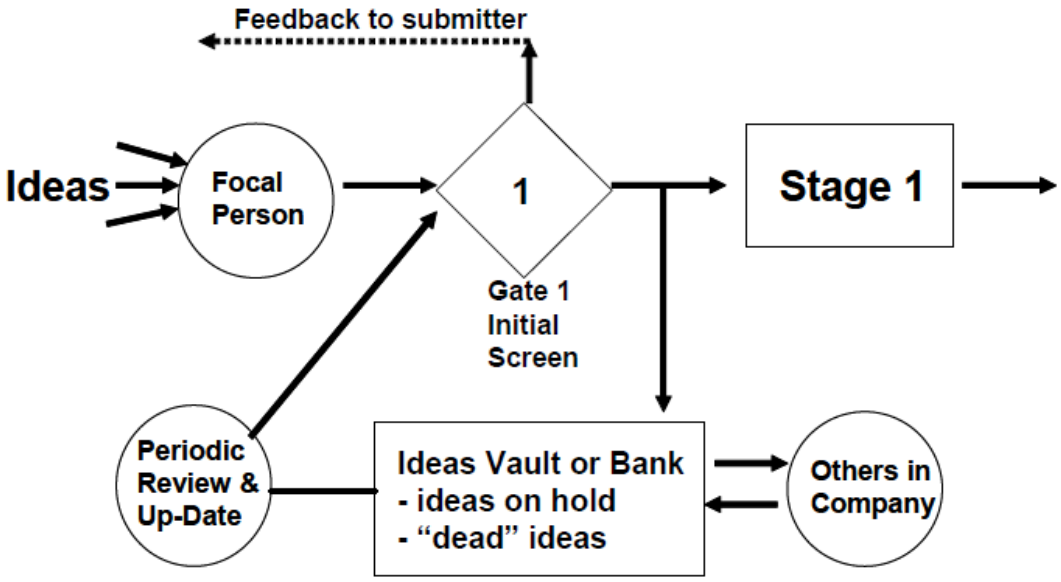

Figure 3: Idea capture and handling system in the front end (Cooper, 2002)

As displayed in figure 3, ideas are brought to a focal person who pushes them to gate one, the initial screening. Ideas that make it through the gate are taken further in the NPD processes. On the other hand, ideas that do not pass gate one are recorded into an idea bank and reviewed periodically for new possibilities. The idea bank is also accessible to other stakeholders in the company, so that the ideas can be browsed, supplemented and commented when new information is available. (Cooper, 2002).

Kim & Wilemon (2002) suggest appointing a leader with experience and knowledge about technologies and the company's products to lead the front end of innovation. Management support is also very important, and companies seeking innovations should accept failures as well. In order to have better control of the FEI, the company should acknowledge the uncertainties therein and consider the ideas from different perspectives. This also improves the chance of good ideas passing the screening. The authors add that the further an idea moves along the NPD process, the harder it becomes to reject it. (Kim & Wilemon, 2002). In large companies that operate on several markets with a multitude of products in their portfolios, it is extremely difficult to find a single person with enough knowledge about everything. It is therefore more reasonable to have several people with their own fields of expertise as the focal people in the discovery phase, with the required management support to back up their FEI work.

Conformingly, Trott (2008) emphasizes that once an idea is approved, it must be carried through. This indicates that a company is willing to accept new ideas, and encourages people to ideate. Verworn and Herstatt (2001) agree that a systematic approach with process models leads to success when the uncertainties of the market and technologies are low. According to the authors, this holds true especially in the case of incremental innovations. However, when uncertainty is high, the models may cease to affect the outcome, as the need for flexibility increases (Verworn & Herstatt, 2001). Screening all approved ideas, however, creates a tremendous pressure to approve only ideas that produce obvious benefit, while some eligible ideas are at risk of being disregarded as unfitting. On the other hand, it may cause pressure to approve ideas that are later on found ineligible.

The front end of innovation is presented in the next section in more detail through models that illustrate it further.

2.2. Front End of Innovation

The primary focus for this study is the Front End of Innovation (FEI), also known as the Fuzzy Front End (FFE). These terms refer to the early stage of a company's innovation management process, where ideas are generated, brought into the company's knowledge base, and pre-screened for eligibility. Trott (2008) identifies it as the stage where the company formulates a concept and makes the decision about further developing it. Similarly, Kim & Wilemon (2002) define it as "the period between the time when an opportunity is first considered and when an idea is judged ready for development." Ideation and a preliminary processing of new product concepts take place in the FEI phase (Poskela, 2009). Overall, the Front End of Innovation is a stage where ideas are brought into the organization's knowledge base, screened for eligibility, and forwarded into development or archived for future review.

Koen, Ajamian, Boyce, Clamen, Fisher, Fountoulakis, Johnson, Puri and Seibert (in Belliveau, Griffin & Somermeyer, 2002) have introduced a New Concept Development model, where the FEI phase is presented as comprising five specific activities: Idea genesis, Idea selection, Concept technology development, Opportunity identification and Opportunity analysis. The front end is followed by a more structured and defined development phase. At the end of the process is commercialization, where the value of the innovation is finally received by the company. The model also supports Trott's (2008) view of innovation, where a concept (an idea), its development and its commercial exploitation are all required. The model is illustrated by the figure below:

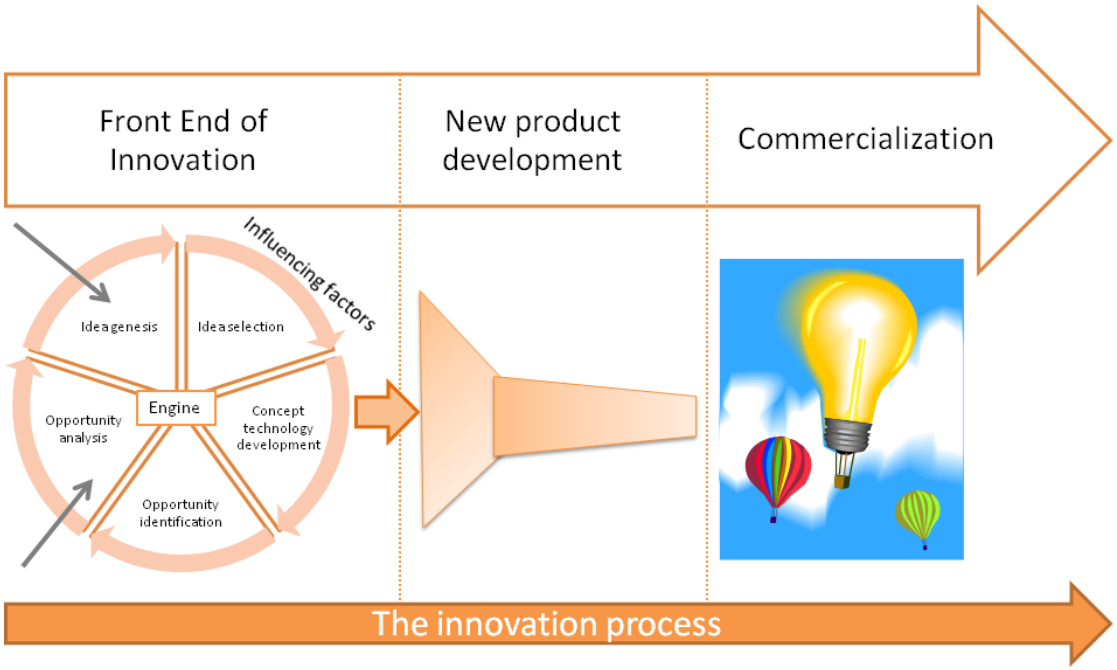

Figure 4: The innovation process according to Koen et al. (in Belliveau, Griffin & Somermeyer, 2002)

Figure 4 shows a representation of the front end of innovation leftmost. There are several *influencing factors* surrounding the activities therein. These factors include for example the organization's capabilities, customer demand, competitor influence, and level of technology. They create physical and current boundaries for implementable ideas. However, some boundaries change over time such as competitor actions, whereas some require investments and effort from the organization itself, such as the level of technology. Koen et al. (2002) claim that the ability to execute a company's strategy depends on rapid communication of the influencing factors throughout the organization.

In the center of all front-end activity, there is an *engine* that comprises the leadership, culture, and business strategy of the company. These cornerstones for innovation illustrate the company vision and set specific goals for all business activities. Around these cornerstones are the five front-end *elements* that occur randomly and sometimes simultaneously. Ideas can freely move within these elements, and use elements several times, if necessary (Ibid, 2002).

Opportunity identification brings about the possibilities of how the company can compete in the market. The identified opportunities are rated in the opportunity analysis, where early assessments about the opportunity eligibility are made. New thoughts are brought into the system in the idea generation and enrichment element, wherein ideas are born, refined and modified according to the boundaries given by the influencing factors and the NCD engine. Because of limited resources, the idea selection element reviews and filters the most attractive and eligible ideas. Koen et al. (2002) claim that the decision makers in idea selection should always think about ways to approve an idea, i.e. think about how the idea would succeed, instead of rationalizing why the idea fails. The ideas that are screened out are archived and reviewed again later, if the influencing factors have changed so much to make them eligible. The authors refer to concept development as the final element in the front end of innovation, and as the exit to the coordinated NPD process. In this element, the idea should include a "win statement" that solidly justifies the use of resources to develop the particular concept further. (Ibid, 2002)

Trygg & Nobelius (2002) also find in their study certain key activities that are specific to the FEI, based on their studies of R&D projects. Mission statement, concept generation, concept screening, concept definition, business analysis and project planning are activities that belong to the front-end processes of the case companies in their study. An important aspect arose in the study to point out that there was no consistency to use a single, fixed process. Some of the listed activities were not applied in all projects, and depending on the type of project, different activities were emphasized differently, even by the same company. Based on their study findings, the authors ascertain that the FEI phase should be adapted to fit the project, available resources and the overall company situation. Communication and unambiguity between relevant parties is vital for success, but managerial flexibility also has a very high role in advancing NPD. (Trygg & Nobelius 2002).

Crawford & De Benedetto (2006) present an NPD process similar to the Stage-Gate model. The gates in this model are called evaluation tasks, which determine whether the idea will continue along the development path or not. In the Crawford-Di Benedetto

model, the ideas go through several screenings, between which they are refined and processed into concepts with applicable market value. The model also presents usable tools for the evaluations in each stage of the process. The two first stages, namely opportunity identification and selection, and the concept generation, comprise the front end of innovation. The criteria for answering the questions presented in the evaluation tasks derive from the evaluation techniques, which are based on existing corporate strategies, guidelines and the direction of development. (Crawford & Di Benedetto, 2006).

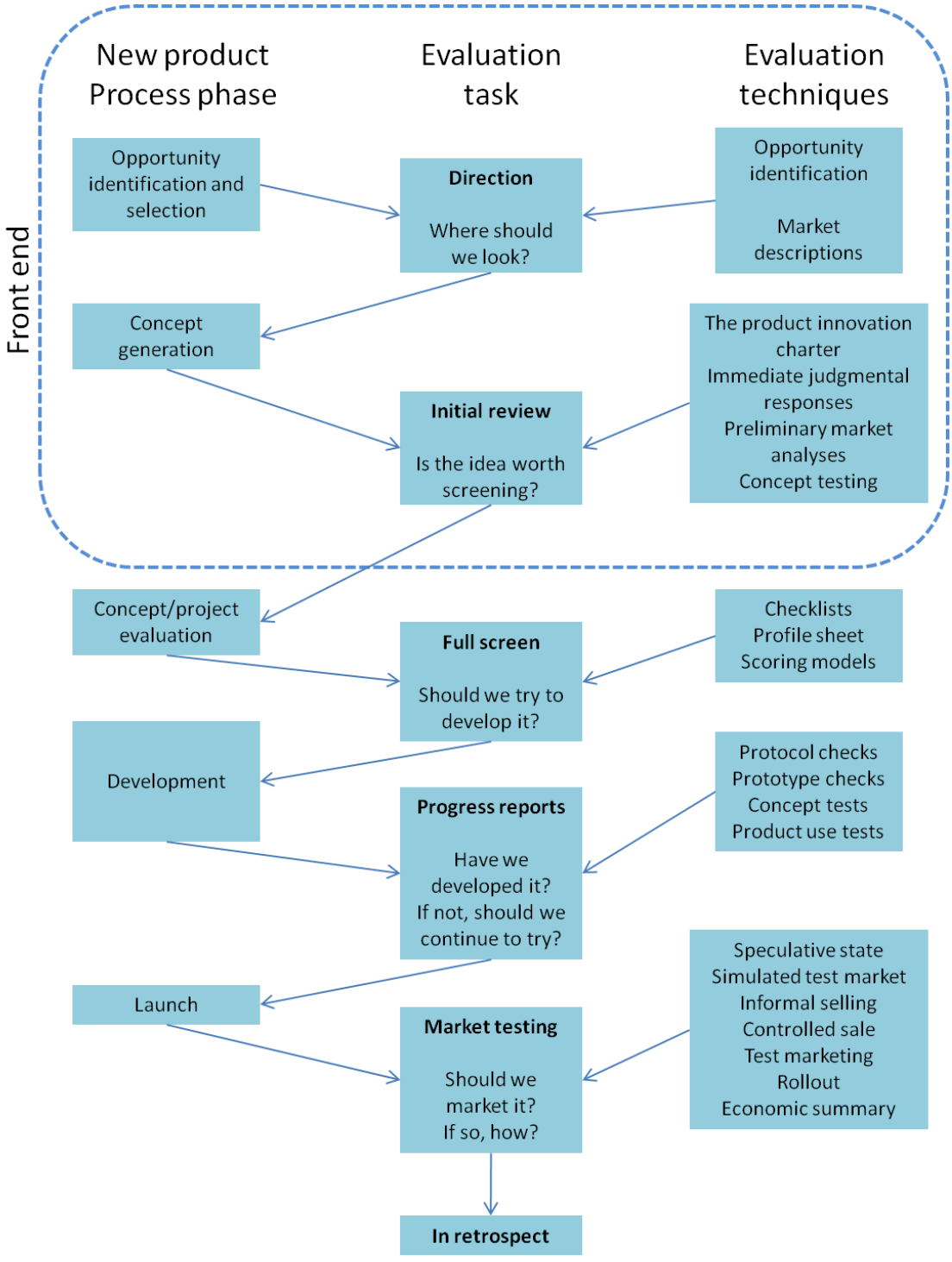

Figure 5: The idea evaluation system, including common techniques (Crawford & Di Benedetto, 2006)

The purpose of this evaluation process is to direct the new idea into the next phases – further development or rejection. As figure five presents, the idea process begins with opportunity identification and selection, i.e. introducing ideas and selecting the ones that are eligible for the company for more specific evaluation. The criteria for this gate are drawn from opportunity identification and the market environment (Crawford & Di Benedetto, 2006).

