STRUCTURING THE FRONT END OF INNOVATION AT AN HIGH TECH COMPANY

Innovation is getting more and more important. With the speed of innovation and the needs of customers it is important to structure the front end of innovation. In this research the relations between absorptive capacity, Lead User method and the front end of innovation are investigated, and a manual is written on how the Lead User method can contribute to more successful innovations for company X

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Words: 24.677

UNIVERSITY OF TWENTE.

Enschede 23-04-2014

PREFACE

This master thesis is the result of a half year research at unit 1, one of the business units of company X located in the Netherlands, and is written to get my master degree in Business Administration at the University of Twente.

The research started in September after some e-mails between the University and company X. The first goal of this research was finding new product concepts for Company X by using the Lead User method in a pilot, a method developed by Eric von Hippel in 1986.

After some weeks of investigating the Dutch electricity market and the development of smart grids by visiting seminars, exhibitions and talking to some experts in the field I get a better understanding of the market in which unit 1 is active. After this investigation and some changes within Unit 1 the scope of the research has been changed. The goal of the research became finding out if Company X as a whole saw the value in the Lead User method to structure the front end of innovation, and write a manual on how this method can be used by unit 1.

I would like to thank my examiners from the University of Twente: Dr. Rik van Reekum and Dr. ir. Erwin Hofman, for the guidance during this research and for giving feedback on the thesis.

Secondly I would like to thank the people from Company X. The 66 people who respond to the questionnaire and the 15 people who were very open during the interviews on the innovation process at Company X and the value of the Lead User method. My special thanks go to my supervisor from company X and the people from Company X unit 1, for having me for the last half year, the collaboration and the guidance during the research.

I hope that this research and manual can contribute to an innovative and sustainable future for Company X Unit 1.

Michel Brookhuis

Enschede, 23-04-2014

MANAGEMENT SUMMARY

Innovation is important in every company, when you do not come up with new products, the competition will overtake you. The innovation process starts with idea generation and finding valuable concepts which lead to new products. When these concepts do not match with the needs of the market they won't be successful and competitors will make better products. At Company X products are developed from the inside of the organization, this can lead to products that do not meet the demands of the customers and are not competitive with products from the competitors. The last product from unit 1 was introduced six years ago and had too many features which made it very expensive. At this moment unit 1 needs new breakthrough innovations and they want a more effective way of innovating. Over the last years Company X attract a lot of employees with expertise in sales and/or marketing, and state in their annual report that keeping up with the technology and cooperate with key customers is very important. Due these changes fewer budgets are available for research and development which made it more important to find a way to structure the front end of innovation, and save time and money.

This first step in the whole innovation process has a lot of uncertainties and is also called the fuzzy front end. To reduce some of those uncertainties, information must be acquired and exploited by the company; this is called the absorptive capacity of an organization. This absorptive capacity can be divided in potential and realized absorptive capacity.

A structured way to gather new information and use this for the development of new products is the Lead User method. Lead Users are people who are facing a problem in their profession or hobby and have a high incentive to solve this problem. They are also willing to cooperate with a company and other Lead Users to share their information and come up with new product concepts for the company. With a multidisciplinary team from the organization a four step process is carried out, from developing a target market and project goal, to organizing a Lead User workshop. The main goal of the research is to *write a manual for Company X Unit 1 on how they can introduce the Lead User method*. The main research question to come to this goal:

How can Lead User method contribute to a more effective front end of innovation?

Next to that it is important to know the relationship from the Lead User Method with absorptive capacity and the front end of innovation, and maybe even more important the willingness of the Company X employees to work with the Lead User method.

In a questionnaire the absorptive capacity of Company X was tested. The outcome of this questionnaire showed that people within Company X are actively looking for information in their target market but also in other markets which can be valuable. Sharing of that information occurs mainly within departments, the sharing of information with other departments or even other business units is less. It means that valuable information is not shared with all the persons and there is not a good integration of the marketing and R&D departments, which can lead to innovations and products which not meet the needs of the target market. When it is about the current customers, the questionnaire showed that they are seen as a valuable source of information when it is about improvements and incremental innovations, but that they can also tribute to more radical and breakthrough innovations.

The interviews, which are done to get a better understanding of the absorptive capacity and the added value and pitfalls of the Lead User method, showed that people find it important to know what the needs and trends in the market are, but that such information is not shared with the research and development department in a structured way. The main decisions on new product development are still made in the hallway or at the coffee machine.

Lead User method is seen as a valuable method to get more structure in the process and seen as a method that can give new insights. Because the business units are growing and ties are getting weaker people do not know what everybody is working on, so working with people from different departments will be valuable and can lead to products that add value.

The pitfalls and dangers that people see in the Lead User method are the time it will cost and the formal structure. To get the most value out of the method it is important that there is enough time and space to do in depth investigation and talk to potential Lead Users. Despite the fact that Lead User method will lead to a reduction of time and costs in the concept development process, the current workload at Company X will make it hard to execute this method well, so time and space must be created by the management in order to solve the organizational problem of Company X. On the final question if people are willing to try a method like this, the responses are positive and people see the value when they get the time and space.

For the implementation of the Lead User method a manual is written for Company X Unit 1 which describes the process and give some directions in which they can start with this method.

SAMENVATTING

Innovatie is een van de meest belangrijke zaken binnen organisaties tegenwoordig. Niet innoveren betekent stilstaan terwijl de concurrentie je voorbij streeft. Het is dus belangrijk steeds nieuwe producten of diensten te ontwikkelen die aansluiten op de behoeften van de markt. Binnen bedrijf X wordt er veel vanuit de technologie geïnnoveerd, nieuwe concepten en producten worden vaak door de mensen van R&D bedacht en ontwikkeld. Deze manier van innoveren kan leiden tot producten die niet goed aansluiten op de markt of niet kunnen concurreren tegen andere producten op de markt. Het laatste product is zes jaar geleden gelanceerd, is erg universeel en heeft hierdoor een hoger prijskaartje dan die van de concurrent. De laatste jaren zijn veel nieuwe mensen aangetrokken in de verkoop en marketing om zo meer marktgericht te opereren. In het jaarverslag van 2013 wordt aangegeven dat bedrijf X geen technologieën mag missen, en dat er samengewerkt moet worden met belangrijke klanten. Door alle veranderingen is er minder budget voor ontwikkeling, daarom is het erg belangrijk een gestructureerde methode te hanteren om effectiever te kunnen innoveren en tijd en geld te besparen.

Het eerste deel van het hele innovatieproces is de ontwikkeling van nieuwe concepten. Dit is vaak een rommelig en onzeker proces en wordt ook wel de ‘’fuzzy front end’’ genoemd. Om onzekerheid weg te kunnen nemen is het belangrijk om informatie binnen te halen, te delen en te gebruiken binnen een organisatie. Dit wordt ook wel de absorptie capaciteit van een organisatie genoemd. Dit is onder te verdelen in potentiele absorptie capaciteit en gerealiseerde absorptie capaciteit. Een goede integratie van de marketing en de R&D afdeling is cruciaal voor dit deel.

Een gestructureerde manier om aan nieuwe informatie te komen en deze te gebruiken voor de ontwikkeling van nieuwe producten is de Lead User methode ontwikkeld. Lead Users zijn mensen die een probleem ondervinden in hun expertise of vanuit hun hobby en daarnaast ook het initiatief hebben om dit probleem op te lossen en er zelf op vooruit te gaan, maar ook bereid zijn samen te werken met andere Lead Users en de organisatie om tot nieuwe concepten te komen. Met een multidisciplinair team binnen de organisatie moet een traject van vier fasen worden uitgevoerd. Van het vaststellen van de doelmarkt en het projectdoel tot het selecteren van de Lead Users en het organiseren van een workshop. Het doel van deze laatste fase is het bedenken van nieuwe concepten die een toegevoegde waarde kunnen hebben voor de organisatie. Het hoofddoel van dit

onderzoek is het schrijven van een handleiding over hoe bedrijf X unit 1 deze Lead User methode kan gebruiken. De centrale vraag in dit onderzoek luidt als volgt:

Hoe kan de Lead User methode bijdragen aan een meer effectief innovatieproces?

Naast deze vraag is het belangrijk om te weten hoe de relaties tussen de absorptie capaciteit, de Lead User methode en de front end of innovation zijn, en misschien nog wel belangrijker, zijn mensen binnen bedrijf X bereidt om met de Lead User methode aan de slag te gaan?

Met een vragenlijst is de absorptie capaciteit van bedrijf X onderzocht. De uitkomst van deze vragenlijst laat zien dat mensen binnen bedrijf X actief op zoek zijn naar nieuwe informatie in eigen markt maar ook in andere potentiële markten. Het delen van deze informatie gebeurt vooral binnen de afdelingen en tussen verschillende afdelingen en business units veel minder, dit zorgt voor een slechte integratie van de marketing en R&D afdelingen, en tot producten die niet aansluiten bij de behoeften van de markt. Tot slot worden klanten als waardevol gezien voor zowel de verbetering van producten als in het vinden van compleet nieuwe producten.

