IMPROVING THE FRONT END PRACTICES OF INNOVATION PROCESS

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Abstract

This thesis was assigned by the R&D Services service line unit of Tieto Finland Oy.

The objective of the thesis was twofold: first, to identify and analyze the challenges of the current innovation process of Tieto, focusing especially to the Front End phase practices of the process; and second, to research and evaluate the commonly available solutions to improve these practices.

The thesis was mainly conducted as a literature review using the bibliographical and evaluative research methods. During the case study also a light-weight survey was conducted, and empirical analysis was used.

The thesis work began by mapping the available publications on the topic. The most potential publications were acquired, studied and reviewed. The basic terms, definitions and concepts of innovation, innovation management and innovation processes were studied and then presented in the thesis. Next, the different innovation process models, and the different Front End models were studied, evaluated and presented. The New Concept Development model was identified as the most suitable model for modeling the Front End, and it was therefore studied and presented in more detail. Finally, the methods, techniques and tools for improving the Front End phase practices were studied, evaluated and presented.

The innovation practices of Tieto were studied as a case study. The current level of understanding of innovation processes was mapped, the challenges were identified and analyzed, and finally a solution proposal was made.

Keywords
Innovation process, Front End of Innovation, FEI, Fuzzy Front-End, FFE, New Concept Development model, NCD, New Product Development, NPD

Miscellaneous
Appendices, 16 pages. Appendices 2 and 3 are confidential.

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Tiivistelmä

Opinnäytetyön tilasi Tieto Finland Oy:n R&D Services service line -yksikkö.

Työllä oli kaksi tavoitetta: identifioida ja analysoida Tiedon nykyisen innovaatioprossin haasteet, keskittyen erityisesti innovaatioprosessin alkupään toimintatapoihin; sekä tutkia ja arvioida yleisesti tunnettuja ratkaisuja näiden haasteiden ratkaisemiseksi.

Työssä hyödynnettiin pääasiallisesti kirjallisuustutkimuksen menetelmiä sekä arvioivaa menetelmää, mutta tapaustutkimuksen yhteydessä hyödynnettiin myös empiiristä tutkimusmenetelmää sekä mielipidemittausta.

Työ aloitettiin kartoittamalla aihepiirin kirjallisuuslähteet. Potentiaalisimmat lähteet hankittiin, arvioitiin ja käytiin läpi soveltuvilta osin. Aluksi selvitettiin aihepiirin terminologia, määrittelyt sekä kuvattiin innovaatio-, innovaatioprosessi-, sekä innovaatiohallinto-konseptit. Seuraavaksi tarkasteltiin ja vertailtiin eri innovaatioprosessimalleja sekä innovaatioprosessin alkupään malleja. Tuotekonseptoinnin malli (NCD) havaittiin sopivimmaksi ratkaisuksi innovaatioprosessin alkupään mallintamiseen, ja tästä syystä sitä tutkittiin yksityiskohtaisemmin. Lopuksi tutkittiin ja arvioitiin innovaatioprosessin alkupään toimintojen tehostamiseen tarkoitettuja metodeja, tekniikoita ja työkaluja. Ja niitä hyödynnettiin tapaustutkimuksen yhteydessä.

Tapaustutkimuksessa tutkittiin Tiedon innovaatioprosessia. Aluksi organisaation nykyinen innovaatioprosessiosaaminen kartoitettiin, seuraavaksi identifioitiin ja analysoitiin organisaation innovaatiohaasteet, ja lopuksi laadittiin ratkaisuehdotus.

Avainsanat (asiasanat)
Innovaatioprosessi, innovaation alkupää, FEI, sumea alkupää, FFE, tuotekonseptoinnin malli, NCD, tuotekehitysvaihe, NPD

Muut tiedot
Liitteitä yhteensä 16 sivua. Liitteet 2 ja 3 ovat salaisia.

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Acronyms and abbreviations

ABC	A-category, B-category, C-category analysis matrix
AHP	Analytical Hierarchy Process method
A-T-A-R	Awareness-Trial-Availability-Repeat method
E2E	End-to-End
FFE	Fuzzy Front-End
FEI	Front End of Innovation
FMEA	Failure Modes and Effects Analysis
IPR	Intellectual Property Rights
IT	Information Technology
NAF	Novelty, Attractiviness, Feasibility method
NASA	National Aeronautics and Space Administration
NCD	New Concept Development model
NDP	New Product Development
OECD	Organization for Economic Cooperation and Development
PDMA	Product Development and Management Association
PMI	Plus-Minus-Interesting matrix

R&D	Research and Development
ROI	Return On Investement
SCAMPER	Substitute, Combine, Adapt, Modify, Put to Another Use, Eliminate, Reverse
SWOT	Strengths, Weaknesses, Opportunities, Threats
TIPS	Theory of Inventive Problem Solving
TRIZ	Teoriya Resheniya Izobretatelskikh Zadatch (Теория решения изобретательских задач), meaning "The theory of solving inventor's problems”
TSG	Technology Stage-Gate™

1 INTRODUCTION

1.1 Preface

Innovation. Most companies, institutions and organizations today claim to embrace it. But simply profiling your organization innovative does not make it so, it is just playing with buzzwords. What does it mean to be a truly innovative? What does it take? And what does it give?

It is becoming obvious that, in order to stay competitive, the high tech organizations across all industries must truly and fully embrace innovation: create innovation policies, strategies, processes and, most importantly, they need to establish a creative culture within the organization.

Furthermore, organizations must improve cooperation and communication with the outside world. Innovation is becoming more and more open.

For the people working in innovative organizations, this ongoing transition provides new and exciting challenges and possibilities to grow. It is no longer enough to be an expert at one area or expertise – in the diverse multifunctional teams of tomorrow, one has to have good communication, customer relations, team working and problem solving skills. Innovation is a team effort.

1.2 Assigner

The thesis was assigned by the R&D Services service line of Tieto Corporation.

With over 16, 000 experts and annual net sales of about EUR 1.7 billion, Tieto is one of the leading IT service companies in the Northern Europe, providing IT, R&D and consulting services for Telecom, Finance, Automotive, Forest, Energy, Healthcare & Wellfare, Manufacturing, Media, Public and Retail industries. (Tieto, 2010.)

The company specializes in customer intimacy and centricity, working together with many of the world's leading companies and organizations, and growing with them. (Tieto, 2010.)

Tieto's main market area is in Northern Europe, Germany and Russia. But in Telecom, Forest, Oil and Gas, and Digital Services, Tieto has a global customer base. Overall Tieto is active in 25 countries. (Tieto, 2010.)

1.3 Assignment

The purpose of this thesis is to study and analyze Tieto's current innovation process, and to research and evaluate the commonly available processes, techniques, tools and guidelines for improving the process, focusing especially to the practices that take place at the Front End phase of the process.

This so called ”Fuzzy Front-End” is the foremost phase of the innovation process, and of the product's life cycle. The decisions made in this phase have a great impact on the rest of the product development process, on the product's life cycle, and on the company. They can affect the development time, budget and resource allocation, business strategies, marketing and sales activities – but most importantly – they can affect the product quality; how well does it meet the customers' expectations and needs, does it have the required features, does it get launched at the right time, etc.

Even though the significance of the ”Fuzzy Front-End” is today understood very well across all industries, and a great deal of research effort is focused on this area, a holistic process for managing and controlling it is missing. This is simply due to the chaotic, fuzzy and unstructured nature of the phase. It is very hard – if not impossible – to define a universally working solution. Best practices, methods and tools do exist, but a solution has to be tailored separately for each organization for best fit.

Research methods

Bibliographical, evaluative and empirical research methods will be used. Literature on innovation processes is going to be reviewed and evaluated, focusing on the Front End of Innovation. In the case study, empirical observations will be utilized to identify the innovatation challenges.

2 INNOVATION

2.1 Definition of innovation

The term innovation is typically understood as ”the introduction of something new” or ”a new idea, method, or device” (Merriam-Webster 2010). Due to the wide use of the term, many different variations of the definition exist. Innovation is often confused or incorrectly associated with the terms creativity, invention and innovativeness. In the context of this thesis, innovation is defined as follows:

> *Innovation is an iterative process initiated by the perception of a new market and/or new service opportunity for a technology-based invention which leads to development, production, and marketing tasks striving for the commercial success of the invention.* (Garcia & Calantone 2002, 112) quoting OECD (1991).

2.1 Types of innovation

In his study of innovation management, Trott (2005, 17) has identified the following seven different types of innovation: product, process, organizational, management, production, commercial/marketing and service innovation. Tidd et al. (2005, 10-11) describe four types of innovation: product innovation (changes in products); process innovation (changes in processes); position innovation (changes in market focus) and paradigm innovation (changes in the organization operation).

As innovation is an iterative and holistic process that involves all the functions of the organization, an innovation usually impacts more than just one part of the organization. This is the case especially if the innovation is radically new to the organization.

In the scope of this thesis the focus is mainly on product innovation. However, many of the presented methods, techniques and tools are applicable to all types of innovation.

2.3 Innovation categories

In their study on technological innovation typology, Garcia and Calantone (2002, 120-

124) recognized innovation types in five separate categories: radical, really new, discontinuous, incremental and imitative innovations.