After the idea has been refined to a marketable concept, it will be initially reviewed. This first review tries to sort out the "big winners" among a myriad of ideas as soon as possible. Tools to categorize ideas include, for example, making a product innovation charter, which contains the strategic guidelines for the company's new product development. Immediate judgmental responses are expert opinions about the idea, which can have a relatively strong influence on the initial review (or it could even be the initial review). Preliminary market analyses are information about market trends, or a quick glance whether or not the idea is attractive to the market. Furthermore, concept testing comes in for verifying the eligibility of the new concept. (Crawford & Di Benedetto, 2006).

Oliveira & Rozenfeld (2010) follow the lines introduced above, but also incorporate other management tools to guide the FEI. According to the authors, companies would benefit from integrating Project Portfolio Management (PPM) and Technology Roadmapping (TRM) into new product development. They claim that the method, called the Integrated Technology Roadmapping and Portfolio Management (ITP) method, covers the FEI phase and enables more efficient information exchange and communication, thus improving the efficacy of the whole FEI.

According to the ITP method, TRM is used to identify new product opportunities first. Afterwards, the projects are evaluated and selected based on PPM. Lastly, the strategic alignment of projects is checked by reflecting the project against TRM. The authors also claim that there are gaps within the process, for which they recommend supplementation by the means and tools provided by idea management. (Oliveira & Rozenfeld, 2010).

2.3. New Business Development and New Product Development

The development of new business is an extension of the traditional Research & Development activities of a company. A more common concept is New Product Development (NPD), which also covers traditional R&D. As this study handles idea management on a general level, these terms are viewed as equivalent. Herein, principles and guidelines for NPD are generalized and extended to cover business and operational development, in addition to the traditional product and service development. Therefore, when this section talks about new product development, it refers to all research and development for technologies, products and business development in general.

The development of new products is acting on business opportunities and integrating the company resources to produce tangible outputs, i.e. products. The business opportunities are triggered and regulated by various factors, such as legislation, customer demands, competitive strategies, and scientific development. Trott (2008) claims that long-term success (for a manufacturing company) is nearly always achieved through competition by product superiority. The new product process must be refined and high in quality to produce competitive advantage for the corporation. Although companies have a process, the quality and thoroughness is often not at a sufficient level. (Cooper & Kleinschmidt, 2007b).

2.4. Product & service strategy

Product strategy is a piece of corporate strategy. Other higher-level strategies, such as competitive strategy define the scope of product strategy, and create a guideline for the company to differentiate itself from competitors. Services are different from products in ways that services are often intangible, perishable, and used as they are produced, and strategies for them are made differently (Trott, 2008).

The strategies made for the company's marketable offering are the action plans for transforming resources into returns for the company. Conclusively, the ultimate function

of (product) strategy is to carry out the company mission, which is especially focused around products in manufacturing companies. However, services are being brought into the offering mix with an increasing rate. This gives meaning to effective management of portfolios in the customer offering mix.

2.5. Portfolio management

Portfolio management is often referred to in financial affairs concerning ownership of other companies' shares. In academic literature, it also refers to product or project portfolios, which are the repositories for the company's product concepts, whether in development or as a part of the product catalogue.

A product portfolio is the set of products the company chooses to manufacture or license for production. The selection of products into the portfolio is based on the company strategies, in addition to current and future market demand. A project portfolio contains the on-going projects a company is working on, and is not limited only to New Product Development projects.

Technology portfolios do not contain tangible products, but rather a selection of the technologies within the industry. According to Trott, in R&D project selection the effect of corporate strategy is most noticeable. From the perspective of R&D, the technology base of a company can be divided into 4 categories (Trott 2008):

- Core technologies
- Complementary technologies
- Peripheral technologies
- Emerging technologies

Core technologies are the ones in which the company is most specialized. They are usually used in the main products of the company. Complementary technologies enhance the core technologies with auxiliary functions, adding value to the product.

Peripheral technologies contribute more to the business than the product, but add value to the product itself if implemented. Finally, emerging technologies are new to the company, but may become important in the future (Trott, 2008). Emerging technologies usually require the biggest R&D input and the level of uncertainty in them is the greatest.

Cooper (2001b) finds four distinct goals for portfolio management: 1) maximizing portfolio value, 2) balancing projects correctly, 3) strategic portfolio alignment, and 4) resource balancing. For maximizing the value of a portfolio, Cooper suggests the use of scoring models based on qualitative criteria. The right balance of projects is a factor for managing and limiting the risks involved in the portfolio. Strategic alignment means setting the portfolio on course with the company strategy, i.e. selecting only those elements to the active portfolio that correspond to the company's strategy or business model. Lastly, resource balancing ensures that the projects or improvements that yield the biggest value are carried out for further development.

Cooper, Edgett and Kleinschmidt (2001a) have identified specific dominant means of portfolio management through their research. According to them, companies dominantly use one of these models:

- Financial methods
- Business strategy
- Bubble diagrams
- Scoring models
- Checklists

The financial methods include net present value and other calculations to determine the potential present and future economic value of the productized idea. Assessment based on business strategy is also a popular tool. Ideas or products are placed in strategic "buckets" and evaluated in terms of available or allocable resources, or priorities for the corresponding "bucket". Bubble diagrams are used as a supporting tool, which illustrate given criteria very informatively. The position, as well as the size of the bubbles in the

diagram matters when assessing the most attractive opportunities. The criteria used may include comparing, for example cost versus timing or strategic issues versus benefits. (Cooper et al, 2001a)

Scoring models, on the other hand are not used as strictly a selection tool, but for ranking different ideas based on pre-determined scoring criteria. Other guidelines are then used for selecting the best scoring projects. A checklist is also considered a supporting tool that is used in the gates of the Stage-Gate process. The decisions to proceed with ideas are evaluated against the items on the lists, which may include whatever criteria the company chooses to use. In addition, there are other company or market specific models, or companies might use a combination of several models to make the process more accurate. (Cooper et al, 2001a).

Portfolio management in New Product Development sets the boundaries and determines the preferred targets for R&D activities. The target for R&D is to produce results that fall into precise strategic "buckets". These are specified in the portfolios for technologies, products, operational processes, etc.

Strategic "buckets" are categories for ideas, based on business unit, technology, or other strategic classification. These categories are meant for prioritizing ideas based on their feasibility and other criteria. The content of these "buckets" is periodically reviewed, and the best ideas are skimmed off the top for further development. (Cooper, 2007a). The following figure illustrates the concept:

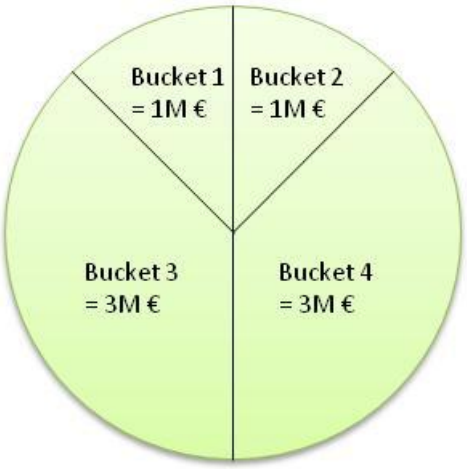

Figure 6: Four buckets or sub-portfolios for project management (Cooper, 2007a)

According to the figure, projects are placed into the buckets until all the allocated resources have been reserved or depleted. Projects within a bucket are ranked against one another to prioritize them for resources. Projects in different buckets are independent, i.e. the implementation of one does not depend on any other projects from other buckets. According to Cooper, this way the project portfolio becomes balanced and the use of resources may be monitored and planned.

In another study, Viskari (2006) has specifically studied the management of non-core technologies. Her suggestion for ideas that are out of scope from corporate strategies or unfitting to the current market situation is to transfer them to a management system called the Research Surplus Portfolio (RSP). This portfolio is an organization wide database and management tool that is used to record and categorize ideas of any scale and maturity. The concept of RSP is depicted below in figure seven.

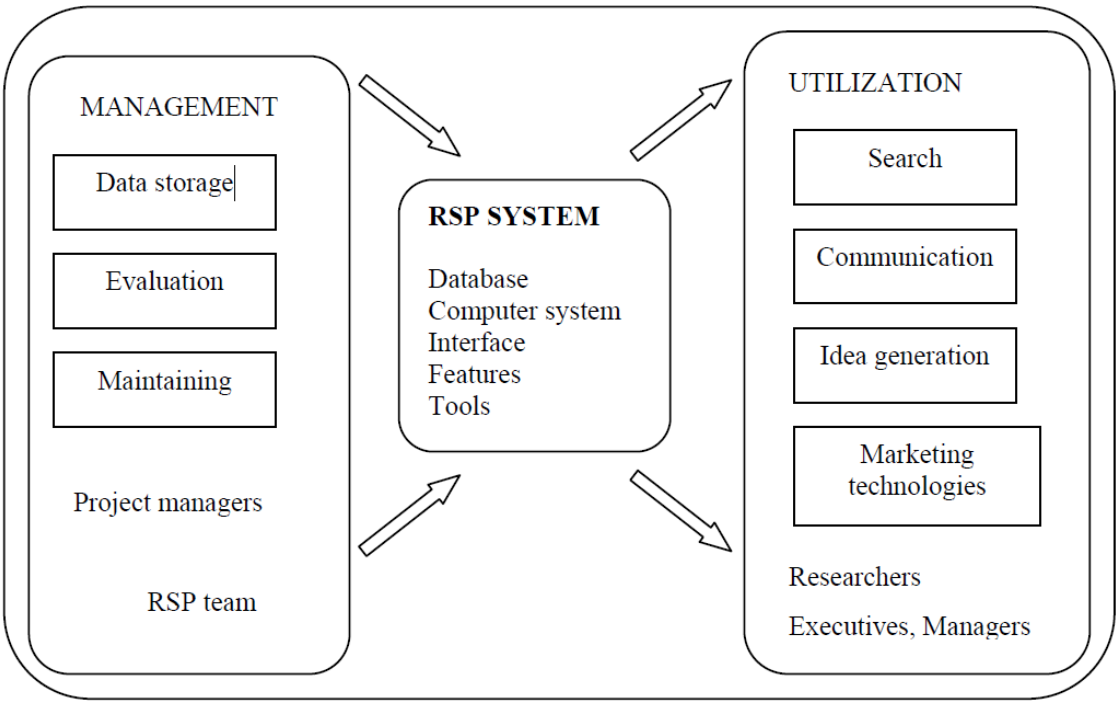

Figure 7: Research Surplus Portfolio concept (Viskari, 2006)

As illustrated in figure seven, the RSP system can be utilized in several ways. Its functions can include a search engine, which according to Viskari (2006) is a vital part of the system, especially from the point of view of new business creation. Additionally, related to the search engine, the portfolio database can be used as an idea bank. The database is periodically reviewed for ideas that match the market need or prospect to pick out the best-suited ones for further research and development. Furthermore, the portfolio enables company-wide communication of technologies that have been researched or in its simplest forms, the kinds of ideas presented throughout the organization. (Viskari, 2006). Using such tools, the company's R&D processes should become more transparent and thus enhance the New Product Development management.

Viskari (2006) also suggests that the RSP could be used as a market place for surplus technologies. Even though an idea was strategically incompatible to a company, it may have market value for another company. In terms of intellectual capital, the idea "owner" could find potential profit in selling or licensing technology or other ideas to

unleash their full market value and to decrease risks involved with ownership. Parhankangas, Holmlund and Kuusisto (2003) claim that an organization should review its technology portfolio regularly to find technologies that have potential outside the company.

2.6. Summary

Cooper's (2002) Stage-Gate model suggests that the FEI phase starts at the discovery stage and ends with the first gate. Other authors identify what these first process steps entail, and thus provide clarity to the fuzzy front end. This study uses the guidelines set by various researchers to exhibit a holistic view of the new business development / new product development process, but will concentrate on the discovery stage and the first gate only (as presented in the Stage-Gate model by Cooper, 2002). However, concepts from the later stages & gates of the Stage-Gate model are also used to tie together the theoretical framework that constructs the case for the conclusions of the study.

As various authors have elaborated, the front end of innovation is an unclear, uncharted area. It is where ideas in the organization start their path towards commercialization or end their paths as ineligible. When the playing field is organized and specified by common guidelines and specific rules, the speed of refining and advancing ideas for financial gain improves. The potential benefits include better accordance with corporate strategy and improvements to management practices with idea management.