De interviews zijn gedaan om beter inzicht te krijgen in de absorptie capaciteit en de mogelijkheden en valkuilen van de Lead User methode. De antwoorden van de interviews laten zien dat mensen het belangrijk vinden om op de hoogte te blijven van de trends en behoeften van de markt, maar dat die informatie niet wordt gedeeld op een formele manier, en dat de grootste beslissingen worden gemaakt tijdens het wandelen naar de kantine of bij het koffieapparaat.

Lead User methode wordt gezien als een waardevolle methode om meer structuur in het innovatieproces te krijgen, maar ook als een methode die kan leiden tot nieuwe inzichten. Omdat de marktgroepen groeien, worden de relaties zwakker tussen de afdelingen, en weten mensen niet meer wat er allemaal speelt in hun marktgroep. Een multidisciplinair team zou waardevol zijn en zou kunnen leiden tot meer waardevolle producten.

De valkuilen en gevaren die mensen zien in de Lead User methode zijn de tijd die het kost en de formele structuur die het met zich meebrengt. Ondanks dat de methode tijd en geld moet besparen binnen het innovatieproces zal het met de huidige werkdruk binnen bedrijf X moeilijk zijn om deze methode in te voeren. Er zal tijd en ruimte gecreëerd moeten worden zodat de methode goed tot zijn recht komt.

Op de laatste vraag; of mensen aan de slag zouden willen gaan met de Lead User methode, zijn de reacties erg positief. Mensen zouden best tijd en energie vrij willen maken om met behulp van Lead Users naar nieuwe concepten te zoeken.

Voor bedrijf X unit 1 is een handleiding geschreven waarin de methode wordt beschreven en een aantal aanbevelingen voor de uitvoer worden gedaan, zodat ze kunnen starten met de methode.

LIST OF ABBREVIATIONS

ACAP: Absorptive Capacity

BU: Business Unit

DSO: Distribution System Operator

EV: electric vehicle

FOE: Front end of innovation

ICT: Information and Communication Technology

KWh: Kilo Watt hour

LET: Lead User Theory

LEM: Lead User Method

MCS: Management Control Systems

NDA: Non-Disclosure Agreement

NPD: New Product Development

PV: Photovoltaic (solar panels)

R&D: Research and Development

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1. INTRODUCTION

Innovation is important in every company, when you do not innovate your competitors will overtake you. The first stage in new product development is finding new product concepts, this can be a very messy process and very uncertain. This stage in new product development is also called the fuzzy front end. Finding these new product concepts can be done by people from inside the organization like the R&D department, it is also possible to listen to the market to get new information and knowledge to find new concepts. Like many other technical companies, Company X developed new concepts and products on their own. This way of innovating also known as technology push, had led to products which did not meet the market needs. Products had too many features and were too expensive or had too less features and nobody needed the product. Since a couple of years most business units started to listen more to their customers but still some innovations are coming from the R&D department. The way of product innovation has to go to a more market pull system, Company X state in their annual report of 2013 that competitors are coming closer and it is getting more and more important to work together with key customers and produce products that have added value in the market and serves the needs of the customers. Over the last years Company X attracted a lot of new people with expertise on sales and/or marketing, due this movement less money is available for research and development, so it is getting more important that the budget which is available is used in a proper way. When finding a way to structure the first stage of innovation and listen more to the customers and other third parties Company X can save time and money in the development process and can also develop products that are more valuable in the market. When this research started at Company X on the first of September the goal was finding new product concepts for Company X Unit 1. When the problem became clearer the research was moved to the research as it is right now, introducing a method to structure the front end of innovation.

This new way of concept development starts with the capability of acquiring and using knowledge and information from the external world. Are you willing to listen to other people? But can you also transform that knowledge inside your company and use it for innovations and new products. This capability is called absorptive capacity, and can be divided in two main parts; the potential absorptive capacity and realized absorptive capacity. The potential absorptive capacity is the degree in which people from inside the organization acquire new knowledge from the outside world, and also sharing this with their colleagues inside the organization. The realized absorptive capacity is the next step, is the

company able to translate the new acquired information in valuable knowledge which can be used to find new products and innovations? To share this information it is important that there is a good integration between the sales, marketing and R&D departments. When this absorptive capacity is high and the organization is willing to listen to the outside world, the uncertainties from the front end of innovation can be reduced.

But this information must be acquired; a structured way to acquire and use this information is the Lead User method. Lead Users are people who are facing a problem from their profession or hobby and have a high incentive to solve this problem. Lead User method was developed by Eric von Hippel, and the goal is organizing a workshop with these Lead Users and experts to come up with new product concepts. The whole project consists of four phases. In the first phase a multidisciplinary team is formed, and the focus and the goals of the project are formulated. The second phase is a research on the trends and needs in the market. Next to those trends and needs interviews are held with experts. In the third phase the main goal is finding Lead Users which will be invited for the workshop in the last phase. The Lead Users can be found on the internet by looking at blogs and forums, another way of looking for Lead Users is to use 'Pyramiding', every person you speak knows someone else with more expertise. In the fourth and final phase the workshop is organized and the Lead Users and experts are invited for two or three days to come up with different new concepts. After the whole Lead User project the company can decide and make a selection, which concepts are valuable and which are not. Before introducing the Lead User method it is important to know how high the absorptive capacity of a firm is because this method is focused on listening to the outside world.

In this research the next main question must be answered:

How can Lead User method contribute to a more effective front end of innovation?

To answer this question the next steps are taken:

This absorptive capacity is tested in a 5 point Likert scale questionnaire which is spread amongst 66 people within Company X, with 42 respondents the response rate was 64%. One of the main outcomes is that people are actively looking for new information for their work (4,14) but that this information is not always used and shared with colleagues (2,71). The same information is also not recorded for future reference, so a lot of information is not used. People think that users can be very helpful to improve current products and developing new product concepts. The results of the questionnaire showed that

the potential absorptive capacity (3,31) is higher than the realized absorptive capacity (2,98), but this difference is not significant.

To get a deeper understanding of the potential and realized absorptive capacity, the current way of concept development and to discuss the added value and pitfalls of the Lead User method, fifteen interviews are held with people that are all active in Sales or R&D, next to that a distinction is made on the experience of the interviewees. The results of the interviews showed that people are actively looking for information in their target market but also in other potential market. When it is about Lead User method, 14 people think that it can be valuable to get more structure in the new concept development within their business unit, but that time and structure are the most important pitfalls. The results of the questionnaire and the interviews led to a manual how Lead User method can be used at unit 1 of Company X.

1.1 COMPANY X

Company X is a Dutch company founded in 1929. Worldwide Company X has more than 700 employees. Company X started as a supplier in a business to business market but last years they started with developing products on their own and creating their own vision. The core business of Company X is making technology for daily use. Company X is divided in different business units which are all focusing on intelligent technology. Every business unit is responsible for the development and commercializing of their own product. (Company X, 2014)

The vision of Company X:

"Company X creates added value with products that solve relevant problems. That is why we talk about technology that matters. The key focus in this is not the technology, but the way in which it is used on a day-to-day basis. The distinctive aspect of the solutions of Company X is that new technologies are processed in a creative and innovative way into elegant, user-friendly products. The success of Company X is based on creativity, a fundamental understanding of technology and electronics, and extremely good cooperation with our customers. We translate our ideas about the market and technology into products which are sold throughout the world".

In the annual report of 2013, Company X stated that there are changes needed in the strategy of new product development. The main points they name are:

- Markets are more turbulent and Company X may not miss a new technology.
- We may not make products that are not what the customers need.
- We must cooperate with our key customers to deliver valuable products.
- We must be more sensitive for the changes in the market.

Company X unit 1 is part of the Company X and producer of the Inverter X, a solar inverter with the possibilities of energy storage. This Inverter X was invented six years ago, and they decided that this Inverter X must have a lot of features and possibilities. The market for energy storage is growing since a couple of years now. Some parts of the Inverter X are a little outdated and the price is higher than the inverter of competitors. Company X is now looking for new solutions in energy usage. An overview of the Dutch energy market and the future of energy can be found in Appendix A. To develop a product that satisfy the needs of the customers against a competitive price Company X Unit 1 wants to use a structured way of concept development like the Lead User method.

1.2 RESEARCH GOAL

After the literature study the research is divided in three main parts. The first part is a questionnaire to get an overview of the absorptive capacity of Company X. The second part are interviews to get a deeper understanding of the absorptive capacity and the added value and pitfalls of the Lead User method, and the third and final part is focused on writing a manual that can be used by Company X Unit 1 in their innovation process.

The main research goal for this research is therefore to:

Write a manual for Company X, on how to use Lead User method to structure the front end of innovation

1.3 RESEARCH QUESTIONS

To realize this goal, there is one main question to answer:

How can Lead User method contribute to a more effective front end of innovation of Company X?

Before answering this main question it is important to know the relation with the absorptive capacity and the willingness of Company X to work with the Lead User method.

So these sub questions must be answered:

What is the relation of absorptive capacity with the front end of innovation and the Lead User method?

Does Company X see value in structuring the front end of innovation with the Lead User method?