Herstatt and Verworn (2001, 6-7) are basing their study on Fuzzy Front-End on the typology identified by Lynn and Akgun (1998), consisting of four types: incremental, technical, market and radical innovation. In the framework presented by Herstatt and Verworn (2001, 6), the categories are aligned with market and technological dimensions as seen in figure 1.

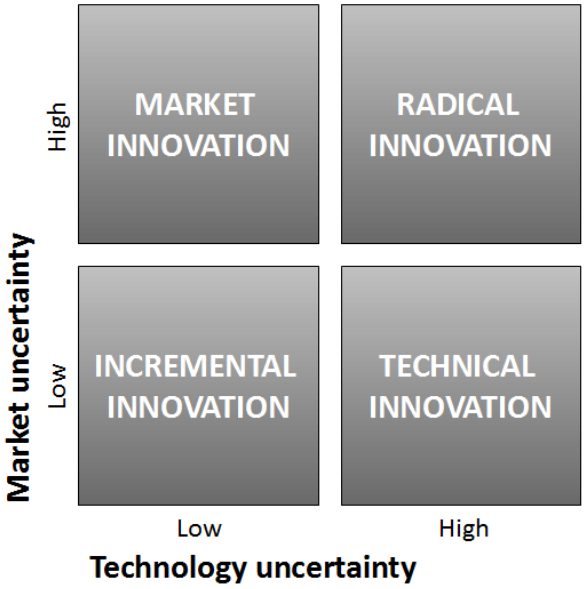

FIGURE 1: Innovation categories aligned with technology and market uncertainty (original figure: Herstatt & Verworn 2001, 6)

As market and technology uncertainties are the two key factors an organization has to consider during the innovation process, aligning the innovation categories with these factors helps greatly in defining the product, product portfolio and marketing strategies.

In a more recent study, Aleixo and Tenera (2009, 794-795) argue that from the innovation process point of view, it is enough to classify innovations according to their truly different characteristics. Hence, they categorize innovations into two categories: radical innovations and incremental innovations. The differences between these two categories are listed in table 1.

TABLE 1: Differences of radical and incremental innovations (original table Aleixo & Tenera 2009, 795)

	Radical innovation	Incremental innovation
Organization	Centralized	Decentralized
Structure	Aggressive technology	Traditional technology
Environment	High uncertainty	Moderate uncertainty
Innovation cause	Market needs	Customer's needs
Development process	Little knowledge, high complexity	Moderate knowledge, moderate complexity
Technology	New	Existing
Duration	Long-term	Short-term
Risk	High risk	Moderate risk
Financial resources	High	Limited

2.3.1 Incremental innovations

Incremental innovations, as the name implies, are incremental, cumulative changes to the existing products or market. Quoting Qin and Wang (2006), Aleixo and Tenera (2009, 795) define incremental innovation as ”a progressive, continuous, and cumulative innovation without a new scientific component for the improvement of the present technology”. Garcia and Calantine (2002, 123) define incremental innovations in a more high-tech product perspective as ”products that provide new features, benefits, or improvements to existing technology in the existing market”.

A steady, constant flow of incremental innovations is vital for companies competing in a technologically mature market. They help in improving the existing products, and extending the existing product lines.

Introducing an existing technology to a new market is also considered an incremental innovation, as long as there is no radical change to either the technology or the market. As the changes are small, and the technology and the market are already familiar to the company, the level of risk is low or moderate.

2.3.2 Radical innovations

A radical innovation, as the name implies, introduces a new and radical change which changes both the technology and the market infrastructure. The term ”discontinuity” is often used to express the radical nature of the change.

Usually radical innovations result in new products and markets. Sometimes a radical innovation can revolutionize the world by creating a whole new industry or market area (e.g. The World Wide Web).

Due to the radical nature of these innovations, the risks are high. There is limited foreknowledge of both the technology and the market.

2.4 Service innovation

As defined by Tekes (2010), ”service innovation is a new or significantly improved service concept that is taken into practice”. Apilo, Taskinen and Salkari (2007, 41) state that in addition to commercializing the idea into a ”service product”, service innovations can affect organizations' (both the customer as well as the service provider) business and operational models, processes and structures. Compared to product innovation, service innovation is more systemic and done in deeper cooperation and interaction with the customer, as the customer is usually participating the process already in the Front End phase. Von Stamm (2008, 359) reminds that the separation between product and service innovation can be ambiguous (e.g. a program providing internet access).

There are specific innovation process models for service innovation. However, as they

broadly follow the same paradigm as product innovation processes, they are not presented here in deeper detail.

2.5 Understanding innovation

To be able to improve innovation practices, innovation must be first truly understood. What does innovation mean? What types of innovation there are? What are the differences between different types of innovation? What type of innovation the organization is mainly focusing on?

To conclude, innovation is a process of discovering, enriching, developing and commercializing new product or service ideas. There are two main categories of innovation, incremental and radical. They are completely different, and hence suitable for different purposes.

3 INNOVATION MANAGEMENT

Innovation management is the organization's collective, continuous and systematic endeavour to harness, develop and utilize the creative ideas of the employees by evolving them into new products, services and processes for the organization.

As Apilo, Taskinen and Salkari (2007, 34) state, there is no one single innovation process that could be replicated from an organization to an another. Organizations are different, with different backgrounds, cultures, strategies, missions and visions. Organizations need innovation management to drive the development of the innovation process, define the innovation strategy, and most importantly, to create an innovation culture.

Leadership and management

As Meyer (1998, 19-21) states in his study of innovation systems, both leadership and management are required for effective innovation. Whereas management focuses on doing the things right, leadership focuses on doing the right things.

Innovation leadership is more about inspiring, enabling and supporting, than controlling, commanding and supervising. In essence, the responsibility of an innovation leader is to create a organization with diverse competences, support the organization's innovation atmosphere, inspire and encourage people, and assure the continuous development of the innovation process. This should be done in cooperation with the teams, the organization and the innovation network. (Apilo, Taskinen and Salkari 2007, 217.)

3.1 Innovation culture

Innovation cannot be forced. In a supportive and encouraging environment, creativity and innovation arise spontaneously. Such an environment is possible only if the preconditions for innovation are met.

It is a common myth and misunderstanding that innovation is an individual accomplishment, an eureka moment. Innovation is a group effort. It requires communication, cooperation, time and inspection from different perspectives.

Skarzynski and Gibson (2008, 22) have identified three critical preconditions for innovation:

- Creating time and space in people's lives for reflection, ideation, and experimentation
- Maximizing the diversity of thinking that innovation requires
- Fostering connection and conversation... that serves as a breeding ground for breakthrough

Koen et al. (2002, 13) list the five most important factors shaping the environment of innovation, as identified by Prather (2002):

- People emotionally committed to the project
- Environment that allows risk taking
- Environment of trust and openness
- Time for free thinking
- Funding for new ideas

Apilo, Taskinen and Salkari (2007, 126) remind that just like the business culture, innovation culture evolves slowly. It requires time, perseverance and organization-wide commitment.

3.2 Innovation strategy

Innovation should have a focus, a purpose. Innovating just for the sake of it makes no sense, nor does it create any added value for the organization. An innovation strategy that is aligned with the organization's mission, vision and business strategy, helps to define the purpose, target and goals of innovation. However, these factors should not choke the innovativeness of the organization; people should be allowed to present their ideas freely.

Just like the organization's mission, vision and business strategy, the innovation strategy should be familiar to everybody. It should have an owner. And it should be revised regularly.

3.3 Innovation process

Innovation process defines the way the organization manages the development of inventions into commercial products, services or processes. The process usually comprises of a set of phases, stages, gates, and rules, defining the order in which the activities are conducted. Numerous different innovation process models exist. Perhaps the most well-know is the Robert Cooper's Stage-Gate™ model.

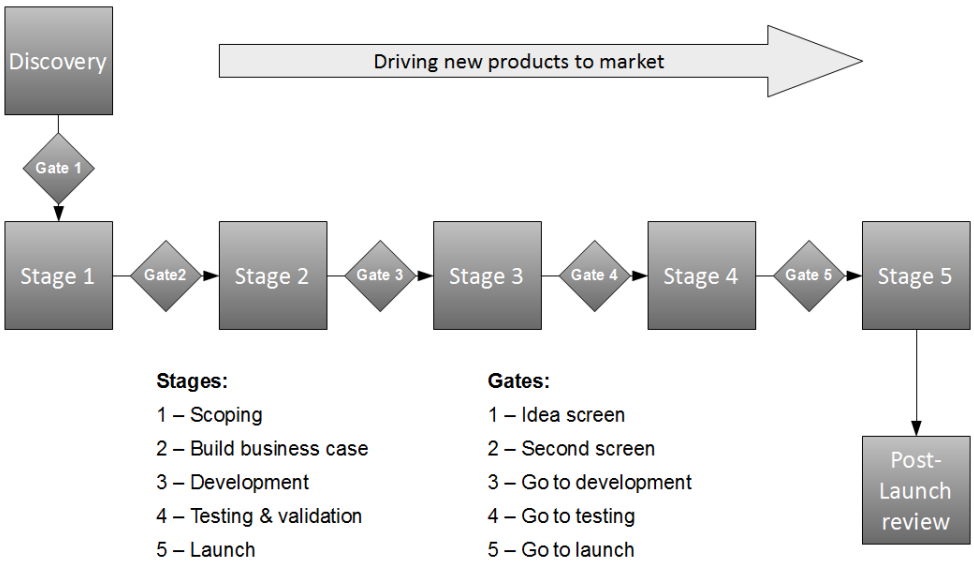

FIGURE 2: Cooper's Stage-Gate™ model (original figure: Cooper 2001, 130)

3.4 Organization

For the innovation process to work smoothly and effectively, the organization's structure, values and teams must support innovation.

