Creating an Innovative Culture for User Involvement

-A Case Study of Climate and Fuzzy Front End Management at TechCo

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Abstract

Title:	Creating an Innovative Culture for User Involvement -A Case Study of Climate and Fuzzy Front End Management at TechCo
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Issue of Study:	As the topical engineering industry has reached a point where technical innovation and technical features have become less important as means of competition, TechCo has realized the importance of user involvement in their early stages of development. However, in order to absorb this new input flow, certain prerequisites are needed namely an innovative climate and a proficient FFE.

Purpose:	The purpose of this master thesis is to investigate how prepared TechCo is for user involvement in the FFE. This will be done by evaluating TechCo's current FFE management as well as the prevailing innovative climate. Furthermore, a theoretical framework will be created, describing how TechCo can improve its innovative climate and manage its FFE more proficiently. This will make TechCo more prepared for user involvement in the FFE.
Method:	Three different methods were used in order to examine the FFE of TechCo's innovation process. Two of these were applied inside the FFE and one outside of it. The creative climate was measured through the creative climate questionnaire (CCQ).
Conclusions:	In order for user involvement to be successful, an innovative culture is needed. Organizational culture can be observed and affected through the climate of an organization. Furthermore, a proficient FFE management should be implemented, as this will enable easier implementation of user involvement. User involvement has in turn been shown to have a positive effect on FFE management. With an innovative climate and proficient FFE, organizations will enhance their overall innovativeness as well as reap the full benefits from user involvement.
Key Words:	Organizing for Innovation, Innovative Culture, Innovative Climate, Fuzzy Front End, Creative Climate Questionnaire

Sammanfattning

Titel:	Skapa en innovativ kultur för brukarinvolvering - En fallstudie av klimat och fuzzy front end management på TechCo
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Problemställning:	Den rådande marknaden har nått en punkt där teknisk innovation och tekniska egenskaper har blivit mindre viktiga konkurrensmedel, varför TechCo har insett vikten av tidig brukarinvolvering i innovationsprocessen. För att kunna dra fördel av brukarinvolvering så krävs det emellertid ett innovativt klimat och en effektiv FFE-process.

Syfte:	Syftet med detta examensarbete är att undersöka hur pass förberedda TechCo är för brukarinvolvering i FFE. Detta genom att utvärdera deras nuvarande FFE management och rådande innovativa klimat. Vidare kommer ett teoretiskt ramverk att skapas för att beskriva hur TechCo kan förbättra sitt innovativa klimat och hantera sin FFE på ett effektivare sätt. Detta kommer troligtvis göra TechCo mer förberedda för brukarinvolvering i FFE.
Metod:	Tre olika metoder användes för att undersöka FFE i TechCos innovationsprocess, två inifrån och en utifrån. Det kreativa klimatet mättes med hjälp av Ekvallenkäten.
Slutsatser:	Det krävs en innovativ företagskultur för att kunna lyckas med brukarinvolvering. Företagskulturen kan observeras och påverkas genom företagets klimat. Vidare bör FFE-processen effektiviseras, då det underlättar implementeringen av brukarinvolvering. Brukarinvolvering har i sin tur bevisats ha en positiv effekt på FFE-processen. Med ett innovativt klimat och en effektiv FFE-process blir man mer innovativ överlag, samt kan dra full nytta av brukarinvolvering.
Nyckelord:	Organisera för innovation, innovativ kultur, innovativt klimat, fuzzy front end, kreativt klimat, Ekvallenkäten

Preface

This master thesis was sprung from an increasing interest for user involvement at TechCo, a world leading player within the engineering industry, and sought to explore "the intersection between human needs, business opportunities, and technical possibilities" (Larsson and F., 2011). The exciting description of the master thesis appealed to us immediately, making it an easy to choice to send in our application. Coming from two different M.Sc. programs, Electrical Engineering and Industrial Engineering and Management, with majors in Production Management and Entrepreneurship and Business and Innovation, the task felt spot on with our key interests. It has been quite an adventure, and we would like to thank everybody who has aided us on our journey.

First of all we would like to thank our two tutors, namely Global Industrial Design Manager B. T. at TechCo and PhD student Susanna Bill at Lund University. We could not have done this without you. You have been our key source of inspiration from the start, and we have learned a lot from you. It has been a privilege, and we hope that we will meet again in the working life.

Furthermore, we would like to thank Associate Professor Andreas Larsson at Lund University and Global Managing Director Equipment J. F. at TechCo, for giving us the opportunity to execute this master thesis. We are really thankful for everything you have done for us.

We would also like to thank the entire TechCo staff for their warm welcoming and valuable contribution to our master thesis. It has been a great pleasure visiting you, and we wish you the best of luck in the future.

A big thanks to our objectors, Frida Gerhardsson and Emelie Åkerlund, whose external inputs have helped us polish the report even further. Finally we would like to thank our friends and family who have been supportive and showed a great amount of understanding and compassion during the past six months.

Lund, December 8, 2011

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Definitions

Innovation Process:	The process which starts with an idea, opportunity or need identification and ends with a product taken to market. It consists of three parts/phases: the Fuzzy Front End, New Product Development and Commercialization.
Fuzzy Front End (FFE):	The first part of the innovation process. It starts with an idea and ends with a finished concept (Koen et al., 2001; Murphy and Kumar, 1997).
New Product Development (NPD):	The NPD is entered after the FFE is ended. Design, prototype testing and so forth is conducted during this phase (Khurana and Rosenthal, 1997)
New Concept Development (NCD):	A model, put forward by Koen et al. (2001), describing the activities in the FFE.
Organizational Climate:	The atmosphere perceived by the employees within the organization through practices, procedures and rewards (Schneider et al., 1994).
Organizational Culture:	The deeply held, shared and taken-for-granted values and beliefs, as well as the underlying assumptions, expectations, collective memories and definitions that are present in an organization (Cameron and Quinn, 1999; Deshpande and Webster, 1989; Ahmed, 1998).
User Involvement:	Involving end users in the innovation process through various methods.
Lead Users:	Users which needs far surpasses those of the common users, and who often create their own solutions to problems (Mohr, Sengupta and Slater, 2010).

Innovation Champion:	An individual or team that promotes, encourages, spurs, supports and drive innovation forward in the organization (Morris, 2007).

Chapter 1

Introduction

The chapter is introduced with a short description of the engineering market. Thereafter, the issue of study is put forward followed by the purpose of the master thesis. Finally, de-limitations and target groups are defined.

1.1 Background

Due to driving forces such as general globalization, availability of information and goods etc., the engineering industry has reached a point where technical innovation and technical features have become less important as means of competition. The customers' core technical needs are already satisfied, and since the immediate need of more technically advanced products is low, the market can be considered mature. Technology has become a prerequisite to exist at the market, rather than a mean of differentiation. TechCo is therefore looking for other ways to distinguish themselves in the market. Other mature industries have proven that maturity opens up doors for other differentiation variables than advancing with the original technology. Consider the computer industry and the introduction of the MiniPC. The MiniPC was a technical setback, but its smaller size and thereby greater portability and smaller price tag made it more suitable for people on the move, attracting a whole new clientele (Shah and Dalal, 2009). Hence, the MiniPC was a success and helped fuel the overall PC market (The New York Times, 2008; PCWorld, 2008), not because of its technology but because of its design. With examples like this in mind, it becomes clear that technical superiority is not always what the user values.

1.2 Issue of Study

TechCo would like to get a better understanding of their customers' needs, so that they can compete in a whole new way. User studies have therefor been conducted, including observations, and it has become clear to TechCo that their products are not always used as intended (Industrial Design TechCo, 2011). An innovation process where the users are involved as much, and preferably as early, as possible is therefore needed if these issues are to be resolved. The industrial design team has made a suggestion on how to make the innovation process more precise and effective, based on early user involvement. During a meeting the design team presented their findings, as well as two mockups that they had created to better address the users' needs. They then continued to ask the representatives of engineering and marketing to propose where in the new process they could be active and help. A pressured atmosphere was sensed in the room and technical personnel were less than excited about the new way of doing things and the resulting prototypes. Expressions like "this can't be done because of..." and "that won't work..." were uttered in a respectful, yet negative way. This, together with some initial interviews at TechCo made us consider if the organizational culture would be able to absorb this new way of development or if it would reject it? Is the company creative and innovative enough? One employee noted, "we're not creative enough, we're not good enough at noticing the little things that the operator wants to highlight". If TechCo implements a new process that is user-centered, will this automatically bring breakthrough innovations? Research argues that breakthrough or radical innovations require certain aspects of an innovative culture (Ekvall, 1996). Will TechCo fall short if they just implement a new user-centered process in the fuzzy front end (FFE) of development? If user-centered processes are to prevail, we argue that the culture must be innovative enough to interpret the users' needs and find novel and innovative solutions to their problems. Literature further argues that risk tolerance, support and commitment are needed in order for FFE activities to be effective (Kim and Wilemon, 2002), which are dimensions of an innovative climate (Ekvall, 1996). Examples from other companies such as Electrolux and Intel, trying to deploy user-driven innovation, shows that innovative culture has been of importance and that a cultural change in technology-driven companies is a difficult task (Wise and Høgenhaven, 2008). Questions like "what organizational and cultural changes are needed in order to make this new way of working successful?", "how can the creative spark be kindled at TechCo?" and "what is the aim of these changes and how does TechCo get there?" started to form in our

subconsciousness and will be the main focus of our work. In order to answer these questions a situation analysis will be conducted, regarding the innovative culture and innovation climate, as well as an estimation of the FFE activities. This will be the base for which means of improvement will be put forward to TechCo, so that they can improve their innovation process and create a long lasting innovative culture, in line with their company's vision.

1.3 Question Formulation

What organizational and cultural changes are needed in order to make user involvement in the FFE successful?

How can the organizational culture be changed?

1.4 Purpose

The purpose of this master thesis is to investigate how prepared TechCo is for user involvement in the FFE. This will be done by evaluating TechCo's current FFE management as well as the prevailing innovative climate. Furthermore, a theoretical framework will be created, describing how TechCo can improve its innovative climate and manage its FFE more proficiently. This will make TechCo more prepared for user involvement in the FFE.

1.5 Delimitations

It was early stated by TechCo that they would rather see the study pinpointed as much as possible, to be able to do a deep and thorough analysis, than just touching the surface in a more widespread study. Due to this, as well as the prescribed limitations of a master thesis, the study will focus on TechCo's creative climate and the FFE of their innovation process.

1.6 Target Groups

This master thesis is primarily directed towards academics, such as students, scientists, and people in the industry, with an interest of culture and innovation, and the benefits that can be achieve by managing one's culture in an effective way. Organizations considering implementing user involvement in the FFE should reflect on the insight provided here.

Chapter 2

Method and Research Design

This chapter describes the process of the master thesis, starting off with a background description. The chosen research method and research approach is then described, followed by a description of the working process. How data have been collected is then described, before ending the chapter with criticism towards the chosen methods.

2.1 Starting-Point

This master thesis has been done as a final part of the two authors' engineering education, industrial engineering and management as well as electrical engineering, at Lund University, Faculty of Engineering. The thesis was originally an initiative by Associate Professor Andreas Larsson, Head of Innovation Technology at Lund University, Faculty of Engineering, and J. F., Global Managing Director of TechCo.

2.2 Research Method

Due to the overall purpose of this master thesis, the authors have chosen to do an exploratory case study (Yin, 2003; Höst et al., 2006). To ensure the breadth and depth of the study, the abductive research approach has been chosen, which iteratively match theories with empirical data in order to bring the study forward and create new knowledge (Holme and Solvang, 1997).

> *"[A case study is] a study design that involves a detailed and*

> *thorough analysis of a single case (such as an individual, organization or situation)."*
>
> Bryman and Bell, 2005, pp. 589

The case study's strength lies in its unique ability to combine a variety of information sources (triangulation) such as documents, interviews, observations and objects (Yin, 2003) as well as the fact that it is flexible by nature, i.e. that one is free to change issues and focus during the study (Höst et al., 2006). The information collected is primarily qualitative (words) but can also be quantitative (numbers). The sources should be as diverse as possible, so that as many variations as possible can be found in the observed phenomenon. The findings of a case study are directly limited to the specific case, i.e. not generalizable. However, the likelihood is of course great that one reaches the same conclusions in a case with similar conditions.

2.3 Working Procedure

The working process has been divided into three phases; the start-up and preparation phase, the implementation phase and the finalizing phase.

2.3.1 The Start-up Phase

The master thesis was initiated with a phone conference with the tutor at TechCo, who presented TechCo's wishes and hopes of a more customer-focused and conceptual innovation process. The thesis would contribute to this development by (1) conduct a situation analysis of the innovation process early conceptual phases (identification of threats and opportunities) and (2) exemplify the focus areas and specific activities to increase the innovation process efficiency and accuracy. Shortly after, a meeting was held with Associate Professor Andreas Larsson, head of Innovation Technology at Lund University, Faculty of Engineering, with the aim of discussing the thesis more practical pieces. The two meetings resulted in a project plan, which has been the basis for this entire report.

When the project plan was approved, literature regarding research methodology and how the thesis should be conducted was obtained in order to ensure the report's scientific quality. Furthermore, a search for relevant secondary data began, particularly in user involvement, fuzzy front end (FFE) and open innovation, as well as the identification of interesting target groups

for the upcoming case study.

A kick-off meeting was held at TechCo's headquarters in western Sweden, where the tutors from the company and academia were represented. Together, the project was discussed more in detail. It was suggested that some initial interviews could assist in identifying what really needed to be done as well as give an insight into the company. It was made clear that the parameters of the project were not final and that the purpose could be modified according to the findings of the initial interviews.

After a proposal from the company tutor, a meeting at TechCo was attended. The main topic of the meeting concerned user-centered development. Three initial interviews were conducted the same day. The meeting in combination with the initial interviews formed a new purpose which was later discussed with the tutors. Whereas the old purpose focused more on the actual user involvement, the new one focused more on the prerequisites for user involvement.

2.3.2 The Implementation Phase

With the purpose and issue of study established, the direction of the information gathering changed and the theory part of the report started to take shape. It was decided that the project should contain two major studies, one of the innovative climate at TechCo and one of the FFE proficiency at TechCo.

After consultation with the tutor at LTH, it was agreed that a quantitative study of the innovative climate could be conducted with the creative climate questionnaire (CCQ) created by Göran Ekvall (1996). After correspondence with the company tutor, the survey at TechCo's entire site in western Sweden was approved.

Both qualitative and quantitative data have been collected and used in order to map TechCo's innovative climate and culture. The qualitative data was collected primarily through a series of interviews, but also through the participation of a managerial meeting, where R&D and product management were invited to discuss the concept of industrial design driven development, as well as the results of the recently conducted user studies. The qualitative data has provided the authors with insights of how innovative TechCo's climate and culture really are. However, due to the master thesis restriction

in time and TechCo's limited ability to contribute with interviewees, only a fraction of TechCo's personnel were interviewed. Hence, in order to get a greater coverage, the qualitative study was complemented with a quantitative study, namely the CCQ. The result of the CCQ was then compared with insights provided by the interviews, in order to understand the underlying causes of the results, and build up a greater credibility of the study. Unfortunately, only about half of the staff responded to the questionnaire, and thus one cannot draw conclusions regarding the overall climate. However, it did provide the authors with an indication of TechCo's creative capability.

The study evaluating the FFE was divided into two parts, enabling observation from two different angles, one from within it and one from outside of it. Evaluating it from within was conducted through a checklist, derived from Khurana and Rosenthal (1997) together with more open questions about the elements in the new concept development (NCD) derived from Koen et al. (2001). The employees involved in this study were all active in TechCo's FFE activities and were chosen by the company tutor. They were considered having great knowledge of the FFE activities. Evaluating it from the outside was conducted through a email question raised to highly active and knowledgeable employees in the new product development (NPD) activities which were also chosen by the company tutor. The question was meant to highlight common problems faced in the NPD and then relate them to deficiencies in the earlier activities. Numerous internal documents were also used in order to establish the current policies for the FFE activities.

During the data collection, the theory part was created together with a summary of the most important theory parts. An iterative process was created which describes how to achieve a proficient FFE and an innovative climate, as these are seen as important parts for user involvement in the FFE.

2.3.3 The Finalizing Phase

During this stage, case TechCo was created. The case was focused around TechCo's innovation process, to be more precise, the parts identified as FFE and the innovative climate at TechCo. An analysis of TechCo was then conducted, where the iterative process put forward in the theory part was used as a guide.

As a last step, the entire report was anonymized, by request of the company.

2.4 Information Gathering

2.4.1 Different Types of Data

Data collected may be of quantitative or qualitative nature (Höst et al., 2006). Quantitative data consists of things that can be counted or classified, whereas qualitative data consists of words and descriptions. For complex studies, it may be necessary to collect both quantitative and qualitative data to support one's conclusions. Quantitative data can be analyzed statistically, whereas qualitative data requires analysis based on sorting and categorizing. Furthermore, data can be divided into primary and secondary data, where the latter consists of already existing data, such as scientific reports and journals (Bryman and Bell, 2005). Raw data is usually very expensive and time consuming to collect, why secondary data should be viewed as a natural and valuable addition. Interviews and observations are the most common types of primary data.

2.4.2 Interviews

Eight interviews were conducted in total at TechCo at both R&D, Marketing and Industrial Design, all of which were conducted face-to-face except one, which was conducted over the phone. All of the interviews were conducted in swedish except two, one in english and one in norwegian. Four of these were initial interviews with the purpose of determining what the study should contain, as well as give an insight into the company's innovation process. These interviews were open, i.e. a conversation was held around some initial topics. This way the interviewed employee could evolve the subject according to what he or she perceived as important. Thus different views could be identified. However it can also result in certain subjects being neglected. To counter this it was made sure that all the subjects were discussed. Two of the interviews were followup interviews, which were used to clarify certain issues, mostly about the innovation process. One of these were conducted over the phone. Two of the interviews were group interviews with two or more participants. Group interviews were chosen in order to address uncertainties concerning the FFE activities by the employees.

Two interviews were conducted with individuals that were not employed by TechCo and had experience with the CCQ and innovative climate. The interviews were open as the main objective was to discuss the CCQ and how to change the climate. This was done as experience in conducting the CCQ

was needed as this is often a neglected part of articles in this area.

Figure 2.1 depicts the relationship between the different interviews.

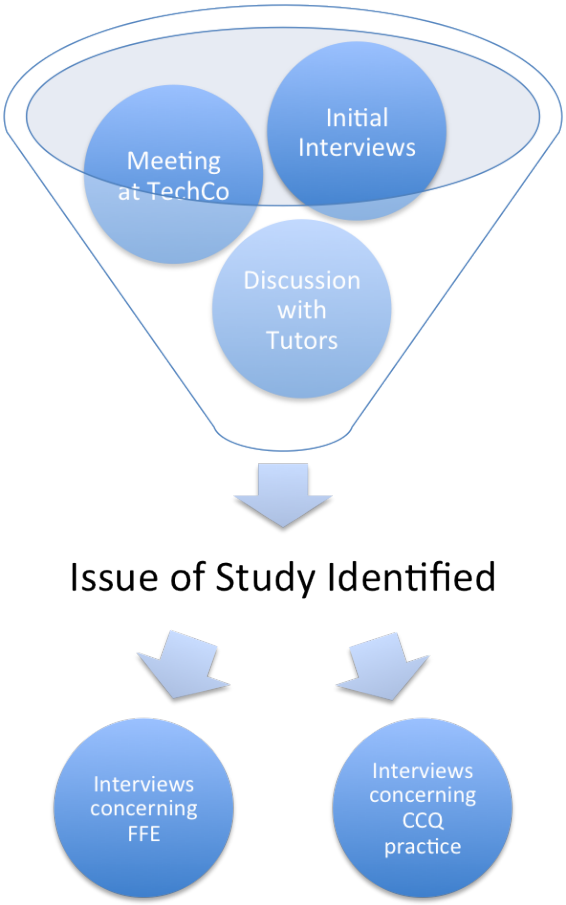

Figure 2.1: Relationship between the interviews conducted.

Notes were taken during the interviews in order to ensure that things perceived as important were not lost. All the interviews at TechCo except one, were recorded and transcribed in swedish or english depending on the language spoken during the interview. Quotes used in the report could therefor be translated from swedish to english. The interviews conducted outside TechCo were recorded but not transcribed.

2.4.3 The Creative Climate Questionnaire

The CCQ measures the creative climate in an organization. In more detail it measures the ten dimensions of creativity put forward by Ekvall (1996). The questionnaire consists of 50 questions, five for each dimension. It has been used extensively in the industry and is considered to be a reliable tool for measuring the creative climate.

The questionnaire was sent out to all employees at TechCo's Equipment site in Sweden by the company tutor. The respondents were given two weeks to answer through Google's survey service. After the first week, a reminder was sent to further promote the questionnaire. A total of 37 answers were received out of the total 85 employees at TechCo Equipment.

2.4.4 Email Correspondence

In order to determine common problems in the NPD, related to the FFE, an email was sent to employees that had great experience of the NPD. The email consisted of a single question together with a list of common problems associated with deficiencies in the FFE. One reply was received.

An email consisting of the checklist put forward by Khurana and Rosenthal (1997) was sent out to the employees which did not answer or could not participate in the group interviews. One reply was received.

2.4.5 Meetings at TechCo

One meeting at TechCo's headquarter in Sweden was attended. The meeting was held by members of the industrial design team and concerned user studies for concept development. Notes were taken during the meeting and some power point material was handed out. The information from the meeting was used to get a clearer picture of how user studies had been conducted and how the general attitude was.

2.4.6 Meetings with the Tutors

Meetings with the company tutor was held twice a month where the academic tutor took part during some of the occasions. An internal agenda was created between the authors which was not always followed sequentially, however all sections were discussed. The meetings were held on two occasions in person, at TechCo and at IKDC. All other meetings were held

over conference phone. The time needed for the meetings varied, however a minimum of one hour was always scheduled.