1.4 RELEVANCE

There is an academic relevance and a practical relevance. The academic relevance can be found in the first two parts of the research, the questionnaire and the interviews. The practical relevance can be found in the second part, the manual on how Lead User method can be used at Company X to get a more structured front end of innovation.

1.4.1 ACADEMIC RELEVANCE

The academic relevance of this research can be found in the first two parts of the research. In the literature study the relation between the Lead User method and the front end of innovation became clear, and also the relation between the absorptive capacity of a company and the front end of innovation. The relation between the absorptive capacity and the Lead User method can be tested, in this research a score is given for the absorptive capacity of Company X, after implementing and using the Lead User method for a while, it will be valuable to test if the absorptive capacity is higher than in this research. With testing this, the relationship between absorptive capacity and Lead User method can be investigated.

1.4.2 PRACTICAL RELEVANCE

The practical relevance of this research can be found in the last part of the research, the manual for Company X. With this manual Company X can decide if they want to use Lead User method in their innovation process. They learn what the method is and how it can be used by the business unit. When using the research and manual to implement the Lead User method time and money can be saved, and the new way of concept development can lead to products that meet the needs of the market.

1.5 RESEARCH DESIGN

The research has taken six months, from September 2013 till March 2014. The research started with some weeks of desk research to get a better understanding of the trends in the energy market, and also to get a better understanding of the opportunities and problems that Company X Unit 1 faces. The study about the energy market is not used in the research but is attached in appendix A. After this desk research, a literature study took place in this literature study three main topics are studied; the front end of innovation, Lead User method and absorptive capacity. After getting a better understanding of these topics, a model is constructed which shows the relations between the topics.

The data collection is divided in two parts. The first part is an online questionnaire spread amongst 66 employees. The goal of this part is to get an overview of the potential and realized absorptive capacity within Company X. The second part are interviews to get a better understanding on how information is shared, the role customers play in new product development and what the added value and pitfalls of the Lead User method are at Company X. At the end of the data collection it became clear that the potential absorptive capacity was a bit higher than the realized absorptive capacity and that the employees of Company X think that users of their product can be very valuable when it is about product improvement and even new concept development.

The final part of the research is a manual based on the handbook of von Hippel for unit 1 of Company X. In this manual the Lead User method is explained and there is an overview of which steps must be taken but also how they must be carried out. The manual is not included in this research document, but is another document which is only available for Company X.

In the figure on the next page the research model is presented, first the literature research to get a better understanding of the topics and create a theoretical ideal situation on how these topics can be useful for the front end of innovation. The literature is also used to formulate the questions for the questionnaire and the interviews. The results of the questionnaire and the interviews are the empirical evidence for the current situation at Company X. The final goal is to compare those two situations and write a manual on how Lead User method can structure the front end of innovation.

1.5.1 RESEARCH MODEL

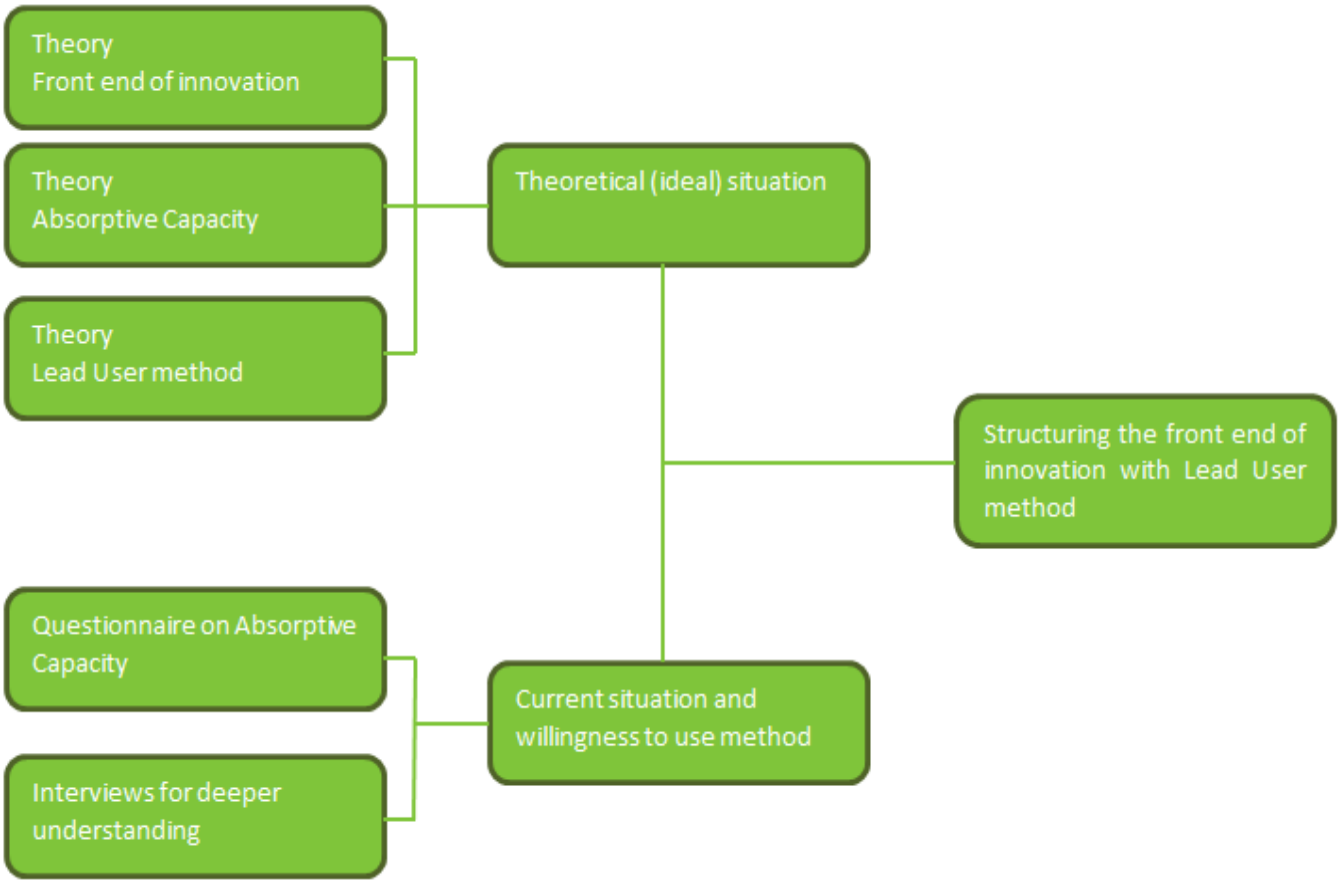

Figure 1: Research model

1.6 OUTLINE AND PLANNING

The total time scheduled for the research is about 6 months, starting from September. There will be space for changes in time and duration of the project. In the table below a more specific outline of the research is given.

Activity	Start Date	Duration	Outcome
Field research and interviews in energy market	09-09-2013	1,5 month	Overview of the current energy market and the challenges in the future
Writing research proposal, feedback and improving	22-10-2013	2 weeks	After feedback, the final research proposal and chapter 1 of the research
Literature research	28-10-2013	3 weeks	Chapter 2 research
Set up and send questionnaire	18-11-2013	1 week	Questionnaire about absorptive capacity
Rewriting research so far/ trend analysis energy market	25-11-2013	2 week	Up to date thesis, and overview trends in the market for the lead user manual
Analyzing answers questionnaire	9-12-2013	2 weeks	Statistics about the potential and realized absorptive capacity
Christmas holidays	23-12-2013	2 weeks	Charge for the final phases
Making interview protocol	02-01-2014	2 weeks	An interview protocol to get deeper understanding of the absorptive capacity
Start planning and holding interviews	06-01-2014	3 weeks	Better overview of absorptive capacity and pitfalls for Lead User method
Writing Manual	27-01-2014	2 weeks	Writing manual for Company X Unit 1
Add conclusions and reflection, writing final thesis.	10-02-2013	2 weeks	Finalizing the thesis

Table 1: Overview of the research

After defining the problem of Company X, the goal of the research and defining the model and design, the next chapter goes deeper in the theoretical topics of this research; the different topics are discussed and a model is presented on how the topics relate.

2. THEORETICAL FRAMEWORK

The theory which is used in this research is based three main topics. The first one is the front end of innovation, also called the fuzzy front end, how does Company X come with new product concepts now? Which factor influence this front end? In this research the absorptive capacity and the Lead User method are investigated. First the absorptive capacity is described; some theory on sharing of information and R&D and Marketing integration is added for a better understanding, and after that the Lead User method is discussed. This chapter ends with a model and a short description of the relation between the absorptive capacity and the Lead User method, and how this plays a role in this research.