Structure

The structure of the organization should conform to the innovation process, rather than the other way around. There should be no barriers, or high fences, around the different divisions and functions. The organization should be cross-functional. The structure should not be too complex or hierarchial, but flexible and adaptive. It should also be permeable, to allow the information to flow freely. (Meyer 1998, 135-139.)

Teams

Based on his study of the innovation strategies of Silicon Valley growth companies, Meyer (1998, 139) has discovered that the teams should be viewed as ”the central innovation organization”. He calls team the ”heart of innovation”. Based on his study, Mayer (1998, 139) establishes that the teams of the growth companies seem to be cross-functional, have a flexible and adaptive structure, they are supported by the company, and given resposibility, authority, accountability and capability.

Values

Instead of just vaguely defining innovation as a value, the organization should understand and embrace the values that enable, support and encourage innovation. Apilo et al. (2007, 217-218) have listed the following values: *we respect innovativity; we are different kinds of people with different expertise, all working together; we have an inspiring vision; we feel safe; we have a climate of trust; we share our know-how; we cooperate and collaborate; we accept change; we tolerate mistakes; we are effective in our work; we accept risk;* and *we learn continuously.*

3.5 Open innovation

Apilo, Taskinen and Salkari (2007, 46) emphasize the growing importance of organizational networking and engagement in open innovation, since a single organization simply can not have all the required resources for innovation in-house, especially in the technology-intensive business. Cooperation with customers, universities, standardization bodies, idea hatcheries, joint ventures, and even competitors is becoming more and more essential.

However, Chesbrough (2003, 37) reminds that not all organizations should migrate to open innovation. Due to business, security, or regulatory reasons some organizations are bound to keep all of their know-how securely within the organization. This is often the case with, for example, with defense, security and government industry organizations.

Definition of open innovation

> "Open innovation is the use of purposive inflows and outflows of knowledge to accelerate internal innovation, and expand the markets for external use of innovation, respectively. This paradigm assumes that firms can and should use external ideas as well as internal ideas, and internal and external paths to market, as they look to advance their technology." (Chesbrough, Vanhaverbeke and West 2006, 1.)

3.5.1 Closed versus open innovation

In a traditional closed innovation environment, all of the innovations originate from within the organization. In an open innovation environment the boundary between the organization and the outside world is more porous, allowing ideas to flow both into the organization and out from the organization. (Chesbrough 2003, 36 & 37.)

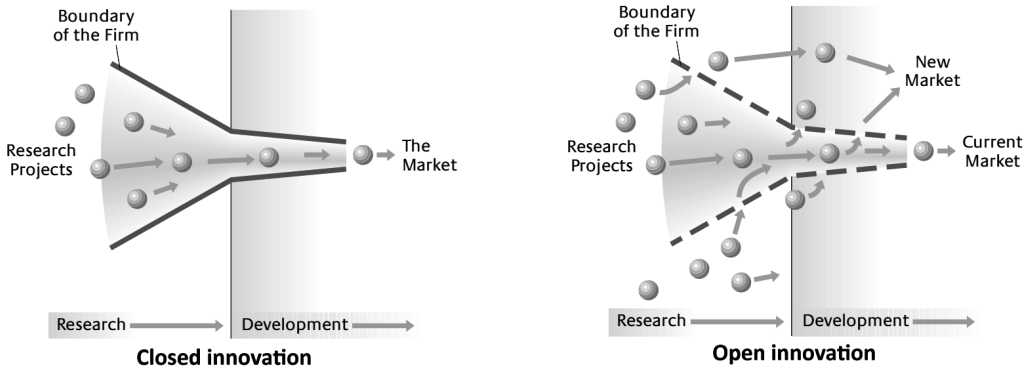

FIGURE 3: Comparison of closed and open innovation (original figures: Chesbrough 2003, 36 & 37)

3.5.2 Engaging in open innovation

When engaging in open innovation, the organization should have a clear picture of its core competences, a clear picture of the missing competences, a clearly defined objective (mission, vision and strategy), and the right partners. (Apilo, Taskinen and Salkari 2007, 47-50.)

The change from closed to open innovation takes time. It requires a cultural change.

3.5.3 Challenges of open innovation

Apilo, Taskinen and Salkari (2007, 49-51) state that overcoming the doubts, fears and prejudices towards open and networked world is the greatest challenge in engaging open innovation. Cooperation requires open and flowing communication, trust, rules and practices.

The organization must understand the importance, and especially the purpose, of the immaterial property rights (IPR). In an open innovation environment, not all of the IPRs are owned by the organization. Respectively, the organization should understand the value of its own IPRs, and maximizing the benefit through licensing, joint ventures and other agreements. (Chesbrough 2003, 37.)

3.6 Importance of innovation management

Whereas creativity and invention are spontaneous, innovation, as a process, is not. Innovation is just like any other organizational process; it has to be defined, managed and fostered.

Innovation management must be professional, effective and comprehensive, otherwise the organization might be focusing on wrong things, or doing things the wrong way, or leaving its creative potential unharnessed, and valuable ideas unutilized.

The importance of innovation culture and cross-functional teams cannot be overemphasized. They are the heart of innovation. Several preconditions for innovation have been recognized. It is essential to pay attention to them.

Open innovation is coming. Organizations should understand the benefits and challenges of it, and start networking and cooperating with the outside world.

4 INNOVATION PROCESS MODELS

4.1 Definitions and terms

Many institutions, organizations, and companies have been involved in the research on innovation processes. Due to the large number of authors, there exist various terms and definitions of the models and processes. Terms ”innovation process” and ”New Product Development process” are being used interchangeably. The same applies to the naming of the first phase of the process, the ”Fuzzy Front-End” or the ”Front End of Innovation”.

In this thesis the following terms are used, and they are defined as follows:

- **Innovation process** *is used to encompass the whole process, from the idea generation to the commercialization*
- **New Product Development (NPD)** *is used to describe the middle phase of the innovation process*
- **Front End of Innovation (FEI)** *is used to describe the first phase of the innovation process*.

4.2 Evolution of innovation processes

The first concept of ”phased project model” was developed by NASA in the 1960s. It was based on four sequential phases (preliminary analysis, definition, design and operation) with checkpoints in between them. The model was designed and applied originally only to large and complex systems, but its principles were soon scaled down suit also the needs of smaller organizations and businesses. (Von Stamm 2008, 49-50.)

Von Stamm (2008, 50-51) establishes that the studies of Hamilton (1982) and Cooper (1986) greatly influenced the progress of the development process. She notices that in his study Hamilton (1982) introduced the ”new product” factor to the process by shaping the phases to better meet the needs of new product development. She also states that Cooper (1986), in his studies leading to his famous Stage-Gate™ model, he

successfully combined the activities of the earlier models, reducing the number of phases to three: pre-development activities, product development and testing, and commercialization. The Cooper's Stage-Gate™ model, comprising of three phases, five stages and five gates, is still the best-known and the most widely-used conceptualization of the innovation process.

Referring to the study of successful industrial innovations conducted by Rothwell (1992), von Stamm (2008, 51) concludes that the evolution of innovation process models has gone through five generations – progressing from simple linear, sequential processes towards to more integrated and dynamic processes, where essential features are: *parallel execution of activities; flexibility of the process; cooperation between the horizontal functions of the company; networking, joint ventures and collaborative research between companies, institutions and organizations;* and *strong focus on the front end activities of the process.*

4.3 Innovation process models

While covering the theory of NPD processes, Trott (2005, 399-403) lists the innovation process models into the following seven categories as originally identified by Saren (1984): *departmental-stage models; activity-stage models and concurrent engineering; cross-functional models; decision-stage models; conversion-process models; response models,* and *network models*.

In reality the fences between the models are vague, and innovation processes are usually a mix of features from separate models, especially as the processes evolve over time. For example Cooper's Stage-Gate™ process can be nowadays seen as a hybrid of activity-stage and cross-functional model processes, although in the literature it is still considered to follow just the activity-stage model.

Departmental-stage models

These models represent the early form of innovation processes. Flow of activities is linear, sequential and departmentalized.

By their nature the processes are rigid and inflexible, since there is no possibility for bi-directional flow. Managing changes in this kind of process model is difficult. Trott

(2005, 401) concludes that ”it is now widely accepted that this insular departmental view of the process hinders the development of new products”.

Activity-stage models and concurrent engineering

As the name implies, the activity-stage model processes focus on activities instead of doing the work in a departmental manner. More iterative flow of work is enabled through the use of feedback loops. This improves the flexibility and lowers the rigidity.

In the late 1980s concurrent engineering was introduced in the activity-stage model processes to overcome the problem of concurrent activities. For example the Cooper's Stage-Gate™ adopted this new paradigm.