Some authors suggest implementing roadmaps and using guidelines from portfolio management to steer the front end of innovation in the desired direction. Cooper (2007a) proposes using strategic "buckets" to categorize and prioritize ideas according to the corporate strategies. These means all integrate the new product and business development activities to the corporate strategy and thus aim for the goals set by the corporation.

The Boston Consulting Group (2008) unambiguously states that an optimal measurement program along the entire innovation management process yields valuable information that can be considered the basis for good decisions. (Boston Consulting Group, 2008). Ultimately, as it has been pointed out by several authors, speed of innovation is an important factor in determining its commercial value in the end of the research and development process. Therefore, it is easy to agree with the view of Cooper et al. (for example 2005), that a well-refined (and defined) NPD process is a key element, and that front-end refining is a building block for breakthrough. In order to start the refining, it is important to find the correct measures and to build a system to measure the correct corporate activities and events.

The next section of this thesis introduces performance indicator measurement and identifies some of the metrics that are commonly used for measuring innovation performance.

3. PERFOMANCE INDICATOR MEASUREMENT

A company can use several indicators to monitor its economic progress in the market. These include historical data, such as sales figures, production amounts and such data that indicate past performance. Future information, such as market expectations and demand curves can also be used as business control information. This section is about measuring the performance of innovation efforts in a company.

3.1 Performance measurement

Parmenter (2007) differentiates between measures that are often confused. He finds three distinct performance measures: 1) Key Result Indicators (KRIs), 2) Performance Indicators (PIs), and 3) Key Performance Indicators (KPIs). Figure 8 illustrates the idea:

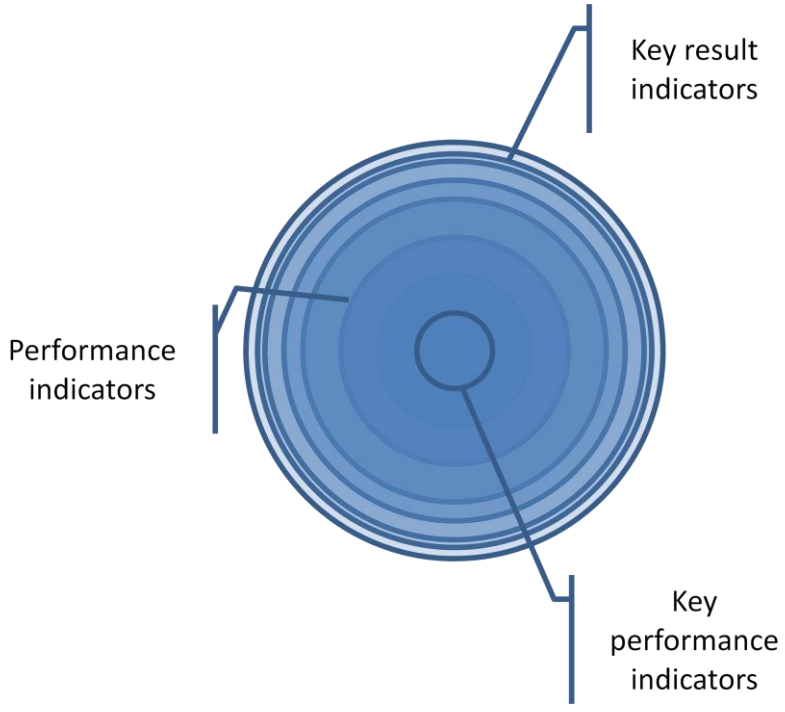

Figure 8: Onion diagram of performance indicators (Parmenter, 2007)

KRIs are the long-term measures that provide historical data about the company's performance against a set of given goals. PIs are the more accurate and specific measures that elaborate on the corporate events. KRIs and PIs are to be measured over time and reported occasionally, for example monthly or quarterly. KPIs, on the other hand are the core measures that are the most important for the company's current and future survival. The company should be aware of these at all times. For some KPIs, weekly or even real-time measurement and reporting is necessary to retain a clear view of the corporation's performance. (Parmenter, 2007).

Because KPIs are the most important measures for the company, it should not have too many of them. Parmenter (2007) suggests abiding to the 10/80/10 rule, which states that a company should have:

- 10 KRIs to tell its past performance in a perspective
- (up to) 80 PIs to tell it what to do
- 10 KPI to tell it what to do to increase performance dramatically

Parmenter (2007) strongly claims that 10 KPIs are enough for any company on the whole corporate level. Although the measurement of performance is important for the company to know where it stands, and which direction is the right one, the distinction between the performance indicators is an important one. Emphasis on incorrect measurement and reporting can produce misleading or wrong information, which can be detrimental for business in the worst-case scenario. (Parmenter, 2007).

3.2 Measurement of ideas and innovations

Collins & Smith (1999) claim that innovation metrics can be an important driver for change in an organization. Metrics to measure innovation align the performance with strategy and communicate targets for innovation throughout the company. They also allow for the evaluation of people, objectives and projects to optimize resource allocation.

Idea measures

As according to definition, innovation only actualizes upon commercial success. Thus, it is more accurate and appropriate to assess the suitability of *ideas* in the front-end phase. Below is a table of criteria on how to measure if an idea is suitable for the company.

Table 1: Selection criteria for new ideas (in Trott, 2008, adapted from *Improving the Effectiveness of Research and Development: Special Report to Management* (Seiler, R.E. 1965), © The McGraw-Hill Companies.)

	Criteria	**Typical questions**
1	Technical	Do we have experience of the technology? Do we have the skills and facilities? What is the probability of technological success?
2	Research direction and balance	Compatibility with research goals? Balance of risk in project portfolio?
3	Competitive rationale	How does this project compare relative to the competition? Is it necessary to defend an existing business? Is the product likely to be a superior?
4	Patentability	Can we get patent protection? What will be the implication for defensive research?
5	Stability of the market	How stable is the technology? Is the market developed? Is there an industry standard?
6	Integration and synergy	What is the level of integration of this project relative to other projects and raw materials? Will it stand alone?
7	Market	What is the size of the market? Is it a growing market? Is there an existing customer base? Is the potential big enough to warrant the resource?
8	Channel fit	Do we have existing customers who might be interested, or do we have to find new customers?

9	Manufacturing	Can we use existing resources? Will we require new equipment, skills, etc.?
10	Financial	Expected investment required and rate of return?
11	Strategic fit	Does it support our short-term and long-term plans for the business?

The elements listed in the table above can be used to evaluate if the idea is suitable to be taken further in development. Not all elements are necessarily required for all ideas, but a set of criteria can be selected for each idea type, based on how the company wishes to emphasize the importance of criteria. Accordingly, ideas that best correspond to the criteria make the most suitable candidates for innovation. (Trott, 2008).

Attention should be focused on key activities, especially the initial screening phase. The screening should even be based on an official checklist of criteria (Cooper & Kleinschmidt 1986). Trott (2008) adds that the screening and evaluation are not individual occasions, but should be carried out in every stage of the management process, as the knowledge about the idea increases. The early screening enables the organization to assess new ideas quickly, and to root out the ineligible ideas early within the process.

Trott (2008) claims that effective management of activities requires measurement. The relevant measures depend on organizational aspects and the business environment. The innovation process is a function that incorporates a selection of inputs and produces certain outputs. The ratio of inputs versus outputs is thus something measurable. Trott summarizes the measurement of innovation in the following table:

Table 2: Innovation measures (Trott, 2008)

Input measures	**Process measures (*Efficiency* of process)**	**Output measures (*Effectiveness* of process)**
Number of new ideas	Percentage of ideas screened out	Percentage of sales from new products
Number of personnel involved in innovation	Time to market	Number of new patents granted
Information technology	Effectiveness of teams	Number of product launches
Percentage of sales on process innovation	Loss associated with project abandonment	Market share
Percentage of sales on R&D spend	Personnel morale	Research papers and media coverage of new ideas

According to Trott (2008), basic input measures include statistical data, such as the number of ideas and the number of people involved. The efficiency of the innovation process is measured by tangible factors such as the percentage of the ideas screened out or the time to market, but also by abstract factors, such as personnel morale. The output of innovation can be mainly measured by the financial outcomes, but also the applications and new ideas that are based on a previous innovation. On the other hand, Cooper (2005) has found through his research that financial factors do not make the best measurement criteria for new projects in their early phases. Vice versa, he claims that they can actually cause more harm than benefit to the projects.

4. THE BALANCED CRITICAL FACTOR INDEX METHOD

This section introduces the methods used to collect and analyze the data for the study. The data was collected from a selected group of experts and managers who have a stake in the idea management process. Their future functions include coordinating the screening process for individual ideas, evaluating the ideas, and other supporting tasks. The intention has been to acquire data from several corporate levels in order to find out how the process measurement and the tools used in the process could be developed to match corporate requirements.

4.1. Description of the Balanced Critical Factor Index (BCFI) method

This study uses the Balanced Critical Factor Index (BCFI) method for data analysis. The method was first introduced as the Critical Factor Index method by Takala and Rautiainen in 2003. Through further development by Takala & Ranta (2007) and Takala & Nadler (2010), the method has evolved to the BCFI method to de-emphasize the importance of standard deviations in the calculations. The method, originally developed to sense and respond to customer satisfaction, is used to find the critical attributes in business processes. It can be used for examining several types of different processes as a management tool to find the business-critical allocation targets for resources. (Nadler & Takala, 2010).

Data for this method is commonly collected by means of a questionnaire. However, because for each process within the company the attributes are individually applicable, a standardized questionnaire cannot be used. The questionnaire should rather be customized for each case in order to get reliable and accurate results (Nadler & Takala, 2010). The next section describes using the method in more detail.

4.2. Using the Balanced Critical Factor Index method

There are three separate phases in the BCFI method:

1) Assessing the current situation and making observations
2) Defining the appropriate attributes for critical factors
3) Data analysis and application of CFI tools

Phase 1 consists of preliminary research of the organization, its processes and the situation in general. This phase finds the appropriate phenomena and the correct elements to research.

Phase 2 is about defining and selecting the relevant attributes to measure the business processes. The attributes are directly used in a questionnaire, sent to respondents that have key roles within the examined processes. The respondents are asked to respond their experiences and future expectations about the processes. They respond on a numerical scale where the higher end indicates better grading for attributes. Also, the opinion of respondents about past and future development is asked with the options 1) worse, 2) same and 3) better.

Phase 3 comprises calculating the following indices for data analysis, according to the BCFI method:

$$\text{SD expectation index} = \left(\frac{\text{SD of expectation}}{10}\right) + 1 \quad (1)$$

$$\text{SD experience index} = \left(\frac{\text{SD of experience}}{10}\right) + 1 \quad (2)$$

$$\text{Performance index} = \frac{\text{Average of experience}}{10} \quad (3)$$

$$\text{Importance index} = \frac{\text{Average of expectation}}{10} \quad (4)$$

$$\text{Gap index} = \left|\frac{(\text{avg.of experience} - \text{avg.of expectation})}{10}\right| \quad (5)$$

$$\text{Direction of development index} = \left|\frac{(b\%-w\%)}{100}\right| \quad (6)$$

The BCFI is calculated with the following equation, with values from the other indices:

$$\text{BCFI} = \frac{\text{SD expectation index} \cdot \text{SD experience index} \cdot \text{Performance index}}{\text{Importance index} \cdot \text{Gap index} \cdot \text{Direction of development index}} \quad (7)$$

The BCFI is calculated separately for future and past development. Thus, it is possible to make a comparison between the perceived states of the attributes according to historical development and the future development direction. With this, it is possible to make a development statistic over time, as the attributes are measured in future instances.

The BCFI values are calculated individually for each attribute. The results can be presented as a bar graph that shows the BCFIs for both past and future development side by side. If results are needed for certain organizational elements (for example only manager-level personnel or for only certain units), the results can be divided accordingly and a separate graph should be made for each statistic.

4.3. Interpreting the results

The smaller an attribute value is, the more critical it is considered. The level of criticality is not reflected by the magnitude of the index. Rather, in the analysis, a number of the most critical attributes (3-5 should be optimal) should be selected for development, depending on the company's resources. The differences between values are not a strict measure of criticalness. As such, attributes with higher index than the ones selected for development are not imminently critical, but can be looked into later (when appropriate resources exist). However, if an attribute has a value significantly greater than other attributes, it can indicate ambiguity about the attribute. Such attributes should be specified and looked into more carefully in the future development. (Nadler & Takala, 2010).

5. CASE: WÄRTSILÄ IDEA MANAGEMENT

At the time when this study was started, the company was about to launch and implement a new web-based application for recording and storing ideas, and pre-screening them for eligibility in the front end of innovation. The main purpose behind the use of such an application is to provide users easy access to a common database, and to facilitate the flow of ideas and information within the organization. In other words, the company wanted to implement effective and value-adding idea management practices throughout the whole organization.

The initial task for this study, as presented by the first research question, was to find out the criteria the company should use for idea screening in the front end of innovation. To find an answer to this question, a survey was made within a limited group of respondents. The questions related to critical attributes in the idea management process. The purpose was to gather information about the reliability of the survey itself, and to validate the attributes used in the survey. The most critical of these attributes would then be identified as criteria for the idea screening. The questionnaire is presented in appendix 1.

Another initial task, presented by the research question 2, was to find out the requirements for reporting to individual business units. Reporting the correct business critical information about the innovation management process and the ideas collected therein may differ, and it is important to produce timely and accurate information to the parties that need it. However, an important part of the accuracy is omitting the unnecessary information. The survey was constructed also to collect information about these requirements, and the recipient groups were selected accordingly. Through the results, the reporting requirements will be constructed from the important attributes.