Meetings with the tutor at LTH were held more sporadically, either when assistance was needed or at the tutors' request. Generally an agenda was not created before the meetings as the trigger for the meeting was usually the main discussion point. These meetings took place at IKDC and were approximately one hour long.

2.4.7 Archival Analysis

Internal documents concerning the innovation process were given per request and were used together with interviews in order to get a clear picture of the innovation process inner works.

2.5 The Credibility of the Study

There are a number of different research criteria for assessing whether a study is valid or not. Some criteria are mentioned more often than others, and can thus perhaps be regarded as generally applicable, while some people argue the need for different types of criteria for different kinds of studies (Höst et al., 2006). A focus on the three criteria known as reliability, validity and representativeness has been chosen for this thesis.

2.5.1 Reliability

The reliability of a study concerns the question whether the result would be the same if the study would be carried out again, or if it is affected by random deviations (Bryman and Bell, 2005; Höst et al., 2006; Yin, 2003). It is therefore important to carefully document the exact working procedures, in order to prevent misunderstandings and ambiguities in any reconstructions of the study. For example, the interviews should be recorded and then transcribed, i.e. written down word by word, even though it is a very laborious process that can take up to 8-10 times as long to implement as the interview itself (Höst et al., 2006).

All the interviews have been recorded and transcribed, except the two external interviews conducted with people with experience of the CCQ and one interview that was conducted over the phone. The result from the CCQ

has been stored both locally and on the web. This has been done in order to assure reliability and minimize the risk of confusion.

2.5.2 Validity

A study is valid if it actually measures what it is intended to measure (Höst et al., 2006). Validity is thus in many respects the most important research criterion (Bryman and Bell, 2005). It may seem obvious, but is actually complicated and difficult to measure, because a question may very well be in a reliable manner, but without for that matter respond to what you want to know. Suppose an investigation aimed at measuring the speed of a large number of individuals by measuring the size of their feet. With perfect measuring instruments, one gets complete reliability, but zero validity, because of the fact that there is no proven correlation between a person's shoe size and his speed (Uppsatsguiden, 2011). To increase the validity of a study one can apply triangulation, which means that you study the same objects with different methods and sources in the area (Höst et al., 2006; Yin, 2003).

In order to assure validity, already applied methods was chosen. The CCQ has been used extensively in the industry and is therefor considered as having a high degree of validity. As the checklist for FFE formalization and integration has also been used before, it is also considered as a valid method. Additionally, the FFE was investigated with two other methods, a self composed interview template and a email question concerning problems in the NPD. As the study of the FFE was conducted with three different methods and as the CCQ was sent out to all the employees, the study's validity is improved. However, all employees participating in the study were chosen by the company tutor which could affect the study's validity negatively. This was countered by interviewing employees from different parts of the organization.

It is important to note that the study is highly focused on climate and FFE management. Important insight into the daily business could therefor been lost. There is a lot happening at TechCo at the moment which could have changed the results of the study.

2.5.3 Representativity

A study is representative if its conclusions are generally applicable, which in large part depends on the sampling of the study (Höst et al., 2006). Surveys

and experiments are, strictly speaking, only generalized to the population being sampled from, whereas case studies and action research in principle are not generalizable. On the other hand it is more likely that the observed object behave similarly in a new context, if it is similar to the context where the study was conducted, why a good and detailed description of the investigated context can help to increase representativeness.

One could argue that the methods presented and used here could be used in other companies as some of the methods chosen has been used in other studies. The conclusions and recommendations however, will only prove valid if the same issues are presented in another organization or if it's undergoing the same changes as TechCo.

2.5.4 How to Evaluate References

Sources can be peer-reviewed and fully credible, but also irrelevant or even false, why one has to critically examine every source that one intends to use in one's study. Höst et al. (2006) recommends that one should ask oneself a couple of questions regarding every source of information:

- Is the material examined, and if so, how and by whom?
- Who is the guarantor of credibility?
- Is the survey methodology credible?
- Are the results produced in a context that is relevant to my questions?
- Have the results been confirmed or led to recognition and have they been referenced in another credible context?

All of our sources have been critically examined with the help of the above information. In addition, multiple references has been sought in order to strengthen the source.

2.5.5 Reflections

Spreading over a period of nine months in total, this master thesis has been quite a journey. It all started in the middle of April last year, with the formulation of an initial purpose and issue of study, in parallel with the authors daily chores at the university. A project plan was created and the project was mutually decided to start after the semester, in the middle of June. However, as would soon to be discovered, it is hard to initiate a master

thesis during the summer vacation time. Information gathering was limited to research methodology, innovation and user involvement. Thus, most of the summer was spent on deciding about research methodology and creating a theoretical reference point, learning as much as possible within the areas of interest. Eventually, the vacation time came to an end and the official kick-off meeting was held at TechCo. A few weeks later, the issue of study had moved its focus and it was decided that the report should be written in English. This was due to a meeting held at TechCo, where the authors, without knowing it, applied user involvement. The authors observed the meeting (in a sense observing the users) and thereby giving the company (user) what they really needed, not only what they believed they wanted.

Although a lot had been learned during the summer, the authors could not help but get a feeling of back to square one. However, it was an educational experience, both in terms of the theoretical and practical knowledge. Thus, it cannot be considered as a real setback. In fact, this initial phase of the master thesis provided a deeper understanding of innovation and innovation processes, as the explorative case study could be considered an innovation process and this early phase to be the FFE of the study.

With the new purpose and issue of study at hand, things started to move forward. People were very friendly and welcoming, both at TechCo and at the academia, making it fun and exciting to explore TechCo and conduct this master thesis. Furthermore, it has been very comforting working as a pair, as it makes it much easier to overcome those days when one feel like discarding all previous efforts and conclusions. Furthermore, the authors argue that it is an asset to come from two different academic backgrounds in order to secure the breadth of the study. All in all, it has been challenging and stimulating to conduct this master thesis, and both authors feel that they have learned a lot and grown as people.

Chapter 3

Theoretical Framework

The chapter is introduced with a definition of fuzzy front end (FFE) where different approaches to it will be discussed as well as ways of evaluating it and implementing proficient management within it. Organizational culture and climate will be introduced and a selection of methods identified in theory intended to promote an innovative climate is defined. Finally, a summary of the most important parts is presented and reflected on by the authors along with an iterative process created by the authors, meant to be used preferably before implementing user involvement.

3.1 The Fuzzy Front End

3.1.1 Definition of Fuzzy Front End

The fuzzy front end[1] (FFE) is the first and most critical phase of the innovation process (Kim and Wilemon, 2002; Herstatt and Verworn, 2001). It is in this phase that the prerequisites for successful projects should be created. FFE stretches from the creative idea generation to a defined concept, which will either be rejected or approved for further development in the following product development phase (Koen et al., 2001; Murphy and Kumar, 1997). Khurana and Rosenthal (1998) include product strategy formulation and communication, opportunity identification and assessment, idea generation, product definition and project planning as well as executive reviews as parts of the FFE. Figure 3.1 depicts a model of the front end of the innovation process. Furthermore, they suggest that these activities are interrelated,

[1] Also known as: pre-development (Cooper and Kleinschmidt, 1994), pre-project activities (Verganti, 1997), pre-phase 0 (Khurana and Rosenthal, 1997/1998).

and that one should strive for a balance between creativity and discipline, in order to become more competent in the FFE. The FFE is completed when a business case is presented and the business unit either makes a go or a no-go decision (Khurana and Rosenthal, 1997).

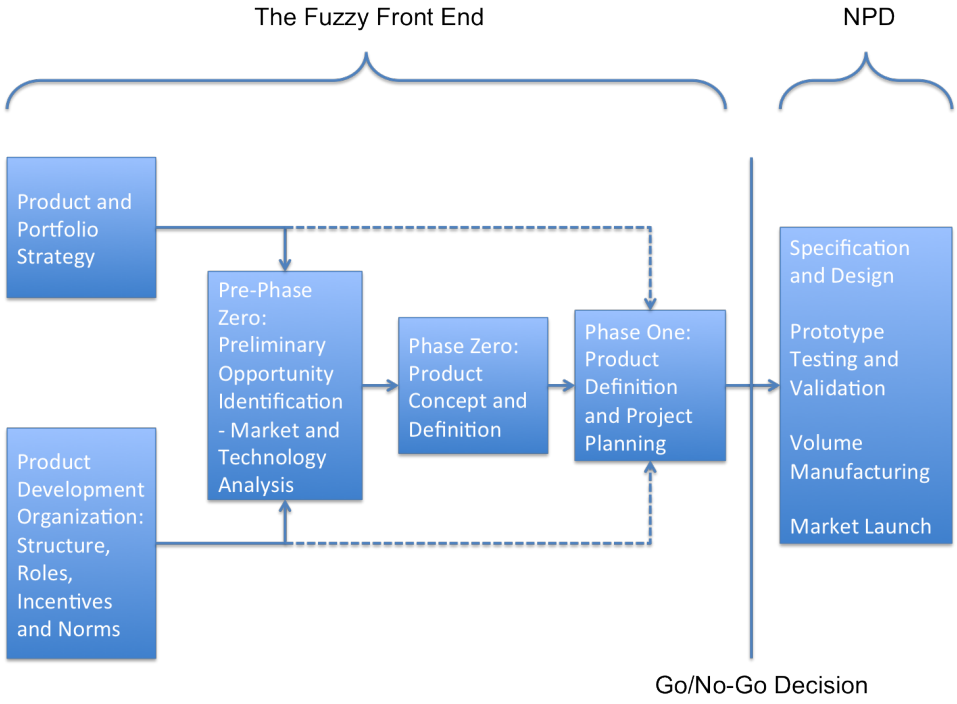

Figure 3.1: Process model of FFE. Adopted and combined from: Khurana and Rosenthal, 1997; Herstatt and Verworn, 2001.

Changes in the FFE are associated with low costs whilst the degree of freedom and impact on project results are high (Herstatt and Verworn, 2001). Hence, the FFE possess a great potential when it comes to improving the overall development process (Koen et al., 2001) and making it more effective, which has been proven in an extensive empirical study by Cooper and Kleinschmidt (1994).

The New Concept Development Model

Koen et al. (2001) defined five key elements of the FFE; Opportunity Identification, Opportunity Analysis, Idea Genesis, Idea Selection and Concept

and Technology Development. These five elements, together with the influencing factors (the environment) as well as the engine (leadership and culture) make up the new concept development model, NCD (Figure 3.2).

- *Opportunity Identification* is typically driven by the goals of the company, and it is in this element that the organization identifies opportunities that it might want to pursue. These opportunities can be things like reducing cost of operations or responding to a competitive threat, and can be a totally new direction for the business as well as a small upgrade of an existing product. Examples of methods, which can be applied in this element, are brainstorming, mind mapping, casual analysis, fishbone diagram, cyberspace discussions, individual insights etc. Opportunity Identification precedes the Idea Genesis in many cases. However, it may also be a method of finding a business opportunity for an idea (Koen et al., 2001).

- *Opportunity Analysis* assists in translating the identified opportunity to specific business and technology opportunities. The attractiveness of the opportunity, fit with the business strategy and culture, together with the risk tolerance of decision makers as well as the size of future development effort, dictates the amount of effort being dedicated to it. Competitive intelligence and trend analyses are used at a large scale in Opportunity Analysis (Koen et al., 2001).

- *Idea Genesis* is the place of birth, development and maturation of an opportunity, into a concrete idea. It can either be a formal process, like brainstorming or idea banks, where new ideas are generated, or outside the process, for example a failed experiment, a strange customer request or a new material offered by a supplier. Enhancing Idea Genesis can be achieved through close collaboration with users, cross-functional teams, other companies or institutions. A more complete description of the idea or product concept is usually the output from this element (Koen et al., 2001).

- *Idea Selection* is in many businesses the critical activity to choose which ideas that should be pursued in order to achieve the greatest business value instead of generating them. Specific selection models are needed in the FFE so that all the following can be considered: market and technology risks, investment levels, competitive realities, organizational capabilities, unique advantages and financial returns (Koen et al., 2001).

- *Concept and Technology Development* is the element where the development of a business case takes place. The business case should be based on estimations of market potential, customer needs, investment requirements, competitor assessments, technology unknowns and overall project risks. In order to manage technical uncertainties, some companies make use of a technology development process. This process can be complete or partly separated from the NCD. In some companies the Concept and Technology Development element is considered to be the initial stage of the NPD process. Hence, developing a business plan and/or a formal project proposal for the new concept is typically the last deliverable before the idea moves into the NPD (Koen et al., 2001).

Influencing factors are made up of organizational capabilities, the business strategy, the outside world and the enabling science that will be utilized (Koen et al., 2001). Koen et al. (2001) argues that these are the primary contributors to random discoveries of new ideas, and that a supportive climate is essential for a productive FFE. The Engine is fueled by the leadership and culture of the organization, and drives the five key elements in the FFE (Koen et al., 2001). Movement between the different elements does not have to be in a clockwise order as depicted. Instead one can jump between them in any order. Repetition of the elements, i.e. looping back, may also happen in contrast to the NPD, where looping back is associated with high costs, delays and poor management (Koen et al., 2001).

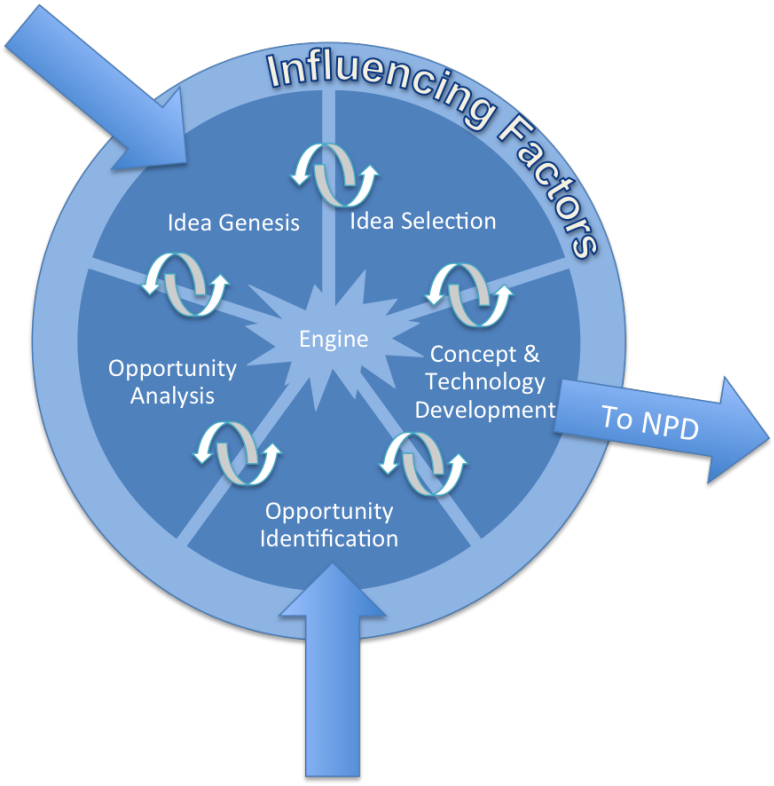

Figure 3.2: New Concept Development Model, NCD. Adopted from: Koen et al., 2001.

Research conducted by Koen et al. (2001) at 23 companies put forward some interesting aspects. First of all, the proficiency of the FFE showed to have a strong correlation with the level of innovativeness, whereas the proficiency of the NPD did not. However, since all of the firms had a good proficiency in the NPD, one cannot conclude that the NPD has no effect on the innovativeness of the firm. It is more likely that the NPD has been the target for enhancements in many companies for a long time, and undergone a lot of improvements, and that more is to be won now by enhancing the FFE than the NPD (Koen et al., 2001). Secondly, the proficiency of the

Engine and Opportunity Identification showed a high correlation with the level of innovativeness (Koen et al., 2001). Thirdly, Idea Genesis was not significantly better in highly innovative companies. Thus, "ideas are a dime a dozen", meaning that it is how you manage and implement the ideas that is important and that all the companies, highly innovative as well as stagnate, need to improve in this area. Fourthly, Concept and Technology Development was found not to have a significant correlation with the level of innovativeness, which according to Koen et al. (2001) could be the result of participants from highly innovative companies being more critical to the process, than those from less innovative companies. Either way, this could be an area in need of improvement for both types of companies. Finally, the technology development process showed high correlation with the level of innovativeness.

3.1.2 Stages of Evolution in the FFE

Based on their research, Khurana and Rosenthal (1997) defined three levels of maturity stages in regards to the FFE; Awareness, Islands of Capability and Integrated Capability, not including the level where the company has no formal FFE. In the first stage, Awareness, the company is aware of the importance of the FFE activities but has little capability associated with it. Companies who realize the potential of a well-managed FFE and have some of the capabilities, although inconsistently, are in the second stage, Island of Capability. Here, formality improvements of the FFE processes are easier to improve than the gaps in integration, and thus many of the elements of FFE process integration are missing. The last stage is when the FFE is integrated in the product development and is called the Integrated Capability stage. Companies in this stage have all their FFE activities managed as a single process and execute NPD projects faster and better than competitors (Khurana and Rosenthal, 2002).

Companies can climb the "evolutionary FFE ladder" through improving both the formality of their FFE processes as well as improving the integration of activities. Khurana and Rosenthal (1997) argues that evolving from Awareness to Islands of Capability can be achieved through formally and systematically conducting a variety of FFE activities, like planning resources and having an explicit product definition. Generally, Islands of Capability companies should focus on understanding the different dimensions of integration in order to climb to the last stage (Khurana and Rosenthal, 2002).

3.1.3 The Importance of Effective FFE Management

> *"Successful business emphasize the up-front homework steps in the new product process -both market and technical assessments - before projects move into the development phase."*
>
> Robert G. Cooper, 1997

Because of the big impact that the FFE will have on the overall success of a project, increased performance of the FFE will bring significant benefits (Khurana and Rosenthal, 1998) and contribute to new products' success (Kim and Wilemon, 2002). Risks as project delays, not meeting budget and various performance problems in the development phase can be effects of an ill managed FFE (Kim and Wilemon, 2002) and delayed, inefficient or insufficient FFE processes can lead to failures in development and/or commercialization as well as lost opportunities (Kim and Wilemon, 2002).

In order to develop a product, a company needs to know what is to be developed. Hence, the project should be defined in the FFE, and clarifying project requirements is the most important objective in the FFE (Murphy and Kumar, 1997). Khurana and Rosenthal (1997) noted however that most companies fail to generate clear and stable product definitions. Other important variables, like target customer, size of market opportunity and alignment with corporate strategy should be outcomes of the FFE. Khurana and Rosenthal (1998) argued that successful companies create a holistic view during the FFE, meaning that a linkage between a wide range of technical and organizational considerations in relation to business strategy, product decisions and the following product development project is created. Well-defined product concept and clear requirement are very important as the cost of killing an idea in the development phase is high (Kim and Wilemon, 2002). It has also been proven that highly innovative companies are more competent in the FFE (Koen et al., 2001).

Prioritizing the FFE phase and successfully managing it should therefore be of importance to companies. However, managers describe it as the greatest weakness in the product innovation process (Khurana and Rosenthal, 1997). Khurana and Rosenthal (1998) defined several critical success factors related to the FFE based on earlier research, which are represented in Table 3.1.

Table 3.1: Front-End Success Factors. Source: Khurana and Rosenthal, 1998.

	Success Factors
Product Strategy	Strategic alignment between NPD and strategy Product positioning NPD portfolio planning - balance risks and resource availability
Product Definition	Early, sharp definition Preliminary market and technology assessment Detailed customer needs analysis Priorities for product features Recognize need to change definition
Project Definition	Project priorities Resource allocation planning Planning for technical/market contingencies
Organizational Roles	Project manager's role Team organization throughout NPD Organizational communications

3.1.4 Evaluating the FFE of an Organization

Due to the variety of (1) definitions and (2) important aspects of the FFE, there are many ways of evaluating a company's FFE proficiency. A couple of these have been summarized for a diverse portfolio of methods.

Problems in the NPD

Based on previous research, Khurana and Rosenthal (1998) defined several NPD problems related to the FFE, see Table 3.2. By finding the most common problems in the NPD one can then compare them to these problems and thereby find areas of the FFE, which are in need of improvement.

Table 3.2: Common NPD Problems Related to the Front End. Source: Khurana and Rosenthal, 1998.

Problem area	Manifestations
Product Strategy	
Unclear product strategy	Projects not prioritized; Too many "pet" projects Cannot determine whether product fits with firms strategy or not - NPD "illegitimacy" NPD program not given priority
Product Definition	
Inadequate product definition	Continually changing requirements (ambiguity about product features/ technology) Over specification of tolerances
Unresolved technical uncertainties	Experimentation discouraged Technology on critical path
Market/customer needs assessment inadequate	Market not assessed User needs not understood
Project Definition	
Project objectives unclear	Difficulty in making trade-offs while deciding project objectives Too many "pet" projects (with loose justification?)
Shortage of key resources	Right people are not released/assigned for key projects Project selection does not consider prior commitments to new product portfolio
Lack of contingency planning	No backup approaches for risky technology
Organizational Roles	
Roles not clarified early on	Different subsystems do not interface well; problems with product distribution and supply
Executive reviewers do not play leadership role	NPD team members lack direction, make frequent changes to product

Formality and Integration of Activities

In order to diagnose a company's FFE, Khurana and Rosenthal (1997) presented a checklist, which evaluates the level of formality as well as the integration of activities in the FFE, see Table 3.3. The result from this checklist was then added and mapped on the two dimensions, see Figure 3.3. Research has shown that world-class companies score eight or higher on both axis (Khurana and Rosenthal, 2002). This method will indicate at what evolutionary stage in the FFE the company is.

Table 3.3: Checklist for evaluation of the level of formality and integration of activities in FFE. Source: Khurana and Rosenthal, 1997.