Cross-functional models

In cross-functional innovation processes, the approach is to create cross-functional project teams with team members from a variety of functions. This removes the inter-department communication problems.

In reality, depending on the organization structure, this can be challenging. Virtual teams, where the team members are not located in the same premises, can be used to overcome this problem.

Decision-stage models

Decision-stage processes consist of a sequence of stages, and transition from one stage to the next one is based on a decision. Iteration is enabled using feedback loops.

Conversion-process models

Conversion-processes consider the development as a black box system, where numerous inputs get converted into an output. This model works well with traditional implementation projects, but due to its lack of transparency, it is not very suitable for new product development.

Response models

The response model is a very abstract model. In these processes, the individuals or

organizations are stimulated in order to get an innovation as a response to the stimulation.

Network models

Network model processes focus on accumulating knowledge from variety of inputs (e.g. different departments and horizontal functions within the company) as the project progresses from an initial idea to a complete product.

Learning-based model

In their study of marketing and discontinuous innovation, Lynn, Morone and Paulson (1996, 15-26) introduced a new learning-based model for an innovation process. They based their work on comprehensive study on innovation processes that were used in several companies developing discontinuous products.

The learning-based innovation process is an iterative, bi-directional, dynamic and flexible process of parallel activities, focused on accumulating knowledge of required product features and market potential. It heavily relies on, and takes full advantage of the benefits of prototyping.

4.4 Characteristics of the process models

It is impossible to define a common set of characteristics that would cover all innovation process models. The stage-gate type of process models have some common characteristics between them; like the fact that they all comprise of stages, gates and phases. However, network and learning-based models deviate from this completely, as they have no such defined structure.

Some efforts have been done to compare the characteristics of the stage-gate models. For example Aleixo and Tenera (2009, 796) have compared five different innovation processes from different eras. The main outcome of the study is the mapping of the stages and phases of the selected innovation processes. Looking at the results, some similarities can be seen, but not enough to draw any conclusions.

4.5 Role of the Front End

In her comparative review of different innovation process models, Bröring (2005, 32)

states that the role the Front End phase varies a lot between different innovation processes. In most of the processes, the role is either not defined or not identified at all. Some activity-stage and decision-stage processes, however, make an exception.

Activity-stage models

While describing his Stage-Gate™ process model, Cooper (2001, 131) defined the following Front End phase activities: discovery (idea generation), scoping (idea enrichment and screening), and building the business case (concepting).

Decision-stage models

In her study of Front End activities of Decision-stage process models, Bröring (2005, 32) has identified the following three activities: information gathering, evaluation of information, and decision making.

Learning-based model and Network models

The learning-based process model defined by Lynn, Morone and Paulson (1996, 15-26) does not explicitly define any phases. According to Trott (2005, 403), the same applies to the Network process model.

By their nature, these process models are iterative and accumulative, collecting knowledge and market signals from all available inputs, evaluating the collected data and making decisions based on the results of the evaluation. Therefore, it can be stated that the set of activities of the learning-based model processes and the network model processes greatly resembles the set of activities defined in the decision-stage model processes.

4.6 Generic model of the innovation process

Several authors have contributed in developing a common high level innovation process model to distinct the process into three clearly defined stages. Cooper (2001, 147) created a three-stage version of his Stage-Gate™ model by combining some of the stages together. Koen et al. (2002, 5) refined this division by introducing a more generic terminology. Three phases were identified: Front End of Innovation, New Product Development, and Commercialization. Figure 4 illustrates the model.

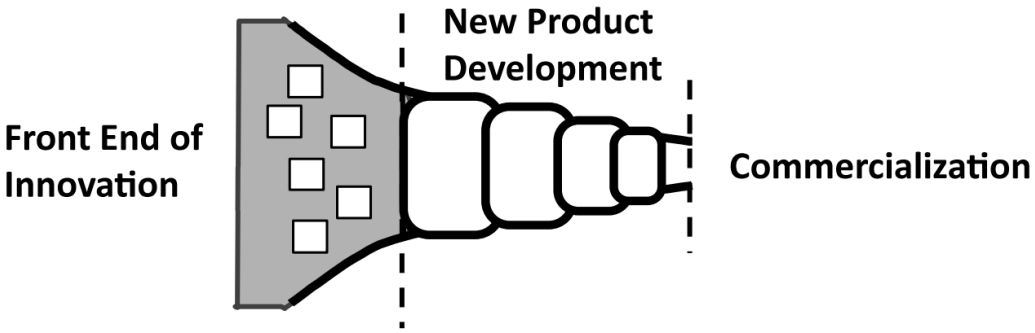

FIGURE 4: The three phases of the innovation process (original figure: Koen et al. 2002, 6)

Front End of Innovation (FEI)

The first phase of the innovation process encloses all the activities prior to development: idea generation, idea evaluation and selection, and concepting.

New Product Development (NPD)

The second phase of the innovation process encloses the actions to develop, test and verify the product concept that was received as an input from phase one.

Commercialization

The third and last phase of the innovation process encloses the actions to commercially exploit the product that was developed in the second phase.

4.7 Summary

To conclude, there are numerous different innovation process models available, each with its own characteristics. There are strictly sequential models, and there are completely dynamic models. Both of them having both advantages and disadvantages. The generic model by Koen et al. was developed to incorporate all the advantages into a single model and leave all the disadvantages out.

Most of the models fail to address the role and importance of the Front End phase. But in the generic model the role and importance of Front End is emphasized.

5 THE FRONT END OF INNOVATION

5.1 The Fuzzy Front-End

Originally the term ”Fuzzy Front-End” was used to define the first phase of the innovation process. In their effort to create a common language to the ”Fuzzy Front-End”, Koen et al. (2001, 46) suggested that the name of the phase should be changed to ”Front End of Innovation” (FEI) to demystify the nature of the phase.

Indeed, the FFE is commonly defined as a chaotic, unstructured maelstrom of creativity, whereas the FEI can be seen as a more structured phase with a clear focus and place in the New Concept Development model (NCD).

5.2 General activities at the Front End phase

After examining the Front End activities of the activity-stage and decision-stage innovation processes, the following three common activities can be identified:

- Generating ideas
- Evaluating and selecting the ideas
- Creating the product concept

Additionally, Koen et al. (2002, 8, 15-17, 17-19) introduce one more activity to list:

- Identification and analysis of business opportunities.

5.3 The importance of the Front End phase

In their study of the Front End, Herstatt and Verworn (2001, 3) state that the Front End phase of the innovation process plays a key role in the process. During this phase the unfit product ideas must be identified and screened out, and the potential ones enriched and refined into strong product concepts.

Decisions made in the Front End phase have a great impact on the quality, costs and timing of the whole process. Quoting Cooper and Kleinschmidt (1994), Herstatt and Verworn (2001, 3) point out that ”the greatest differences between winners and

losers were found in the equality of execution of pre-development activities".

5.4 Characteristics of the Front End phase

To emphasize the fundamentally different nature of the FEI phase, its characteristics are compared to the characteristics of the more widely known NPD phase in table 2.

TABLE 2: Differences of FEI and NPD phases (original table: Koen et al. 2002, 6)

	FEI	NPD
Nature of work	Experimental, often chaotic. "Eureka" moments.	Disciplined and goal-Oriented.
Commercialization date	Unpredictable or uncertain.	High degree of certainty.
Funding	Variable.	Budgeted.
Revenue expectations	Often uncertain, with a great deal of speculation.	Predictable, with increasing certainty.
Activity	Individuals and team conducting research to minimize risk and optimize potential.	Multifuction product development team.
Measure of progress	Strengthened concepts.	Milestone achievement.

5.5 Front End models

5.5.1 Sequential models

In the stage-based innovation process models (action-stage and decision-stage models), the Front End phase is sequential. Actions are performed in sequential

manner, with decision gates in between them. (Cooper 2001, 129-132 ; Khurana and Rosenthal 1998, 59.)

Along with the Cooper's Stage-Gate™ model (which is an action-stage model), the decision-stage model described by Khurana and Rosenthal (1998, 59) is often mentioned.