5.1. Status assessment and data collection

In the first phase of the study, the situation was assessed by studying previously collected survey data about idea management, internal policy documents, and strategic guidelines. Additionally, certain individual managers were approached by e-mail concerning their departments' policies about the subject. The results provided an insight into the status quo of idea management activities throughout the company. With this, enough information was provided to continue to the second phase - defining the relevant attributes for critical factors.

The criteria for selecting attributes to the questionnaire are derived from the reviewed literature for this study, as well as previous data collected within the company. The previous data comprises of memos, notes from workshops and meetings, project documentation and personal correspondence with people who are directly involved with the planning and implementing of idea management within the company.

5.2. Pilot questionnaire

For the survey, a questionnaire was made with seven attribute categories: idea management, general idea correspondence to strategy, idea collection, the estimated improvements by idea management and the conceived importance of idea management to solution and product development, operational development and business development. Attributes for these categories were selected based on previous data from company resources, previously collected data and observations during the study.

The leading thought was to find out about the expected importance of a centralized idea management system for the company in the future, as well as employees' experiences from the past. The attributes were selected to yield information about the current situation and experiences.

The first questionnaire was sent to a group of five employees within the Research and Development department "New Technologies & Innovations" team by internal corporate email. The purpose for the pilot round was to verify the reliability of the research method and to ensure that the recipients understand the questionnaire. A covering letter was enclosed to explain the purpose of the survey, and to elaborate on how to respond to the questionnaire.

With the pilot survey, the questioned attributes were validated, and the unambiguity over them could be minimized. Based on the received feedback, the attached covering letter and instructions for the questionnaire were reviewed and clarified. While it was understood that not all the employees had the experience or the expertise to answer all attribute questions, the respondents were given the option to leave such questions unanswered. Since all attributes were analyzed and handled individually, blanks in the individual statistics were not considered to compromise the reliability of the survey.

5.3. Main survey

The reviewed survey was sent to groups of respondents, selected according to organizational departments. As one of the research questions of this study was to find out what are the individual reporting needs for separate organizational departments, this division was logical and the results received pertained directly to them. The respondents were given the option to omit an attribute if they were uncertain of it. This yielded an insight to the gap in the knowledge base, and potential needs for information among the respondents. The questionnaire was sent in two stages, first within the Research and Development "Common Technologies" department and later on to other departments. The list of corporate units from which employees responded is presented in appendix 2.

In the first round of the actual survey, the questionnaire was sent to 122 employees with a two-week reply time. At this time, 11 responses were received. To improve the reliability and coverage of the results, a second round was made after recording and summarizing the data from the first round. Whereas the respondents for the first round

were all from the same organizational division, respondents for the second round were employees in different divisions and departments. Because the respondents were also asked to forward the survey to other employees in their own organizations, the exact number of survey recipients is unknown. The second round yielded nine additional responses, bringing the total response number up to 20. Although this number is still relatively small, the results yield an insight to the questioned attributes from the point of view of the respondents' research and development organization. Therefore, the acquired data can be considered valid and usable to draw conclusions through analysis. The next section will present and analyze the survey results in detail.

6. ANALYSIS OF STUDY RESULTS

This section presents the results from this study. Firstly, the collected data is introduced in a summary table of averages and standard deviations for the questioned future expectations and experiences of the surveyed employees. Also presented in the table are the percentages of replies for the direction of development for the next two years and the past two years. The data is preliminarily analyzed and compared with other observations that were made before administering the survey.

After the preliminary analysis, the results will be shown as they as processed with the BCFI method. Results are shown for totals, and then separately broken down based on the employee level (manager/non-manager) of the respondents. Also, a distinction will be made between separate corporate locations, in order to analyze if the location has an effect on the results. Finally, a summary of the results will be presented in the end of the section. What needs to be noted, however, is that the method does not yield any means, but rather only information about the current issues and targets for development.

For some cases, the direction of development index resulted in a zero value. For these cases, the index value was manually set to 0,01 with the logic that when there are equal expectations or experiences for worse and better development (or all agree on the attribute remaining the same), there is ambiguity about the actual progression. Thus, the BCFI value for these attributes rises well above other attributes. These are interpreted as ambiguous attributes, which need to be clarified for the respondents in the development activities of the studied process.

6.1. Preliminary analysis

The preliminary analysis summarizes and presents raw data in the form of averages and standard deviations. Additionally, the percentages of responses for the direction of future and past development are presented.

Table 3: Statistics for preliminary analysis

Idea management	Average of expectations	Standard deviation of expectations	Average of experience	Standard deviation of experience	Direction of future development			Direction of past development		
					Worse	Same	Better	Worse	Same	Better
Current idea handling	8,47	0,77	5,32	1,97	0,00 %	11,11 %	88,89 %	5,26 %	68,42 %	26,32 %
Quality of incoming ideas	7,82	1,07	6,56	1,86	11,76 %	35,29 %	52,94 %	0,00 %	75,00 %	25,00 %
Management commitment	8,32	1,00	5,63	1,74	0,00 %	42,11 %	57,89 %	0,00 %	72,22 %	27,78 %
Speed of idea processing	8,05	1,08	5,05	2,09	5,26 %	21,05 %	73,68 %	5,56 %	83,33 %	11,11 %
Amount of incoming ideas	8,00	1,24	4,89	2,00	0,00 %	22,22 %	77,78 %	5,56 %	55,56 %	38,89 %
Amount of approved ideas	6,69	1,78	4,13	2,09	0,00 %	50,00 %	50,00 %	6,25 %	62,50 %	31,25 %
General idea correspondence to strategy										
Accordance to corporate strategy	7,61	1,04	5,67	2,17	0,00 %	66,67 %	33,33 %	0,00 %	83,33 %	16,67 %
Accordance to unit strategy	7,95	1,13	5,84	2,09	0,00 %	55,56 %	44,44 %	0,00 %	63,16 %	36,84 %
Accordance to product lifecycle	7,63	1,57	5,95	2,25	5,26 %	47,37 %	47,37 %	0,00 %	68,42 %	31,58 %
Accordance to environmental norms	8,05	1,78	5,95	2,34	0,00 %	26,32 %	73,68 %	0,00 %	42,11 %	57,89 %
Accordance to core competencies	8,32	0,95	6,32	2,11	0,00 %	42,11 %	57,89 %	0,00 %	68,42 %	31,58 %
Accordance to project portfolios	7,58	1,71	5,56	2,25	0,00 %	31,58 %	68,42 %	0,00 %	57,89 %	42,11 %
Importance of idea management for solution/product development in these areas:										
Core technologies	8,21	1,13	6,42	1,92	0,00 %	15,79 %	84,21 %	0,00 %	73,68 %	26,32 %
Supplementary technologies	7,63	1,50	5,58	2,04	0,00 %	27,78 %	72,22 %	0,00 %	78,95 %	21,05 %
Emerging technologies	7,84	1,80	5,84	2,09	0,00 %	27,78 %	72,22 %	5,26 %	52,63 %	42,11 %
Importance of idea management for operational development in these areas:										
Culture	7,05	1,43	5,17	2,20	0,00 %	55,56 %	44,44 %	11,11 %	77,78 %	11,11 %
Internal processes	7,20	1,58	5,47	2,09	0,00 %	47,37 %	52,63 %	10,53 %	78,95 %	10,53 %
Importance of idea management for business development in these areas:										
Business models	7,59	1,54	5,59	2,06	0,00 %	41,18 %	58,82 %	5,88 %	70,59 %	23,53 %
New markets	7,76	1,52	5,63	2,45	0,00 %	25,00 %	75,00 %	0,00 %	68,75 %	31,25 %
Idea collection										
Method	8,50	1,05	4,75	2,17	0,00 %	10,00 %	90,00 %	5,00 %	75,00 %	20,00 %
Integration with other processes	7,75	1,33	4,42	2,27	0,00 %	21,05 %	78,95 %	5,26 %	73,68 %	21,05 %
Search functions	7,79	1,69	3,94	2,75	0,00 %	22,22 %	77,78 %	5,88 %	76,47 %	17,65 %
Statistics	7,56	1,29	4,25	2,74	0,00 %	23,53 %	76,47 %	6,25 %	81,25 %	12,50 %
Improvements by idea management to these attributes										
Direct financial risks	6,88	1,26	5,20	2,04	0,00 %	46,67 %	53,33 %	0,00 %	64,29 %	35,71 %
Workload	6,95	2,32	5,28	2,44	21,05 %	52,63 %	26,32 %	5,88 %	82,35 %	11,76 %
Information flow	7,80	1,20	4,89	2,00	0,00 %	31,58 %	68,42 %	5,56 %	72,22 %	22,22 %
Decision-making	8,00	0,97	5,18	2,32	5,88 %	23,53 %	70,59 %	6,25 %	68,75 %	25,00 %
Know-how	8,10	1,52	5,84	2,06	0,00 %	36,84 %	63,16 %	5,56 %	77,78 %	16,67 %

Table 3 shows that the idea collection method has high importance. This is also supported by the expected direction of development, for which 90 % of the respondents expect an improvement. The averages of expectations for current idea handling, management commitment, and the importance of idea management for the development of core technologies are likewise seen as very important. This would indicate a lack of clear procedures and disintegration from set processes. Also, it shows that the core technologies of the company are a focal point for new product development, and that idea management is definitely needed there.

The lowest average score was given for the expected amount of approved ideas. This could mean that a fixed idea management process could restrict the amount of new ideas. Also, the expectations for direct financial risks were low, which means that the respondents do not see a high chance of financial risks associated with idea management. Furthermore, workload did not get a high average score, but its standard deviation was by far the biggest, indicating that there is uncertainty about the real workload incurred by idea management.

The averages for the respondents' experiences were significantly lower than the expectations for the future. This is in general indicative of a need for development within the studied process. The highest average score was given for the quality of incoming ideas. This shows that the company has been receiving ideas that are considered to be of good quality and feasible for further development. Also, in the past, some kind of idea management has been relatively important to the development in core competencies and core technologies, signaling that the company has its strongest focus on them.

According to experience, search functions were given the lowest average score. This is a clear indication of the lack of a common (IT-based) knowledge base for ideas. Also, the amount of approved ideas has been low. The reasons for this are found in idea correspondence or the processes of idea handling. According to prior data, small (incremental) ideas have been prioritized lower than major ones, and sometimes rejected because a major idea has taken precedence over available resources. Furthermore, idea management statistics are seen as lacking. Due to the lack of an integral idea management system, ideas have not always been precisely recorded and documented into the company's knowledge base. This has undoubtedly led to redundancy and loss of information.

Noticeable figures in the direction of development index among the respondents are focused around idea collection. Improvements for the idea collection method are almost unanimously expected. The integration with other processes and statistics are also seen as important development objects. The expected development for current idea handling

supports the other aforementioned expectations. Furthermore, idea management is seen as important to business development in new markets. An interesting fact to note is that the future expectations mostly focus around the operational management of ideas, and that idea management as a function is seen as most important for the company's core technologies.

6.2. Analysis of BCFI results

The BCFI method yielded information about the situation scoped by the selected attributes as a whole. Firstly, this section presents an overall figure of the situation. Then, the situation is illustrated based on the surveyed company divisions in Finland and other countries. The results are also displayed according to the employee role (manager/expert). In all the figures presented in this section, the scales of the diagrams are limited, so that they remain easily readable even though there are peak values that exceed the scale maximum. The accurate peak values for attributes are not imperative per se; rather the acknowledgement that their value is significantly greater than others is sufficient information. For each index, the three smallest and three greatest values are acknowledged as the most and least critical attributes, respectively.

6.2.1. Overall BCFI

The overall perceived situation of the idea management function is according to the following figure:

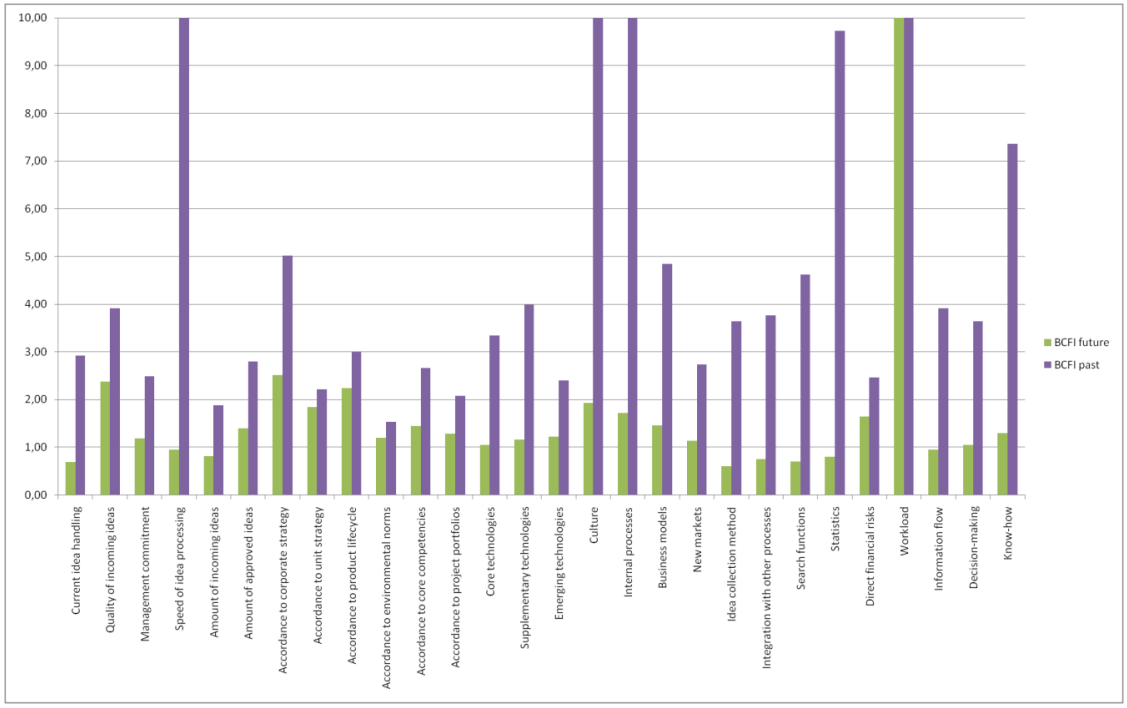

Figure 9: BCFI chart for all respondents

According to the figure, the overall most critical attributes for the future are the idea collection method, current idea handling and search functions for the idea database. There are high expectations for common procedures and methods regarding idea management. Other important attributes include integration with other processes, the speed of idea processing, and proper statistical reporting of idea management. The least critical attributes are workload, the quality of incoming ideas and the accordance to corporate strategy. Since the workload is off the scale, the result can be interpreted in the way that there is no consensus or clarity among the respondents. For the other two peak attributes, the interpretation is that they are handled sufficiently already, and that there is no need to emphasize them specifically in the development processes.