2.1 ''THE FUZZY FRONT END''

The front end of innovation also known as the ''fuzzy front end'' is the stage before the new product or process development. There is a relation between this front end of innovation and the new product development process, but most times this front end is more uncertain and chaotic, while the NPD process is more structured. The goal of the company in the front end is to minimize the risks and find the highest potential (Koen, et al., 2001). The article of Cooper (2002) is about a stage gate process and the first steps are mostly seen as the generation of new ideas. There are five elements in the front end of innovation which are: opportunity identification, opportunity analysis, idea generation, idea selection and concept and technology development (Koen, et al., 2001). The front end of innovation is mostly seen as the main weak point in the new product development process. According to the article of Khuruna & Rosenthal (1997) there are three reasons why failures occur in the front end of innovation, these are: New products are canceled during the development because they do not fit the strategy of the company, people spend too less time on new products because they are too busy with other work, and last the announcement of new products is later then the introduction which make the new concept a moving target. Company X uses most of a technology push system for their new products. This can lead to products which are not what the customers want (Chau & Tam, 2000). So it is important to reduce the risks and uncertainties, in the article of Dougherty (1992), it is mentioned that integration of the market and the technology plays a huge role when firms want successful innovations (Dougherty, 1992). When talking about more incremental innovations and improvements in the existing products Company X is listening to customers and partners. The development new

concepts at this moment are all intern at Company X. They come up with their own ideas and try to build the best products. People think that the customers do not know what they need because they do not know what the possibilities and the new techniques are. This resistance against information from the external world is called the not-invented-here syndrome (Hussinger & Wastyn, 2011). After some interviews with different Company X employees, this way of concept developing is used by Company X. They also say that there are some changes the last years. Customers are getting more important in the development of new products, but not enough. Using customers and other parties can be valuable according to different employees. As mentioned by the article of Chau, (2000) the life cycle of new technologies is getting shorter and it is getting harder for designers in companies to keep up with all the trends and changes in the market. An open platform where companies work together with suppliers and customers can make it a lot easier and can save a lot of time and money (Chau & Tam, 2000). Looking to the outside world, working together with other parties and use that information to develop better products is called the absorptive capacity.

2.2 ABSORPTIVE CAPACITY

Absorptive capacity was first introduced by Cohen & Levinthal, (1990). The definition they use for absorptive capacity is: *The ability of a firm to recognize the value of new, external information, assimilate it, and apply it to commercial ends* (Cohen & Levinthal, 1990, p.128).

In more recent work of Zahra & George (2002) this definition is expand with a sustained competitive advantage. They see ACAP as dynamic capability of a firm. Absorptive capacity is related to the learning of an organization so it is also important that information that is acquired is shared within the company, people within the organization must know this new information so they can also use this. Using task forces and cross functional teams makes it easier to disseminate information through an organization (Jansen, van den Bosch, & Volberda, 2005). Absorptive capacity can be divided in four different dimensions, the four dimensions are:

- Acquisition: Identifying the external knowledge but also get it in your company.
- Assimilation: When the knowledge is intern it is important that it is well understood by the different people within the company.

- Transformation: The transformation of the newly acquired knowledge into the change of the current routines in the organization. In this dimension the information becomes natural in the organization.
- Exploitation: The new acquired information is used to create new processes and products (Zahra & George, 2002).

Zahra & George make a distinction between potential and realized absorptive capacity. When a firm is capable of finding and acquire knowledge we talk about potential absorptive capacity. When an organization is also able to transform and exploit the new knowledge we speak about realized absorptive capacity. An organization which is able to use their realized absorptive capacity is more efficient than organizations which only acquire information and do not use in their innovation process.

To recognize and use external information it is important that there is already knowledge about the trends and the target market. Without this knowledge it is very hard to understand and recognize valuable information of the external world (Lane & Lubatkin, 1998).

When it is about new product development it is important to acquire new information, but which parties are valuable and for what kind of innovation? Bonner, (2004) conclude that in a Business-to-Business market your customers can be valuable in product innovation. When it is about incremental innovations the advantages are high when they use embedded and homogeneous customers, but for highly innovative product they saw that different perspectives were important and so different customers with all their own perspective are most valuable (Bonner & Walker Jr., 2004). With the use of feedback of customers it is possible to improve your product and get some incremental innovations. Customers are thinking in today's possibilities and cannot tell you the next big technology. You have to listen to their needs and not make what they want (Baker & Sinkula, 1999). Next to your customers, it is also important to scan your external environment and know your suppliers and also competitors well. A learning orientation makes people not only collect all this kind of information but also of this information is applicable. ''Customer research should not be regarded as the route to the answer but as critical market intelligence that can focus the NPD team's search for an ingenious solution'' (Baker, 1999, p.298).

2.2.1 SHARING INFORMATION AND R&D- MARKETING INTEGRATION

As mentioned in the literature about absorptive capacity the sharing of information is important.

In a company like Company X where different business units are active, it is hard to share all information. Hansen, (1999) showed that there are weak and strong ties when it is about information sharing. Both have pros and cons. But he concludes that weak ties are more valuable when it is about information that is not complex and independent. Strong ties, which are taking a lot of time to maintain but giving people also a better overview which person had which information, are more valuable when it is about technology, and when the information is dependent. For breakthrough innovations a stronger relation between the business units but also between the departments are more valuable than informal weak ties (Hansen, 1999). Next to these strong and weak ties it is also possible to introduce a control system, Simons (1994), describes four main management control systems (MCS). *Beliefs systems*, introducing value cores of the organization. *Boundary systems*, which defines limits and the boundaries which can be used as standards. *Diagnostic control system,* whereby formal feedback is used on the base of predefined goals. And the last one, *Interactive control system,* whereby more interaction and a dialogue is made possible (Simons, 1994). When talking about innovation, beliefs systems are used to inspire employees to find new solutions. Boundary systems also try to motivate people but with some boundary restrictions, the same is true for the diagnostic control systems. The interactive system makes it possible for firms to position themselves in a dynamic market place and give employees more space to finds new solutions (Widener, 2007).

According to the literature of Moenaert the relation between the marketing and the R&D department is crucial for success in new product development by reducing uncertainties. Uncertainties are defined as the gap between the information that is already known by the organization and the information they don't have, but which they want to have. So when this gap is big, more control and monitoring is needed (Gallbraith, 1973). They mention that concepts that are based on consumer needs or as a response to competitors are more successful than concepts which are based on pure technological opportunities (Moenaert & Souder, 1990) Research of Souder (1987) showed that this technical expertise is not useless but correlate positively with the technological and commercial success. A technological innovation is a process with a lot of information acquiring and sharing. Therefore it is important that people from different departments give input. The main problem in the relation between the marketing and R&D

department is the communication. There is a difference in language use, but also differences in values and function loyalties (Moenaert & Souder, 1990), therefore it is important to have more integration between the departments. Moenaert describes three main categories: task specification, organizational structural design, and climate methods. Task specification, which is more formal integration, the tasks are planned and coordinated. Structural design focuses on the elimination of boundaries, and the improvement of direct contact like for example, task forces. The third ones are climate methods, these final methods are aimed at promoting the more cultural sense of the departments.

Next to R&D and Marketing, Sales plays also a crucial role in the new product development. They are most active on the market and can gather information that is not available for other people which are involved (Anderson & Dubinsky, 2004). In more recent work of Ernst (2010), the distinction is made between marketing and sales. They found a significant positive effect on the relations between marketing, sales and R&D when it's about success of new product development. They conclude that the relation between Sales and R&D is the most important in the concept and development stages and less important when it's about the product implementation (Ernst, Hoyer, & Rubsaamen, 2010). This integration of the different departments makes it easier to share, but also transform and exploit new acquired information, and increase in this way the realized absorptive capacity of an organization.

To realize more information sharing and more cooperation between the departments there are different methods, in this research Lead User method is chosen. With this method multidisciplinary teams with people from different departments are working together for new concept development, so information must be shared during the meetings in this method. Therefore this topic on sharing information is not coming back in the model, but is seen as a part of the Lead User method.

2.3 LEAD USER METHOD

As described the Lead User method can make the so called ''fuzzy front end'' less ''fuzzy'' and more structured, but also focus on more information sharing between the departments.

Lead User method was introduced by Eric von Hippel in 1986. He defines lead users as: ''*users whose present strong needs will become general in a marketplace months or years in the future*'' (von Hippel, 1986, p. 791).

Lead users differ from normal users in the way that they think from their own real world, so they can't think outside of that and define what the needs and concepts of the future are. ''general'' customers can be useful for improving your products and help with incremental innovations (Churchill, von Hippel, & Sonnack, 2009). According to von Hippel (1988) lead users have two main characteristics:

- Lead users experience a problem years before the public acknowledge them
- Lead users have a high incentive to solve these problems

The figure below shows the difference between Lead Users and normal users of a product.

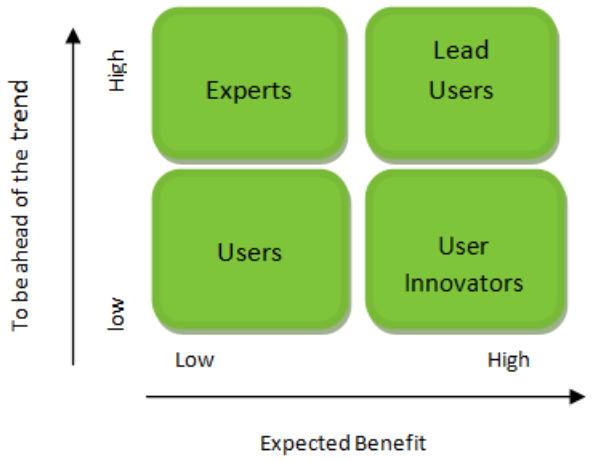

Figure 2: Stakeholders in the market

Lead users are most useful when a new product solves a problem and make the future of the users easier. Lead users are less useful when it is for example about new materials for industrial use (von Hippel, Horizontal innovation networks - by and for users, 2002).