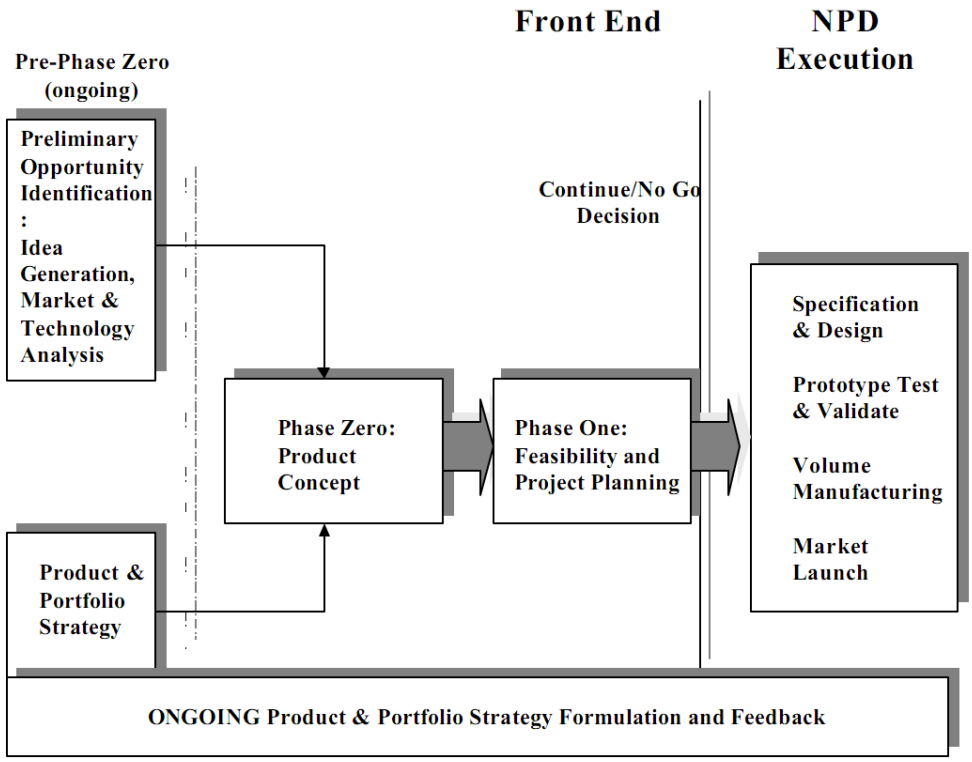

FIGURE 5: The innovation process model by Khurana & Rosenthal (original figure: Khurana & Rosenthal 1998, 59)

Koen et al. (2002, 7) argue that the sequential models are not really suitable for modeling and controlling the Front End phase, because of the very nature of the phase. In practice, the activities are usually performed in a non-sequential order and iterated several times over while refining the ideas. The model should not restrict this by forcing the activities into a rigid sequence and by defining gates between the sub-phases (idea generation, idea selection and concepting).

5.5.2 Dynamic models

Contrary to the sequential models, the dynamic Front End models are non-sequential, iterative and they strongly support parallel processing. This brings flexibility to the process, as the activities can be performed in the best suitable order, and be iterated as many times over as needed.

Network model and learning-based processes

Even though the network model type of innovation processes, as described by Trott (2005, 403-404), and the learning-based model of Lynn, Morone and Paulson (1996, 15-26) are not explicitly defining a Front End phase, they can be categorized as dynamic models due to their flexible, iterative and adaptative nature. However, due to the above mentioned limitation, these models are not covered in the thesis in detail.

New Concept Development Model (NCD)

Pointing to a study by Krough, Ichijo and Nonaka (2000), Koen et al. (2001, 6) state that without a common language and vocabulary, it may be impossible to compare the FFE practices across companies. To address this problem, their research team developed a theoretical model of the Front End, using terminology common to all companies. Koen et al. call this model the New Concept Development Model (NCD).

5.6 Conclusion

The Front End of Innovation is the dynamic and iterative beginning phase of the innovation process. It consists of activities to generate, enrich, review and screen the new product ideas and concepts.

Both sequential and non-sequential models exist for modeling the phase. However, it is nowadays well understood that the Front End phase requires a dynamic and iterative approach. Traditional sequential models fail to address this need.

6 NEW CONCEPT DEVELOPMENT MODEL

Instead of comprising sequential phases, stages and gates like the traditional Front End models, the New Concept Development (NCD) construct is a non-linear relationship model comprising three parts: the **engine** (leadership, culture and business strategy), the **five inner elements** (opportunity identification, opportunity analysis, idea generation and enrichment, idea selection, and the concept definition), and the **influencing factors** (factors that are relatively uncontrollable). (Koen et al. 2002, 8.)

According to the authors of the model, Koen et al. (2002, 9), the circular shape of the model is to emphasize the way the ideas are allowed to flow in the model. Koen et al. express that ideas can, and are expected to, freely iterate and circulate between and among all the elements.

Figure 6 illustrates the model.

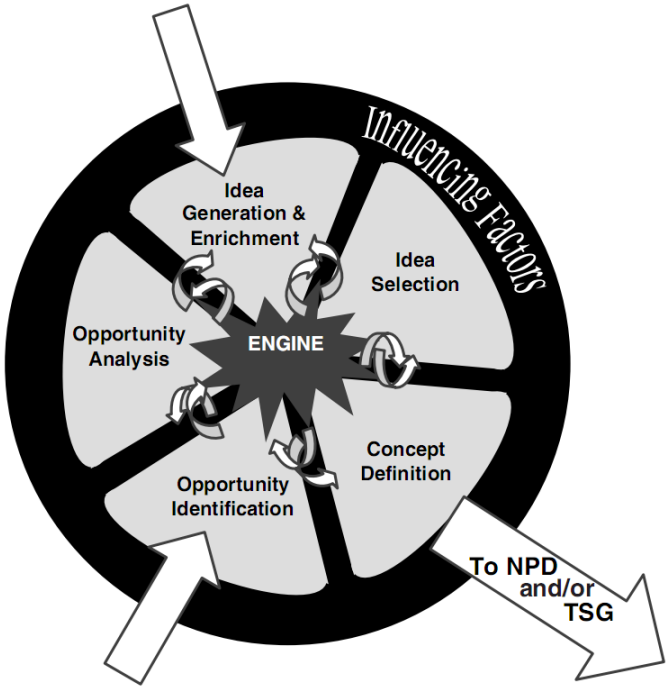

FIGURE 6: The New Concept Developing model (original figure: Koen et al. 2002, 8)

6.1 Influencing factors

This outmost part of the model represents the influence of the environment where the FEI exists. Koen et al. (2002, 10), have identified the following factors: corporation's organizational capabilities, customer and competitor influence, outside world's influence, and the depth and strength of the enabling sciences and technology. Koen et al. (2002, 10) state that the ”organizational capabilities determine whether and how opportunities are identified and analyzed, how ideas are selected and generated, and how concepts and technologies are developed.”

These factors are seen as uncontrollable from within the FEI. However, some of them can be affected indirectly via the engine part of the model.

6.2 The Engine

According to Koen et al. (2002, 12), the engine contains the elements of leadership, culture, and business strategy. These all are innovation management issues, which were covered in more detail in chapter 3.

6.3 The Five Front End Elements

Although the elements are here discussed in sequential manner, the approach does not imply that they are engaged in such order in reality. As Koen et al. (2002, 9) clarifies, the flow of activities in the Front End ”can encompass the elements in any order or combination and may use one or more elements more than once”.

However, Koen et al. (2002, 8) specify that projects can begin at either opportunity identification or idea generation and enrichment elements. These starting points are illustrated with white arrows pointing into the model in figure 6.

Essentially, the objective of the five front elements is to harness the creative power of the organization to create and develop pursuable development-ready product concepts which conform with the organization's business goals.

6.3.1 Opportunity identification

Typically initiated and driven by business goals, in this element the organization

identifies opportunities it might want to pursue. Opportunites can originate from roadmaps, trend analyses, competitive intelligence, market reasearch or scenario planning. (Koen et al. 2002, 15-17.)

Koen et al. (2002, 7) define **opportunity** as ”a business or technology gap, that a company or individual realizes, that exists between the current situation and an envisioned future in order to capture competitive advantage, respond to threat, solve a problem, or ameliorate a difficulty”.

Apilo, Taskinen and Salkari (2007, 134) point out opportunity identification is a joined effort. Everyone in the organization can, and should, participate in the opportunity identification activities, bringing different perspectives (customer relations, marketing, technology) on the issue.

6.3.2 Opportunity analysis

After an opportunity has been identified, it needs to be analyzed, evaluated and assessed to find out whether it is worth pursuing or not. These activities take place in the opportunity analysis element. (Koen et al. 2002, 17.)

6.3.3 Idea generation and enrichment

In this element the focus is on generating, developing and enriching ideas. Creative culture, active cooperation and flowing communication are essential in making this phase productive.

Koen et al. (2002, 7) define **idea** as ”the most embryonic form of a new product or service. It often consists of a high-level view of the solution envisioned for the problem identified by the opportunity”.

Koen et al. (2002, 19) emphasize the evolutionary and iterative nature of the idea generation phase by stating that ”ideas are built up, torn down, combined, reshaped, modified, and upgraded. An idea may go through many iterations and changes as it is examined, studied, discussed, and developed in conjuction with other elements”.

6.3.4 Idea selection

In the idea selection element, the organization selects the ideas to pursue. The decision is based on archieving the most business value. (Koen et al. 2002, 22.)

Koen et al. (2002, 22) state that usually ideas are iterated among the elements several times before they get selected.

6.3.5 Concept definition

The concept definition element is the exit element to the NPD or Technology Stage-Gate (TSG) phase. To pass the gate to NPD/TSG, the innovation idea has to be developed into a solid, convincing and attractive product concept. (Koen et al. 2002, 26-27.)

Koen et al. (2002, 7) define **concept** as a draft of a product that ”has a well-defined form, including both a written and visual description, that includes its primary features and customer benefits combined with a broad understanding of the technology needed”.

According to Koen et al. (2001, 51), the concept should be based on ”estimates of market potential, customer needs, investment requirements, competitor assessments, technology unknowns, and overall project risk”.

Technology Stage-Gate™

Technology Stage-Gate is a structured process for managing high-risk new technology projects. It is designed to be used within and at the transition phase from FEI to NPD in projects where the discovery of the new technology is considered risky. The TSG focuses on lowering the risk of the project. After the TSG process completes (or when the risk level is considered low enough) the project moves to NPD. (Ajamian and Koen 2002, 267-269.)