The most critical attributes in the past have been the accordance to environmental norms, the amount of incoming ideas and the accordance to project portfolios. The experiences indicate that there have been guidelines to follow despite the lack of a common idea management. It is notable several attributes have high BCFI values. The attributes are internal processes, speed of idea processing, culture and workload. Their high values can be explained by the lack of common functions. Because the procedures within this process have differed from department to department, the attributes measure differently throughout the organization.

6.2.2. BCFI for Finland

The following figure illustrates the situation among the respondents in Finland:

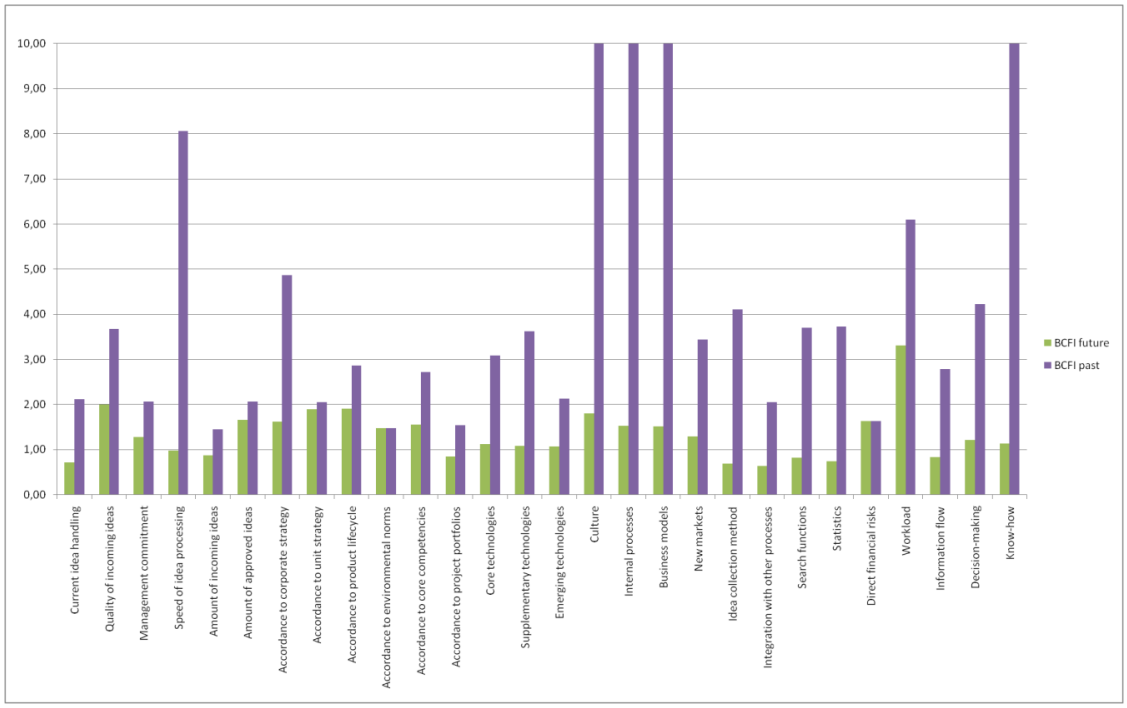

Figure 10: BCFI chart for respondents in Finland

The situation among the Finnish respondents differs from the overall situation somewhat. For the Finnish respondents, integration to other processes is seen as the most critical future attribute, followed by the idea collection method and current idea handling. In general, the index scores are all quite low, which indicates that the attributes are all considered to be relatively important. To be noticed here is that there are no high peaks in the future BCFI values. The highest values are found for workload, accordance to product lifecycle and the quality of incoming ideas. This indicates that all attributes are somewhat handled well already, and that there is a consensus among the respondents about the meanings of individual attributes. However, workload, as the attribute with the highest index value, is interpreted as ambiguous due to the lack of common procedures.

Regarding past development, the most critical index values are the amount of incoming ideas, and the accordance to environmental norms and project portfolios. The values are distributed broader compared to the future BCFI. Peak values are found in internal processes, culture, the importance of idea management to business models, and know-how. This indicates that these attributes are vastly unclear, and that they have not been actualized as such during the surveyed past development (two last years).

6.2.3. BCFI for other countries

The figure below illustrates the situation for survey respondents in other countries than Finland:

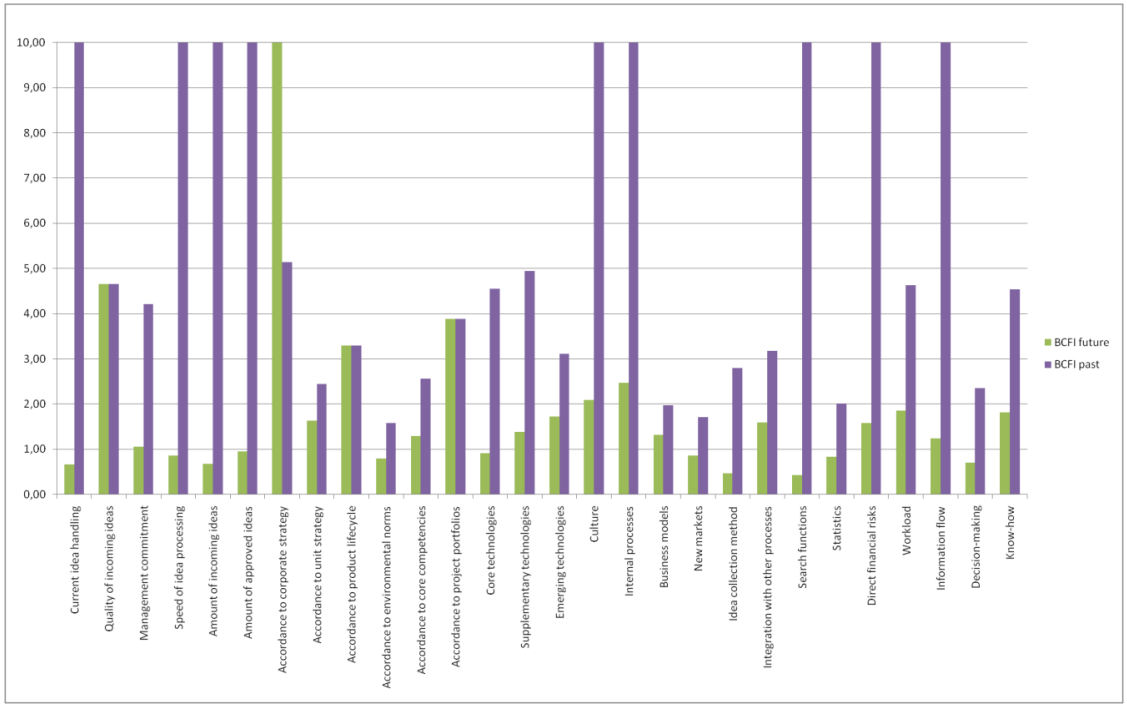

Figure 11: BCFI chart for respondents in other countries

Similar to other results, the respondents in other countries than Finland also see idea search functions, idea collection method and current idea handling as the most critical future attributes. It seems that the view about idea accordance to corporate strategy is unclear, as there is a peak value in the attribute. Other high attributes are the quality of incoming idea and the accordance to project portfolios. Based on the results and prior data, these attributes have been effective in the past, which is proven by their past BCFI values (identical to future values).

According to the results, there are no outstanding past critical values, as basically the lower end of the value spectrum is on the same level. This is an indication of already

established processes that are run on a satisfactory level. However, there are more peak-value attributes among the results. Partially this is explained by increased inaccuracy caused by the low number of respondents. What also affects the results is that the respondents were from several countries/departments, and the procedures may differ from one organizational unit to another. To improve the accuracy and validity of the results, common practices should first be implemented. After following common procedures globally, the situation should be surveyed and re-analyzed.

6.2.4. BCFI for Managers

The following figure shows how respondents in managerial positions evaluate idea management.

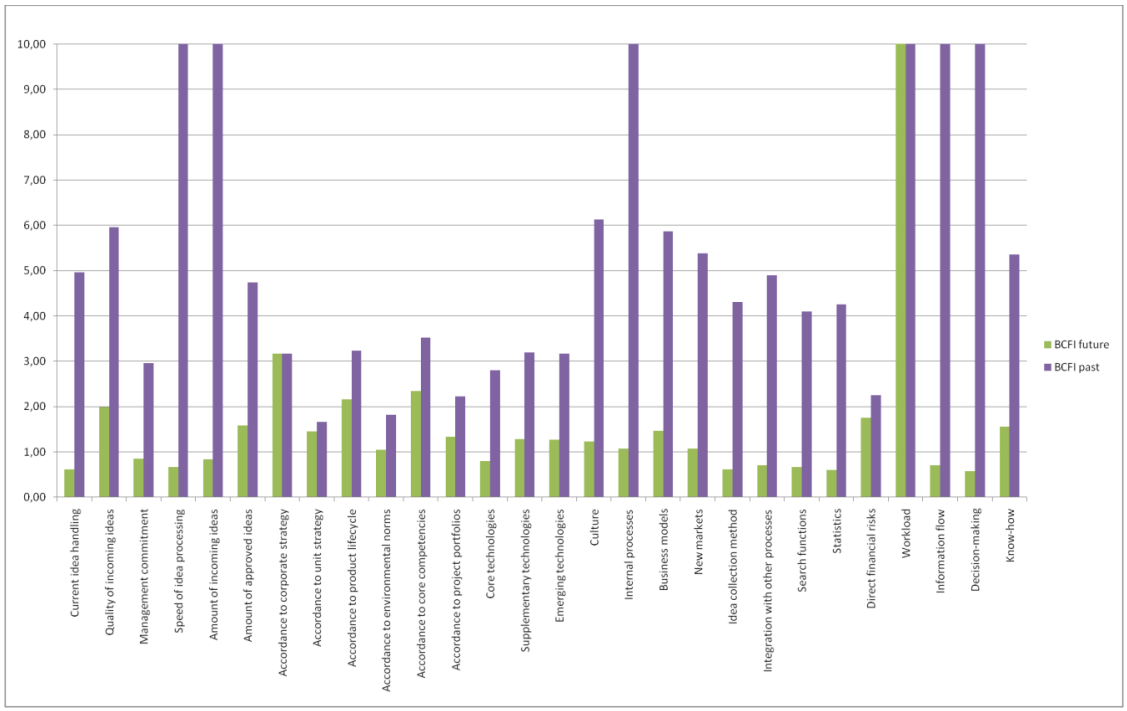

Figure 12: BCFI chart for respondents in managerial positions

For the respondents in a managerial position, decision-making is the most critical attribute. There are high expectations that idea management will improve this attribute.

Other attributes found critical are idea statistics, idea collection method and current idea handling. These are all attributes wherein employees with managerial positions may have a direct role. Some other attributes are also considered critical, such as management commitment and information flow. The notable peak-value among managers is workload. This is caused by the ambiguity around the new procedures.

There are no outstanding past critical attributes. The managers have, however considered the idea accordance to unit strategies, environmental norms and project portfolios very important. However, peak values are found in several attributes, including workload, internal processes and information flow. It is obvious that these attributes are important, but the individual procedures in separate organizational units have caused ambiguity.

6.2.5. BCFI for Experts

The following figure shows the expert-level employees' view on idea management.