Lead users do not have to come from your target market, Hienerth (2007) found in his research on this topic that users from a different market find more novel concepts. When people are further distanced from the technology they find less novel concepts.

To start a lead user project, Eric von Hippel wrote a handbook, where the four phases of the project are described (Churchill, von Hippel, & Sonnack, 2009). The time normally needed for such a project is about four to six months. The first phase consists of defining the focus of the project and its overall goals. It is important to identify needs and define your searching field in this stage but also define what kind of innovation you want, extending a product or a real breakthrough innovation. In this phase you also have to select the project team from your own organization. According to von Hippel such a team consist at least four persons from different expertise, like a team leader, a technical-, manufacturing- and a marketing expert (Churchill, von Hippel, & Sonnack, 2009).

In the second phase you start with the research. As a team you start investigating what the needs and trends of the market are. There are different ways to achieve the information that is needed. In most cases the team starts with a literature scan about the trends in the markets, these trends can be discussed. After this scan most of the time interviews are done with experts in the target market. After this research it is important to write down the needs of the customers and analyze the similarities and differences.

Phase three is used to make sure the needs in trends in phase two are found more specific. With these trends you have to make propositions, is this possible to do and can we make money with it (Churchill, von Hippel, & Sonnack, 2009)? It is important in this phase to find the right lead users for your project. In the fourth phase you need these in meetings for concept development. There are three types of Lead Users according to von Hippel:

- Lead users in your target market
- Lead Users which use the same applications in a high end market
- Lead Users with respect to important attributes faced by users

In the fourth and last phase of the project you develop with your team and your lead users the new product concepts. You write the specifications for new products, discuss the economic potential of the concepts and discuss how the new product can be developed and produced (Churchill, von Hippel, & Sonnack, 2009).

One of the most difficult tasks in this process is to find the right lead users. The identification of lead user in the literature of van Hippel is more focused on industrial products. In this method lead users are found by trends, and expectations (Churchill, von Hippel, & Sonnack, 2009). In more recent work is argued that lead users in consumer market also can be identified by competence. Skills and knowledge, willingness to learn and experiment, and the ability to engage in dialogue are those competences (He & Chen, 2010). Another way of finding Lead Users is with the use of pyramiding. Pyramiding is finding Lead Users by asking people if they know people which know more about a topic. Via this way you find with every other person a person that knows more about a topic. When you found your person with the desired expertise you have reached ''the top of the pyramid'' as they call it (Poetz & Prügl, 2009). According to Eisenberg, (2011) there is a new phenomenon when it is about finding lead users; ''Netnography'' which is a combination of ethnography and internet. You find your Lead User by looking at forums about the topic and find the most active members and posters. The use of user toolkits for innovation is a different way of innovation with Lead Users. This is based on a trial and error principle. Companies give their customers the opportunity to try new products and find new solutions. With these this toolkit the customers can learn how to use the product but also how to improve it (von Hippel, 2001). But why will lead users share their valuable data for free? According to Harhoff, Henkel. & von Hippel, (2003) people will share their information because they cannot innovate their whole idea by themselves, they need information from other parties and try to benefit from that innovation. When this information is not shared everyone must innovate on their own which lead to a lot of different products. The sharing of information leads also to a better welfare of society.

When looking at the Lead User method there are some strong points but also some pitfalls for high tech companies. One of the strong points of Lead User method is that when using Lead Users but also lead user experts you get very valuable information and it will save your R&D department a lot of work (Churchill, von Hippel, & Sonnack, 2009). The use of lead user method is also much faster than other traditional ways of identifying new product concepts and also less costly, but provides also better outcomes than traditional methods (Herstatt & von Hippel, 1999). Lillien et all. (2002) tested several hypotheses about Lead Users methods. They found that this method lead to new product lines and also products with a bigger potential. They thought that lead user methods had also some negative outcomes like, product concepts which do not fit in the strategy of the company or that concepts that are developed are hard to protect. During their research they rejected those hypotheses. When organizations want to implement Lead User method there are

some barriers and pitfalls which can lead to problems and rejecting the theory. Managers are sometimes not sure about the added value of the information of Lead Users. They think that their own R&D department has the same information. Another issue is the mindset of the company, they are used to their own methods and do not know a lot about lead users, this makes it hard to implement the method. (Churchill, von Hippel, & Sonnack, 2009). Olson describes in his article seven factors that are important when you want to use Lead Users. His main points are a good support from the management during the project, a good in depth investigation in the topic and an extensive trend analysis. Your project is dependent on your own search for Lead, Users, when you find the best users your project will be a success. And his final advice, test always the developed concepts on general users; they are your target market (Olson & Bakke, 2004).

2.3.1 THE RELATION BETWEEN ABSORPTIVE CAPACITY AND LEAD USER METHOD

In this research it is supposed that before a company can implement the Lead User method a certain level of absorptive capacity is needed. When a company is not willing to listen to the outside world, or listen to their customers, the Lead User method will not be valuable at all. After introducing the Lead User method at Company X it is supposed that the absorptive capacity will go up because the implementation of the Lead User method pushes people to go to the outside world and share acquired information with people from different departments in the project team.

Because there are no scores known of the absorptive capacity of Company X, this capacity is tested with a new questionnaire. This makes it hard to conclude if the absorptive capacity of Company X is high enough to implement the Lead User method. After analyzing the questionnaire and the questions in the interviews on how important people find information from the outside world, and the value they see in the Lead User method it is determined if Lead User method can add value.

The score that comes forth from the questionnaire can be used in future research and can give better insights in the relation between the absorptive capacity and the Lead User method.

2.4 CONCEPTUAL MODEL

To show what the relations are between the different topics in this research the next model is developed. Company X wants to develop products that meet the needs of their customers better, so a more effective way of innovating is needed which saves time, money and makes sure that there are fewer uncertainties in the front end of the whole process. Effectiveness of the front end of innovation is operationalized as the number of concepts that leads to innovations which are successful in the market. The Lead User method has a positive effect on the effectiveness of the front end of innovation and can reduce the uncertainties, and lead to more market conform innovations.

The absorptive capacity is split in potential and realized absorptive capacity as described in the literature. This absorptive capacity has an influence on the Lead User method and the front end of innovation. Before Lead User method can be implemented in a company a certain level of absorptive capacity is needed, the company must be willing to listen to the outside world and use the acquired information. On the other hand, when Lead User method is implemented in an organization the absorptive capacity will go up, because the method pushes the organization to invite Lead Users and experts to come up with new concepts.

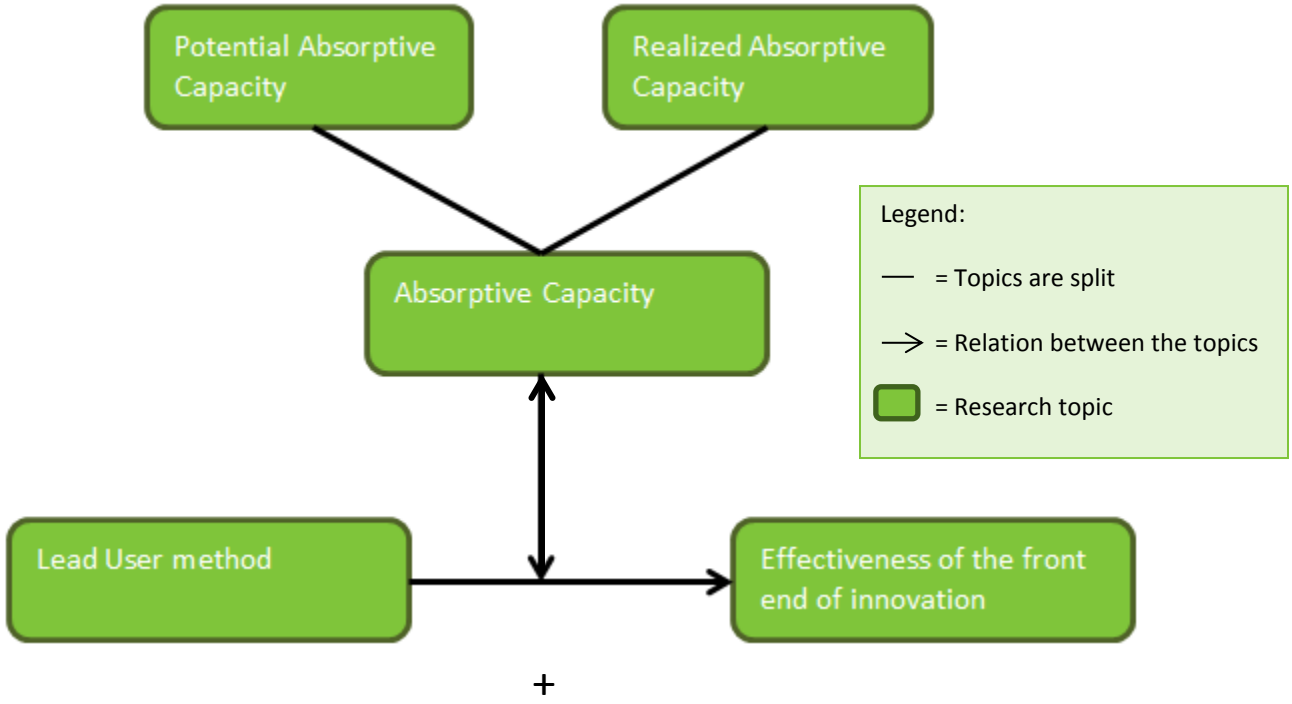

Figure 3: Conceptual model, relations between absorptive capacity, Lead User Method and the front end of innovation

3. METHODOLOGY

After describing the theoretical topics in the previous chapter, this chapter describes the methods that are used to gather the data that is needed and how this data is analyzed. There are two parts in the data collection. The first part is the questionnaire about the absorptive capacity of Company X. The second part are the interviews with people from different business units to get a deeper understanding of the absorptive capacity at Company X and finding the added value and pitfalls for the implementation of the Lead User method. After these parts a manual is written on how Lead User method can be used at Company X and how it gives more structure to the front end of innovation.