6.4 Evaluation of the model

It can be concluded that, as an iterative, dynamic and flexible model, the New Concept Development model is an excellent tool for managing the activities of the Front End of Innovation phase. It emphasizes the importance of keeping the idea

generation and enrichment activities separate from idea selection activities, as well as the importance of the idea selection and the concept development activities.

The marketing activities are well integrated into the model. The importance of parallel execution of technology development and marketing activities is emphasized.

7 HOW TO IMPROVE THE FRONT END PHASE PRACTISES

This chapter introduces guidelines, tools, techniques and methods which can be applied to improve the FEI phase activities. In addition, they can have an effect on the whole innovation process, not the Front End phase alone.

To emphasize the importance of innovation culture, strategy and leadership, the focus is first set to provide guidelines and methods for those activities. After that, the available guidelines, techniques, methods and tools for FEI activities are analyzed, evaluated and screened.

7.1 Culture, strategy and leadership

Contrary to popular belief, ideation is not innovation. Innovation is a process of enriching, developing, screening and commercializing the ideas generated by ideation. Ideation is just the tip of the iceberg of an innovative organization. The invisible, beneath the surface base of the iceberg is the innovation culture, strategy and leadership of the organization. Innovation cannot thrive if these things are not developed and fostered. (Baermann 2005, 2.)

As already discussed in chapter 3, creating an innovative culture takes time. It cannot be aggressively forced. It must be allowed to evolve freely, actively fostering the growth along the way.

Koen et al. (2002, 15) have listed the following methods for improving the leadership, culture and business strategy: *creating a culture that encourages innovation and creativity; involving a business-champion (a person that can allocate resources for the project) early in the process; creating a collaborative culture that encourages knowledge creation; defining and maintaining a purpose for innovation;* and *setting aggressive goals.*

In his study of corporate innovation, Baumgartner (2009, 3-4) has listed the following essential management activities: *ensuring an environment of trust; establishing innovation goals; designating responsibility of the innovation process, and allocating enough resources for it; developing a communications plan; demonstrating*

innovation by leading by example; reducing the level of creative risk, by creating an environment where all ideas as welcome and sharing ideas is encouraged; establishing a rewards scheme; and *implementing creative ideas.*

Furthermore, as stated and listed in chapter 3, certain preconditions have to be met for innovation culture to emerge. Apilo, Taskinen and Salkari (2007, 217) and Meyer (1998, 135) also emphasize the role and importance of passion and inspiration in creating a productive culture and atmosphere of creativity and innovation.

To conclude and summarize, the following activities are required – and can be used – to create a solid foundation for innovation:

- Build a creative innovation culture that is based on trust, openness, diverse expertise, freedom, communication and active sharing of ideas.
- Set and define clear goals for innovation by defining the organization's mission, vision, business and innovation strategies.
- Choose an appropriate innovation process, and customize it to meet the organization's needs. Communicate the process to everyone. Assure that it is followed. Revise the process regularly.
- Designate an owner for the innovation process.
- Allocate enough resources for the innovation process. Create diverse cross-functional teams. And arrange them enough free time, freedom, authority and resources to innovate. Give the teams an autonomy to select the most suitable working methods for them.
- Define clear rules and criteria for selecting ideas and product concepts. However, make sure that these do not affect the freedom of idea generation. Rules are needed to focus on innovations that meet the organization's goals and strategies.
- Establish a rewards scheme to increase the motivation to generate and share ideas, and to contribute in developing them into solid product concepts.

As Baumgartner (2009, 4) states, the implementation of these actions naturally varies from organization to organization depending on the existing culture, tools, goals and

facilities. In many modern organizations several of these activities are already taken care of naturally, without yet harnessing the full potential of innovation.

7.2 Opportunity identification and analysis

Innovation process is a parallel flow of both technology development and marketing activities. It is paramount to understand that one cannot succeed without the other. Unfortunately in too many organizations, marketing and sales are still considered a joined activity or a phase that takes place after the product development phase, misunderstanding very essense of marketing.

Marketing plays an essential role in the innovation process' Front End phase. This is also emphasized in the Koen et al's (2002, 8, 15-16) NCD model, where the opportunity identification and analysis are integral parts of the Front End. Within the context of these two elements the focus is mainly on the marketing aspect.

The activities focus on mapping and analyzing the needs and potential of the current market and forecasting and envisioning the future. Koen et al. (2002, 17, 19) list the following activities:

- Roadmapping
- Technology trend analysis
- Customer trend analysis
- Competitive intelligence analysis
- Market research
- Scenario planning

In the case of incremental innovations, these activities are naturally less demanding and risky to perform than in the case of radical innovations. Radical innovations are discontinuous, meaning that they introduce a completely new technology, market or business model. In such case relying on existing market, trend and customer data is not possible. In his study of marketing discontinuous innovations, Moore (1999, 6) emphazises that the whole company must take part when the company is entering a new market.

The role of sales must not be forgotten. It is important to align and synchronize the marketing, development and sales activities. The role of pre-sales in the short time-to-market business of today is very important. A company should not sell ideas, it should sell products. The large majority of ideas do not evolve all the way to products. Pre-sales should not promise to the customer something that might never get developed. On the other hand, the customer should be involved in the innovation process in an as early phase as possible, particularly in the case of service innovation. Communication and cooperation between functions are paramount to handle this issue efficiently and succesfully.

7.3 Idea generation

There exist numerous different methods for generating ideas. In this thesis the focus is on the ones that can be best utilized in the innovation process context. Before studying the methods and tools, it is important to understand the enablers behind them.

Creativity + Collaboration = Innovation

An organization full of creative people does not necessary make the organization creative. Organizational creativity requires a creative culture and tools for creative collaboration. Collaboration is an essential element of organizational creativity and innovation. A cross-functional team of creative people with different backgrounds and expertise can potentially be much more creative than any individual member of the team can be on her own. (Baumgartner 2009, 5.)

The team should be given freedom to decide which techniques they want to use for idea generation. Naturally, if innovation techniques are not familiar to the team, training should be arranged.

In the idea generation phase it is paramount that the ideas are not criticized. That is taken care of in the later phases of the process. Criticism demotivates and kills creativity. Instead, all the ideas should be praised, no matter how radical or inappropriate. (Baumgartner 2009, 6.)

Literature review

In the literature on innovation, there exist quite a universal understanding of the idea generation techniques, methods and tools. For this reason, only a few sources were selected for deeper analysis.

In the context of their study on the NCD, Koen et al. (2002, 20-21) list the following methods for idea generation: *organizational culture that encourages organizational creativity; incentives to raise motivation (also non-financial incentives like awards, peer recognition and performance appraisal); web-based idea bank; someone to coordinate ideation; mechanism to handle ideation outside business units; metrics to measure ideation; frequent job rotation to share best practices across the company; methods for sharing knowledge (core competences, core capabilities and shared technologies) across organization; diverse teams; methods for identifying unarticulated customer needs (ethnography, lead user approach); involving the user in the process; discovering the archetype of your customer;* and *identifying new technology solutions.*

Baumgartner (2009, 7-10) has provided a more practical approach, as he is focusing on techniques instead of guidelines. He has identified five techniques: *suggestion scheme based idea management; campaign based idea management; brainstorming; creative spaces* and *skunkworks.*

However, Baumgartner (2009, 7) argues that the suggestion scheme based idea management system is flawed. It is an online version of the old suggestion box approach, where all people across the organization can submit ideas. According to Baumgartner (2009, 7), these approaches usually tend to fail after 12 to 18 months of operation because: there is no structure to idea submission, it is causing a tremendous workload for the team or individual in charge of the system; a large percentage of the ideas are not relevant to organization's current business needs; there tends to be a high level of repetition; and the system can be hijacked for political, rather than business reasons.

Cooper (2001, 154-177) focuses more on sources for ideas rather than techniques for ideation. He provides the following list: *look for disruptions in the customer's*

industry; use the voice-of-customer research; work with lead or innovative customers; utililize fundamental research breakthroughs; harness the creative ability of the entire organization; establish a proactive idea focal point and work the idea sources (generate a product idea, and then figure out which sources are need to create the product); set up an idea bank; try immersion – then harvest ideas (select a product area where the organization does not yet have presence, set up a team to investigate the selected product area, and collect the ideas they come up with); amplify thin ideas through plussing (set up a highly skilled cross-functional team and give them a skinny new product idea, and ask them to amplify it); competitors are a good source of ideas; trade shows are an excellent source of ideas; trade publications provide ideas from around the world; review patents; suppliers are a good source of ideas; universities are a good source of ideas; implement an in-house suggestion scheme; and *provide scouting time to promote creativity.*

In addition, there are also some generally known methods and techniques for ideation. The ones most applicable to be used in organizational innovation context: *Attribute listing; Six thinking hats; Unfolding, TRIZ contradiction analysis; and SCAMPER.*

To conclude, there is a vast number of guidelines, methods, tools and techniques available for idea generation – many of them mere statements emphasizing the importance of different aspects of the innovation culture, some mainly sources of ideas, but some of them are more practical techniques or tools. To create a more general toolbox for idea generation, the findings of the literature review are generalized and presented in two categories: guidelines and idea sources, and methods and techniques.