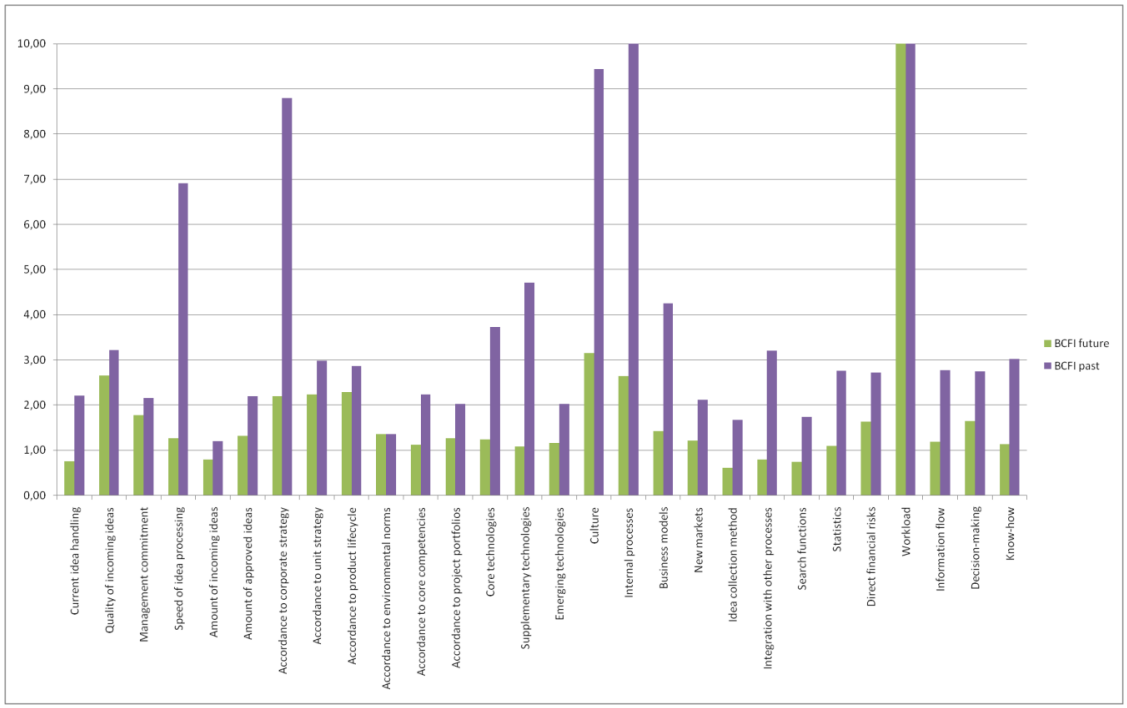

Figure 13: BCFI chart for respondents in expert positions

The BCFI values for experts show similar results for the future and past development. The most critical future attributes are the idea collection method, search functions and current idea handling. As with other respondent groups, workload has received the highest index value, i.e. there is no common view on the actual implications (they might differ from one expert to another).

Past critical values are seen in the amount of incoming ideas, accordance to environmental norms and the idea collection method. There are not so many extreme peak values as with other respondent groups, but only internal processes are seen as ambiguous, as the index value is far higher than with other attributes. Culture and workload also have high values, due to the separate and differing procedures so far.

6.3. Summary of results

The studied data showed quite similar results throughout the respondents. The BCFI method indicates that idea collection, current idea handling and search functions make them the most critical attributes for the future development of an idea management system for the case company. Among the respondents, there are high expectations for improvements in these attributes. Integration with other corporate processes is also rated among the critical attributes, which signals a will to embed the idea management function into the everyday operational activities within the company.

The BCFI method shows that there is ambiguity of practices among the respondents. Workload is an attribute whereupon there is no common agreement, as it has received the highest BCFI values among all respondent groups. Clearly, it is a situation-dependent attribute, and as such differs from one respondent to another.

For the past, the critical attributes are concentrated around the accordance to environmental norms. Due to the field of industry, this is a logical occurrence. Among the expert respondents, the idea collection method is also seen as a critical attribute. It can be deduced that the lack of common procedures is the biggest cause of ambiguity. This will be clarified in the future with the introduction of new, organization-wide disciplines.

7. DISCUSSION OF STUDY RESULTS

This section discusses the results from the study in reference to the research questions. The study was made to find suitable criteria for early screening of new ideas and reporting idea management information in the front end of the innovation process, i.e. the phase where ideas are brought from individuals to the organizational knowledge base. The data for the study was firstly collected from earlier surveys and other corporate documentation. Furthermore, the main data shown in the results was collected by means of a survey specifically about idea management.

The method used for this case study is the Balanced Critical Factor Index method, which processes the perceived future expectations and experiences of employees into comparable indices. These indices were calculated separately for the future and past in order to find the critical factors for idea management. This yielded results and knowledge about the respondent employees' awareness and overall knowledge of idea management, as well as their expectations for it in the future.

Following Parmenter's (2007), Cooper's (2005), and other authors' guidelines, the conclusions of this thesis do not include references or recommendations to financial measuring. It has been indicated in several other studies and occasions that something as unspecific as the front end of innovation cannot yield exact financial information, as any "accurate" financial information (in this phase) could be misleading and yield false information for the decision-making process later. Resultantly, the idea evaluation could be biased towards ideas that promise seemingly fast returns. Moreover, the case company did not want to measure customer value in the point where the market prospect is unclear.

Since a company's strategy represents its desired future direction, the company should be best prepared to plan and implement ideas or projects that are in accordance with its strategy. When the strategic criteria are clear, the assessment of ideas also becomes clarified, and new ideas can be directly dropped into their proper channels for further development (roadmaps) or repositories for later use.

Following a certain roadmap or predefined process may clarify the path from idea inception to a specific deliverable, but it also sets a scope for eligible ideas. Everything outside the scope either goes through the “fuzzy” path where the future is completely uncertain or becomes rejected as strategically unfitting. Effective idea management should always follow up and review even such ideas to decrease the risk of omitting potential opportunities. In other words, the front end of innovation should be followed by a set of preset paths for ideas in certain technologies or solutions, with enough flexibility and resources for other kinds of solutions.

One should bear in mind that implementing an idea, even a small one, is always an investment for the company. From changing an office layout to designing a new product, not to mention changing entire strategies, everything draws resources and requires management to call for value-creating results. It is therefore necessary to have a well-established support system in place, to ensure the best available knowledge for making decisions.

On the other hand, the management should create and support an environment where ideas are appreciated and welcomed from all levels in the organization. As Koen et al. (2002) suggested, evaluators of ideas should be advised to think how ideas could succeed (in the future), not to find only reasons why they fail immediately.

In this following discussion, individual research questions and their answers are presented first, followed by the implications and recommendations to the case company.

7.1. Criteria for the initial screening of individual ideas

The first research question was to find out what criteria should the company use for the initial screening of individual ideas. The answer to this question is extracted from the survey, i.e. the attributes which respondents considered the most critical. The five most critical (applicable) attributes from each respondent group are taken into account, and listed according to the frequency of appearance in the groups (as indicated by the low

index values in appendix 3). Applicable criteria are considered measurable numerically per each individual idea. As such, for example the current idea handling is not an applicable attribute for screening, although it may be applicable for reporting idea management activities as such.

The applicable criteria are:

- Accordance to unit strategy
- Accordance to environmental norms
- Accordance to project portfolios
- Core technologies
- Supplementary technologies

These attributes form the basis of initial idea screening. The importance of strategy is emphasized strongly in all of them, with the exception of environmental norms that are externally mandated. Selection of core technologies (to produce) is a strategic choice for the company, and therefore restricts the scope of (accepted) ideas. Another criterion is the availability of resources, which is of general interest to company, as new projects are always an investment in terms of costs, labor and intellectual capital.

However, these criteria should not be strict and completely inelastic. As the industries and technologies develop, ideas that do not adhere to the criteria should not be completely disregarded, but rather saved and reviewed periodically for future application. Also, there may be other criteria in addition to these, or just some of these may be used if it is necessary to simplify the evaluation process.

Ideas need to be scored on a set scale to make them comparable to one another. The scoring makes the basis for reporting, although the single-element score (for example, only strategic fit) is not the sole approval criteria. Rather, the organizations themselves define the lower limits of idea scores to approve.

7.2. Measuring and reporting the front end of innovation activity

The second research question asked how to measure and report the idea management process in the front end of innovation. The answers for this question are also drawn from the survey. The conceptual attributes and suitable other performance indicators are the solution. Because it was assumed that different stakeholder groups might require different indicators, the results were presented individually for the respondent groups.

The attributes that measure the front-end activity are:

- Current idea handling
- Amounts of ideas and patent applications
- General statistics about the front end
- Workload of evaluators in the front-end
- Idea readiness for implementation
- Implementation before vast development

Current idea handling is the process where the idea is recorded, evaluated and upon where further actions for it will be decided. Measurement of the process includes tracking the time from the initial recording of an idea until the point where a decision is made about using or archiving the idea. Also, the time required for finishing early evaluations should be measured to assess the efficiency of the process. The outcome of the idea handling process is ideas categorized in strategic “buckets” according to their strategic accordance.

The amount of ideas in terms of totals is a definite performance indicator for any company whose strategy is strongly based in research and development. The number of new ideas and patent applications is the basic important measure that indicates how much idea management is needed.

According to the results of this study, workload was seen as vague. Therefore, the processing times for ideas from the initial recording to their approval or rejection should be measured. Also included in the workload are the numbers of evaluations by individuals in different organizational units. One of the important measures is the organization's readiness to implement ideas. Time, money and human resources are all needed in addition to strategic accordance to make ideas eligible for development. The workload indicator also serves another purpose – it shows who does the most evaluations for each category. This way, if the same employees always evaluate ideas in their categories, their expertise may increase which increases their strategic importance to the organization.

These indicators are measured by scoring the ideas with separate scores for each indicator. They measure the organization's capability to produce new ideas that correspond to its strategic goals. The scores are reported individually, so that ideas can be properly compared against one another. Based on the given scores, proper follow-up procedures are used for separate ideas, and based on the process scores, resources are allocated to the front-end processes to keep it running in balance and according to corporate strategy. An example of process measurement is displayed below:

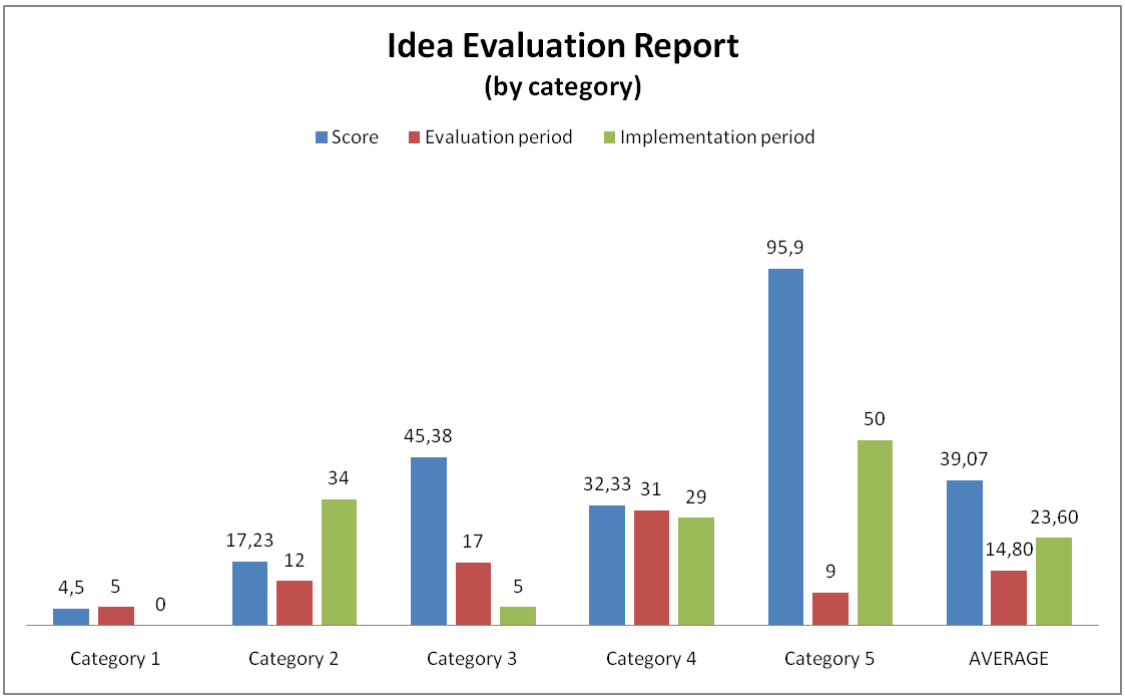

Figure 14: Example of an idea evaluation report about idea handling

The figure displays an idea evaluation report where shown the averages for scores of idea categories, the duration of their evaluation, and (if applicable) the time it has taken to implement the ideas the first time are shown. The last bar in the diagram shows averages for all categories within the particular category. This kind of report can be used to measure the efficiency of the evaluation process and to pinpoint where resources are needed. If the idea handling in a category is very slow, the category may require additional experts or control for the evaluation to enhance it.

The other statistics yield further performance indicators. These should be sufficiently accurate to produce the information that different stakeholders require. The other indicators are:

- New ideas per organization and department
- Rating and number of comments per idea
- Integration with other processes

- Usage of idea in external resources

The basic measurable is the raw number of ideas per organization within a time period. It is also important to have the given ratings and the numbers of comments for each idea separately, as an idea may develop through public commentary along its official evaluation.

The integration with other processes is trickier to measure. Idea management should be involved with all phases of the innovation process, ensuring the flow of information from the idea database to other processes, so that both are constantly updated by one another. The adherence to other company processes indicates a strong methodological basis for new product development - the company already has a mindset for roadmapping. There are defined strategic roadmaps for technological development, so it is not necessary to redefine any strategic buckets. There is only a need to define a rule set for using the ideas within the “buckets”, and importantly to communicate and record the use of ideas, so that idea management throughout the innovation process can be measured.

Sometimes an idea may originate from external sources or it might be used internally in other organizations. The information about the previous use of ideas is important for informing the company about the existence of the idea in an application. If the idea has no novelty value, further development as such would be redundant. Also, it is valuable knowledge for the following NPD if the idea is already put to use in the front-end process, before vast development effort.

7.3. Follow-up procedures for evaluated ideas

This section suggests answers for the third research question: What follow-up procedures should the company consider for evaluated ideas? Given the narrow frame of the studied process, the options on a higher level are to:

- Approve idea for further development or implement immediately
- Return idea to archive for later review
- Reject idea as ineligible or because it is already in use

When an idea is evaluated, it is given a certain rating based on the existing criteria. High-scoring ideas are then approved for immediate implementation or future development and moved into a strategic "bucket" to wait for further processing according to the "bucket" roadmap. The roadmaps are based on technologies and organizations. Ideas are archived for future use if they are not mature for current business or if the company does not have the required resources. These ideas should be reviewed and re-evaluated periodically according to the availability of resources related to the strategic "buckets" of the ideas. If an idea is not strategically eligible or is already used in the organization, it is rejected and stored into the database. Even rejected ideas may become eligible in the future, and they should be reviewed these as well, but less frequently than "on hold" ideas.