3.1 THE QUESTIONNAIRE

The first part of the data collection will be a cross sectional study, an online questionnaire is done at one point in time to get a better understanding of the absorptive capacity, which is discussed in chapter two of this research. The questions are closed-ended and must be answered on a 5 point Likert scale which goes from strongly disagree to strongly agree. The advantage of an online survey is that people cannot forget to answer some questions or give two answers. I expect that when people can fill in the questionnaire online they are more likely to do it because it takes less effort because they can sit down behind their desk and send the answers directly to the researcher. Due the used tool; Google forms it is possible to get a quick overview of the results which gives the researcher an overview of the outcomes. The questionnaire is spread under 66 employees of Company X. These 66 are equally spread over the six largest business units within Company X. To get a broad overview, people from all different departments and with different experience times at Company X are approached. All people answered the questionnaire anonymous. The reason to go for a questionnaire is to get an overview of the current situation at Company X from a large group of people. A questionnaire is easier to analyze and provides more uniformity (Babbie, 2010). The questionnaires will be analyzed with SPSS 21. The absorptive capacity is divided in two types: the potential and the realized absorptive capacity, these two types are operationalized as follows: The potential absorptive capacity is measured with question about how often employees visit other divisions and try to acquire new knowledge for the company in the outside world, this can be knowledge within the target market but also knowledge from other markets. Also questions are asked about how the organization reacts on changes in the market and can serve new wishes of customers. The realized absorptive capacity is operationalized with questions about the ability

of the organization in recognizing the value of the new information and if they store the information for later use. Finally some questions are asked about how the new information is used when it is about new products (Jansen, van den Bosch, & Volberda, 2005). The whole questionnaire as it was presented to the Company X employees can be found in appendix B, the questions about potential absorptive capacity are marked with a P and the question about the realized absorptive capacity with a R, these marks were not visible for the employees of Company X. To analyze the questionnaire, first the reliability will be measured with Cronbach's alpha α, for a questionnaire like this a score >0,7 is acceptable. (Bland & Altman, 1997). For further analysis the descriptive statistics will be calculated, this gives an overview of the scores given. A distinction will be made between the business units, but also between the different departments. To see if the differences between the business units and departments are significant a one-way Anova test is done. The results of this questionnaire can be used to see what the score of Company X is on absorptive capacity for future research and if Company X is willing to listen to customers and other third parties.

3.2 INTERVIEWS

For the second part of the data collection semi-structured interviews are held with fifteen people divided over the different business units. According to the literature of Moeneart, (1990) the integration of R&D and Marketing is important therefore the interviews are held with people from sales/marketing and also with people from R&D. Due the changes during the last years from supplier, to making own products and the development of the different business units, the interviews are held with people with less experience (< than 10 years) and also with people with lots of experience (>25 years). Most of the selected people have also answered the questionnaire. The people that are interviewed all agreed that only their function is mentioned in this research. This way of data collection is most suitable because it is important to know what the different points of view are about Lead User method. (Barriball & While, 1994). The advantages of this method are the high validity because people can go deeper in the subject and explain why they did something, and you can explain questions and other issues which are not clear for the interviewee. Some weaknesses of this method are that the quality of the research depends on the skills of the interviewer, that it is quite time consuming with fifteen interviews, and that it is quite difficult to analyze the answers, because the questions can change and it is hard to decide what is important and what is not (Barriball & While, 1994). The protocol for the interviews can be found in Appendix D. To make it easier to analyze all the answers of the interviews, transcripts are made. The

transcriptions are word-for-word, so emotions, false starts and words that are mumbled are left out. The transcriptions are in Dutch and quotes will be translated in the result section of this research.

The first goal of the interviews is getting a deeper understanding of the current way of developing new product concepts, the role customers play, and the absorptive capacity of Company X. The second goal is to find out if employees see the Lead User method as a valuable method to structure the front end of innovation. It is important to know what the pitfalls and dangers are when using Lead User method in a company like Company X. The questions for the interviews were formulated after analyzing the results of the questionnaire, so it was possible to get deeper understanding on the most valuable questions.

The analysis of the interviews is based on the method of pattern matching which was introduced by Ying (1994). With this method it is possible to compare the empirical evidence with the ideal world from the theory (Dewulf & Graaf, de, 2010). So with this method it is possible to compare the different theories about absorptive capacity, information sharing and Lead User method with the situation as it is at Company X. To amplify this, some examples are presented from the interviews. The general criticism on this method is the lack of precision and next to that also the control effect, the researcher can influence the situation just with his appearance, and the biased viewpoints, this occurs when the researcher has a selective perspective or interpretation of the situation (Amaratunga, Baldry, Sarshar, & Newton, 2002).

An example of how the method will be used can be found below:

Theory (ideal)	**Empirical evidence**	**Confirmed?[1]**	**Examples**
R&D-marketing integration is crucial for success in new product development (Moenaert & Souder, 1990)	Most of the interactions between R&D and marketing is on the own initiative of the people. There is no formal integration	✘	●The relation is difficult, giving R&D specs results in resistance. And when you give them too much freedom, the solution is too technical. (PM1, r.3390) ●When it is needed, this is not regularly or very often. (AM6, r.887)

Table 2: Example of the pattern matching method

[1] Possible answers:
The theory is confirmed: = ✓
The theory is partly confirmed = ✓✘
The theory is not confirmed = ✘
No data available to compare theory and pragmatic reality = -

After analyzing the answers from the interviews a manual is written on the use of Lead User method and how the method can add value to the new product development process of Company X Unit 1.

3.3 THE MANUAL

The manual that will be written for Company X Unit 1 will be guidance for the business unit to show how Lead User method can be used and be a valuable addition to the innovation process. The manual is divided in four parts as described in the handbook of von Hippel. The final handbook is as mentioned not in this document but available for Company X.

Phase 1: *Preparing for your lead user project.*

In this phase the goals and the area of the new product and target market will be defined. Also a planning must be made for the research in phase two. After the goals and target product/market are known, a project group must be selected.

Phase 2: *Identifying Trends and Key Customer Needs*

As described in chapter two this phase is used to do an in depth investigation on trends in the target market. In this phase there will be a literature study and interviews with lead user experts. The goal of this phase is to identify the trends from the literature, but also get new information from the open interviews with the lead use experts. Those experts can be found in literature and magazines on this topic. For example an innovation manager of a grid operator or energy supplier can be a Lead User expert.

Phase 3: *Understanding the needs and solutions of Lead Users*

In this phase it is important to get a better understanding of the identified needs of phase two. The main challenges in this phase are identifying the Lead Users which you need for interviews and in phase four for the meetings. The project group has first to come up with some basic new concepts. It is important to try to make a business case for these concepts and present them to the management. After this it is time to identify the Lead Users and interview them about the new concepts.

Phase 4: *Improving solution concepts with lead users and experts*

In this final phase the main activity is organizing a workshop with the identified Lead Users, experts, and project group. These workshops take usually two to three working days of intensive design work. In these workshops the concepts developed in phase three must be worked out. Ten lead users are normally invited to these workshops. At the end of this phase new product concepts must be developed. The key elements of these concepts are: specification of the design of the products is there a commercial potential, the ways the products must be developed and produced. At the end of the pilot an overview will be written about the new concepts.

The next chapter gives an overview of the results of the questionnaire and the interviews. The results of the questionnaire are focused on the absorptive capacity of Company X and the differences there are between business units, but also between departments. The results of the interviews will give a better understanding on this absorptive capacity and a better insight in the willingness of Company X when it is about using Lead User method to come up with new product concepts.

4. RESULTS

After Describing the methodology in the previous chapter, this chapter gives an overview of the results and is divided in two main parts. In the first part the results of the questionnaire are analyzed, a significance of 95% is used in these results. The second part describes the results of the interviews; the questions in the interviews are based on the outcomes of the questionnaire. The results can be found in the different tables, paragraphs are added for the added value and pitfalls of the method. This chapter ends with a comparison of the theory, and the reality as it comes forth from the interviews.