7.3.1 Guidelines and idea sources

Many of the listed guidelines simply emphasize the importance of different aspects of the innovation culture. As the innovation culture is already handled in this chapter, those guidelines are not repeated here.

Guidelines

The following generalized guidelines can be identified:

- Include the customer in the process in an as early phase as possible. If you have several customers, cooperate with the lead ones. Try to find the unarticulated customer needs. Look for disruptions in the customer's industry.
- Utilize job rotation to share knowledge, expertise and best practices. This also can raise the motivation of the employees.
- Utilize an organization-wide knowledge sharing system.
- Use metrics to follow and improve the ideation.

Sources for ideas

The following generalized idea sources can be identified:

- Customer. Establish feedback channels. Utilize beta testing. If possible, be your own user (enable and encourage the employees to use the product).
- Internal sources. Harness the creative ability of the entire organization.
- Competitors. Analyze the solutions the competitors provide.
- Universities and research institutions are excellent sources of ideas.
- New technology solutions. Follow constantly the progression of technology. Incorporate latest technology in the product development.
- Trade shows and publications. The organization should participate in the events both as a presenter and as a visitor. These are also a great way to network with other organizations.
- Patents. Reviewing patent applications can raise ideas.
- Suppliers

7.3.2 Methods and techniques

Ethnographic research

Ethnography is a research method for participating, observing and describing the behavior of existing or potential users. Users can be passive when it comes to articulating their problems, they can miss the core problem, or they simply might be

used to live with the problem. Ethnography is a great method for identifying those issues.

Ethnography can be performed on a single product context, to observe how the users actually use the product (Is the product easy to use? Is the customer happy with the product? What features are used? What features are missing? What are the problem areas?). It can also be applied in a wider context to observe the daily life of the users (What do they do? When and how do they like to do it? What would they like to do? Do they have a problem they need a solution for?).

Lead user method

Originally developed by Eric von Hippel in the 1980s, the lead user method focuses on identifying the needs of the lead users. Lead users usually have needs that are ahead of the trend. The early identification of the needs makes it possible to develop products faster for the mainstream users.

Campaign based idea management

According to Baumgartner (2009, 7), in campaign based idea management, the idea is to launch short term campaigns to solicit ideas on specific issues. The objective and time frame are deliberately limited, so the target of ideation is clearer and people are bound to focus their ideation on strategic business needs.

When engaging in campaign based idea management, the organization should have a constant and steady flow of campaigns on different issues to provide continuous challenges and keep the ideation going. The campaigns should be heavily promoted to get as many people involved as possible. (Baumgartner 2009, 8.)

Brainstorming

Brainstorming is probably the most popular and well-know ideation technique. However, according to Baumgartner (2009, 9), the traditional brainstorming method is not particularly effective. This is because of group dynamics; some people tend to stay quiet, some tend to dominate, and ideation is usually grouped around a few central ideas.

To overcome this problem, Baumgartner (2009, 9), has identified three more

effective brainstorming approaches:

- Online brainstorming. Brainwriting. A venue where all people are welcome to present their ideas freely and possibly anonymously. And where all are free to build upon others' ideas.
- Non-verbal brainstorming. Brainstorming without using words. Techniques like nominal group technique, modeling, doodling and rightbraining can be used.
- Write first, then shout brainstorming. From brainwriting to brainstorming. Combines the advantages of private ideation and groupwork.

Creative spaces

As the name of the method implies, creative spaces is about arranging and equipping a space for arousing creativity. This is a place where people can meet to collaborate in a relaxed atmosphere.

The space should be equipped at least with whiteboards, flip-charts, post-its, paper and pens to capture the results of the work. Tech toys, computers, music systems and modeling tools certainly help to increase the creativity.

Skunkworks

As Baumgartner (2009, 10) defines it, ”a skunkworks is a loosely organized corporate research unit or a facility that is free to explore any innovative research”. Although skunkworks as an unit is not consistently profitable, it is highly innovative. And as a such, it occationally comes up with a development idea that can be highly profitable.

As an alternative to skunkworks, the company can allow employees to spend some percentage of their time to freely explore ideas (e.g. Google), or allocate a separate budget for radical ideas. (Baumgartner 2009, 10.)

Web-based idea bank

This method is based on the idea of online brainstorming and brainwriting. All people across the organization are welcome to contribute in creating, enriching and developing the ideas. The method is harnessing the benefits of online community and social networking.

However, a clear focus, goals, and a time frame have to be set for the ideation. Otherwise the idea bank can turn into a suggestion scheme based system, which, according to Baumgartner (2009, 7), are bound to fail.

Prototyping and beta testing

Lynn, Morone and Paulson (1996, 16-26) emphasize the importance of prototyping. They define prototyping as an iterative process, where prototype development, customer probing and learning is done in cycles. In each iteration, the prototype is improved based on the accumulated knowledge from previous rounds; next it is given to the customer to try it out; and finally the feedback is collected from the customer. And then start over again.

Attribute listing

Attribute listing is a technique for handling problems in smaller parts. It is especially useful in engineering context. The approach is analytical.

The system is first broke down into smaller parts. Next the attributes of the parts are identified. The attributes are then evaluated one by one, identifying the purpose and ”value” of them. Finally the attributes are modified to improve the system.

Six thinking hats

The six thinking hats technique focuses on looking at the problem from different perspectives. It requires a team of at least six members.

Each member of the team is given a ”hat”. There are six hats with different colors and headlines (points of view): white – information (asking information from others); black – judgment (pointing out why ideas do not work); green – creativity (offering ideas); red – intuition (explaining hunches, feelings and gut senses); yellow – optimism (being positive and supportive); and blue – thinking (using rationalism). After the hats are shared, the problem is introduced to the team and the discussion about it is started. Each member should participate in the discussion, contributing from the perspective dictated by the color of his/her hat.

Unfolding

Unfolding is a simple technique to minimize the effect of preconceptions and prolong

the creativity period. In this technique the focus is not set on the core problem right away. Instead, the story unfolds in steps, starting from the outermost concept. In each step the team discusses about the case, and when the understanding reaches an acceptable level, more detail is added to the story, getting closer to the core problem.

SCAMPER

SCAMPER is a technique which utilizes a set of questions to come up with new ideas. It is an acronym of the following actions: *substitute* (which part of the system can be substituted to make an improvement); *combine* (which parts of the system can be combined, and how); *adapt* (what part of the system could be changed, and how); *modify* (what happens if a part of the system is modified); *put to other use* (could the system be used somewhere else); *eliminate* (what parts can be removed, and what would happen then); and *reverse* (what happens if things are done in reverse order).

TRIZ

Originally developed by Genrich Altschuller and his colleagues in the 1960s, TRIZ is a method for solving problems systematically. It is also known under the acronym TIPS (Theory of Inventive Problem Solving). TRIZ draws analogies to existing solutions. After going through thousands of patents, Altschuller identified thirty nine generic solution patterns.

When applying TRIZ, the activities flow as follows: identify the functionalities of the idea; indentify the things that work against the identified functionalities, these are called *harms*; identify the ideal solution to implement the functionality and then work back from this ideal solution until the solution is possible and rational; find the contradicting functionalities and harms, and select two of them; and finally apply the selected functionality/harm pairs to the matrix of generic solutions patterns.

TRIZ is a complex and demanding method. It needs a lot of practice.

More techniques

In addition to the ones listed here, there exist a great number of techniques for idea generation. Most of them focus on improving individual creativity, but many of them can be applied also in the context of organizational creativity.

7.4 Idea selection

The idea selection element is the single most critical part of the Front End phase. Its sole purpose is to identify the potential ideas, and boldly screen out all the inappropriate ones. Efficient screening of ideas is paramount – the organization must not waste its scarce resources on cases with no potential.

There is no one-size-fits-all solution for idea selection. Every organization is different with different culture, strategy and products. A custom solution is needed. (Tucker 2008.)

7.4.1 Evaluation criteria

Screening and selecting ideas without having a clearly defined idea, evaluation criteria in place does not make sense. If the ideas are not carefully evaluated, every idea is of equal value, and the selection can be based on gut feeling alone. On the other hand, as Baumgartner (2009, 10) points out, ideas should not be over-evaluated. It is impossible to avoid the risk completely. He reminds that most innovative ideas with the biggest potential return on investment (ROI) are also the most risky.

According to Tucker (2008), evaluation criteria should be clear and comprehensive, but also simple and memorable. Baumgartner (2009, 10) also emphasizes the importance of flexibility.

Tucker (2008) emphasizes, that in most organizations the idea selection criteria is simple list of a few carefully selected questions. It is all about having a solution that fits the organization's needs.

Tools and techniques

There are numerous tools and techniques available to help in defining the idea evaluation criteria. Rebernik and Bradač (2010, 16-17) have composed a list of the most potential tools: *ABC analysis, AHP-based approach, anonymous voting, A-T-A-R model, check lists for business idea evaluation, consensus mapping, cost-benefit analysis, decision trees, Delphi technique, evaluation matrix, FMEA, force field analysis, Kano analysis, Kepner Tregoe matrix, NAF, nominal group technique, paired*

comparison analysis, Pareto analysis, PMI analysis, prioritization, repeatable questions diagrams, sticking dots, SWOT analysis, TRIZ, value analysis, and *Vroom-Yetton-Jago decision model.* After examining the techniques, it can be concluded that the evaluation matrix, SWOT, checklists and cost-benefit techniques are the most useful in this context. They can be – and usually are – used during both idea selection and idea analysis.