The follow-up procedures for individual ideas should also be inspected on a more detailed level. If an idea is approved for further development, it does not automatically mean that it will be used. Also, should an idea be rejected, it still needs to be acknowledged as information for future use. For ideas that are used, it is important to record the usage into the same idea database, as this information produces valuable knowledge resources for the organization.

The suggested follow-up procedure for ideas that are approved is to check their "buckets" frequently and make a feasibility study for them in order according to their rating. This way the cost of implementing the ideas is found out as is their value in the "buckets". The most feasible ideas are then picked for use or development. At all times, idea management should be aware of the ideas waiting for development and react if there are "better" ideas waiting to be introduced into the strategic "buckets. 85 % of the "bucket" budget will be reserved for major projects and 15% will be kept for small and quickly implementable ideas. Both proportions of the budget are kept flexible with the option to supplement each other when necessary.

For ideas in their strategic “buckets” the use of more informational charts, such as bubble diagrams will provide the necessary information about the most eligible ideas for further development. The figure below presents an example of a bubble diagram for comparing differently rated ideas:

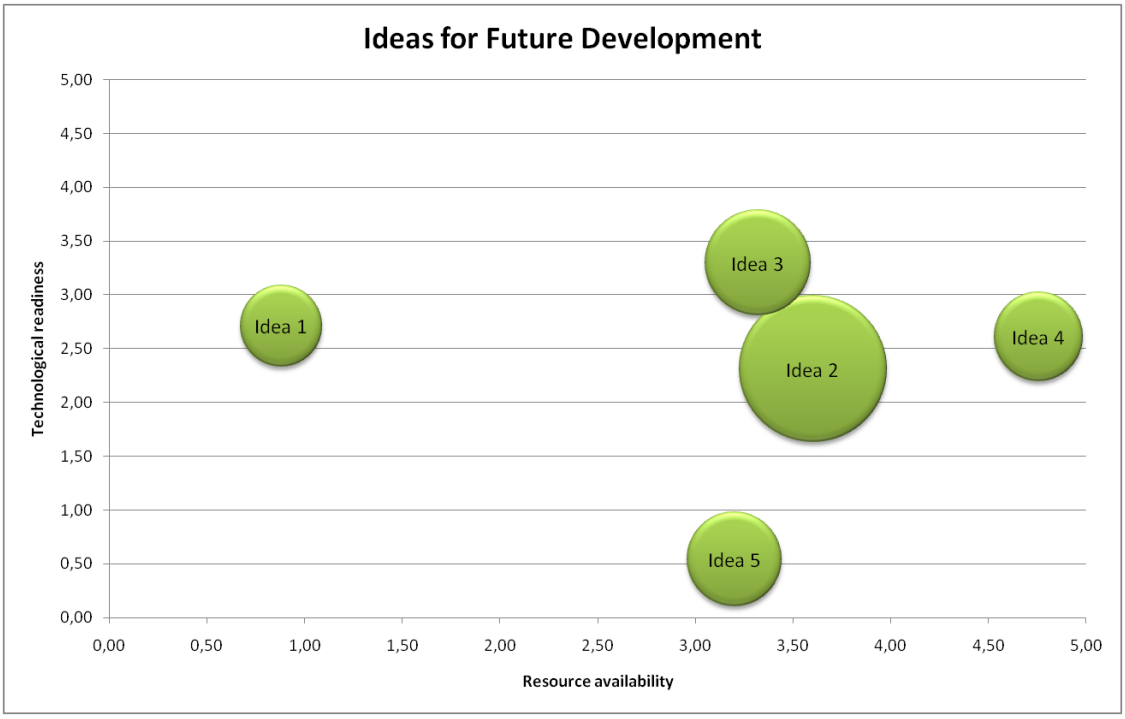

Figure 15: Example of bubble diagram for comparing ideas in a strategic “bucket”

In the figure, the availability of company resources to implement the idea immediately is in the x-axis. Technological readiness for immediate implementation is read on the y-axis. The size of the bubbles represents the overall correspondence to the strategies in the particular strategic “bucket”. Depending on the strategic “bucket”, the measures are changed according to unit strategy, i.e. if supplementary technologies are considered more important than core technologies, the accordance is measured instead. A separate diagram is made for every strategic “bucket”.

When ideas are archived for later use, they need to be marked for review at a certain time. If the ideas are re-evaluated as eligible, the same procedures apply as in the

previous paragraph. Otherwise, they can be returned again for later review or rejected at this point. The review should always include browsing the idea database for ideas with the same related keywords. If there are other similar ideas or applications of the idea, this information can be used in the re-evaluation of the idea at hand.

Rejected ideas need to be archived in the idea database for informational purposes. These ideas may still prove eligible in the future, whereupon they should be reviewed for example once per year. If an idea is completely out of strategic scope or already in use in the organization, the information should be available to everyone, so that the idea will not be suggested again the same way.

7.4. Developing the measurement of the front end of innovation

This section suggests answers to the fourth and last research question: How are the toolset and reporting for idea management further developed to correspond to stakeholder requirements? First of all, when considering the front end of innovation, one must bear in mind that it is a narrow part of the whole new product & business development process. In order to keep the processes efficient, the reports should not be complex. The reports should include 5-7 performance indicators about the ideas and the process itself. It should also be considered apart from measuring the whole innovation process. Innovation is defined as the outcome of theoretical conception, technical invention and commercial exploitation, which means that its front end is too early in the process to measure the fulfillment of all these conditions.

As the early evaluation of an idea is not supposed to provide a complete business case enclosed with a fixed plan of implementation, it should only provide an answer to the question: Do we proceed to the next stage? For the whole front-end, the measurement shows if the company is getting the right ideas according to the correct criteria. What needs to be considered is the purpose of measuring – is information all the organization needs or are there triggers that activate within idea management when an indicator shows a certain level? Furthermore, the control measures for the idea management

(what to do when a performance indicator shows a particular result) should be in use and clear for idea management. This study did not examine or list the methods for creating new ideas, as this subject is digested in other literature, and already used in companies extensively.

As statistics was considered an important attribute by the manager respondents, it is clear that they require timely information about the activities within their own area of responsibility. There might be some existing guidelines for individual units, but at this point, it is also important to communicate common guidelines throughout the company. Customized reporting about each organizational unit with enough details will allow for information in detail, and summaries of the overall situations will illustrate the situation for the entire company.

In order to know which attributes are relevant, the survey used for this study should be re-iterated periodically. The greater the number of respondent, the more accurate results can be drawn. Also, it is important to get results from all organizational units, so that the units can be compared across the board. Long-term performance measures enable the comparison of different periods and thus a steady development figure can be made.

7.5. Implications to corporate management

Measuring the front end of innovation processes may yield a deeper insight into the corporate knowledge base instead of only producing number data about idea activity. If evaluation tasks are concentrated in a specific area or individual person, this reporting may lend a hand to charting the overall competencies within the organization. Additionally, observing the ideation activity in individual departments, the knowledge base and competencies within an organization can be measured. This is especially important for research & development, where the competence levels and expertise are expected to be high. In other words, the company will be enabled to construct a knowledge network around idea management.

Other measures are to observe the understanding of corporate strategy and technological readiness for new projects through the new ideas. These elements are important for communication throughout the entire organization and may provide valuable information to corporate management.

It is obvious that from a vast pool of ideas it is impossible to use all. The company could consider still making business with the unused ideas. An application similar to the Research Surplus Portfolio can be used for archiving and managing the ideas "on sale".

Further still, a measure for clearly disruptive ideas that do not correspond to existing strategies should be considered for the future. These ideas might produce value in the long run, and researching them is important. On the other hand, if the strategy of a "bucket" is defined as researching new opportunities, the strategic fit for these ideas increases significantly. The scales for measuring technological readiness and available resources could even be reversed, and the ideas with the smallest scores would be considered for further research.

7.6. Validity and reliability of the study

A seamlessly accurate analysis would require more responses from all company departments. Due to the relatively small number of respondents, this study has produced only partially applicable results as such. However, the value and reliability of this study will increase if the study is repeated later, with the experiences compared to the expectations of the current study, to find out the course of development in idea management.

As the case company is highly concentrated in engineering, the results received from this survey had mostly a technical point of view. Most of the respondents work within research and development, and while their field is central for idea management, the point of view of other departments was not sufficiently represented. In the future if the

survey is iterated it should be applied to all departments for a holistic view of the perceived situation.

The study is also time-dependent. At the time when this study was made, the case company was just about to launch a new idea management tool for processing and pre-screening ideas in the front end of the innovation process. It should be noted that, although individual departments had some idea management practices in use, the company did not have previous experience about it organization-wide. This situation will likely not repeat itself in the same way, and therefore any future surveys should be made according to the prevalent situation. Some of the attributes may need to be reviewed, although most of them are on a general level re-usable as such.

The method used in the study does not give the means to manage ideas or enhance reporting as such – these are the result of strategic and operational development. Other statistical methods could have yielded information in higher detail and provided more specific analysis tools. However, the method does yield information about the important issues, as they are perceived. The survey should be repeated every year, and if possible, for the same units (and the same employees) to yield comparable results.

The results showed that the case company is inclined to follow its strategies and processes very strictly. There is a strong tendency to approve ideas mostly in line with corporate strategy, which allows very little leeway for new, disruptive innovations. Although the company has a department that researches new technologies and projects beyond the existing strategy, the next challenge lies in finding the precise measure that considers this as well.

Overall, the study provided results that confirm some premade assumptions about the company's situation with idea management. New information was produced about the future expectations and the possible direction of the development of the front end of innovation. The results gave possible, but not exhaustive answers for the research questions.

7.7. Suggestions for future research

New product development, in all its forms is not a static process. Due to its heuristic nature, the methods therein change constantly according to new knowledge, the projects at hand, and the people involved. However, as business strategies themselves are usually not changed overnight, and large companies often do not change their processes instantly, it is recommended to upgrade the results of this study in some years. Then the applied parts of it can be evaluated against the company's processes again.

The operational options to take for directing the front end to produce certain types of ideas were left out of this study. It was assumed that the case company has basic ideation skills and is active in developing them. However, it would be interesting to study in which specific ideation tools produce the best ideas for the front end of innovation, and later on if these eventually turn out to be actual innovations.

The fuzzy front end remains an unclear area, even though it is clarified with a common frame and language. However, it is both interesting and useful to study how can ideas be turned into value-producing knowledge in the early stage, and how can that value be (more accurately) measured.

As such, the theoretical part of this study could be used to describe the overall new product and business development process for any company. However, the results presented herein apply only to the situation in the case company at the time of the study. It would be interesting to make similar studies on other companies in different (and similar) circumstances and in different industries, whereby the effects of the FEI elements and influencing factors could be analyzed. If there were common features and details to be found, that have not been present in previous studies, it would contribute more to the understanding of the front end of innovation as a whole.

This thesis has mostly handled idea evaluation. The next logical step is actual management of a large number of ideas. The case company should consider studying the required processes for data mining to keep the idea database in control.

8. CONCLUSIONS

The following conclusions apply to the early evaluation of new ideas as well as to the front end of innovation as a process. They can be used as guidelines for developing idea management support for the innovation process. The conclusions confirm some of the raised issues about idea management and provide clarification for the front-end activities.

The function of idea management in the Front End of Innovation is to facilitate the flow of information from individual sources to the collective corporate knowledge base and vice versa. It also monitors the front-end activities and translates new rules and regulations into operative practices. In other words, the idea management function supports the organization to reach the goals for new ideas set by corporate management, in accordance with the organization's strategies. Figure 14 illustrates and summarizes the recommendations made herein, in the context of the theories presented in this thesis.

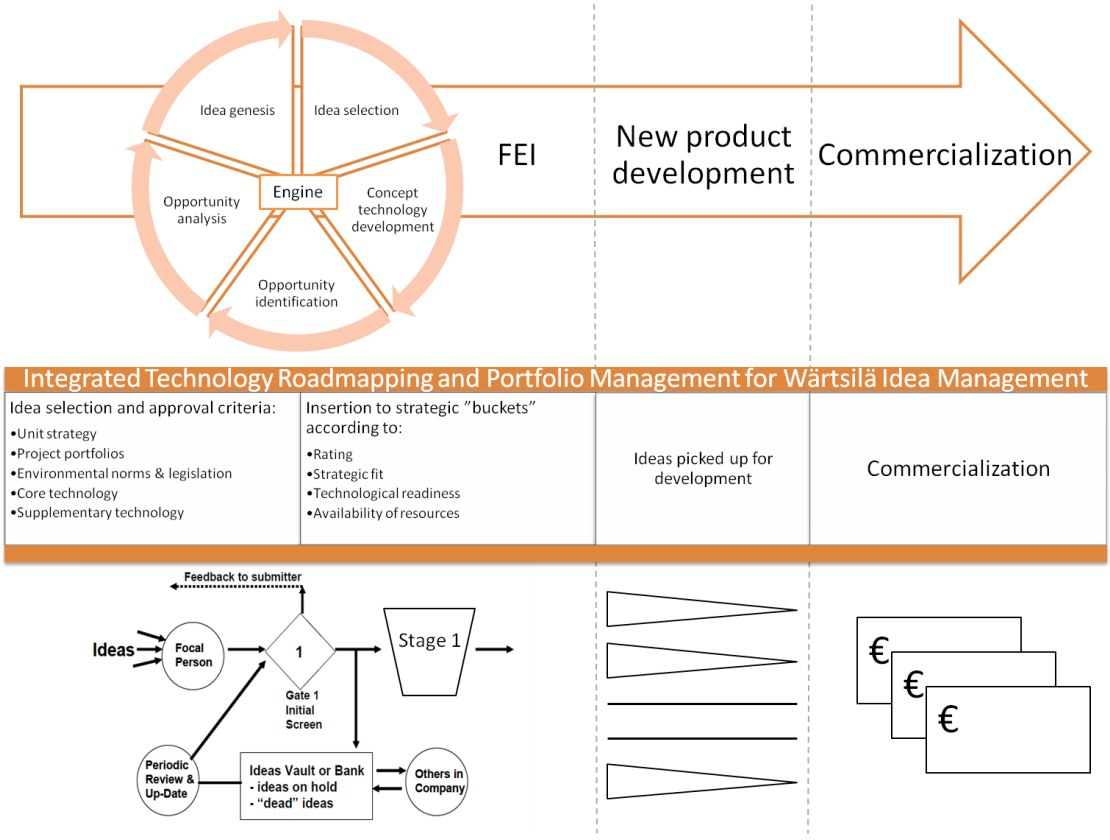

Figure 16: Suggestion for Wärtsilä idea management (adapted from Cooper, 2002; Cooper & Kleinschmidt 2007a, 2007b and Koen et al, 2002)

As displayed in the above figure, the front end of innovation comprises of the "spoked wheel" (by Koen et al, 2002), an idea screening and review plan (by Cooper, 2002; bottom left in the figure), and the criteria for proceeding with the idea towards its commercialization. Technology and business roadmaps are defined according to market opportunities, and all new ideas are categorized under a suitable roadmap. This simplifies the development of some ideas, which allows more resources for the ideas that require further analysis or studies before implementation. The triangular shapes in the new product development phase represent (Stage-Gate) processes, whereas the straight lines represent immediately implementable ideas which go through even simpler processes.