4.1 QUESTIONNAIRE

As mentioned in the methodology chapter the questionnaire was spread amongst 66 employees of Company X and there are differences in the response rate between the different business units. In total the response rate was (42/66)*100 = 64%. This is divided over the business units as this:

Business unit	Sample (A)	Response(B)	Response rate (B/A)*100
Unit 1	16	14	(14/16)*100 = 88%
Unit 2	7	4	(4/7)*100 = 57%
Unit 3	10	4	(4/10)*100 = 40%
Unit 4	13	7	(7/13)*100 = 54%
Unit 5	10	5	(5/10)*100 = 50%
Unit 6	10	8	(8/10)*100 = 80%

Table 3: Response rate per business unit

Before analysing the scores of the different questions the reliability of the questionnaire; the Cronbach's alpha α is calculated. For a research like this the Cronbach's alpha must be over 0,7 (Bland & Altman, 1997). For the potential absorptive capacity the Cronbach's alpha is 0,827 and for the realized absorptive capacity this is 0,737. The questionnaire is reliable and the questions are consistent. There is an overview of tables with results in Appendix C.

Some remarkable outcomes from the questionnaires are the high scores when it is about the search for new knowledge to do the job which is 4, 19 but when the question is about using that same knowledge the score is only 3, 02.

When it is about knowledge sharing it becomes clear that there are differences in who they share information with. Within the business unit the information is most of the time shared with people which are also active in the same department. This is in line with the expectations on forehand. The information sharing between the business units scored low (2,43).

Result which were not expected are the high scores for the value of users when it is about improving products and develop complete new product concepts. These scored 4,59 and 4,12. So people think that these people can be very helpful but when it is about how they use their users the scores are much lower. Panels meetings with users are not used to get new information and also asking users for new ideas is not included in the process.

In comparison with the other business units, the people within Unit 1 give the same scores on the first points that are mentioned above. When it is about arranging meetings with users or other parties they give lower scores than the other business units, but this is not significant. A one-way Anova test shows that there are significant differences between business units when it is about the appliance of new acquired knowledge to the job. Livestock management gives a higher score than the other divisions. AVI scores significant lower on the question: I'm looking for knowledge in other areas than my target market.

Another remarkable score is the score on the questions: more guidance from experts in market research and innovation management will be helpful. These scores are 3,81 and 3,83.

In Table 4 a distinction is made between the potential and realized absorptive capacity per Business Unit. The potential absorptive capacity scored a 3,31 while the realized absorptive capacity scores a bit lower, 2,98. The difference between these scores shows that employees of Company X acquire new information but that it is not always used when it is about new product development. As seen in the table all scores on potential absorptive capacity are between 2,91 and 3,90, the scores on the realized absorptive capacity between 2,72 and 3,67.

	Potential absorptive capacity			Realized absorptive capacity		
	N	Mean	Std Deviation	N	Mean	Std Deviation
Unit 1	14	3,03	0,626	14	2,72	0,569
Unit 2	4	2,91	0,458	4	2,91	0,640
Unit 3	4	2,93	0,537	4	3,15	,0219
Unit 4	7	3,46	0,231	7	2,84	0,485
Unit 5	5	3,90	0,321	5	3,35	0,388
Unit 6	8	3,67	0,466	8	3,27	0,251
Total	42	3,31	0,587	42	2,98	0,509

Table 4: Scores on potential and realized absorptive capacity

Another distinction can be made, namely between the different departments, the difference between the commercial site of the business units; Sales/Marketing and the research and development side. Before the questionnaire there were some expectations about the differences between these two groups. A difference score was expected on the question: the marketing and sales department are involved in new product development. The expectation was that R&D would score this much lower than Sales/Marketing. The scores after the questionnaire are almost the same. 3,45 and 3,38. A one-way Anova test is done to see if there were significance differences between the different departments. Only two questions scored significant different, these to questions were: complaints of clients fall on deaf ears in our business unit and employee's record and store newly acquired knowledge for future reference.

4.2 INTERVIEWS

The first goal of the interviews is getting a deeper understanding of the current way of new concept development at Company X, the role that the customers play, and the absorptive capacity. The second goal is related to the Lead User method; see employees at Company X Lead User method as a valuable way of structuring the front end of innovation, and the pitfalls and dangers which the employees see.

In Appendix D the interview protocol is presented, the transcripts that are made are excluded from this research and are for confidential use for company X.

The answers of the interviews are analyzed with the pattern matching method. The results of the interviews are summarized in the tables below. The first column shows the theory (ideal), the second column is the empirical evidence as it found at Company X, the third column shows if the empirical evidence at Company X is in line with the theory. The fourth and last column shows some examples as they are said by different interviewees. There are three tables. The first table is about the front end of innovation, the second table focuses on the sharing of information and the third one is about the Lead User method. The questions about how valuable the method is and the pitfalls of the method cannot be analyzed by theory because this is an opinion of a person, the analysis of these questions can be found after the tables.

Theory (ideal)	Empirical evidence	Confirmed?	Examples
Due the shorter lifecycle of technology working together with suppliers and customers saves time and money (Chau & Tam, 2000)	Over the last years some changes occurred. Customers become more important, and Company X listens more to them. They are mostly used for feedback and improvement of products to develop faster.	✓ ✗	●*When there are compliances of customers it is coming to us. But when it is about a new feature it stays at product management.* (PD1, r. 408) ●*On the other hand, the feeling of we can do it better is still there, NIH syndrome.* (MM4, r.646)
Using technology push can lead to products which are not matching with the market (Chau & Tam, 2000)	In the past years, some products are launched which were over dimensioned or there is no market for it, or the market is not ready yet.	✓	●*The product was universally, then it is definitely too expensive. You can do everything but that is too much*. (HD1, r. 42) ●*It is invented from the technology, it was too expensive and not user friendly*. (MM4, r. 674) ●*We start innovating but miss the time to market.* (MM4, r. 1293) ●*I think the problem of developers is that they make products to complex.* (PS2, r. 4171)
The concept development can be a messy process (Koen, et al., 2001)	At this moment it is quit ad hoc, when someone gets an idea, no matter what source it come from. They decide intern if there is capacity and people want to work on it. So there is no formal structure which can be called messy.	✓	●*Ideas come from inside, talk about it at the coffee machine, Do we want to put time in it? And then we give a go or no go.* (BD5, r.1382) ●*Sometimes there are meeting but also a lot of ad hoc.* (PM3, r.1681) ●*The ties are very short, but you have to watch out for ad hoc policy.* (EM5, r.2779)

Theory (ideal)	Empirical evidence	Confirmed?	Examples
To get the most valuable information and successful products it is important to know your suppliers, customers, and competitors (Moenaert & Souder, 1990) *How much do you look at your target market but also to different markets? *= not based on theory	People are looking for information in newsletters, exhibitions. This is the main way to gather information from the market and competitors. Next to that there is contact with customers and business partners. But not everyone has this knowledge.	✓✗	●*Rule number one is, never do what the customers asks. The customer has no idea. You have to understand their needs and problems* (RD7, r.2169) ●*We went to customers to see how they use our products and we also purchased and analyzed competitive systems*. (MM4, r. 646) ●*We are working with a partner model and we see that it is difficult to keep the feeling with the market.* (RD8, r. 3121)
R&D-marketing integration is crucial for success in new product development (Moenaert & Souder, 1990)	Most of the interactions between R&D and marketing is on the own initiative of the people. There is no formal integration	✗	●*Integration of R&D and sales is important. People stay in their own department. We do use scrum to inform the people of marketing and sales*. (RD4, r. 2502) ●*The relation is difficult, giving R&D a spec results in resistance. And when you give them too much freedom, the solution is too technical.* (PM1, r.3390) ●*When it is needed, this is not regularly or very often.* (AM6, r.887)
Customers are only valuable for incremental innovations (Hansen, 1999)	Customers are giving feedback and talk to sales and support to improve products and do small incremental changes.	✓	●*That are not innovations that are small improvements, to make it better.* (RD7, r.2207) ●*Customer support gets a lot of feedback from customers and this is shared with us, but not enough.* (PM3, r. 1796)

Theory (ideal)	Empirical evidence	Confirmed?	Examples
*Lead User method can be a valuable way to structure the concept development of Company X *= not based on theory	Most of the people think that is good that more structure in the concept development process is good. And the Lead User method good be a good method.	✓	●*Absolutely, it happens way to less. I think it is good to structure it*. (EM5, r. 2846) ●*I think it is valuable for some business units, organizations when you need more creativity.* (BD3r. 1227) ●*I think it is important to bring market information in a more structured way in our Business unit* (S1, r. 3803)
Lead User method takes time to do it well. An extensive analysis and in depth investigation in the topic (Olson & Bakke, 2004)	It is important to put time in the development of new products, but it is not more important than the daily business. So it may not take too much time.	✘	●It is important that it has a priority in agendas of people and that is not part of the daily business. Next to that the daily business may not be forgotten. (S1r.3807) ●*It may not become a distraction form the main proceedings.* (RD8r. 3273)

4.2.1 THE ADDED VALUE OF LEAD USER METHOD

The reduction of time and money is one of the drivers to implement the Lead User method according to the literature. Researches at different companies like 3M showed that using the Lead User method indeed saves time and money. It is impossible to check if Company X can save time and money with implementing the method for two reasons. The first reason is that in the current situation at Company X people do not know how much time they spend on the development of new product concepts, this a task that they do in their daily job, between their tasks. The other reason is that the money spent on the Lead User method varies every time and before the method is implemented it is impossible to say how much money a Lead User project will cost. Based on the literature and other companies which already use the Lead User method Company X must assume that using the Lead User method can save time and money.