Formality of Front-End Process	Integration of Activities
1. Customer and market information is used early on to set scope for product (target markets, customer segments, features, and price).	1. There is a clear vision of product lines and platforms for specific markets.
2. Core team jointly reviews product concept and senior management formally approves.	2. R&D and NPD have matching agendas and plans.
3. Early concept and other feasibility prototypes are planned, tested, and completed at front end so that there are no surprises later.	3. Balance is sought and achieved among multiple NPD projects belonging to different platforms/product lines (e.g. risks, novelty).
4. Product definition is explicitly developed and documented.	4. Project priorities are consistent with product strategy, portfolio plans, and resource availability.
5. Major supplier and tooling considerations are explicit at front end.	5. Resource allocations consider multiple project requirements and their relative priorities and preexisting project commitments.
6. Manufacturing, distribution, and logistics requirements are planned. Product concept is modified to reflect process and logistics constraints.	6. Early identification of technical and organizational interfaces is done for systems products so that development can proceed smoothly.

Continued on next page

Table 3.3 – continued from previous page

Formality of Front-End Process	**Integration of Activities**
7. Need for new technology for products is clearly stated.	7. Core front-end team includes representatives from manufacturing, logistics, and after-sales service, apart from engineering and marketing.
8. Project targets (time, cost, quality) and relative priorities are clear.	8. Staffing policies and project-specific staffing are consistent with the product strategy.
9. Resource requirements are formally defined.	9. Need for new innovations is anticipated so that extensive innovation is not required during the product development process.
10. Roles and responsibilities for tasks and communications for core team are clear and well executed.	10. If there is uncertainty on any dimensions (e.g. technology or markets) organization has carefully planned alternative approach
11. Roles for executive review team are clear and well executed (review criteria, decision responsibility, ongoing interaction with core team).	

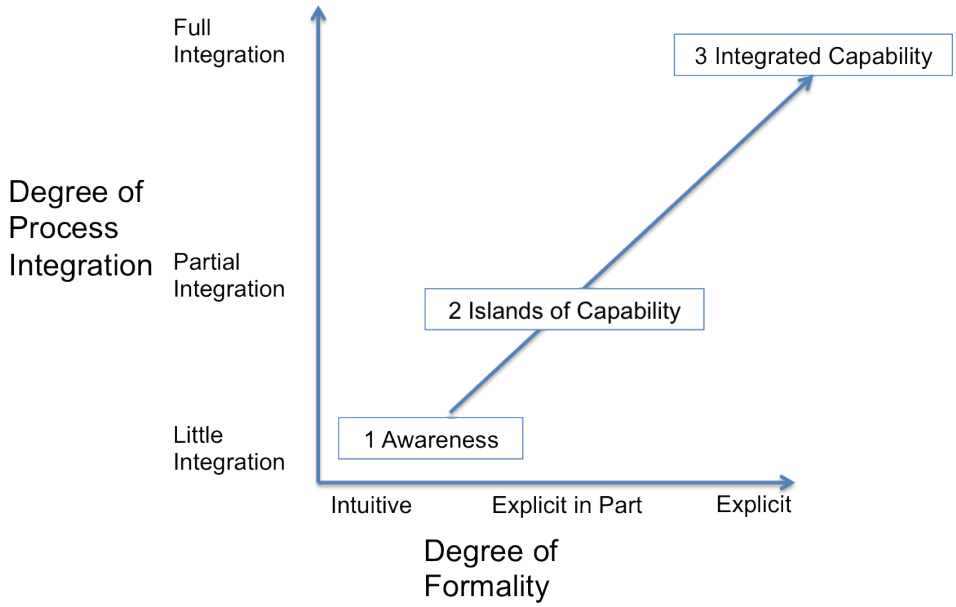

Figure 3.3: Diagram for mapping the organization's evolutionary stage in FFE. Source: Khurana and Rosenthal, 1997.

Proficiency of the NCD

By evaluating the elements and the Engine in the NCD, one can get a clear picture over all the key parts of an organization's FFE status. This evaluation method is directly relatable to innovativeness, as the research conducted regarding the definition of the NCD used innovativeness as a reference point (Koen et al., 2001).

3.1.5 Implementing Effective FFE Management

Due to the importance of the FFE in regards to the efficiency of the new product development (NPD), Kim and Wilemon (2002) presented a selection of methods to improve the management of the FFE, which are described here below.

Assign an Appropriate Individual or Team to Lead the FFE

Due to the variety of aspects associated with the activities in the FFE, such as consumer acceptance and both technical and economic feasibility, it

takes an individual (or team) with a broad range of sufficient knowledge and expertise within the field to manage it effectively (Kim and Wilemon, 2002). Technology, market, resource requirements, company fit and capabilities, as well as company limits, are mentioned as examples of areas of interest.

Support and Commitment

Without an acceptance of failures and an encouragement of employees to come up with new ideas and put them forth, the FFE performance is likely to deteriorate in the long run (Kim and Wilemon, 2002). The support from senior and functional management, together with the time and resources spent, is important for the FFE to be perceived as valuable by the organization. This would symbolize the Engine and the Idea Genesis in the NCD model by Koen et al. (2001). Hence, it is important that senior managers decide which fuzzy ideas to support, so that the necessary resources can be provided as well as a clear vision of the company objectives (Quinn, 1985). Furthermore, Quinn (1985) argues that top executives, who appreciate innovation and manage their company's value system as well as atmosphere in a supportive manner, contribute greatly to continuous innovation within the firm. Project leaders will therefore benefit from knowing how to gain commitment and involvement of management (Kim and Wilemon, 2002).

Acknowledge and Support Product Champions

A particularly important class of people to support is the product champions. Product champions are people who create, define or adopt a new idea. They are sometimes referred to as mavericks, iconoclasts or crusaders, who take risks and transforms companies by turning them upside down (Mohr, Sengupta and Slater, 2009). Product champions can be of great value when it comes to transforming a fuzzy idea into a concept worthy of development and commercialization. Hence, it is important to support them, so that they can persevere despite the frustrations, ambiguities and setbacks which are often accompanied with major innovations (Kim and Wilemon, 2002).

Embrace Uncertainty

Because of the difficulties of determining whether an idea will be a success or a failure, early on in the FFE, companies should consider many alternatives to realizing the idea before finalizing it. This would minimalize the chance of making wrong go or no go decisions. However, it can be time consuming and costly to hold many alternatives too long. Therefore, Kim and Wilemon

(2002) put forward the notion that companies could select a few promising alternatives, and have them compete with each other until a winner concept is recognized. However, they mention that this kind of internal competition in the FFE can be counterproductive. So if used, it should be carefully managed. Referring to the NCD model, this is mentioned in the Idea Selection element, where Koen et al. (2001) argues that ideas must be allowed to grow and advance with less certainty.

In order to be able to manage the FFE one has to understand the causes of fuzziness, i.e. how they affect the FFE and how they are related to each other (Kim and Wilemon, 2002). Furthermore, a considerable amount of information is needed such as how people communicate and interact, how knowledge networks are established, and how decisions are made etc. The latter is of extra importance when it comes to achieving effective performance. Kim and Wilemon (2002) argue that there are two screening phases in the FFE. The first screening is to determine whether an idea begins the FFE or not, whereas the second screening is to determine whether it ends the FFE or not. Two types of errors can be made during these screenings; (1) rejecting an idea that is a possible success, and (2) failing to reject an idea that is a possible failure. A weak evaluation process leads to more type 2 errors, whereas a stronger counterpart leads to more type 1 errors. Hence, one has to get to the bottom with whom or what functional group that is most likely to dominate each screening decision, and what kind of screening criteria that is important in each screening. According to Kim and Wilemon (2002), market potential and/or company fit are especially important in the first screening, whereas competitive reactions, resources, feasibility or profitability are more important in the second one.

Formalize and Create a Holistic FFE Process

In order to reduce uncertainties in the FFE phase, project members should be able to seek relevant information and process it quickly. Organizations should therefore continually gather data regarding changes in technology, markets, internal organizational development and priorities, as well as external development and competitors (Kim and Wilemon, 2002). Organizations should also facilitate easy information transfer within and between functional groups, to minimize misunderstandings and internal resistance to new ideas, see the next section (Kim and Wilemon, 2002).

Research on how a formal process affects the FFE performance is in part

an unexplored area, and it is controversial to say that it is as effective to formalize the FFE as the development phase. However, Kim and Wilemon (2002) argues that formalizing the FFE process has many advantages, and that it can together with information be a cornerstone of managing the FFE systematically. Insights provided by Khurana and Rosenthal's (1998) case studies are the notion that organizations, who take a holistic approach to the FFE, benefit from great success. Here, the evolutionary FFE stages model might provide insight into a company's present formalization and integration, and thereby highlighting means of improvement.

Attain Internal Cooperation and Support

The development phase is characterized by a lot of specialized roles, which are performed by different functional groups. Hence, it is of essence to support cross-functional cooperation in the FFE (Kim and Wilemon, 2002). Early cross-functional cooperation in the FFE minimizes resistance and ambiguity throughout the whole development process, by creating an early understanding of the different functions' capabilities and limitations. It enhances the idea and technology transfer between the functional groups, and leads to better communication and relationships within the company.

Emphasize External Involvement and Cooperation

Studies have shown that innovations can be developed in cooperation with the customers and/or users, and sometimes even by the customers/users themselves (Von Hippel, 1982). In fact, in some industries the main innovator is not the manufacturer but the user (Von Hippel, 1988). Hence, much can be won by communicating with the customers, as it provides the project members with an important insight of the customers' current, as well as future, needs (Kim and Wilemon, 2002). However, according to Cooper (1997), customer focus is lacking in new product projects, and especially in the FFE. By gathering information from focus groups and direct contact with the customers, as well as from interactions with lead users, one gets better at selecting the right ideas, and a shorter FFE phase can be obtained (Kim and Wilemon, 2002). Furthermore, is the Idea Genesis phase of the NCD model likely to get enhanced if customers and/or users are involved (Koen et al., 2002).

Early cooperation with suppliers and intermediaries should also be of interest to the organization, and Kim and Wilemon (2002) highlights three

major benefits. First of all, an acceleration of the project can be achieved, as the participants share the information and problems from the start. This can save a lot of preparation time in their own, as well as joint technologies and requirements. Secondly, because suppliers are proven to be a source of innovation (Van Hippel, 1988), they can help identify problems at an early stage and come up with solutions (Kim and Wilemon, 2002). Thirdly, the project team can get an early and better understanding of the external groups' capabilities.

By seeking horizontal cooperation, such as joint ventures and strategic alliances, the level of fuzziness can be diminished. Furthermore, the exploration of new markets and development of new technology jointly can help maximize the resources from each party, ensuring a more effective outcome. However, factors such as similar development experiences and outcomes, bargaining power and attitudes towards cooperation, to name a few, must be considered (Kim and Wilemon, 2002). Last, but not the least, governmental agencies and universities can be valuable allies, facilitating the value of an idea.

3.2 Culture and Climate

3.2.1 Organizational Culture

Organizational Culture refers to the deeply held, shared and taken-for-granted values and beliefs, as well as the underlying assumptions, expectations, collective memories and definitions that are present in an organization (Cameron and Quinn, 1999; Deshpande and Webster, 1989; Ahmed, 1998). It consists of a deeply rooted set of values and beliefs, which provide norms for behavior in the organization (Mohr, Sengupta and Slater, 2010; Deshpande and Webster, 1989) and a sense of identity to personnel, as well as unspoken guidelines for how to get along in the company (Cameron and Quinn, 1999). Organizational culture helps members of the organization to understand why things happen the way they do (Mohr, Sengupta and Slater, 2010; Deshpande and Webster, 1989). Because the values are so deeply embedded they are often implicit and hard to articulate (Mohr, Sengupta and Slater, 2010) and employees are unaware of it until it is challenged, made open and explicit or until an employee experiences a new culture (Cameron and Quinn, 1999). Organizational culture is undetectable most of the time (Cameron and Quinn, 1999) and its values hard to change (Mohr, Sengupta and Slater, 2010). This becomes a problem when trying to implement or-

ganizational change as these often fail or remain temporary, if a cultural change does not accompany it (Cameron and Freeman, 1991).

Ahmed (1998) divides culture into explicit and implicit culture. Implicit culture refers to the values, beliefs, norms and premises, which determine the typical patterns of behavior by the people, i.e. the explicit culture. It is easier to manipulate the explicit culture, creating organizational procedures and control routines. The degree and extent to which this happens is depending on the strength of the culture, which in turn depends primarily on two things:

1. The pervasiveness of the norms, beliefs and behaviors in the explicit culture, i.e. the proportion of members holding strongly to specific beliefs and standards of behaviors (Ahmed, 1998).

2. The match between the implicit and explicit aspects of culture (Ahmed, 1998).

Culture can also be thought of in terms of cultural norms, essentially varying along two dimensions; intensity and crystallization (O'Reilly, 1989). Intensity refers to the amount of approval/disapproval attached to an expectation, whereas crystallization refers to the level of consistency with which the norm is shared (O'Reilly, 1989). O'Reilly (1989) argues that a strong culture can only exist when both intensity and crystallization exist in consensus, and that is the reason why organizational culture is so hard to develop or change.

Organizational culture can be represented using the competing value framework, see Figure 3.4. It basically consists of two dimensions, emphasis on flexibility and spontaneity i.e. the range from organic to mechanistic processes, and conflicting demands created by the internal organization and the external environment i.e. the emphasis on internal maintenance or on external positioning (Dension and Spreitzer, 1991, Deshpande et al., 1993). From the different quadrants, four types of cultures can be identified; Clan, Adhocracy, Hierarchy and Market (Dension and Spreitzer, 1991; Deshpande et al., 1993). Most companies can and do have elements from several of the different types. However, there will always be one type dominating the others in the company (Deshpande et al., 1993).

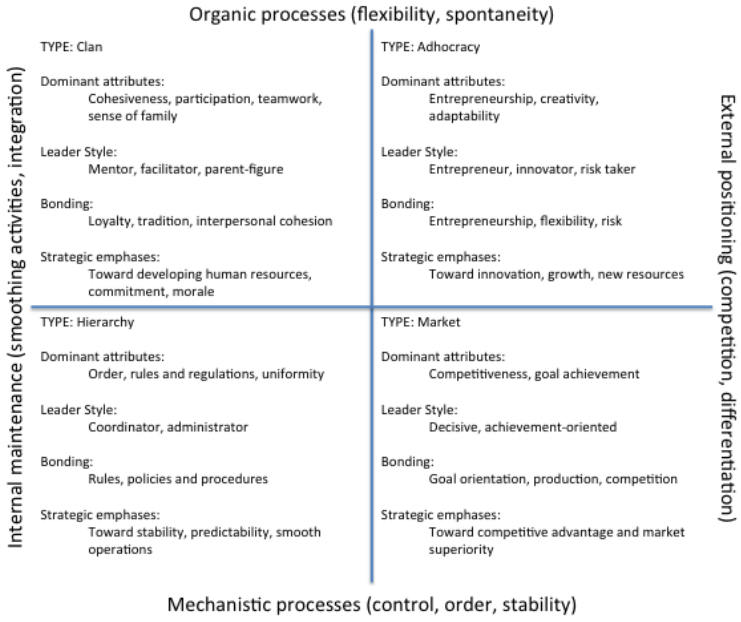

Figure 3.4: The Competing Value Framework. Source: Deshpande et al., 1993.

Organizational Climate

The atmosphere perceived by the employees within the organization through practices, procedures and rewards is called organizational climate (Schneider et al., 1994). It contains the true priorities of the organization and explains how the company runs on a daily basis (Ahmed, 1998; Mohr, Sengupta and Slater, 2010) and is a product of these (Schneider et al., 1994). Climate is created through executive behavior and actions that they reward rather than through what managers, company newsletters or annual reports declare (Schneider et al., 1994). Leaders have therefore a great effect on climate. However, other groups or individuals may have a greater influence on the climate (Ekvall, 1996). One can to a large extent say that climate is the observable manifestation of culture (Sengupta and Slater, 2010), or that it reflects tangibles that produce culture (Schneider et al., 1996). Ekvall (1996) defined climate as an attribute of an organization where a multiple of attitudes, feelings and behaviors characterizes the life in the organization. This

definition of climate denotes that there is, for instance, trust and openness between the members as well as commitment and motivation to some extent (Ekvall, 1996). Ekvall (1996) argues that the climate has a strong effect on many different aspects such as high or low quality of products or services, radically new products or only small improvements, etc. Organizational processes are also affected like decision making, psychological processes of learning, creating etc. (Ekvall, 1996).

Based on previous research, Schneider et al. (1996) identified four key dimensions of climate of which three are related to function and one related to goals. Ekvall (1996) defined 10 dimensions of climate based on theory, field research and experience of consultancy in organizational psychology. The different definitions strongly resemble each other where Ekvall has made a finer distinction of the dimensions. The dimensions are therefore represented together in Table 3.4.

Table 3.4: Dimensions of climate. Source: Schneider et al., 1996; Ekvall, 1996.

The Four Key Dimensions of Schneider et al.	**The Ten Dimensions of Ekvall**
Nature of Hierarchy Are decisions made centrally or through consensus and participation? Is there a spirit of teamwork or is work more or less individualistic? Are there any special privileges accorded to certain individuals, such as management staff?	**Debates** In companies where many voices are heard, and where people are eager to put forward their ideas, the level of this dimension is high. Companies with a low level of debates suffer from people following authoritarian patterns without questioning.

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Table 3.4 – continued from previous page

The Four Key Dimensions of Schneider et al.	**The Ten Dimensions of Ekvall**
Focus of Support and Rewards What aspects of performance are appraised and rewarded? What projects and actions/behaviors get supported? Is getting the work done (quantity) or getting the work right (quality) rewarded? On what basis are people hired?	**Idea Support** The level of idea support is high in an organization where ideas and suggestions are received in a supported way by workmates and managers, and people listen and encourage initiatives, and where the atmosphere is constructive and positive. Low level of this dimension results in fault finding and obstacle rising, which results in every suggestion being immediately disproved.

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Table 3.4 – continued from previous page

The Four Key Dimensions of Schneider et al.	**The Ten Dimensions of Ekvall**
Nature of Interpersonal Relationships Is there trust or mistrust? Are relationships reciprocal and based on collaboration, or are they competitive? Does the organization socialize newcomers and support them to perform, or does it allow them to achieve and assimilate simply by independent effort? Do the individuals feel valued by the company?	**Trust/Openness** In an organization with high levels of trust, employees are willing to put forward their ideas and opinions, and initiatives can be taken without fear of reprisal and ridicule in case of failure, and communication is open and to the point. However, in organizations with low levels of trust, there is a fear of being exploited and robbed of one's good ideas and thus suspicions between people exist. **Playfulness/Humor** I.e. the level of spontaneity and ease that is displayed. High level of playfulness and humor is associated with a relaxed atmosphere where jokes and laughter are present. Organizations with a low level of playfulness are associated with a stiff, gloomy and cumbrous atmosphere. **Conflicts** High-level companies are characterized by elements like plots and traps, and groups or individuals disliking each other, and gossip and slander is present.

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Table 3.4 – continued from previous page

The Four Key Dimensions of Schneider et al.	**The Ten Dimensions of Ekvall**
Nature of Work Is work challenging or boring? Are jobs tightly defined and produce routines or do they provide flexibility? Are sufficient resources provided to undertake the tasks for which individuals are given responsibility?	**Risk Taking** Cautious, hesitant mentality and trying to cover oneself in many ways before making a decision, characterizes companies with low risk taking. High-risk taking companies on the other hand take decisions and actions with haste. **Idea Time** Companies with a high level of this dimension give their employees the time to elaborate, discuss and test new ideas that are not planned or included in the daily work of the employee. Employees at low level companies have their time highly scheduled, making thinking outside the planned routines impossible. **Dynamism/Liveliness** When low level of this dimension is present, there are no surprises, no new projects, no different plans and everything goes its usual way. On the contrary, in companies with high level of this dimension, new things are happening all the time and changing ways of thinking and handling issues often occur. **Challenge** A high-challenge climate is associated with employees experiencing joy and meaningfulness in their job and thereby they invest much energy. A low-challenge climate commonly manifests itself with employees showing lack of interest for the job.

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Table 3.4 – continued from previous page

The Four Key Dimensions of Schneider et al.	The Ten Dimensions of Ekvall
	Freedom The level of independence in which behaviors is exerted. In companies with high level of this dimension, employees make contacts, discuss problems, make decisions, etc. In companies with a low level of this dimension the employees are passive, rule-bound and eager to stay inside established boundaries.

3.2.2 Innovative Culture and Climate

As climate has a strong correlation with processes within an organization (Schneider et al., 1997), one can ask oneself if it inhabits the same influence on innovativeness. As organizational processes such as creating, problem solving, decision-making, etc. certainly has an effect on the products made at a company, they thereby dictate the level of innovativeness of these products. One could then argue that a linkage between innovation and culture exists. Ekvall (1996) indicates this relation through his research in the climate field. He notes that climate is the most crucial variable regarding innovativeness in comparison to three other organizational variables, Formalization, Goal Clarity and Professionalism. Furthermore, he argues that Formalization seems to have a negative effect on innovativeness and that Goal Clarity and Professionalism might have no effect on the innovativeness on their own, but together they seem to reinforce the innovative climate. Based on research related to different industries, Ekvall (1996) links the level of the 10 dimensions to companies that are either innovative or stagnated. He also shows the effect of organizational structure elements and leadership style on climate. This is represented in Table 3.7. It is important to note that a positive effect on Conflicts results in an increase of Conflicts and a negative effect results in a decrease of Conflicts.
The different organizational structure elements are defined as follows (Ekvall, 1996):

- *Centralization* is characterized by top management control, one-way communications and narrow delegations (Ekvall, 1996).
- *Formalization* is characterized by a strict, extensive and crucial system of written rules, complex decision procedures and specific communication channels (Ekvall, 1996).
- *Order and Clarity* is characterized by explicit roles, requirements, instructions, responsibilities, schedules and plans (Ekvall, 1996).
- *Goal Clarity* is characterized by clear goals of the organization, either as a whole or for departments, as well as managers communicating visions, goals and strategies.