Evaluation matrix

Evaluation matrix is a evaluation and decision making tool. The data is presented in a compact and structured matrix form, with the questions on the rows and the corresponding values on the columns. The technique is powerful, yet easy to use.

SWOT

SWOT is a simple and powerful analysis tool for identifying the Strengths, Weaknesses, Opportunities and Threats of a project. It is commonly known and widely used, especially in business context.

Checklists

Checklist is a commonly known memory backup tool for listing things to remember. Although the tool is extremely simple, it can be very powerful and useful in many situations.

Cost-benefit analysis

Cost-benefit analysis is a technique for making economic decisions. It is used to identify and list the costs and the related benefits of a project.

7.4.2 Selection team

According to Tucker (2008) it is essential to get the right people on the selection team. They should know how to utilize the idea selection criteria, and dare to use it instead of selecting ideas based on gut feeling. They should be unbiased, entrepreneurial, and willing to participate in the ideation themselves. Often the ideas do not get selected the first time around, they might need some enriching first.

Koen et al. (2002, 25) point out that some individuals (the ones with high Myers-

Briggs preferences for intuition and thinking) are naturally better in making idea selection decisions than others. Personality does count here.

7.5 Concept definition

In the concept definition element, all the information related to the selected idea is collected, analyzed and processed to create a compelling business concept – a case for investment. The business potential of the case is then evaluated by the screening committee to decide upon whether to accept the case, send it back to NCD for improvement, or dismiss it. If the case gets accepted, it moves onwards to the next phase of development. (Koen et al. 2002, 26-27.)

Tools and techniques

Examining the requirements for the business case evaluation, it can be established that an appropriate combination of checklist, evaluation matrix, cost-benefit analysis and SWOT analysis techniques can constitute the most efficient evaluation criteria. It is essential to make sure that the business case gets evaluated from all possible perspectives.

In his study of idea selection techniques, Ozer (2009, 4-20) has composed a comprehensive list of issues that should be considered when making the investment decision:

- Technical analysis. Is the organization technologically capable of developing the product? Is all the required know-how found in-house?
- Market analysis. Is the organization capable of performing the required marketing activities? Is the target market new to the organization?
- Financial analysis. Could the product be financially profitable? What are the expectations on ROI?
- Organizational analysis. Do the organizational processes, structures and cultures enable the development of the product?
- Strategic analysis. Does the product meet the organization's strategies?
- Relationship analysis. Are all the required relationships in place (partnering,

distribution, customers, etc.)?

- Industrial analysis. What are the characteristics of the target industry (requirements, limitations, regulations, etc.)?
- Competitive analysis. What is the competitiveness of the product? Who are the players?
- Similar case analysis. Has the organization developed similiar products? How did they succeeded? Is there a threat of internal competition?
- Consumer and consumption analysis. Who is the target customer? Is market research required? What issues did the market research reveal?
- Expert analysis. What do the experts say about the potential of the product?

In addition, Koen et al. (2002, 27) emphasize that all items in the evaluation criteria should have clearly defined boundary conditions. This facilitates greatly the decision making process.

7.6 Summary

It is essential to understand the role and the importance of innovation culture, strategy and leadership. They are the engine of innovation. The organization should first and foremost focus on improving the innovation culture, defining the innovation strategy in align with the organization's business strategy, and making sure that the leadership (doing the right things) is in good hands.

There are numerous different tools, techniques, methods and guidelines for all the activities of the Front End. The organization should take a close look at all of these, and then select the most suitable ones.

The importance of idea selection and product concept development cannot be exaggerated. The organization must have selection criteria in place for both of them. It is paramount to know when an idea/product concept is ripe enough to enter the development phase.

8 CONCLUSION

The objective of this thesis was twofold: first, to identify and analyze Tieto's current innovation process, focusing especially to the Front End phase practices of the process; and second, to research and evaluate the commonly available solutions to improve these practices. The bibliographical and evaluative research methods were used to review the existing literature sources on the topic. Both to get a deeper understanding of the topic, and to evaluate the applicability of the existing tools, techniques and methods.

The thesis first covered the very basics of innovation; the definition of innovation, the different types and categories of innovation, and the differences of product and service innovation. A common understanding of the basic terms and concepts was seen as a crucial prerequisite for understanding the rest of the thesis. Next, the focus was broadened to cover innovation management: the meaning and importance of innovation culture, strategy, leadership and organizational support; the paramount importance of the innovation process; and the concept of open innovation. After providing a solid overview on the topic of innovation management, the focus was set on innovation processes. Different innovation process models were presented and analysed. It was concluded that the role and importance of the Front End phase was not addressed enough in most of the models. The generic innovation process model of Koen et al. was presented as a solution for that problem. Next the focus was narrowed down to the Front End of Innovation phase. The general activities and characteristics of the phase were studied, and the importance of the phase was pondered. Also the different models for the Front End were presented and evaluated. It was concluded that a dynamic and iterative approach is needed to manage the Front End phase activities. The New Concept Development model was presented as the most promising candidate. The model was studied, evaluated and then presented in detail. It was concluded that the model is an excellent tool for managing the Front End phase activities, as it is both iterative and dynamic. It also integrates the marketing and technology development activities well together.

Next the thesis focused on studying, evaluating and presenting the most promising

available guidelines, methods, tools and techniques for improving the Front End phase practices. In conclusion, the importance of innovation management (creating the innovation culture, defining the innovation process, defining the innovation strategy, and putting this all in good hands) was emphasized. It was also concluded that the organization should take a look at all the provided guidelines, methods, tools and techniques, and select the ones most suitable for the organization. Furthermore, the importance of idea and concept selection criteria was emphasized.

The innovation practices of Tieto were studied as a case study (appendix 2). The current level of understanding of innovation processes was mapped using a simple survey (appendix 1), results were analyzed, the challenges were identified and analyzed, and finally a solution proposal was made (appendix 3).

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APPENDICES

Appendix 1: Innovation Test

Original test by Apilo, Taskinen and Salkari, published in their book ”Johda Innovaatioita” (2007).

GRADING SCALE

0 I know too little about this issue to estimate it

1 A lot of improvement is needed

2 Some improvements already started

3 Heading to the right direction

4 Issue is almost taken care of

5 We are experts at this

INNOVATION PROCESS

____ People have a common understanding of the innovation process

____ In addition to development, innovation process covers also innovation strategy and concepting

____ Innovations are mainly implemented following the innovation process

____ Systematic searching, evaluation and enrichment of ideas is part of the innovation process

____ All of the organization's functions contribute in the innovation process

____ External partners (universities, idea hatcheries, partners, etc.) are involved in the innovation process

____ Customers are participating in the innovation process

____ Innovation process has set goals

____ Innovation process performance is measured and improved continuously

____ Someone owns, and is responsible of, the innovation process

____ Average value

INNOVATION CULTURE

____ Innovativiness is one of the organization's values

____ Presenting new ideas and processes is encouraged

____ Sharing of information and knowledge is encouraged

____ Changes are seen as possibilities

____ Communication is active on many levels and in multiple directions

____ Time is allocated for free innovation

____ Continuous learning is encouraged

____ Mistakes are seen as possibilities to learn

____ Organization wants to provide better solutions for the customer

____ Incentives and rewards support group work

____ Average value

INNOVATION STRUCTURE

____ The organization's structure is a flexible process organization

____ Cross-functional teams are implementing the development projects

____ People involved in the innovation process interact continuously

____ Project and solution knowledge and know-how is collected and utilized

____ Innovation belongs to the whole company

____ The top management carries the responsible of innovation strategy

____ Organization does not limit or set boundaries for creating innovations

____ Organization engages actively in open innovation

____ When searching partners, the innovation capabilities of the candidate organization are evaluated

____ Organization cooperates with competitors

____ Average value

INNOVATION STRATEGY

____ Whole organization has adopted the innovation strategy

____ Innovation strategy defines the organization's target innovation level

____ Innovation strategy is continuously updated align with the business strategy

____ Organization uses product/technology platforms

____ Core competences are developed in orderly fashion

____ There are programmes to gather strategically important development projects into bigger entities

____ Roadmaps are used to envision the future

____ Scenarios are used to prepare for the future

____ Portfolio management is used to allocate development needs and resources

____ Organization continuously seeks for possibilities to renew

____ Average value

INNOVATION RESOURCES

____ Continuous learning is supported

____ Knowledge and know-how is managed and led

____ People with different education and experience backgrounds are recruited

____ Innovation and innovativiness is trained

____ Open innovation is utilized

____ Cooperation with universities and research institutions is active

____ Innovation budget is split based on risk and innovation level

____ Different sources of funding are versatively utilized to fund research and development

____ Technology competences are development continuously

____ Market research is developed continuously

____ Average value

Appendix 2: Case study

The contents of this appendix are confidential.

Appendix 3: Presentation of the results

The contents of this appendix are confidential.