Idea management in the front end of innovation controls the flow of ideas through focal people (idea coordinators) into an initial evaluation and screening. The leading criteria for this are the fit to unit strategy, project portfolios, environmental norms, core technologies and supplementary technologies. In this phase, the idea is evaluated either eligible or ineligible for further actions. The next subsections specify the conclusions for idea and process evaluation.

8.1. Idea evaluation in the Front End of Innovation

Firstly, for each "bucket", a clear roadmap of technology development is required. Thereon, when there are enough ideas for each "bucket", feasibility studies are carried out for the best-rated ideas. This thesis recommends constructing the "buckets" based on the budget for R&D for each technology.

Ideas that are screened out are archived and a date is set for their review. Idea management goes through all archived ideas at fixed intervals and maintains interaction between the idea originators and organizations in order to develop both the ideas in the strategic "buckets" as well as the archived ones. Also, idea management will be responsible for finding connections between separate ideas and experts with the competencies to develop them further.

"Dead" ideas are kept in a database and used for informational purposes. The reasons given for the rejection of these ideas will direct the topics of new ideas, i.e. the same idea will not be proposed several times as such. However, the rejected ideas are reviewed (less frequently than "on hold" ideas) if corporate strategies change. Ideas that are completely out of strategic scope will be made obsolete and further reviews will be withheld.

This forms the base for front-end evaluation. The process of scoring and evaluation should be kept simple and straightforward to ensure fast throughput of ideas in the front end. Idea management needs to be constantly aware of the threshold for recording new

ideas and work to lower it. The company should have a culture that nourishes the flow of ideas and an attitude to make ideas work (i.e. evaluate how ideas could be made eligible) instead of rejecting ideas that are ineligible at the time of initial evaluation.

8.2. The front end process measurement

It is important for the idea management to have a solid grasp of the ideas in the database at all times. The purpose for measuring the front end is to know exactly how many and what kind of ideas the organization is receiving. Also, the origin of ideas may have strategic value for the company.

The performance indicators to use are:

- Number of ideas and patents in the organization
- Number of ideas implemented before development
- Average duration of front end evaluation (from idea recording to decision about usage or rejection)
- Average time from idea evaluation to implementation
- Idea strategic accordance
- Technological readiness
- Estimated availability of resources

The basic indicators are the numbers of ideas and the ratio of patents in a given time period. It is also important to know if there are ideas that are implemented without vast development. For “normal” ideas, i.e. ideas going through screening and evaluation, the mean time spent between initial recording and recommendations about the future use is an important indicator that measures the evaluation performance of the idea management organization. Strategic accordance, technological readiness and the estimated availability of resources are indicators that measure the organization’s capability to implement the ideas.

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APPENDIX 1: SURVEY QUESTIONNAIRE

Dear respondent,

You have been selected for this survey because of your expertise and know-how. By this survey we are collecting information about your experiences and expectations of idea management in Wärtsilä.

Background

Wärtsilä will soon launch a global application for collecting and screening ideas from all employees. The aim is to enhance the process of idea recording and processing, so that ideas can be refined already for the very beginning of the idea screening process. The application will also be the primary channel for disclosing and handling inventions. However, this questionnaire is about collecting and managing ideas in general, and does not cover inventions.

The information collected by this survey is used to further develop our idea handling and follow-up processes to ensure the best possible support for our company departments.

A reminder of our definitions:

- ✓ IDEA is a description how to improve something
- ✓ INVENTION is a patentable idea
- ✓ INNOVATION is an idea or invention developed to create added value

Questionnaire

The questionnaire on the next page contains 28 attributes. The first two columns, **expectations** (how will the attribute correspond to Wärtsilä's needs in the future) and **experiences** (how the attribute has corresponded to Wärtsilä's needs in the past and at the moment) are answered with a grade on the scale of **1** (poor) **to 10** (excellent). Please answer from your own point of view.

The **"How will it become in the next 2 years?"** column indicates how, in your opinion, the attribute will develop over the next two years. The **"How has it developed over the past 2 years?"** column indicates how, in your opinion, the attribute has developed over the last two years until now. Please answer by entering an **"X"** for the appropriate option. No entries are made on the grey topic rows.

You may skip an attribute if you think that you don't have the required information to respond. The answers will be analyzed to establish an understanding of the current status of idea management, and to find the attributes to prioritize in future development.

How to respond:

EXAMPLE	**Expectations for the future**	**Experiences from the past**	**How will it become in the next 2 years?**			**How has it developed over the past 2 years?**		
ATTRIBUTES	(1-10)	(1-10)	worse	same	better	worse	same	better
Idea management								
Current idea handling	9	8			X		X	

Please send your respond by email attachment by February 4th, 2011 to: **arto.jyrala@wartsila.com**

Thank you for your time!

	Expectations for the future	**Experiences from the past**	**How will it become in the next 2 years?**			**How has it developed over the past 2 years?**		
ATTRIBUTES	(1-10)	(1-10)	worse	same	better	worse	same	better
Idea management								
Current idea handling								
Quality of incoming ideas								
Management commitment								
Speed of idea processing								
Amount of incoming ideas (1 = low, 10 = high)								
Amount of approved ideas (1 = low, 10 = high)								
General idea correspondence to strategy								
Accordance to corporate strategy								
Accordance to unit strategy								
Accordance to product lifecycle								
Accordance to environmental norms								
Accordance to core competencies								
Accordance to project portfolios								
Importance of idea management for solution/product development in these areas:								
Core technologies								
Supplementary technologies								
Emerging technologies								
Importance of idea management for operational development in these areas:								
Culture								
Internal processes								
Importance of idea management for business development in these areas:								
Business models								
New markets								
Idea collection								
Method								
Integration with other processes								
Search functions								
Statistics								
Improvements by idea management to these attributes								
Direct financial risks								
Workload								
Information flow								
Decision-making								
Know-how								

APPENDIX 2: SURVEYED CORPORATE UNITS

All respondents were employees of Wärtsilä Industrial Operations. Listed below are the specific departments from where responses were received.

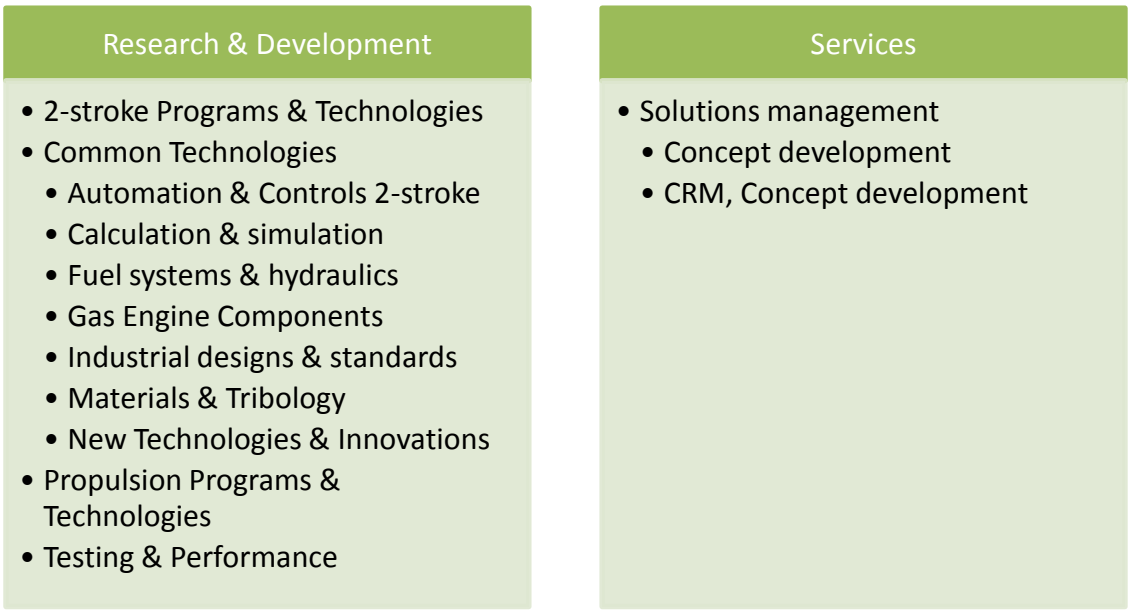

Figure 17: Organizational departments of survey respondents

APPENDIX 3: BCFI VALUES FOR RESPONDENT GROUPS

Table 4: BCFI values for respondent groups

	ALL		FINLAND		FOREIGN		MANAGERS		EXPERTS	
ATTRIBUTES	**Future**	**Past**	**Future**	**Past**	**Future**	**Past**	**Future**	**Past**	**Future**	**Past**
Current idea handling	0,69	2,92	0,71	2,11	0,66	55,12	0,62	4,96	0,75	2,21
Quality of incoming ideas	2,38	3,91	2,00	3,67	4,66	4,66	1,99	5,96	2,65	3,21
Management commitment	1,19	2,48	1,28	2,07	1,05	4,21	0,85	2,96	1,78	2,16
Speed of idea processing	0,95	11,64	0,97	8,06	0,85	56,74	0,67	58,82	1,27	6,92
Amount of incoming ideas	0,81	1,88	0,87	1,45	0,68	45,19	0,84	59,76	0,80	1,20
Amount of approved ideas	1,40	2,80	1,65	2,06	0,95	56,94	1,58	4,74	1,32	2,19
Accordance to corporate strategy	2,51	5,02	1,62	4,87	85,67	5,14	3,17	3,17	2,20	8,79
Accordance to unit strategy	1,84	2,22	1,89	2,05	1,63	2,44	1,45	1,66	2,24	2,98
Accordance to product lifecycle	2,24	2,99	1,91	2,87	3,29	3,29	2,15	3,23	2,29	2,86
Accordance to environmental norms	1,20	1,53	1,48	1,48	0,79	1,58	1,04	1,82	1,36	1,36
Accordance to core competencies	1,45	2,66	1,55	2,72	1,28	2,57	2,35	3,52	1,12	2,24
Accordance to project portfolios	1,28	2,08	0,84	1,54	3,88	3,88	1,34	2,23	1,26	2,02
Core technologies	1,05	3,35	1,12	3,08	0,91	4,56	0,80	2,80	1,24	3,72
Supplementary technologies	1,16	3,99	1,09	3,62	1,37	4,95	1,28	3,20	1,08	4,71
Emerging technologies	1,23	2,40	1,07	2,13	1,72	3,10	1,27	3,17	1,16	2,02
Culture	1,94	86,03	1,81	83,36	2,09	83,45	1,23	6,13	3,15	9,44
Internal processes	1,72	90,75	1,52	86,87	2,46	98,58	1,08	80,77	2,65	96,26
Business models	1,45	4,84	1,52	10,62	1,32	1,98	1,47	5,86	1,42	4,25
New markets	1,14	2,74	1,29	3,44	0,85	1,71	1,08	5,38	1,21	2,11
Idea collection method	0,61	3,65	0,68	4,11	0,47	2,80	0,62	4,31	0,61	1,67
Integration with other processes	0,75	3,77	0,63	2,05	1,59	3,17	0,70	4,90	0,80	3,20
Search functions	0,70	4,63	0,82	3,70	0,43	42,87	0,67	4,10	0,75	1,74
Statistics	0,80	9,74	0,75	3,73	0,83	2,00	0,61	4,26	1,10	2,76
Direct financial risks	1,65	2,46	1,63	1,63	1,57	94,32	1,75	2,25	1,63	2,72
Workload	18,97	16,97	3,30	6,10	1,85	4,62	85,62	85,62	13,37	12,26
Information flow	0,95	3,92	0,84	2,78	1,24	61,86	0,70	60,33	1,19	2,77
Decision-making	1,05	3,64	1,21	4,22	0,70	2,34	0,57	57,34	1,65	2,75
Know-how	1,29	7,36	1,14	10,23	1,81	4,53	1,56	5,36	1,13	3,02