Using "cherry picking", i.e. picking the best alternative from the different variables, it is clear that an innovative climate has a high level of all the ten dimensions of climate, except Conflicts. One can also see in Table 3.7 that having a leadership style of Change/Development and an element of Goal Clarity in the organizational structure will influence the climate in the most positive way. Ahmed (1998) defines two basic organizational structures that either hinder or promotes innovation; namely Mechanical Structures and Organic Structures, respectively (Table 3.5 and Table 3.6). One can clearly link the attributes of mechanical structures to two of the different kinds of structure elements that Ekvall (1996) defined, namely Formalization and Centralization, see Table 3.6. The Organic Structure seems however to relate to the dimensions of climate. Deshpande et al. (1993) showed that two of the four culture types, Market and Adhocracy, were associated with the best performance. This, together with the link between innovativeness and organizational performance (Deshpande et al., 1993), hints that these cultures are better suited for innovation. Linking Ahmed's (1998) organizational structures to Deshpande et al. research one clearly notes that Ahmed's Organic Structures (promoting innovation) are represented in the Adhocracy type, and that the Mechanical Structures (hinders innovation) are represented in the hierarchy type. However, the market type, which showed the greatest performance had mechanical structures, whereas the clan type, which had the second lowest performance, had organic structures. This could prove that external positioning has a much greater effect on innovativeness than what organizational structure has. However, Deshpande et al. (1993) noted that the research was only conducted at Japanese firms, meaning that a specific national culture was also present, which most likely affected the outcome of the study.

In 1997, Judge et al. presented the findings of their study, comparing the R&D culture and climate between innovative and less-innovative companies, which strengthened a lot of Ekvall's (1997) dimensions. They claimed that innovative companies acted as focused communities rather than traditional bureaucratic departments, valuing the social side as much as the technical side of the organization, trying to promote a sense of sharing and togetherness as much as nurturing technical abilities and expertise. This is in line with the dimensions Playfulness/Humor and Conflicts, and they concluded that the key distinguishing factor between innovative and less-innovative companies is the ability of management to create a sense of community in the workplace. More specifically, highly innovative firms emphasize operational autonomy but retain strategic autonomy for top management, e.g. top management sets the goals to be achieved but then provide freedom to individuals to be creative in the way they achieve the goals, which is in line with Ekvall's (1997) dimension of Freedom. Furthermore, they appear to emphasize personalized intrinsic rewards for individuals as well as groups, whereas their less innovative counterparts tend to rely almost exclusively on extrinsic rewards, see the dimension Idea Support. They also linked slack, i.e. spare time and resources, and future expectations of uninterrupted slack to innovativeness, as it provides scope for the organization and its members on a continual basis to take risks that they would not take under conditions of no slack, or interruptions in slack. Once again, strengthening two of Ekvall's (1997) dimensions, namely Idea Time and Risk Taking.

People play a role in the organizational culture, and hence organizations have to consider what type of employees that can most effectively drive innovation, and what motivates this type of employee (Ahmed, 1998). According to Ahmed (1998) it appears to be a general agreement that personality is related to creativity, and from a diverse range of research (psychology to management) it has been found that some personality traits are more desirable to the innovative organization. However, solely recruiting people with creative personality traits is hardly likely to be any more useful than picking leaders through the use of trait theory approaches. Nevertheless, it is important to support and nurture the individual employees and their creative characteristics, such as the ones listed below:

- High valuation of aesthetic qualities in experience
- Broad interests
- Attraction to complexity

- High energy
- Independence of judgment
- Intuition
- Self-confidence
- Ability to accommodate opposites
- Firm sense of self as creative (Baron and Harrington, 1981; Ahmed, 1998)
- Persistence
- Curiosity
- Energy
- Intellectual honesty (Amabile, 1988; Ahmed, 1998)
- Internal locus of control (reflective/introspective) (Woodman and Schoenfeldt, 1990; Ahmed, 1998)

It has been proven that people respond positively when they are faced with a challenging task, given that they are provided with sufficient scope to generate novel solutions, and that open ended, non-structured tasks engender higher creativity than narrow jobs (Shalley and Oldham, 1985; Ahmed, 1998). Shalley and Oldham (1985) claims that it is not the individual who lacks creative potential, but it is the organizational expectations that suppress the individual's inclination to innovate.

Table 3.5: An organic structure enhance innovation. Source: Ahmed, 1998.

Organic structures
Freedom from rules
Participative and informal
Many views aired and considered
Face to face communication, little red tape
Inter-disciplinary teams, breaking down departmental barriers
Emphasis on creative interaction and aims
Outward looking, willingness to take on external ideas
Flexibility with respect to changing needs
Non-hierarchical
Information flow downwards as well as upwards

Table 3.6: Mechanical structures hinder innovation. Source: Ahmed, 1998.

Mechanical structures	Structure elements
Much information flow upwards, directives flow downwards Hierarchical Little individual freedom of action	Centralization
Bureaucratic Many rules and set procedures Long decision chains and slow decision making Communication via the written word Formal reporting Rigid departmental separation and functional specialization	Formalization

Table 3.7: Innovative vs. Stagnated organizations. Source: Ekvall, 1996.

	Type of organization		Level of effect on climate dimensions from Leadership style in relation to each other			Effect on climate dimensions from organizational structure			
Climate dimensions	Innovative	Stagnated	Change/ Development	Employee/ Relations	Task/ Structure	Centralization	Formalization	Order and clarity	Goal Clarity
Challenge	High	Low	Highest (positive)	Medium (positive)	Lowest (positive)	Negative	Negative	Positive	Positive
Freedom	High	Low	Medium (positive)	Highest (positive)	Lowest (positive)	Negative	Negative	None	Positive
Idea support	High	Low	Highest (positive)	Medium (positive)	Lowest (positive)	Negative	Negative	Positive	Positive
Trust/ openness	High	Low	Medium (positive)	Highest (positive)	Lowest (positive)	Negative	Negative	Positive	Positive
Liveliness/ Dynamism	High	Low	Highest (positive)	Medium (positive)	Lowest (positive)	Negative	Negative	-	Positive
Humor/ Playfulness	High	Low	Highest (positive)	Medium (positive)	Lowest (positive)	Negative	Negative	-	Positive
Debates	High	Low	Highest (positive)	Medium (positive)	Lowest (positive)	Negative	Negative	-	Positive
Conflicts	Low	High	Medium (negative)	Highest (negative)	Lowest (negative)	Positive	Positive	Negative	Negative
Risk taking	High	Low	Highest (positive)	Medium (positive)	Lowest (positive)	Negative	Negative	-	-
Idea time	High	Low	Highest (positive)	Medium (positive)	Lowest (positive)	Negative	Negative	-	Positive

3.2.3 Creating a Climate and Culture for Innovation

Organizations are made up by the people within them, and if the employees don't change, organizational change cannot happen (Schneider et al., 1996). Structural changes, like changes in hierarchy, technology, etc., are only effective to a level that is associated to the changes in psychology of the employees (Schneider et al., 1996). Consider for instance the most difficult change that AT&T had to make in the early 1980's, where they had to change the psychology of their employees from a "we know best and have monopoly" attitude to a more humble attitude of customer and competitor insight (Schneider et al., 1996). Schneider et al. (1996) argues that there can be no sustained change without changing the psychology of the employees. To bring about these changes of employee psychology one has to change the beliefs and values of the employees (Schneider et al., 1996). This implies that the culture must be changed, as the culture is made up by deeply held values and beliefs (Mohr, Sengupta and Slater, 2010; Deshpande and Webster, 1989; Schneider et al 1996), i.e. the collected psychology of the employees. Schneider et al. (1996) propose that cultural changes can be achieved through changes in climate. The linkage between organizational change and organizational climate is thereby confirmed. More specific, if you want to make an organizational change in order to become more innovative, the culture should be changed to match the organizational change. This can be done by manipulating the climate to break down typical organizational barriers such as "one correct answer" thinking, failing to challenge the obvious, pressure to conform and fear of looking foolish (Ahmed, 1998) and challenging the status quo, this way eliminating classical killer phrases (Ahmed, 1998) such as, "it will cost too much", "we have never done things that way" and "if it's that good, why hasn't someone thought of it before?"

Challenge and Freedom

Balanced autonomy is defined as having control over means as well as the ends of one's work (Judge et al., 1997). There are two types of autonomy, strategic and operational. Strategic autonomy refers to the freedom of setting one's own agenda, while operational autonomy concerns the freedom to attack a problem set by the organization, in an individual way. Hence, operational autonomy encourages and promotes entrepreneurial spirit, whereas strategic autonomy has more to do with the level of alignment with organizational goals. Giving too much strategic autonomy makes the employees lose track of focus, ultimately leading to less innovations. In contrast, hav-

ing too little operational autonomy also affects innovativeness negatively, as too rigidly specified instructions and control hinder creativity and leads to a bureaucratic atmosphere. Hence, firms need to find a balance between strategic and operational autonomy.

Dynamism/Liveliness

Tiresome bureaucratic procedures create bottlenecks which suffocates attempts at innovation (Ahmed, 1998). In fact, a large proportion of suggestion schemes appear to fail not because there is a lack of ideas but because of time-consuming processes and structures, which are so burdensome and unwieldy that they create high level of unresponsiveness. It is up to the leaders to re-engineer out unfruitful elements of bureaucracy, and replace them with a climate for innovation (Ahmed, 1998).

Idea Support

Leadership commitment to innovation is of little value without an organizational structure that promotes interaction and involvement of the employees (Ahmed, 1998). Hence, it is important to create a physical environment with awards, quality circles and special recognition schemes that encourage to actively participating in the innovation program.

Rewards can be either extrinsic or intrinsic (Judge et al., 1997). Extrinsic rewards consist of material rewards, such as higher salary and bonuses, whereas intrinsic rewards are based on internal feelings of accomplishment by the recipient. For example, being personally thanked by the CEO or recognized by the peer group. It appears that people motivated by intrinsic rewards are more creative than people motivated by extrinsic rewards, as people motivated by extrinsic rewards tend to focus on getting the rewards rather than unleashing their creative potential. Furthermore, extrinsic rewards appear to promote competitive behaviors which disrupt workplace relationships, inhibit openness and learning as well as discourage risk-taking (Judge et al., 1997) as this might be negatively evaluated (Ahmed, 1998). However, extrinsic rewards have to exist at a base level, ensuring that individuals are at least comfortable with their salary in order to make them motivated at all.

Trust/Openness

For employees to be creative and innovative, they have to understand the value of the innovation agenda, and how far they are being empowered to achieve its goals (Ahmed, 1998). Hence, it is of great importance that management explicitly defines the domain of action and priority, as well as the level of responsibility and empowerment provided. This is often done through statements of mission and vision (Ahmed, 1998). Devised correctly, they can act as powerful enablers. Incorrectly, they can cause just as much damage, breeding cynicism and discontent.

Playfulness/Humor

With a recruitment process that ensures social "fit" beyond technical expertise and a well-designed integration and socialization process, highly innovative companies create group cohesiveness and environments of cooperation (Ahmed, 1998). Furthermore, they appear to have more reasonable goal expectations, not overloading individuals with too many projects, as that creates time pressures which militate strongly against innovativeness. Less innovative firms on the other hand appear to be concerned about explicit, aggressive individual goals, creating environments of independence (Ahmed, 1998).

Risk-Taking

Without a defined risk tolerance, employees tend to be unwilling to try and innovate (Ahmed, 1998). They need to know the level of risk acceptable in the company, in order to define the space within which they are allowed to act in an empowered manner, i.e. to what extent they can focus on pet projects instead of routine operations. Together with an understanding of the penalties if their traditional tasks are neglected, they get a clear definition of the priority and space for innovative actions (Ahmed, 1998). The best way for leaders to define the action space is to stipulate a broad direction which is consistent and clear, and place trust in employees'ability to stretch out to go goals, rather than provide them with detailed specifications of how to achieve the goal.

Idea Time

Slack is the cushion of resources which allows an organization to adapt to internal and external pressures, and has been positively correlated to

innovation (Ahmed, 1998). However, it is not just the existence of slack but the existence of slack over time that appears to have a positive effect on innovation (Judge et al., 1997). Hence, one should generate a base-line stock of slack in a variety of critical resources, such as time and funds for new projects.

3.3 Summary of Theory

In the previous theory part, four important links have been identified, (1) proficiency of the FFE has a positive effect on innovativeness, (2) culture has an effect on the FFE proficiency, (3) organizational change cannot fully happen without a change in culture and (4) in order to change the culture one can manipulate the climate. These links are represented in Figure 3.5.

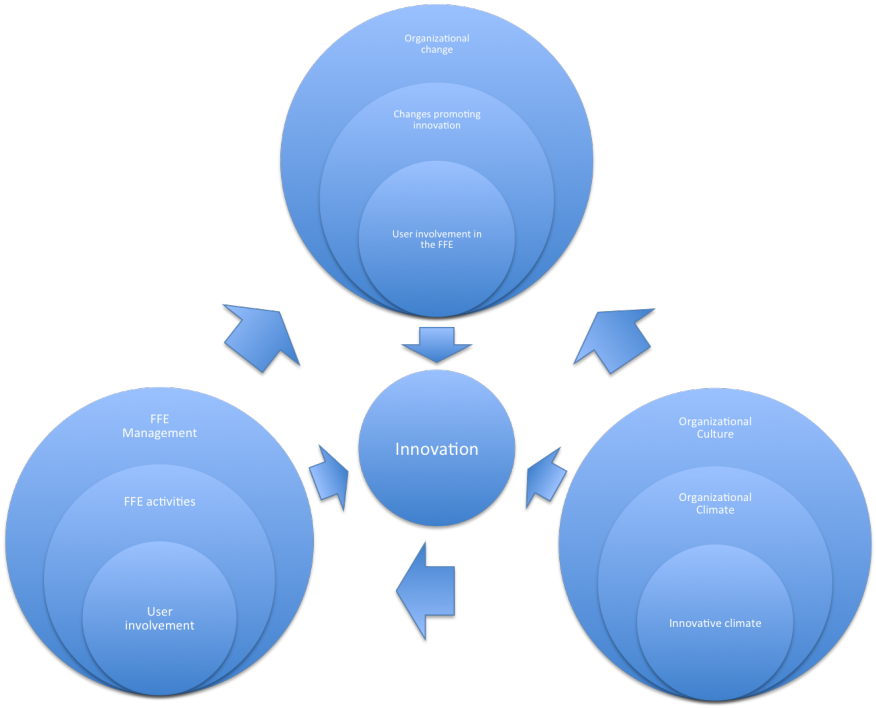

Figure 3.5: Links between the different parts of theory

Implementing user involvement in the FFE at a company that has none of it at the moment is certainly an organizational change of magnitude. Many things need to be reconsidered such as, what users does the company

have, which users should take part in what studies, how should concepts be validated and so forth. Although these things are important it has been identified that this kind of an organizational change should be accompanied with an evaluation and, if needed, a change in culture. As user involvement is an organizational change, which is implemented to better serve the true needs of the end user in a way that traditional market research cannot, its consider as a change promoting innovation. This together with the activities in the FFE should emphasize creativity under uncertainty. Since it is in the FFE where the ideas for new products are generated an innovative culture is a prerequisite in order to generate novel and innovative products and support the new stream of ideas generated from the process. As the user involvement is to take place inside the FFE, companies should also consider how evolved their FFE is. Chances are, that a company has a proficient NPD but lacking in the FFE. Improving one's FFE could therefore bring new success and even more innovative products. These insights have provided the basis for the iterative process that should be conducted preferably before or together with the user involvement implementation. It consists of three steps, see Figure 3.6, which needs to be visited more than once especially for the culture part as the culture takes a long time and is hard to change.

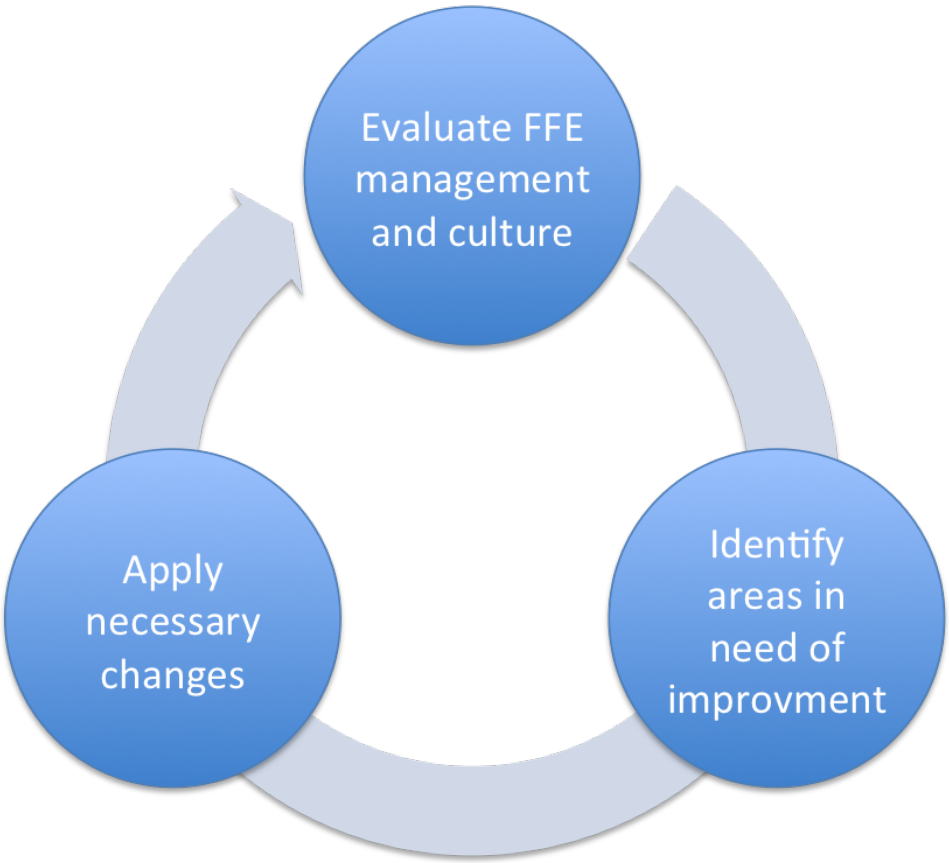

Figure 3.6: Iterative process creating innovative culture and proficient FFE management (Bosson & Nilsson, 2011).

- First of all, a company needs to **evaluate** its present FFE management and Culture. However, because the Culture is hard to measure, the authors propose that an evaluation of the climate will give an adequate indication of the culture. If the culture one is interested in evaluating is an innovative culture then the survey provided by Ekvall (1996) should be chosen as it evaluates the innovative climate. The proficiency of the FFE can be evaluated in numerous ways, the authors propose that attacking from two angles should provide the best result, one which evaluates it from within the FFE, in this case evaluating the NCD (Koen et al., 2002) and measuring the formalization and integration (Khurana and Rosenthal, 1997), and one outside the FFE linking problems in the NPD with shortcomings in the FFE.

- When the evaluation is complete one needs to **identify** the areas of improvement by for example benchmarking the climate against innovative companies' climates. The areas found can then be prioritized in different ways depending on what the organization values most. However it is important to note that prioritizing in regards to the climate could result in negative results, this because you often have to address all the areas in order for the culture to change. Additionally if a dimension is considered adequate one can forget to continue promoting it, which could result in it decaying over time.
- The most challenging part is probably **applying** the changes, for FFE management, company policies can quite easy be set up in order to improve the proficiency. However, the current culture can disrupt these changes and employees can be unwilling to adapt to them. It is clear that applying changes to the climate in order to change the culture is an grueling task which needs extensive founding and time, one important thing to remember here is to be patient and persistent.

It is important to note that it is in one sense an iterative learning process, were managers and leaders will learn which changes in climate will give good results. Some ways of changing it has been identified in theory and discussed in the previous section, however, managers and leaders should regard these as starting points and find there own ways in promoting the dimensions.

Chapter 4

Case Study

This chapter describes TechCo. It starts with an introduction of the company. TechCo's innovation process is then described, followed by their existing user involvement, sales organization, information and idea dissipation as well as their climate and culture as well as the results from the CCQ.

4.1 The Company

TechCorp was founded in Sweden in the beginning of the 20th century (TechCorp, 2011). The company is owned by the public limited company InvestCo plc since the first half of the 1990s (TechCorp, 2011) and had more than one billion GBP in revenues in 2010 (InvestCo, 2011). TechCorp consists of three business units (BU), 1, 2 and 3. Figure 4.1 depicts the organization. BU 1 produces manual and automated tools for the engineering market where TechCo is a sub-division creating manual products. BU 2 produces materials (consumables) needed when using products from BU 1 or other similar products.

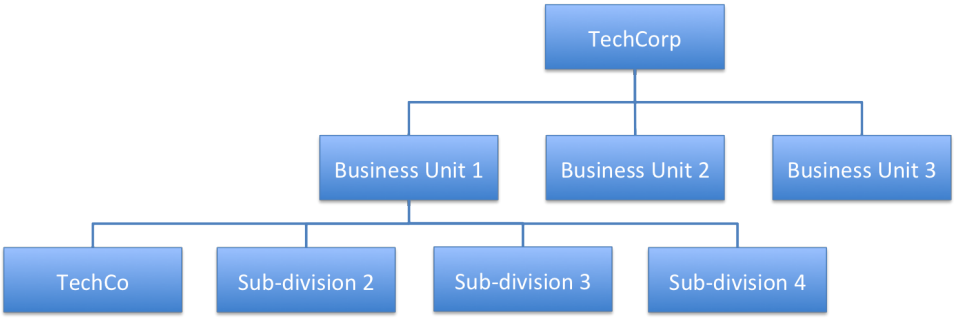

Figure 4.1: TechCorp's structure (Industrial Design TechCo, 2011)

With over hundred years of experience within the engineering industry, TechCorp is "a world leader within its market and an international supplier of products, know-how and services that none can match" (TechCorp, 2011). The organization has always had a strong technical interest, and today the company has the vision "to be the global leader, to be our customers' preferred partner and the global authority within the engineering market" (TechCorp, 2011).

However, in later years TechCorp has fallen behind in the manual market, i.e. in TechCo's market (Industrial Design, Marketing and R&D TechCo, 2011). TechCo's products are neither the most technical advanced nor the most user-friendly products anymore (Industrial Design, Marketing and R&D TechCo, 2011). TechCo has been caught in a vicious circle, where time is scarce and the company has lost confidence in its internal ability to create novelty, and instead just try to cope with what the competitors come up with (R&D TechCo, 2011).

TechCo reorganized in 2010, as all marketing and R&D was moved to western Sweden as well as a global purchasing department was created, in order to create a more centralized organization (Marketing and R&D TechCo, 2011). Before the reorganization, both marketing and R&D was conducted regionally at three different places, which resulted in a lot of similar products being developed and produced throughout the world (R&D TechCo, 2011). This left the product portfolio filled with somewhat duplicates of the same products, creating unnecessary development costs for the global organization. The reorganization has been very time consuming. About half of all the people in the new centralized marketing and R&D departments are fairly new to the organization, and therefore has a lot to learn. Hence,

TechCo stands in front of a great challenge, integrating the new employees and trying to ignite the creative spark, at the same time as the everyday chores must be performed.

However, TechCorp has a strong brand with high credence, closely associated with high quality and the best consumables in the world (Marketing and R&D TechCo, 2011). Hence, TechCo has the opportunity to live up to its vision, and become the global leader within its market.

4.2 The Innovation Process

TechCo's innovation process is divided into four project types, launch, module, technology and concept projects. Launch projects often consists of a variety of module projects and should deliver a marketable product (Internal Document TechCo, 2011) and is initiated by the product roadmap (see Section 4.2.2)(Marketing TechCo, 2011). Launch projects and module projects follows the PDM process presented in Section 4.2.1.

Technology and concept projects follows a subprocess of PDM (Internal Document TechCo, 2011) and are initiated by the technology roadmap (see Section 4.2.2). Technology projects are meant to bring new technology to the R&D community where concept projects are meant to bring verified concepts to the R&D community for usage in launch or module projects (Internal Document TechCo, 2011). It is important to note that technology, concept and module projects are initiated continually and not only before a launch project.

To what extent TechCo recognizes this as their innovation process is however unclear, Figure 4.2 therefore depicts the authors interpretation of TechCo innovation process.

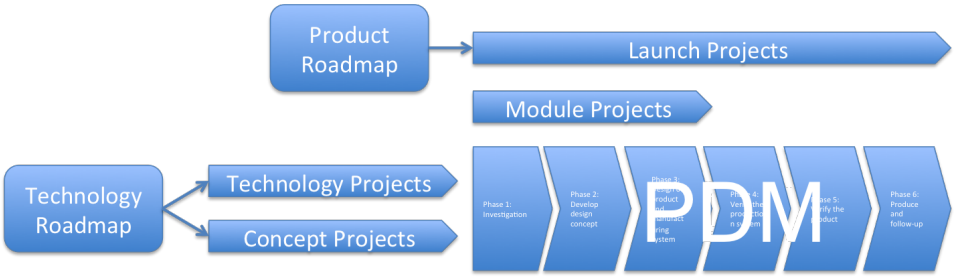

Figure 4.2: TechCo's innovation process (Bosson & Nilsson, 2011). Inspired by Internal Document TechCo, 2011

4.2.1 PDM

TechCo's development process, PDM (short for product development manual) is a traditional stage-gate process, originally developed for launching projects at a production site in Sweden and is used for two different types of projects, namely launch projects and module projects (Internal Document TechCo, 2011). Launch projects should bring marketable products, i.e. DP 5 status, and module projects should deliver a part of a system or product to DP 3 status. Module projects are to a greater extent R&D's responsibility from beginning to end, and can be commenced as a result of technology development or a launch project (Marketing TechCo, 2011). A overview of the PDM process is represented in Figure 4.3.

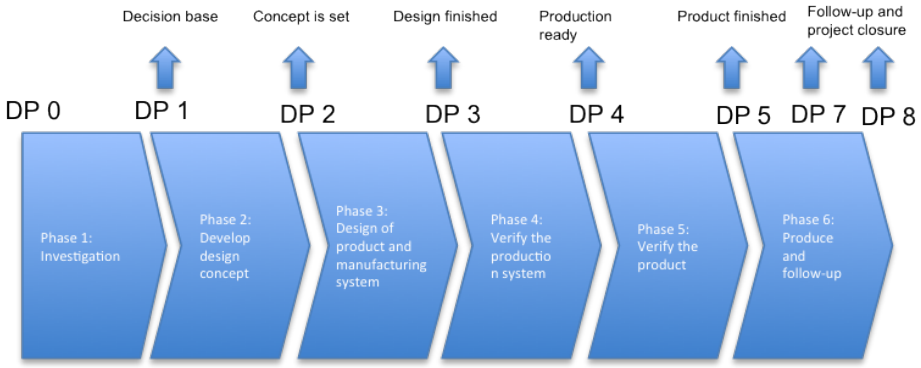

Figure 4.3: PDM. Source: Internal Document TechCo, 2011.

In order to enter *phase 1*, decision point (DP) 0 has to be approved by the global R&D department. DP 0 is based on a business development

request (BDR) which contains information about the expected amount of sales, technical risk and primary market segments etc. The information is to a large extent based on the sales organization's input. The input could for instance be, a certain product's price limit. The R&D department has never turned down any project at DP 0. One interviewed employee noted that the low rejection rates could be an effect of the marketing department self-screening its ideas, so that bad ideas never reached R&D.

> *"I have understood that one have never said no to something at DP 0... maybe that's the way it always is, and bad ideas never reaches here..."*
>
> Marketing TechCo, 2011

When DP 0 has been approved, phase 1 is initiated and the marketing department starts an investigation, covering areas like the product's marketing possibilities and effect on other products (Internal Document TechCo, 2011). A market product specification (MPS) should be realized so that R&D in turn can construct a product requirement specification (PRS) in phase 2. Furthermore, a business case is also constructed. However, this business case rarely hits the mark, some projects cost much more, whilst generating less then anticipated and vice versa (Marketing TechCo, 2011). In order to make it more reliable, sensitivity analysis has recently been implemented (Marketing TechCo, 2011). The MPS lists all the demands and wishes of a product from the market, as well as the legal constraints that must be followed in order to sell the product on a specific market (Marketing TechCo, 2011). The information is acquired from sales personnel, customers, competitors and users, where benchmarking against competitors is used extensively.

All the demands, wishes and complaints are reinterpreted to need-descriptions, which must be met by one or many products. The specifications are as loosely defined as possible, so that R&D's creativity won't be stifled, except in cases where marketing knows that the product has to be in a certain way in order to be marketable (Marketing TechCo, 2011). R&D is present when the MPS is created in order to assure that the specifications are feasible and to suggest finished functions that they want to add into the product. The MPS has recently undergone some changes as there only existed a hybrid MPS/PRS document before (Marketing and R&D TechCo, 2011). This was an effect of the old organization as the R&D department was in charge of phase 1 as there was no marketing department (R&D TechCo, 2011). The

old document described needs as well as technical requirements, whereas the new MPS consists of need-descriptions alone. Easy to carry, environmentally friendly etc. are examples of need-descriptions that could be presented in a MPS (Internal Document TechCo, 2011)

Manufacturing, distribution and logistics are considered early on, whereas the location for production is left open. This is due to the reorganization of the production facilities, as TechCo has the plan to make all the production sites identical (Marketing and R&D TechCo, 2011), making the choice of production site redundant (Marketing and R&D TechCo, 2011).

Phase 2, the conceptual phase, starts when DP 1 is approved by R&D. The main objective of this phase is to confirm the requirements as technically possible (Internal Document at TechCo, 2011) as well as settling patent issues. In this phase the PRS is constructed by the R&D, based on the MPS. Communication is frequent between marketing and R&D for clarifications, validation of requirements in relation to the MPS as well as decision making (Marketing TechCo , 2011).

> *"When they start writing their requirement specification over there, that's when they come back with the question, but can we do like this? You say that you want a concept like this, but that means that either this solution or that or that and they get completely different, with those cost demands you got, super cheap, then we can't take solution one and two but only solution three. Ok, but, we say, we think that solution two is much more interesting, yes but then you will have to pitch in, then you have to be able to sell it for a little bit more money and get a little bit more cost for us to move with."*
>
> Marketing TechCo, 2011

Concept analysis is conducted by R&D to further validate that the MPS is technically feasible, which can be done by building "heaps" (R&D TechCo, 2011). Phase 2 ends when a clear and feasible PRS is finalized.

During *phase 3*, detailed design drawings for the products are created, and no further development is carried out after this stage (R&D TechCo, 2011). Prototypes are built and tested in order to validate that the product is in line with the PRS as well as the standards of the industry and TechCo. It

is hard to stop a project once it enters this phase (R&D TechCo, 2011).

Formality and Integration of Phase 1 and 2

Using the checklist from Khurana and Rosenthal (1997) the formality and integration of phase 1 and 2 was measured. However, the opinions on how things were actually done differed amongst Marketing and R&D. A worst case and a best case has therefore been created, depicted in Figure 4.4. When answering the checklist, discussions erupted amongst the participants as uncertainties arose between them.

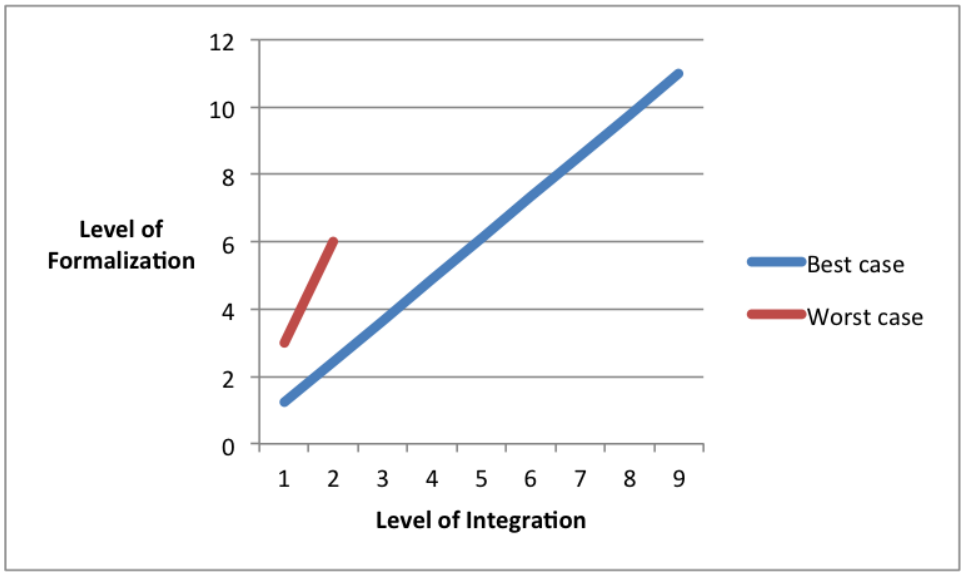

Figure 4.4: Best and worst case level of formalization and integration.

4.2.2 Product and Technology Roadmaps

In order to shorten the time to market (TTM) for launch projects and make the TTM more estimable and accurate, product and technology roadmaps are used (R&D TechCo, 2011). The roadmaps are tools for long term planning of the product range and technology development, so when a launch project is started, the required technology is already adopted by the company. This way, TechCo can avoid unnecessary uncertainties during the launch project, and hence be more confident in planning a product release date. However, this has not been the case in recent projects, where the

launch projects have been initiated without the new technology at hand, resulting in project delays (Marketing TechCo, 2011).

The product roadmap should stretch for three to five years and is constructed by the Portfolio Management & Marketing team (Marketing TechCo, 2011). The requirements of the first year are fixed, whereas the following years can be changed in accordance with new market requirements, new capacity constraints and so forth (Marketing TechCo, 2011). However, according to R&D, the product roadmap only stretches for one year in practice (R&D TechCo, 2011). Before a launch project is started, in accordance with the product road map, a pre-study resulting in a BDR is started which in turn moves the launch project into PDM (Marketing TechCo, 2011). The descriptions of projects in the product road map are brief. However, complementary presentations exist in order to present the projects to management (Marketing TechCo, 2011).

Based on the product road map and other in-house ideas, the technology road map is created. In-house ideas are often generated through problems being translated into opportunities (R&D TechCo, 2011). Employees can formally submit an idea of a project to the technology council via a project proposal (Internal Document TechCo, 2011). If approved by the technology council, the project is added to the technology road map (internal TechCo document). Technology projects and concept projects are then initiated according to the Technology road map. The New Technology department and product development are then responsible for running the projects (R&D TechCo, 2011).

Project closing is decided by the technology council (Internal Document TechCo, 2011). Technology and concept projects should only enter PDM if deemed ready for development and of course valid for a certain launch or module project in order to shorten the TTM (R&D TechCo, 2011). For concept project this means, DP 2 status.

Module projects are not only initiated through launch projects. As they can be initiated continuously in accordance with the roadmaps so that when a launch project is started, finished modules already exists (R&D TechCo, 2011).

4.3 User involvement

In phase 1 and 2 of PDM, user involvement is scarce. However, valuable user insights are acquired through pro product testers (Marketing and R&D TechCo, 2011). These testers are highly skilled and have great knowledge of the engineering industry that TechCo caters to (R&D TechCo, 2011). They are employed by TechCo and used in order to validate the technical properties of the new products and assisting in benchmarking TechCo's own products with the competitors' products. When creating a new product, they are involved from phase 1 until phase 4 where validation of the product is conducted (R&D TechCo, 2011). They are never directly involved before the concept has been set (after DP 2), though indirectly in the form of inputs such as "this product is good/bad" and "you ought to take a closer look at that product" etc. (Marketing TechCo, 2011). These testers have a great deal of influence concerning the products technical attributes, but less concerning their design (R&D TechCo, 2011). When the product is done, TechCo has it critically examined and tested, before it sets out for mass production (Marketing and R&D TechCo, 2011). First by the pro testers, and secondly by well selected customers, which understand the value of close cooperation and treasures the integrity of TechCo (Marketing TechCo, 2011). When the pro testers have had their saying, the product is either a target for improvements or directly shipped out to the testing customers. No product is ever sent to customers for testing without the approval from the pro testers (R&D TechCo, 2011).

Indirect user involvement in the form of complaints transformed into potential product improvements are also used in phase 1 and 2 of PDM (Marketing TechCo, 2011). It is suspected by marketing that information is lost throughout the communication chain from customer to TechCo, especially from the sellers to the marketing department (Marketing TechCo, 2011).

Efforts have been made in order to enhance the user involvement outside of PDM by incorporating insight from user studies in conceptual development (Industrial Design TechCo, 2011). These studies would bring TechCo closer to its end users and provide valuable insight to the customers' actual needs. Relying on market input and customer complaints alone could be contra productive as described further by an employee.

> *"You get feedback of something, but not of the full picture. And then you just sub optimize the next solution, and you make the*

> *whole thing worse. If you don 't understand the real usage, then these things can really happen. And I 've seen this before, and they end up, the organization takes this kind of survival mode, going like wow, they always complain. There 's no solution to that problem, because nobody ever takes the effort into asking what actually is the problem?"*
>
> Industrial Design TechCo, 2011

Although the attitude to this new way of working has been rather chilly, there already seems to be a mutual recognition of the importance of customer visits (Industrial Design, Marketing and R&D TechCo, 2011). Customer visits provide TechCo with useful insights. Additionally it will also give the customers a feeling of value and importance, that TechCo really listen to them and put a lot of effort into understanding their situation (Marketing TechCo, 2011). Such a customer would not likely change to another brand (R&D TechCo, 2011). However, consideration must be taken not to create expectations of things to come, as certain features might never be realized.

4.4 Sales Organization

TechCo sells its products through distributors (Marketing TechCo, 2011), subsidiary companies and direct sales (R&D TechCo, 2011) all of which denoted here as sales organization. The sales organization sells equipment as well as consumables (Marketing and R&D TechCo, 2011).

TechCo acquires a lot of their market information from the sales organization, i.e. what the customer wants and needs and how much they are willing to pay for it. Opportunities can therefore be lost if sellers only focus on things that they believe will affect their sales and ultimately their earnings (Marketing TechCo, 2011). Unfortunately the sellers have no way of perceiving the global demand, thus, customer ideas and requests could be lost as the seller does not perceive an adequate demand in his market (Marketing TechCo, 2011). However, if the same request presents itself in many regions, the demand would be attractive to TechCo, as TechCo caters to the whole world (Marketing TechCo, 2011).

The sellers often integrate with customers when selling consumables, as these are sold on a more frequent basis than machinery. If synergy could

be obtained between TechCo and BU 2 more insights would be obtained (Marketing TechCo, 2011).

> *"...our advantage is that we are often at the customer, because the customer of course needs [a specific type of consumables] at regular intervals, while a machine, they buy maybe once every two years, every four years. Between those events we're at the client delivering consumables, and there we have many opportunities to listen to the customer if he is satisfied with the product and check if there is something new going on, if he has a need for new machines? Is any investment underway? But that synergy effect We can not do."*
>
> Marketing TechCo, 2011

4.5 Information and Idea Dissipation

The sales organization has a special communication channel called TechCo Cares where the sales organization can put forward their ideas, problems and suggestions of improvements to TechCo. However most of these matters concern logistics instead of innovative ideas (Marketing TechCo, 2011). Product related issues are either solved directly by Product Care or put forward as a product improvement which could then be used in phase 1 of PDM or in future projects. However, it has ben noted that no formal forum is present to handle these issues. Instead the matters are sorted and and then checked off resulting in some kind of "wish list" (Marketing TechCo, 2011).

It has been explicitly noted that TechCo is bad at saving and sharing ideas throughout the whole company, i.e. take advantage of the whole company's shared knowledge. No process is present for synchronization between the departments when it comes to ideas (Marketing TechCo, 2011) and no formal forum or idea bank is present on a company or a global level, although ideas of them have been discussed (Industrial Design TechCo, 2011). One employee noted that people have good ideas but they are not made use of.

> *"...there's ideas-men, there are good ideas, people inside R&D have of course ideas, but it is not taken further..."*
>
> Marketing TechCo, 2011

There seems however to be indications of local idea banks and brainstorming sessions around the company (Marketing and R&D TechCo, 2011).

4.6 TechCo's Climate and Culture

The past years have been turbulent for TechCo, as the company has undergone a major reorganization as well as a massive recruitment of new personnel (Marketing and R&D TechCo, 2011). This has been difficult to cope with, as even the managers did not fully grasp the new way of working, and thus was not able to coach the staff in an optimal way (R&D TechCo, 2011). A lot of time has been spent on creating the new organization (Marketing TechCo, 2011) as well as integrating the new personnel (Marketing and R&D TechCo, 2011). The work was further hampered by a "we know best, so dont tell us what to do" mindset among members of the old R&D department (R&D TechCo, 2011). Additionally, there was a manager with a tough leadership style who caused a lot of conflicts (R&D TechCo, 2011). He could even resolve to personal attacks if anyone came up with an idea that he did not like, thus making people reluctant to make their voices heard (Marketing and R&D TechCo, 2011). However, these tendencies have been on the decline ever since a change in leadership (R&D TechCo, 2011).

The interviewees claim that TechCo has a lot of creative and talented people, and although time is scarce, a will exists to discuss new ideas (Marketing and R&D TechCo, 2011). Furthermore, people are encouraged to come up with new ideas (Marketing and R&D TechCo, 2011). For instance, there exists a system for rewarding ideas that get patented (R&D TechCo, 2011). However, slow decisions concerning testing of new ideas results in the company being perceived as sluggish (R&D TechCo, 2011).

It is perceived that the marketing department has an unrealistic time plan (Marketing and R&D TechCo, 2011). More than often, marketing ask for more features to be added to the products, without altering the time schedule. Marketing is aware of the fact that these requests are problematic for the R&D department, but is eager to satisfy the customers' needs and cope with the competitors' products (Marketing TechCo, 2011). Thus, discussions between marketing and R&D regarding what should be done, and what can be done are frequent (Marketing and R&D TechCo, 2011). Usually, this results in an alteration of the time plan and budget, as well as R&D people being tossed between different projects in order to put out the most urgent

fires (Marketing and R&D TechCo, 2011).

Industrial design believes that communications at TechCo are overly complicated, where employees use technical lingo in order to be considered as experts. Furthermore, when presenting their findings in a meeting at TechCo, a specific model of the working procedure was used in order to raise sympathy for user studies (Industrial Design TechCo, 2011). However, even though the working procedure was presented in a structured way, much in line with the normal praxis of the company, reactions to the concepts were chilly. Phrases like "this can't be done because of..." and "that won't work..." were uttered in a respectful but yet negative manner. The moderator (industrial design) of the meeting had to, on more than one occasion, explain that these were just models designed to give concepts tangibility and not models of finished concepts. However it was clear that the employees had, and were willing to share, albeit with a negative spin, lots of input on the concepts, ranging from mechanical issues to general user behavior issues .

During the interviews and the meeting, it has been noticed that all the participants have been social, happy and friendly spirited. Additionally, the longtime employees has shown a great amount of passion for the company.

4.6.1 Results from the CCQ

Figures 4.5 to 4.11 presents the results from the CCQ at TechCo. The values representing an innovative and stagnated company are standard values from Ekvall (2001). The R&D and marketing department are represented in the figures. "Other" represents managers and employees in supportive roles as economists etc.

In order to represent the data better, the data has been normalized with the climate of a stagnated organization. Furthermore, the conflict dimension has been reversed for a more consistent representation, this means that a large value on the conflict dimension results in a climate with low levels of conflict.

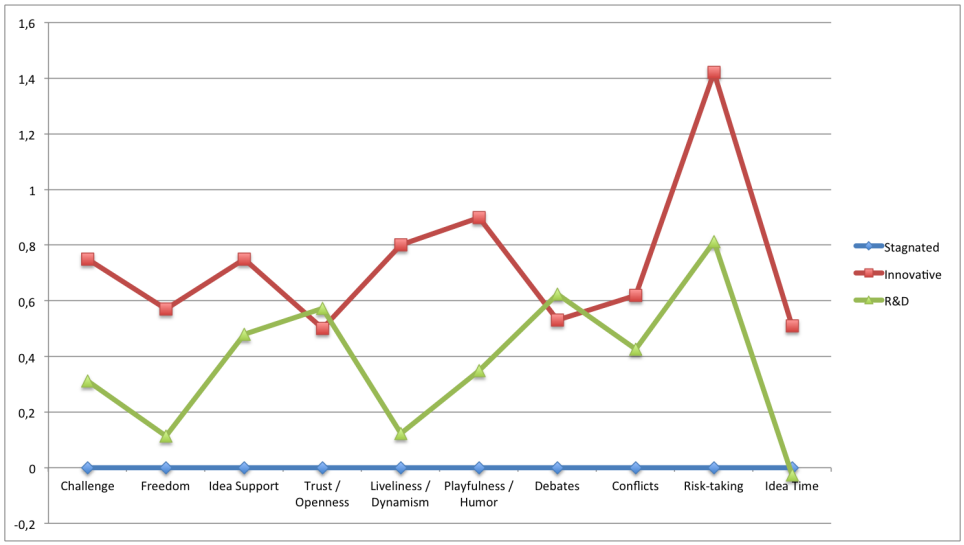

Figure 4.5: Creative Climate at R&D.

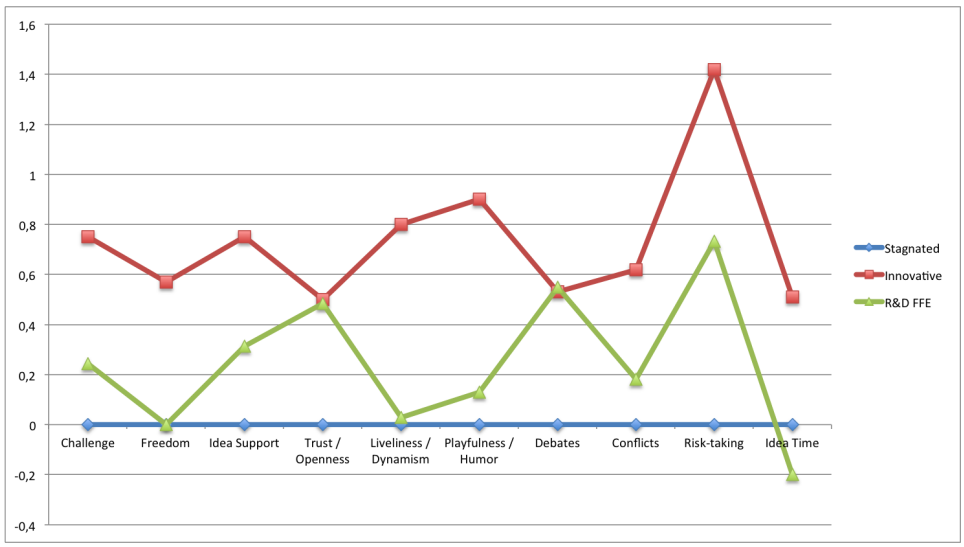

Figure 4.6: Creative climate at R&D active in phase 1 and 2.

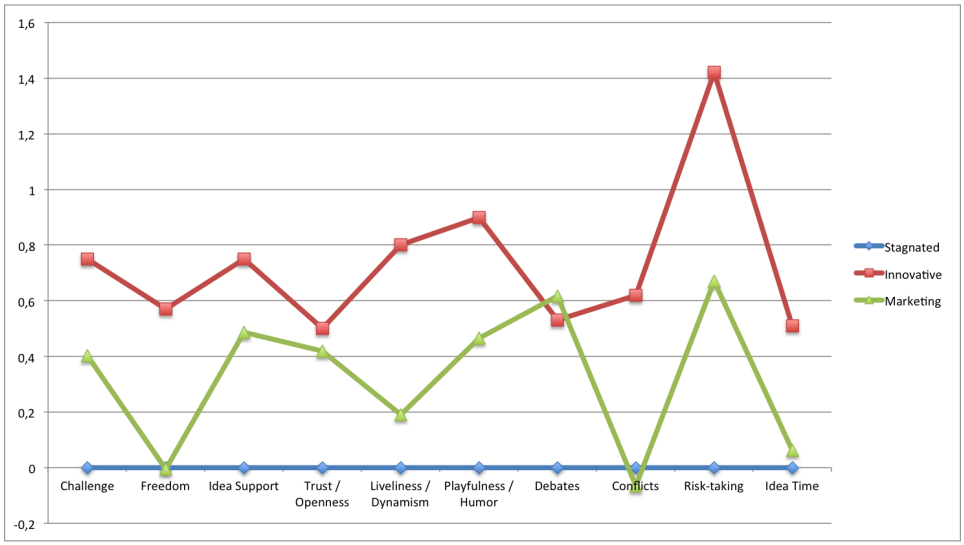

Figure 4.7: Creative climate at Marketing.

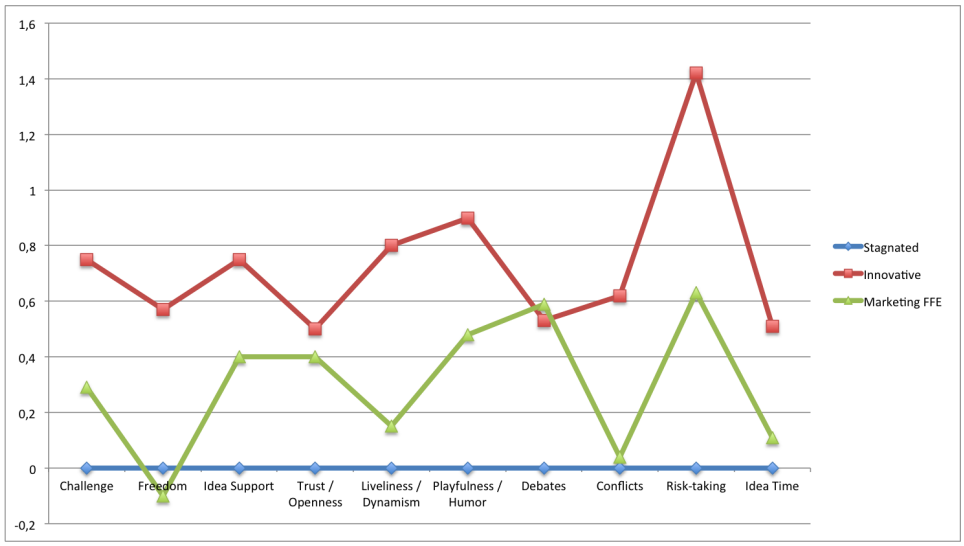

Figure 4.8: Creative climate at Marketing active in phase 1 and 2.

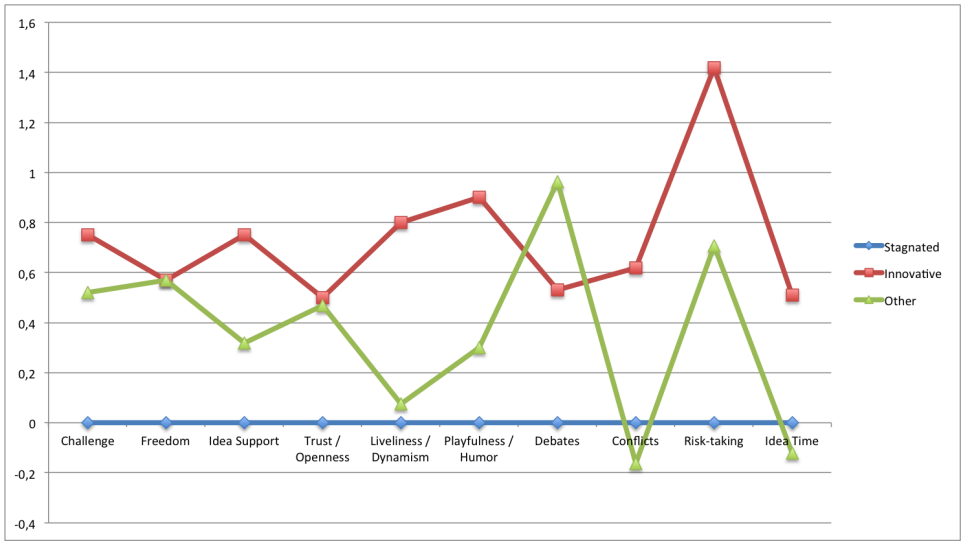

Figure 4.9: Creative climate for others.

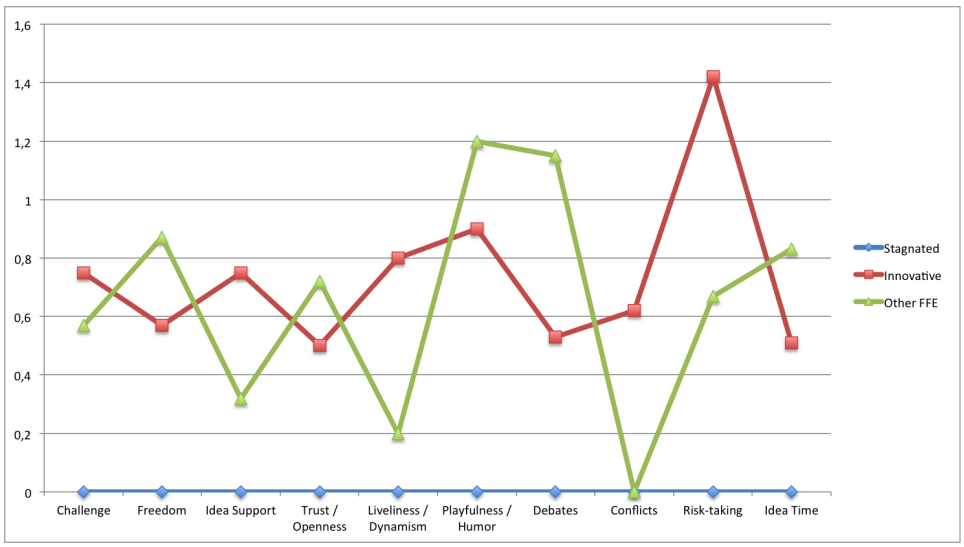

Figure 4.10: Creative climate for others active in phase 1 and 2.

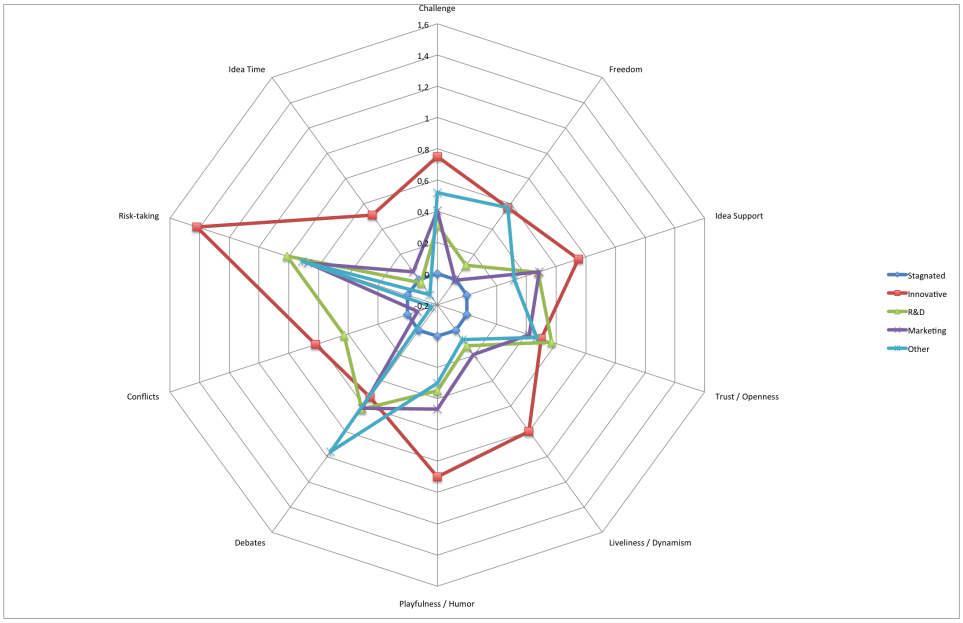

Figure 4.11: Creative climate for all the departments.

Chapter 5

Analysis

With the theoretical framework in mind, TechCo's FFE is analyzed regarding structure and key dimensions of the NCD model. An augmented NCD model is created in order for easier analysis of TechCo's long- and short term planning. Finally, hands-on methods meant to better the innovative climate is discussed.

5.1 TechCo's FFE

5.1.1 Structure

It is clear that phase 1 and 2 of PDM inhabits typical processes associated to the FFE defined in theory. However, PDM does not seem to move in accordance with Koen et al. (2002) NCD model, but in a more sequential fashion. Additionally, FFE properties have been encountered outside of PDM in TechCo's innovation process, i.e. technology and concept projects. Figure 5.1 depicts the identified areas inhabiting FFE qualities in TechCo's innovation process. Due to the complexity of TechCo's innovation process, the NCD model has been altered. This will result in two different bases for decision making. One that takes short term aspects into consideration when conducting launch projects and one that takes long term aspects into consideration when creating technology and concept projects.

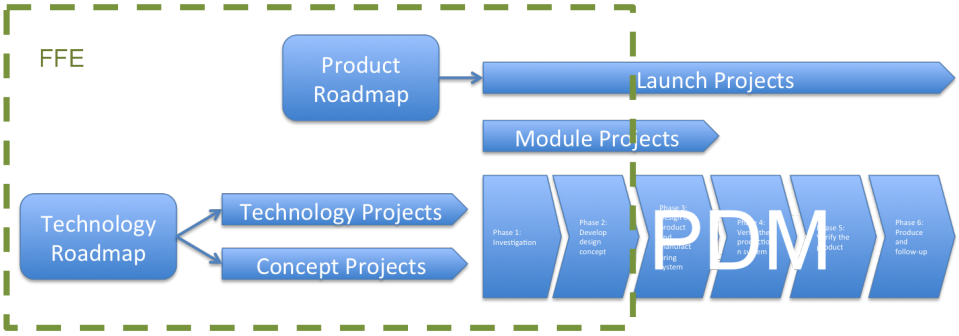

Figure 5.1: Identified FFE areas in TechCo's innovation process.

5.1.2 The Five Key Dimensions of the NCD Model

Opportunity Identification and Opportunity Analysis

Product improvements which is considered to improve the profitability of the company, are seen as important opportunities. The strong tendencies of following competitors are made clear as their products are often the basis for opportunity identification and analysis. Products which are as good as, or slightly better, than a competitor are seen as production worthy.

Opportunity identification is also present within the company, where problems are translated into opportunities. These are however more likely to be used in technology and concept projects instead of launch projects as TechCo does not want to introduce new technology into launch projects. To which extent or with what method these are analyzed is however unclear, although competitive analysis seems to be used a lot.

Opportunities are often driven by the goals of a company (Koen et al., 2001) it could be argued that TechCo has the goal of being a follower. However, this has not been perceived when interviewing the employees, as many of them talk of ambitions of becoming a market leader. Today, there seems to be weaknesses in the product strategy as problems occurring in the NPD can be related to product strategy. No clear vision of product lines for specific markets further strengthen the weakness in strategy. Perhaps the lack of a clear product strategy is the reason for following the competitors. If TechCo enhances its product strategy it will become easier to identify and analyze opportunities as opportunities not in line with TechCo's strategy will instantly be dismissed. Additionally, competitors' products will not af-

fect TechCo's product line to the same extent if the competitors' strategy differs from TechCo's strategy.

Implementation of user involvement will assist in opportunity identification and analysis. When visiting customers and empathizing with the end user's environment, opportunities are sure to present themselves. TechCo has therefore taken a large step in enhancing their opportunity identification as user observations have already been conducted. TechCo should expand their usage of user involvement for all kinds of projects and include all types of expertise in the process.

Idea Genesis

It seems that TechCo gets a great deal of its ideas from the market, i.e. customer complaints, sales input and competitor analysis when a launch project is planned. If a competitor has a new product or feature, it is likely that TechCo will try to incorporate a similar product into its product line. However, the quality of the data acquired through the sale organization could be questioned as marketing argues that sales has their own agenda. This comes as no surprise as the sale organization's job, is to sell products. If TechCo is to continue using information from sales to the same degree, new guidelines are needed for the sales organization. For instance, sellers income could be based on a mix of sales and ideas presented. Lost information would thereby be minimized. Additionally, TechCo needs to clearly illustrate the sales organization's role, today sellers might not be aware of their role as an idea source.

Internal idea generation, incorporated into new products is present at TechCo. These ideas are more likely to be used in future technology projects and concept projects through the technology roadmap before being a part of a launch project. If these ideas are a result from user involvement is however, unclear.

Although the information from sales can be enhanced, idea genesis will benefit from close collaboration with users (Koen et al., 2001). TechCo would probably benefit from exchanging "seller involvement" with user involvement. Internal ideas, not based on user involvement, should not be dismissed as these could bring breakthrough innovations. Breakthrough innovation are very hard to find through user involvement, if not impossible.

Idea genesis can also be enhanced through cross functionality and cooper-

ation with other companies and institutions (Koen et al., 2002). TechCo would therefore benefit from cross functional teams in the FFE, which is at the moment quite divided, this will be discussed further in Section 5.1.3. Cooperation with other companies and institutions is evolved in Section 5.1.3.

Idea Selection

Ideas are to a large extent selected through a low risk, high return policy, with a relatively short payback time for launch projects. This becomes quite evident as a BDR is created early on in the FFE for launch projects. Calculating the financial return this early on in the FFE is however nothing but a wild guess at best (Koen et al., 2002). Furthermore, even though a launch project is not supposed to move into phase 1 if the BDR does not show enough promise, a launch project has never been rejected this early on. It seems strange to use this method as the products which are examined by the BDR have already been put into the product road map and should therefore be produced anyway. This method of selection could be a result of the competitor following syndrome, as ideas concerning competitors' products are less risky. At this stage, ideas should rather be chosen according to unique abilities, if TechCorp is ever to become a market leader.

Selecting product ideas which will generate "wow" attributes would be a more suitable selection method instead of looking at what competitors are doing. This way TechCo can push their own ideas on how to fulfill users' needs. Identifying the "wow" attributes is however easier said than done (as these are often unspoken by the customer) but with the new initiatives in user involved development this will become easier. These attributes can also come from inside the company with an employee having a creative idea. With more lenient selection models there is a bigger likelihood that radical innovation will take place which could prove to be highly profitable for years to come. The competitive information should rather be used in order to assure that the linear attributes are at a market standard. For this selection model TechCo needs to gain the confidence to believe that they can produce better products than their competitors.

As the project portfolio is so diverse (launch, module, technology and concept), different selection models are needed, of which the method described above should be used for long term planing, i.e. technology and product roadmap. When selecting ideas for launch projects however, a risk avoid-

ance tactic is needed as TechCo wants to minimize the TTM for launch projects. For instance, the technology required should already be ready, to a certain point, for development and commercialization.

These methods should also be considered when analyzing opportunities as they will eventually give birth to ideas (if the opportunity has presented itself before the idea).

Concept and Technology Development

TechCo develops its business case at the end of phase 1 and not at the end of their FFE. Thus it does not follow the NCD model (Koen et al., 2002). The business case consists of estimations of market potential, customer needs, investment requirements, competitor assessments, technology unknowns and project risk which is in line with the NCD model (Koen et al., 2002). Some of these variables are in need of improvement, namely technologies unknown. The most recent projects have suffered from long delays because of the technology being new to the company. The problems in phase 3 further shows that unresolved technical uncertainties are present. This could in turn result in changed product requirements, as the technology that was intended for the project could not be finalized in time.

TechCo's technology development process is placed outside the launch projects and thereby its NCD process. A new NCD process with a more long term decision base is thereby introduced. This seems logical, as TechCo does not want technical risks in their launch projects which could result in delays. If TechCo continues with this way of working, these kind of problems will hopefully be diminished as well as enhancing the predictability of launch projects.

5.1.3 Implementing Effective FFE Management

Assign an Appropriate Individual or Team to Lead the FFE

The FFE at TechCo is divided between the different involved core teams. In phase 1, the core team mostly includes employees from marketing where R&D personnel are present in order to ensure feasibility. In phase 2 however, the roles are reversed and marketing is present in order to ensure that the requirements are in line with the MPS, thus ensuring viability, i.e. selling ability. Even though the "know how" from the different departments is

present, it is not dispersed evenly throughout the FFE.

As TechCo is now realizing the importance of user aspects, which are not necessarily highly technical, more competence is needed in order to assure the desirability of the products. This is a variable typically owned by the industrial design department, as they have expertise in not only "making things beautiful" but also in usability. In order to assure that these three variables; viability, feasibility and desirability, are present and synchronized, a team/individual which has expertise in all of these areas is needed (Kim and Wilemon, 2002).

A more cross functional team should be in charge of the whole FFE as the divided tactic of today will create barriers inside the FFE. Work would be further enhanced, as the translation of the MPS to PRS would benefit from a close collaboration. The two newly created MPS and PRS should stay separated, enabling TechCo to realize where a problem stems from if the customer is not satisfied. Either the requirement does not serve the need presented in the MPS or the need is not properly known.

Support and Commitment

Without support and commitment of new ideas in the FFE, the performance of the FFE is likely to deteriorate (Kim and Wilemon, 2002). Support and commitment is likely to improve if an innovative climate is present. TechCo's innovative climate will be discussed in section 5.3 where methods of improvements will be put forward.

Acknowledge and Support Product Champions

No clear product champion has been identified in the research conducted at TechCo, but there is probably one or more present. Chances are, that one or more are present within the industrial design team, as they have clearly defied status quo with their product concepts' new form factors. However, similar groundbreaking ideas could have sprung from anywhere within the corporation, and thus one cannot focus on identifying product champions solely within the industrial design team. TechCo's management should keep an eye out for these "mavericks" and then support them, as they can help transforming fuzzy ideas into concepts (Kim and Wilemon, 2002) as well as pushing strange and highly innovative ideas through the pipeline.

Embrace Uncertainty

It is clear that TechCo does not allow their product ideas grow under uncertainty in their launch projects. This is embedded in the PDM development process, as ideas not deemed profitable get weeded out before phase 1. As mentioned before, the BDR is unlikely to provide true figures on the financial return (even the business case produced in phase 1 has been shown to not hit the mark). It is clear that these measuring tools should not be used this early on in a launch project as the uncertainties are too high. It can result in good, innovative ideas being tossed away in favor of non-innovative, "tried and true" products, as these are more predictable in regard to financial return etc. Thus, TechCo is prone to rejecting ideas that have a possibility of success (Kim and Wilemon, 2002).

A lack of confidence or the pressure from the financial world could be the reason for these rigid selection methods. The later one makes a lot of sense as the financial world is mostly interested in short term profitability and is therefore prone to risk reduction. These two variables could also be the reason for relentless benchmarking and idea generation from competitors' products, as these have already been tried in the market place and are therefore associated with lower risks.

If the BDR would be removed and the business case transferred to the end of phase 2, ideas would be able to grow under uncertainty to a larger extent. As an idea matures through phase 1 and 2, it will be easier to decide whether it can be applied in the launch project. If deemed as too demanding in regard to time and costs, the idea should be transferred to the roadmaps, given that the idea has potential for future projects.

Formalize and Create a Holistic FFE Process

The opinion on how formal and integrated the FFE is at TechCo differs greatly. In the best case it is completely formal and almost completely integrated, thus achieving the highest rank at the "evolutionary FFE ladder", namely Integrated Capability (Khurana and Rosenthal, 1997). In the worst case it would only live up to the requirements of the middle rank, Islands of Capability (Khurana and Rosenthal, 1997), where the company realizes the potential of a well-managed FFE and has some of the capabilities associated with it, although inconsistently. It is plausible that the real value of formalization and integration is somewhere in between these two. It is

however strange that the level of integration is perceived as low by some. TechCo's FFE, in launch projects, is made up by employees from the NPD and vice versa. This should create integration to a large extent. The divided FFE could explain the different views of formalization and integration, as marketing gave a lower score than R&D. This could be an indication that different considerations are taken into account during the two phases of the FFE.

TechCo could ensure that the same considerations are taken during the entire FFE by joining the two phases and assigning one core team in charge of it. This would probably enhance the formality and integration more than introducing new formalities. By linking business strategy and product strategy to the FFE, TechCo can achieve a holistic FFE (Khurana and Rosenthal, 1998). The importance of a clear strategy is thereby once again evident. TechCo needs to convey a clear product strategy to their employees in order to achieve a holistic FFE process.

Attain Internal Cooperation and Support

As the employees working in phase 2 are basically the same people as in the NPD there should be no problem in attaining internal cooperation and support in the NPD. However, one could question the logic behind this as the differences in the characteristics between the FFE and NPD are quite substantial. Perhaps characteristics from the structured NPD has been transferred to the FFE resulting in a less creative environment.

TechCo needs to consider the possibility in dividing the FFE and NPD from each-other in order to assure a more creative environment in the FFE. However, in doing so, many aspects would need to be reconsidered as it would put a larger strain on knowledge transfer between the FFE and NPD. Additionally, it could create new barriers between employees.

Emphasize External Involvement and Cooperation

Development with end users during FFE is week at TechCo at the moment. However, there is a growing interest in user involvement in the early stages (hence this master thesis) and studies have already been conducted. TechCo should keep conducting user studies and try to involve the users to a larger extent, throughout the whole innovation process, preferably already in the FFE. Simply listening to the market through intermediates, instead of ob-

serving it can be contra productive and in worst case even cause serious problems, see appendix "The Wicked Cycle". With early involvement, the customers'/users' true needs can be found as well as their future needs (Kim and Wilemon, 2002)

It has been noticed that TechCo is moving away from close collaboration (partnership) with their suppliers, towards having them as mere routine suppliers. This seems to be leveraged by the owners of the company, a speculation that this is due to risk minimization as these kind of suppliers are associated with low risk and thereby low impact is hard to defer from. For whatever reason, the authors fear it is a mistake as suppliers as partners can greatly improve the TTM as well as being a source of innovation on their own (Kim and Wilemon, 2002; Von Hippel, 1988).

TechCo should seek horizontal cooperation at a larger scale. Today, TechCo cooperates with universities, but this could be greatly improved. For instance, a close cooperation with Chalmers University of Technology should be sought, due to its close proximity to TechCo's headquarters. A close cooperation would probably reduce the level of fuzziness and ensure a more effective outcome of projects (Kim and Wilemon, 2002). Furthermore, it would promote TechCo as a company among the students, hopefully securing future job applications. This kind of horizontal cooperations would probably be more suitable for technology and concept projects, as they are not under the same time constraints as launch projects. TechCo should also seek more cooperation with its own departments. BU 2 has its own clientele base and expertise that should be utilized throughout the entire innovation process. The sales organization should also be aware of these synergy effects and motivated them in gathering intel about machinery not only when they are selling them but also when they are selling consumables. This could be done by educating them more. This would have two advantages as they would get more competent and have greater knowledge of TechCo's products. Additionally, they would see the importance of their customer relations, which could motivate them in gathering intel as they would feel involved in contributing to TechCo's success.

5.2 NCD as a Source for Long- and Short Term Planning

In order to bring clarity to TechCo's future FFE management, an augmented NCD model has been created, see Figure 5.2. The model shows how FFE activities for launch projects can be used in long term planning, i.e. product and technology roadmaps. Opportunities and ideas will present themselves in the FFE which might not be applicable in that specific launch project. These opportunities and ideas could however be highly attractive for future projects which is why they need to be saved and analyzed with different criteria than for the short term planning, i.e. planning for that specific project. Proposal of selection methods have been discussed in Section 5.1.2. The model assumes that user involvement is used in launch projects to a greater extent than today.

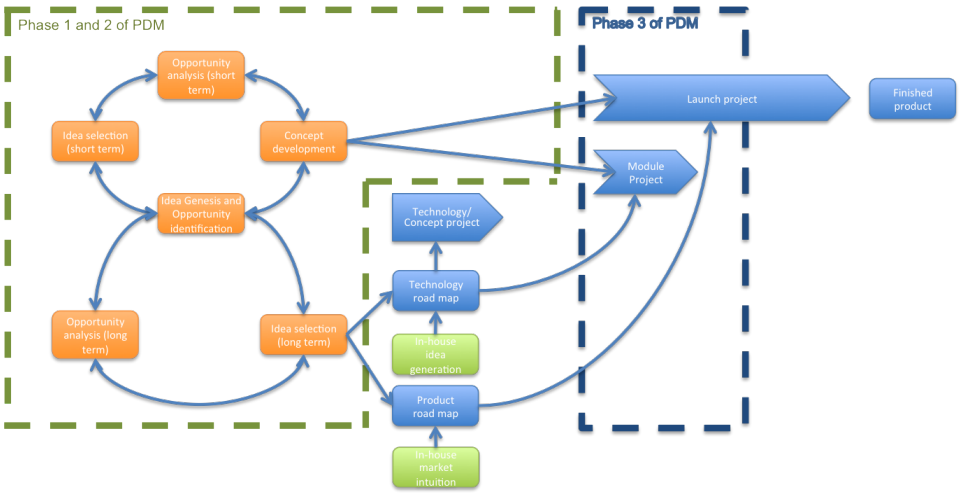

Figure 5.2: Long time and short term planning (Bosson & Nilsson, 2011).

Ideas and opportunities that are deemed fit for future products should be placed in the product and technology road map. The technology roadmap is in turn effected by the product roadmap as the technology needed for a launch project should be available when the project starts. The model takes the company's own ability in generating good ideas into consideration, represented by the green boxes. These ideas will be important for long time profitability as future products requirements are hard to realize from how

the market is today. The extrapolations of todays needs into the needs of tomorrow requires a level of market intuition which can only come from within the company. Additionally, it is necessary for companies to push their technologies as these innovative and new-to-the-industry technologies can prove to address needs which cannot be understood through user involvement or future needs. They could even set a new industry standard.

5.3 Creating an Innovative Climate

It is clear that TechCo understands the value of managing its innovation process proficiently, and that user involvement is an important step in doing so. TechCo has thus come a long way on the road to becoming more innovative. However, additional changes are needed in order to secure a successful implementation of user involvement. Without an innovative culture, TechCo is unlikely to draw the full benefits from involving users in the innovation process.

Tech's current creative climate is ranked midway between that of an innovative company and a stagnated company. A closer look reveals that both the R&D and marketing department perceive the climate as generally less creative in the FFE, whereas people working in supportive or strategic functions (e.g. assistants/economists and managers respectively) perceive the opposite.

It is of course desirable to improve all the creative dimensions, but if time and resources are limited, it is recommended that TechCo focuses on improving the dimensions which received the lowest scores first. These will hereafter be referred to as critical. In R&D's case, that would be idea time, freedom, dynamism/liveliness and in the FFE also playfulness/humor. The situation is similar in the marketing department, except, employees are troubled with conflicts rather than a lack of humor. Among the managers and the people in supportive functions, TechCo should first and foremost focus on improving idea time and Dynamism/Liveliness as well as eliminating conflicts.

5.3.1 Idea Time

According to the CCQ, employees feel welcome to discuss new ideas. The interviews and the CCQ however indicate that people are not given enough time to come up with new ideas, and even less time to test them. This is probably due to delayed projects and new personal in need of training

absorbing a lot of time.

As time passes, new employees will become more time efficient and productive thus freeing up time. Furthermore, the completion of the delayed projects will free additional time. However, without explicit encouragement and support by management to come up with new ideas, time will likely be spent on something else. Hence, it is recommended that TechCo's management makes clear statements regarding the importance of innovation, and generate a base-line stock of slack in time for all new projects (Ahmed, 1998; Judge et al., 1997).

5.3.2 Conflicts

It is no wonder that conflicts arises when trying to reorganize a company, as people are usually creatures of habit. Different feelings towards the reorganization are probably normal, especially if it has resulted in the relocation and dismissal of a close colleague. Massive recruitment of new staff must also have been challenging and caused a great deal of confusion regarding rolls and responsibilities in the company. The confusion was probably worsened by the fact that the new organization was new to all employees where even the managers did not fully grasp the new way of working. However, on a more positive note, the reorganization seems to have evened out the power allocation within the organization as well as eliminating the "we know best, so don't tell us what to do" mindset.

TechCo is likely to get a better score at this dimension as time passes and people get more acquainted with each other and the new way of working. However, an implementation of more effective FFE management may speed up the process and help eliminating uncertainties of roles and responsibilities, thus minimizing conflicts founded in misunderstandings.

5.3.3 Dynamism/Liveliness

The interviews and the CCQ indicate that TechCo is perceived as sluggish by the employees. This is a common trait amongst companies with complex structures and tiresome bureaucratic procedures (Ahmed, 1998). Thus, one can wonder if TechCo is complex and bureaucratic. None of the interviewed employees have pointed this out explicitly. However, the large extent of documents and guidelines combined with employees not grasping how everything fits together could be an indication of complexity and bureaucracy.

TechCo should remove unfruitful elements of bureaucracy such as long decision chains and slow decision making, and replace them with a more open and innovation-friendly climate (Ahmed, 1998). TechCo should break down departmental barriers and strive for a non-hierarchical structure with interdisciplinary teams (Ahmed, 1998).

5.3.4 Challenge and Freedom

According to the CCQ, TechCo have a dimension of freedom that is equal to that of a stagnated company, whereas the dimension of freedom places in between that of an innovative and stagnated company. Furthermore, the CCQ indicate that although people perceive their work to be meaningful and stimulating, they do not find it as satisfactory as it should be in regard to their efforts. In accordance with information acquired through interviews, this is probably due to rigid instructions and the fact that time is scarce. People are not given the power to make decisions on their own, nor the possibility to plan their work after their own head. Instead they suffer from long decision chains, which cause even more delays, at the same time as they are being tossed between different projects in order to put out the most urgent fires.

People respond positively when they are challenged, given that they are provided sufficient scope to generate novel solutions (Ahmed, 1998). TechCo should place trust in the employees ability to stretch out to goals rather than prescribe details of specific actions which stifle and smother actions of creativity (Ahmed, 1998). In other words, employees should be empowered to innovate freely and plan their work after their own head, without being hampered by formalities such as asking for permission to test a new idea.

5.3.5 Playfulness/Humor

According to the CCQ, the spirit and atmosphere is liberal at TechCo. People have a sense of humor and there is a great deal of fun and jokes. This has been noticed during the interviews and the managerial meeting. Although pessimistic opinions were expressed during the meeting, the mood and atmosphere was playful. However, according to the CCQ, playfulness and humor has a lower score in the FFE. This could be explained by employees already engaged in delayed projects are needed in the startup of new projects. Thus, moving them between two projects could result in stress and

thereby a less humorous attitude. Lingering feelings of mistreatment could also restrict the playfulness at TechCo.

Playfulness and humor will probably get stronger by its own, given some time, as employees get to know one another as well as the change of leadership. However, TechCo should develop their recruitment process to ensure social fit beyond technical expertise in order to prevent social mismatch within the staff (Ahmed, 1998). Furthermore, a well-designed integration and socialization process should be implemented, in order to speed up the creation of group cohesiveness and environments of cooperation (Ahmed, 1998). In addition, rewards should be awarded at a team level rather than at an individual level, as the latter creates environments of independence (Ahmed, 1998). The completion of delayed projects will also enhance playfulness and humor, given that the amount of new delays and multiple projects per employee is retained at a minimum.

5.3.6 Idea Support

According to the interviewees, support and encouragement is given to people who come up with new ideas. This was reflected in the CCQ, as employees feel welcomed to come up with new ideas, as others will listen, support and encourage. However, the interviews and the CCQ indicate that people perceive that new ideas are not made use of, that the organization is sluggish. This is probably due to a complex organizational structure and bureaucratic procedures. Thus, solving these issues will likely have a positive effect on both dynamism/liveliness and idea support. In addition, it may improve the dimension of risk-taking as well.

Leadership's commitment to innovation is of little value without an organizational structure that promotes interaction and involvement of the employees (Ahmed, 1998). Hence, it is important to create a physical environment with awards, quality circles and special recognition schemes that encourage to actively participating in the innovation program (Ahmed, 1998).

An environment should be created which encourages spontaneous meetings, so that people can discuss ideas under relaxed forms, and without having to go through tiresome procedures such as booking a room for the meeting and send out invitations.

Extrinsic rewards such as salary and bonuses have to exist at a base level in

order to motivate people at all (Ahmed, 1998). However, they should not be used to a larger extent, as people motivated by extrinsic rewards tend to focus on getting the rewards rather than unleashing their creative potential (Ahmed, 1998). Furthermore, they appear to promote competitive behaviors which disrupt workplace relationships, inhibit openness and learning as well as discouraging risk-taking, as this might be negatively evaluated (Ahmed, 1998). Instead, people should be motivated further by intrinsic rewards such as being personally thanked by the CEO or recognized by the group of peers (Ahmed, 1998).

5.3.7 Risk-Taking

During the interviews it has been told that TechCo are avoiding risks and slow at adopting new ideas, of which the latter is indeed reflected in the CCQ. The dimension of risk-taking is however closer to that of an innovative company than that of a stagnated company even though TechCo's slow ability to adopt new ideas is pushing the rating down.

In order to further strengthen TechCo's risk-taking, managers should communicate the company's policies for risk-taking. This will clearly define the space in which employees are allowed to act in an empowered manner, i.e. to what extent they can focus on "pet" projects instead of routine operations, in order to make innovative initiatives (Ahmed, 1998). Together with an understanding of the penalties if their traditional tasks are neglected, they get a clear definition of the priority and space of innovative actions, i.e. how much risk they can take (Ahmed, 1998). The best way for leaders to define the action space is to stipulate a broad direction which is consistent and clear, and place trust in employees' ability to stretch out to goals, rather than provide them with detailed specifications of how to achieve the goal (Ahmed, 1998).

5.3.8 Trust/Openness

Both interviews and CCQ indicate that there is a lot of trust and openness at TechCo. Instead of talking behind each others backs, conflicts and disagreements are treated openly and usually resolved. People trust each other and are thus not afraid of getting stabbed in the back. Hence, employees should be willing to put forward their ideas and opinions as well as taking initiatives without fear of reprisal and ridicule in case of failure. Thus,

TechCo is in a good position, given that they can provide the employees with sufficient scope and resources to create novel solutions.

Ideas are unlikely to arise if the employees do not understand the value of the innovation agenda and how far they are being empowered to achieve its goals (Ahmed, 1998). It is therefore of great importance that management define the domain of action and priority, as well as the level of responsibility and empowerment provided (Ahmed, 1998). This can be done through statements of mission and vision (Ahmed, 1998). Furthermore, TechCo should tread carefully when rewarding people at an individual level, as that creates environments of competition, strongly undermining the will to share thoughts and ideas (Ahmed, 1998). Rewards should rather be awarded at a team level, creating a strong group cohesiveness, as already argued in Section 5.3.5.

5.3.9 Debates

TechCo's score at debates rated equally or above that of an innovative company throughout all of TechCo. There is however room for improvement, as one of the CCQ questions stood out in a negative way. According to the CCQ, new ideas are not frequent at TechCo. It is likely that this stems from the low level of idea time. Furthermore, people might have grown tired of the fact that it takes forever for an idea to make a change, and thus perceive idea generation as a waste of time. This reasoning is reflected in the dimension idea support, where people claim that new ideas are not made of use. However, ideas could in fact be frequent, but that they are not spread evenly throughout the company, as there is no global forum for saving and sharing ideas.

TechCo could improve the idea dissipation and overall debates by creating a global forum where debates can be held freely and without supervision. Perhaps an intranet discussion forum where employees can discuss, put forward and rate colleges ideas could be created. TechCo should at least have managerial meetings where managers can put forward his or hers departments' ideas.

Chapter 6

Conclusions

The chapter first addresses contribution made to academia, followed by the contributions made to the industry. The chapter ends with suggestions for further research at TechCo.

6.1 Contributions to the Academy

The theoretical framework has been developed to communicate the organizational and cultural changes that a company has to take into consideration in order to successfully involve users in the FFE of the innovation process. The framework is based on theories of user involvement, innovative climate and culture, as well as effective FFE management, and the combination of these theories is a relatively undiscovered area. Thus, the framework has created a stronger understanding for the inter-relationship of these theories.

The framework was applied to TechCo, resulting in an augmented NCD model consisting of two different selection and analysis methods intended for usage when conducting launch projects. One for short term planning, and one for long term planning. In order for this model to be used at other companies than TechCo, they need to inhabit the same project types.

As the framework is based on general theories, it is argued that it can be applied to other companies as well. Although it has been developed for the purpose of first evaluating and then improving TechCo's preparedness for user involvement in the FFE, it is likely to make TechCo more efficient and innovative in general. Thus, it can also be applied to other companies with the purpose of making them more efficient and innovative.

6.2 Contributions to the Industry

TechCo's innovation process has been mapped through extensive research and the FFE has been clearly identified. This has brought clarity to the FFE processes present at TechCo, assisting in analysis and evaluation of it. TechCo's FFE has been analyzed through a launch project where recommendations are presented for short term planning as well as for long term planning. This has resulted in two different selection and analysis methods intended for usage when conducting a launch project.

In order to improve their FFE, TechCo needs to consider a wide variety of aspects ranging from strategic issues, as product strategy, to specific FFE improvements, as selection methods. These issues are fundamental and deeply embedded into the organization's risk avoiding policies. However, it is clear that these need to change in order for TechCo to become a market leader. It has been shown that the FFE activities will benefit from the user involvement, thus making TechCo a more innovative company.

The level of confusion about how things are done could be an effect of the large number of new employees at the company. The reorganization could also have a major impact on these activities as the company is "finding itself" anew, where local "how things are done" are all coming together under some level of chaos. This could mean that the study was conducted to soon, and that the company needs to settle before using the measuring methods presented in the theory. During the investigation it was noted on one occasion that if the question had been asked one week before, the answer would not have been same. This observation strengthens the reasoning made above. However, the high level of disagreement can also be an effect of misinterpretations of the questions during the interviews.

Affecting the FFE and success of user involvement at a higher level, has been identified as the innovative climate. TechCo showed to have a climate in between that of an innovative and stagnated company thus making TechCo well on its way to reap the benefit of user involvement. Recommendations on every dimension have been presented, some based in theory as well as subjective ideas presented by the authors. TechCo is to direct their attention to the dimensions referred as critical, i.e. the dimensions with the lowest scores.

The innovative climate in the FFE has been shown to generate lower score than the overall climate. A clear reason for this has not been identified, however the greater workload and the collaboration between different units could be a part of the reason.

The recent reorganization and massive recruitment could lower the overall score, as it is reoccurring at the different dimensions. TechCo's innovative climate could therefore, given some time, mend itself to a large extent. However, TechCo should still consider the presented recommendations as the present climate could get a firm grasp of the organization, proving it more difficult to change in the future.

6.3 Future Research

- How should TechCo continue their implementation of user involvement, which users should be involved? Where in the innovation process should they be involved?
- Are the results obtained by the CCQ general for companies undergoing similar reorganization?
- Future TechCo, has the recommendations improved the climate?
- Evaluation of the purchasing function, is purchasing in line with the organization's overall strategy?
- The Sales Organization's point of view?
- Is the reorganization of the production facilities in line with TechCo's product strategy?

Chapter 7

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PDM

MPS Template_A_110623

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Appendix A

Interview Templates

A.1 Initial Explorative Questionnaire

A.1.1 Research and Development

Personal

- Please give a short description of yourself, what is your role at TechCo?

Organization

- How does the present development process work? What phases does it include, what/who decides which development projects that will be started?
- How well do you think the present cooperation is with marketing? Do you often interact with marketers and in that case in what way?
- Do you have a close collaboration with suppliers? Do you develop together with them?
- Do you consider that TechCo tries to take in external knowledge, for instance, do you search trough the knowledge environment for new ideas/technologies/innovations actively?
- Do you consider that knowledge and innovations procured within TechCo which does not fit in with the core competence is brought outside the company borders through for instance licensing and paten sales?

Users

- What kind of user involvement do you have at TechCo today?
- How close is your personal collaboration with users, how much interaction, in what phases of development?
- Do you consider yourself having a good insight in the user needs of functionality?If yes, how did you obtain this insight?
- Does TechCo have contact with former customers, do you know why they changed supplier?
- How do think your ideas for development of new products/markets are treated? Are you encouraged to put forward your ideas? Do you often put forward your ideas? Are they reworded or punished?
- Do you consider TechCo having a tolerance for failures or are they non tolerable (if possible give concrete example)?
- Do you consider that TechCo has the best possibilities for development of the entire product? That is do you consider that things developed by suppliers could just as well be developed by TechCo?
- Do you consider parts of the management as being personally involved in innovative projects?
- Do you consider that TechCo is willing to let go off old bestsellers in benefit for new innovative products?
- Do you consider that managers are willing to cannibalize successful products? I.e. when a new technology is found are managers willing to invest in these, thereby making there own products obsolete?
- Do you know of anybody within the company that breaks the rules, takes risk or turns the organization upside-down? Are you one of these? Do these people have influence in TechCo?
- Do You have R&D operations that are located separately from the company?
- Is imagination encouraged at TechCo? For instance, do you have brainstorming meetings where You discuss different user areas for different products?

Products

- What do you think makes TechCo's products unique, better than other products and so forth?
- What clear differences in product range can be seen between the different markets?

Marketing Mayopia

- In what business/businesses is TechCo in according to you? Please answer at the highest possible level and as quick as you can.

A.1.2 Marketing

Personal

- Please give a short description of yourself, what is your role in TechCo?

Organization

- How does the present development process work? What phases does it include, what/who decides which development projects that will be started?
- How well do you think the present cooperation is with R&D? Do you often interact with engineer and in that case in what way?
- Do You have a close collaboration with suppliers? Do you develop together with them?
- Do you consider that TechCo tries to take in external knowledge, for instance, do you search trough the knowledge environment for new ideas/technologies/innovations actively?
- Do you consider that knowledge and innovations procured within TechCo which does not fit in with the core competence is brought outside the company borders through for instance licensing and paten sales?

Users

- What kind of user involvement do you have at TechCo today?

- How close is your personal collaboration with users, how much interaction, in what phases of development?
- Do you consider yourself having a good insight in the user needs of functionality?If yes, how did you obtain this insight?
- Does TechCo have contact with former customers, do you know why they changed supplier?
- How do think your ideas for development of new products/markets are treated? Are you encouraged to put forward your ideas? Do you often put forward your ideas? Are they reworded or punished?
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- Do you consider that TechCo has the best possibilities for development of the entire product? That is do you consider that things developed by suppliers could just as well be developed by TechCo?
- Do you consider parts of the management as being personally involved in innovative projects?
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- Do you consider that managers are willing to cannibalize successful products? I.e. when a new technology is found are managers willing to invest in these, thereby making there own products obsolete?
- Do you know of anybody within the company that breaks the rules, takes risk or turns the organization upside-down? Are you one of these? Do these people have influence in TechCo?
- Do You have R & D operations that are located separately from the company?
- Is imagination encouraged at TechCo? For instance, do you have brainstorming meetings where You discuss different user areas for different products?

Products

- What do you think makes TechCo's products unique, better then other products and so forth?
- What clear differences in product range can be seen between the different markets?

Marketing Mayopia

- In what business/businesses is TechCo in according to you? Please answer at the highest possible level and as quick as you can.
- What kind market study methods are most commonly used today at TechCo? Do you think they are enough? If not, what do you think can improve them?

A.2 Evaluation of the FFE

- How are ideas generated? Through formal processes, brainstorming, idea banks etc.? Are ideas generated outside the companies processes used, from example failed experiments, strange customer requests etc? Do you cooperate cross functionally and/or with other companies?
- How do you identify opportunities? Is processes like brainstorming casual analysis etc. used or do directive come from above?Are you good at this?
- How do you analyze the opportunities? By trend analyses and/or competitive intelligence? Are you good at this?
- What aspects are taken into consideration when selecting ideas for further development, market risk, technical risk, unique abilities, etc.? Are ideas allowed to grow under uncertainty?
- On what aspects is the business case developed around - customer needs, competitor assessment, etc.? Are you good at this? Are you good at identifying new technologies in need of development before the NPD?

A.3 Ekvall Studies Conducted by Others

- How was the Ekvall study conducted, who where involved etc.?
- What were the results, which dimensions where lacking?
- How was the climate change in order to strengthen the week dimensions? Difficulties?
- What did you do in order to keep the strong dimensions equally strong?
- How long did it take to reach the desired results?

Appendix B

Email questionnaires

B.1 Formalization and Integration

It would be much appreciated if you could answer the following checklist, the only necessary answer is yes or no (Y/N if you want). When you answer it, consider that the checklist is for phase 1 and 2, things that are done in later stages should therefor not be present.

Formality of Front-End Process	Integration of Activities
1. Customer and market information is used early on to set scope for product (target markets, customer segments, features, and price).	1. There is a clear vision of product lines and platforms for specific markets.
2. Core team jointly reviews product concept and senior management formally approves.	2. R&D and NPD have matching agendas and plans.
3. Early concept and other feasibility prototypes are planned, tested, and completed at front end so that there are no surprises later.	3. Balance is sought and achieved among multiple NPD projects belonging to different platforms/product lines (e.g. risks, novelty).
4. Product definition is explicitly developed and documented.	4. Project priorities are consistent with product strategy, portfolio plans, and resource availability.
Continued on next page	

Table B.1 – continued from previous page

Formality of Front-End Process	Integration of Activities
5. Major supplier and tooling considerations are explicit at front end.	5. Resource allocations consider multiple project requirements and their relative priorities and preexisting project commitments.
6. Manufacturing, distribution, and logistics requirements are planned. Product concept is modified to reflect process and logistics constraints.	6. Early identification of technical and organizational interfaces is done for systems products so that development can proceed smoothly.
7. Need for new technology for products is clearly stated.	7. Core front-end team includes representatives from manufacturing, logistics, and after-sales service, apart from engineering and marketing.
8. Project targets (time, cost, quality) and relative priorities are clear.	8. Staffing policies and project-specific staffing are consistent with the product strategy.
9. Resource requirements are formally defined.	9. Need for new innovations is anticipated so that extensive innovation is not required during the product development process.
10. Roles and responsibilities for tasks and communications for core team are clear and well executed.	10. If there is uncertainty on any dimensions (e.g. technology or markets) organization has carefully planned alternative approach
11. Roles for executive review team are clear and well executed (review criteria, decision responsibility, ongoing interaction with core team).	

B.2 Problems in phase 3

Hello, as you may or may not know we are two students conducting our master thesis at TechCo and where wondering if you could list the most common problems in phase 3 of PDM from your experience, we are not referring to problems of the process, rather problems which frequently appear in the development of products in Phase 3. To help you out we have some problems in mind which are generally common in companies. Feel free to refer to those (if they fit with your experience of usual problems) for your convenience. we

hope you have the time to answer this email and would appreciate it greatly.

mvh/best regards

Jon Bosson & Marcus Nilsson

Problem area	Manifestations
Product Strategy	
Unclear product strategy	Projects not prioritized; Too many "pet" projects. Cannot determine whether product fits with firms strategy or not - NPD illegitimacy". NPD program not given priority.
Product Definition	
Inadequate product definition	Continually changing requirements (ambiguity about product features/ technology) Over specification of tolerances
Unresolved technical uncertainties	Experimentation discouraged Technology on critical path
Market/customer needs assessment inadequate	Market not assessed User needs not understood
Project Definition	
Project objectives unclear	Difficulty in making trade-offs while deciding project objectives Too many pet" projects (with loose justification?)
Shortage of key resources	Right people are not released/assigned for key projects Project selection does not consider prior commitments to new product portfolio
Lack of contingency planning	No backup approaches for risky technology
Organizational Roles	
Roles not clarified early on	Different subsystems do not interface well; problems with product distribution and supply
Executive reviewers do not play leadership role	NPD team members lack direction, make frequent changes to product

Appendix C

Cultural Norms Promoting Innovation (Ahmed, 1998)

C.1 Challenge and Belief in Action

The degree of which employees are involved in daily operations and the degree of "stretch" required. Key attributes:

- Don't be obsessed with precision
- Emphasis on results
- Meet your commitments
- Anxiety about timeliness
- Value getting things done
- Hard work is expected and appreciated
- Eagerness to get things done
- Cut through bureaucracy

C.2 Freedom and Risk-Taking

The degree to which the individuals are given latitude in defining and executing their own work. Key attributes:

- Freedom to experiment

- Challenge the status quo
- Expectation that innovation is part of your job
- Freedom to try things and fail
- Acceptance of mistakes
- Allow discussion of dumb ideas
- No punishment for mistakes

C.3 Dynamism and Future Orientation

The degree to which the organization is active and forward looking. Key attributes:

- Forget the past
- Willingness not to focus on the short term
- Drive to improve
- Positive attitudes towards change
- Positive attitudes toward the environment
- Empower people
- Emphasis on quality

C.4 External Orientation

The degree to which the organization is sensitive to customers and external environment. Key attributes:

- Adopt customers perspective
- Build relationships with all external interfaces (supplier, distributors)

C.5 Trusts and Openness

The degree of emotional safety that employees experience in their working relationships. When there is high trust, new ideas surface easily. Key attributes:

- Open communication and share communication
- Listen better
- Open access
- Accept criticism
- Encourage lateral thinking
- Intellectual honesty

C.6 Debates

The degree to which employees feel free to debate issues actively, and the degree to which minority views are expressed readily and listened to with an open mind. Key attributes:

- Expect and accept conflict
- Accept criticism
- Don't be too sensitive

C.7 Cross-Functional Interaction and Freedom

The degree to which interaction across functions is facilitated and encouraged. Key attributes:

- Move people around
- Teamwork
- Manage interdependencies
- Flexibility in jobs, budgets, functional areas

C.8 Myths and Stories

The degree to which success stories are designed and celebrated. Key attributes:

- Symbolism and action
- Build and disseminate stories and myths

C.9 Leadership Commitment and Involvement

The extent to which leadership exhibits real commitment and leads by example and actions rather than just empty exhortation. Key attributes:

- Senior management commitment
- Walk the talk
- Declaration in mission/vision

C.10 Awards and Rewards

The manners in which successes (and failures) are celebrated are rewarded. Key attributes:

- Ideas are valued
- Top management attention and support
- Respect for beginning ideas
- Celebration of accomplishments e.g. awards
- Suggestions are implemented
- Encouragement

C.11 Innovation Time and Training

The amount of time and training employees are given to develop new ideas and new possibilities and the way in which new ideas are received and treated. Key attributes:

- Built-in resource slack
- Funds budgets
- Time
- Opportunities
- Promotions
- Tools
- Infrastructure e.g. rooms, equipment etc.
- Continuous training
- Encourage lateral thinking
- Encourage skills development

C.12 Corporate Identification and Unity

The extent to which employees identify with the company, its philosophy, its products and customers. Key attributes:

- Sense of pride
- Willingness to share the credit
- Sense of ownership
- Eliminate mixed messages
- Shared vision and common direction
- Build consensus
- Mutual respect and trust
- Concern for the whole organization

C.13 Organizational Structure: Autonomy and Flexibility

The degree to which the structure facilitates innovation activities. Key attributes:

- Decision making responsibility at lower levels
- Decentralized procedures
- Freedom to act
- Expectation of action
- Believe the individual can have an impact
- Delegation
- Quick, flexible decision making, minimize bureaucracy

Appendix D

"The Wicked Cycle"

This example was created in order to show the shortcomings of only listening to the market and not truly understanding the needs of the customer.

Consider a product used in an rough working environment, the product is quite heavy and bulky in order to assure usage without breaking. When the time comes to develop a new model of this product, marketing asks the market what they think the new product needs, i.e. what the customer needs, as well as look into the most common customer complaints. Consider that the answer from both inputs are, "the product breaks to easily". The natural response to this complaint will be "lets make it tougher and more rigid so it will hold despite rough handling, surely this is the most important customer/user need". Said and done, a new version, more rigid is crated. Odds are that this new product will be heavier and more bulkier then its predecessor. Consider that the reason for high breaking levels was that the user mismanaged the product because of its weight and bulkiness, for instance not moving it correctly when changing work place. The new product will probably result in more mismanage, or at least equally mismanage. When the time comes for a new model, the market voices will be the same and the resulting product worse, see Figure D.1.

Figure D.1: "The Wicked Cycle" (Bosson & Nilsson, 2011).

If this phenomenon occurs at a company, it will result in frustration at the company and for the customer/user. However the dissatisfaction will most likely prove to be double for the user as he/she will have to use a product which is harder to operate properly as well as it breaking more often.

If the true need was recognized, then perhaps a small, portable and lightweight product would have been created. It would not be as durable as the heavy weight one but, because of it not being as prone to mismanage, it would not break as often.

Appendix E

Innovation

"Innovation distinguishes between a leader and a follower"

Steve Jobs

Innovations can basically be categorized into two main types, incremental and breakthrough innovations. Based on what kind of innovation that is being developed, different kinds of marketing and research methods must be chosen (Mohr, Sengupta and Slater, 2009). In incremental innovations the product development is in line with the current market and the market is often well established and the customer needs well known (Mohr, Sengupta and Slater, 2009). Breakthrough innovation however, is applied to new markets with completely new products, and in extreme cases the solution can precede the customer/user's needs (Mohr, Sengupta and Slater, 2009). Figure E.1 illustrates the different methods useful for incremental and breakthrough innovation as well as for the intermediate innovations.

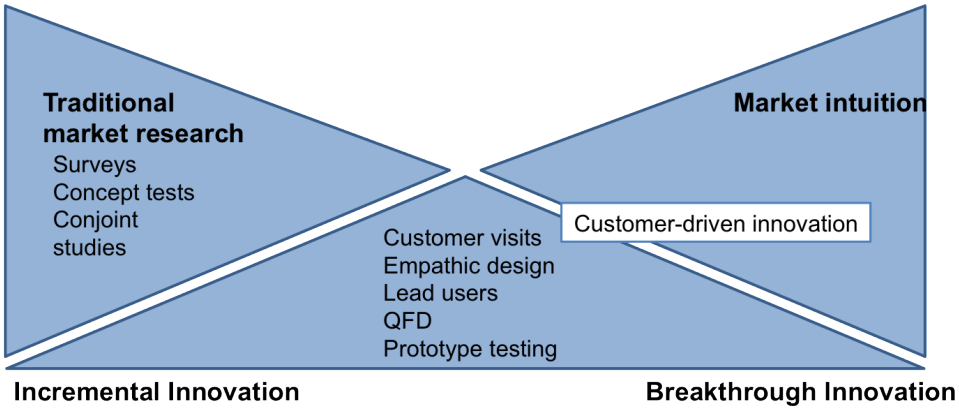

Figure E.1: Different types of innovation and the methods associated with them. Adopted from: Mohr, Sengupta and Slater, 2009.

Appendix F

Kano Concept

Also known as the Kano dimensions/diagram, the Kano concept provides a graphical interpretation of three types of product attributes in relations to customer satisfaction/dissatisfaction (Mohr, Sengupta and Slater, 2010) see Figure F.1.

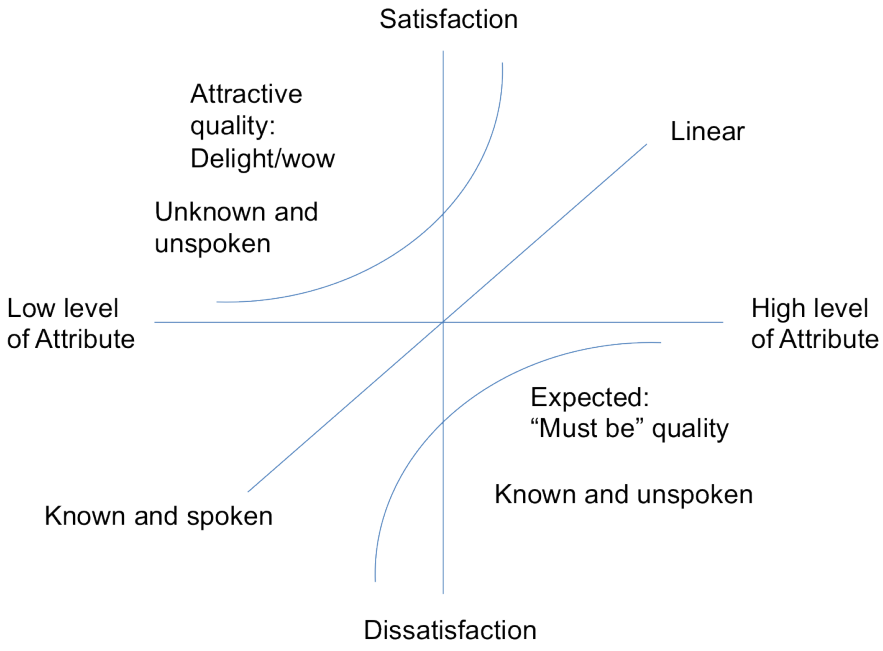

Figure F.1: Kano Chart. Source: Mohr, Sengupta and Slater, 2010.

- Attractive quality: attributes which give the customer a wow feeling.

The absence of this attribute will not give any dissatisfaction but the mere existence of it brings great satisfactions (Mohr, Sengupta and Slater, 2009).

- Linear: attributes that are known and an increase in the performance of the attribute bring a linear increase of satisfaction. They are usually known and voiced by the customer (Mohr, Sengupta and Slater, 2009).
- Expected: these attributes must be represented in a product, as a lack of these attributes will automatically bring dissatisfaction (Mohr, Sengupta and Slater, 2009). Consider a cell phone which does not make calls.

Appendix G

User Involvement

G.1 The Importance of User Involvement

The traditional push-strategy with in-house development tends to fail due to lack of understanding for the user true needs (Carlson and Wilmot, 2006). Nor is the pull-strategy sufficient, as it treats the user as an object rather than a living source of information. The only way to systematically creating value for the user is to simultaneously interact with both market and the sources of new ideas (Carlson and Wilmot, 2006). This is challenging, since there exists many developers who fully believe they understand the user's needs, when they in fact do not (Kujala et al., 2010). Hence, a change in mindset is required in order to implement user involvement in the innovation process.

G.2 Definition of Users

Kuala (2001) define users as anyone interacting with the future product. Furthermore, in product development, the user could also be a customer (the one who pays for the product) or separated from the purchasing decision. Both groups are important stakeholders in product development, though customer's primary goal is usually only to provide the users with a system supporting them in their tasks.

G.3 Definition of User Involvement

Kuala et al. (2005) define user involvement as a general term describing all kind of direct contact with users, and the level of user involvement can

be broadly characterized as being somewhere on the continuum from informative, through consultative to participative. Wise and Høgenhaven (2008) use the term user-driven innovation, a process based on an understanding of true user needs and a more systematic involvement of users in order to develop new products, services and concepts. The two definitions are similar, and thus the two terms are considered to be equated in this report.

G.4 Different Types of User Involvement

Users can either be directly or indirectly involved in the innovation process, depending on what question the company seeks to answer and the users ability to understand and communicate their needs. Bisgaard and Høgenhaven (2010) have identified four generic categories of user involvement, namely user innovation, user test, user participation and user exploration. User innovation and user test try to answer the question of how to offer the solution to the users, whereas user participation and user exploration aim to answer the question of what to offer the customers and users. How to offer the solution to the users can most often be answered in-house, though some companies might want to involve users in order to get more advanced knowledge.

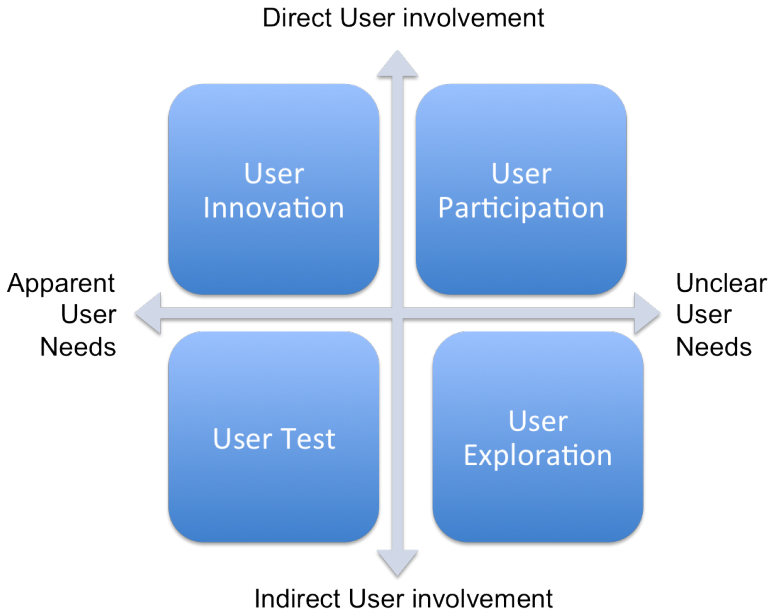

Figure G.1: Different dimensions of user involvement. Source: Bisgaard and Høgenhaven, 2010.