The question about how valuable the Lead User method can be for Company X results in different answers of the people of different business units. The general viewpoint of the interviewees is that Lead User method can add value to the concept development process of Company X. Due the growth of the last years the business units expand and it is getting harder to know what everybody is doing, more structure is valuable. Most of the business units see the value for new breakthrough innovations and not for small incremental innovations. Only two of the interviewees said that this method is not valuable at this moment because there are lots of ideas that are planned for the future so they do not want to put a lot of time in a new way of finding concepts. *I think it can be valuable for other business units and organizations, when you need creativity or inspiration. But we have hundred ideas, which three of four are really beneficial that is our challenge* (BD3,2014 r. 1245). People think that it is important to understand what the trends in the market are and that parties from other markets can add value to the new products, people from intern only see and seek solution in their own market and technology; they find it difficult to think out of the box. Lead User method can help to get new insights and ideas. ‘’*I think that we need this kind of mentality to come up with fantastic products which are wanted by the market*’’ (AM6, 2014, r. 983). In the most business units new ideas for concepts can come from different sources and when they come, the business unit decides if it can add value and can be profitable. When there is no capacity at that moment the new ideas are slowly dying. Only one business unit has a periodical meeting with different disciplines to decide which new ideas and concepts are good enough to develop. The most difficult point at this moment is the time it will cost. The workload is quite high and people are

all busy with their daily jobs so there is not a lot of time. Time for this method must be created and the management.

When the question: *Do you want to take part in a Lead User project and do you think that people within the Business unit are willing to take part?* is asked. People are all very positive to try a project like this. This is an indication that people think that this method can be valuable. They also think that other people in the business will participate.

4.2.2 PITFALLS OF THE LEAD USER METHOD

Next to the positive intentions of the interviewees and the willingness to participate when this method will be introduced there are also different pitfalls and dangers which came up during the interviews.

The literature gives different points which need attention when introducing Lead User method, like the support from management and to put enough time and effort in the process. The interviewees at Company X saw next to these points also different dangers and pitfalls for the Lead User method.

The main pitfall which they see is that it is getting to informal. That people are going to come up with ideas which absolutely do not fit the strategy of the business unit. *'' It can become one big pool of ideas, which becomes confusing and then slowly dies''* (RD8, 2014, r.3274). "You have to go in a certain direction, and not start dreaming'' (EM5, 2014, r.2929). *''You must define roles and responsibilities"* (RD4, 2014, r.2648). *"When external people come up with ideas which seems to be quite close to your market, it is often quite far away of it"* (RD7, 2014, r. 2354). When the method is introduced as described in the literature this issue is not a big deal.

Information sharing is also seen as one of the dangers, but the interviewees are divided when it is about this point. The people are divided over three opinions.

- We have to make use of non-disclosure agreement (NDA), for the right intentions and not for the legal issues. *With companies you sign an NDA, just for the intention that we want to talk to each other* (RD8, 2014, r. 3395)
- We don't need NDAs but we don't share valuable information from our side. *You decide up front what can be shared and what not. And that someone supervise that.* (BD3, 2014, r.1289)
- We share our information, because the more information is shared the more valuable the results will be. When you do not share information it is useless. When you share it, it can be valuable (RD8, 2014, r. 3386).

The most people see that it is important to share information but that there is always information that you do not share with people you invite. One remarkable comment during the interviews: *People can come up with the same idea as you had and then the question arises from who was the original idea*. (RD7, 2014, r. 2387)

4.2.3 THEORY VS. PRACTICE

As is seen in the three tables and the questions above there are some differences and similarities between the ideal from the theory and the empirical evidence as it is found at Company X. The differences are described below:

- Working together with customers and suppliers lead to more market conform innovations, at Company X it is getting more important to listen to their customers. They see that the products they develop with this information have a better connection with the market and are more successful. Real co-working with suppliers, customers and other third parties like Lead Users and Experts will be important for the development of future products.
- The current way of technology push driven innovations and the dangers are mentioned during the interviews and occurred at different products of Company X. As stated in the annual report and from the interviews it becomes clear that a more market pull mechanism is needed to develop products which do meet the needs of the customers, and innovate more effective.
- A good relation between Marketing/Sales and R&D is crucial for successful product development. Within Company X there is a lot of ad hoc policy; people are sitting in one big room so people can talk easily with each other. Only when it is necessary people from R&D and marketing arrange a meeting but most of the time it is the responsibility of the people in which way they talk to each other and share information. With Lead User method this integration is necessary to form a good project team and get the most value from the project. During the interviews people state that a better integration of the different departments would make the product development easier.
- Knowing your suppliers, competitors and customers is important for every business unit. They are actively looking for new information by looking at competitors and try to find new trends by reading newsletters, be present at different exhibitions and talk to customers. Some of the business units work with business partners who sell the products to the end users. In these business units they see that it is not easy to keep up with the needs of the market and end user, therefore implementing Lead User method is valuable.

- Lead User method takes time to do it well, extensive analysis and in depth investigation is needed, but also it saves time and money in the innovation process. From the interviews becomes clear that people think that Lead User method can be valuable for Company X, but that time can be one of the bigger issues. The workload is quite high so it is not possible to do this method next to the daily business. There must be time and space created by the management to implement the Lead User method. Saving time and money can be achieved because concepts are developed well and there are fewer changes needed during the development of the product. At this moment it is not clear how much time is spend on the development of new products and the Lead User method is not yet implemented so nothing can be said about the how much can be saved.

5. CONCLUSIONS & IMPLICATIONS

After analyzing the results in the previous chapter, this chapter gives the conclusions, theoretical and practical implications will be described, and an answer on the research question is formulated. The research is finalized in chapter 6 with improvements for future research and a personal reflection on the research and the process.

5.1 CONCLUSIONS

The conclusions are divided into two parts. The first parts are the conclusions from the front end of innovation, absorptive capacity and the questionnaire. The second part are the conclusions from the interviews and mainly focused on the value of the Lead User method for Company X.

Looking at the front end of innovation at Company X, it can be concluded that new concepts and ideas can come from different sources and persons, there is no structured way in which new ideas are generated. The can come from the market by sales, marketing and support but also from the R&D department. When there is enough capacity and people are convinced that it can add value they start the development. Mainly these decisions are made at the coffee machine and in the hallways instead of during arranged meetings. This is not in line with the strategy which is based on external knowledge and cooperation with key customers.

From the questionnaire we can conclude that people are actively looking for new information with a score of 4,19 but that from all that information that is coming in, not all is transferred and exploit to knowledge that is used for the developing of new products (3,02). Because the information is not stored for later reference (2,71), some information gets lost. When looking at the absorptive capacity, the potential absorptive capacity is a bit higher than the realized absorptive capacity, which means that not all information is used. The scores for the potential and realized absorptive capacity are 3,31 and 2,98. When we compare this to the vision Company X has, technology that matters, that the technology has to add value in how it is used on a day-to-day basis, and user friendly interface, this seems not very high. This vision suggests that it is important to get a lot of information and share this within the company so also R&D knows what the market needs. This is also not high when comparing it with the strategy which comes from the annual report of 2013; which states that Company X has to cooperate with their key customers and develop products that are fit within the market. To answer the research questions, the absorptive capacity based on the vision and annual report of Company X is a bit lower than expected

and there are no differences between the business units. The question: Is the absorptive capacity high enough to acquire and exploit external knowledge and use the Lead User method is hard to answer based on the outcomes of the questionnaire. Based on the individual questions and the outcomes from the interviews it can be concluded that people are willing to listen to and cooperate with other parties and that they are looking for new information outside Company X, so based on those outcomes implementing the Lead User method must be possible. The scores of the absorptive capacity which comes forth from the questionnaire can be valuable for future research to get a better understanding on the relation between Lead User method and absorptive capacity.

Sharing of information and integration of the Marketing and R&D department are crucial for successful product development. Sharing of information within Company X occurs within the departments, and less between departments and between business units. This can result in that different business units are struggling with the same problem without knowing from each other. When employees want more information from other departments they have to search for it and try to find the right persons. There are no formal relations between the Marketing and R&D department. Most of the new concepts are coming from the market and are tested by the people from sales, marketing and product management. When they don't see value in the ideas, it is not shared with R&D. People say that when R&D gets the chance to do something new, they start immediately.

It is getting more and more important to know what the needs of the customers are, business units are growing and it is getting harder to innovate on an ad hoc base, therefore more structure in the front end of innovation would be valuable. Lead User method is seen as a possible valuable method to achieve this. It can be used for breakthrough innovations and not so much for incremental innovations and improvements. This can be done based on the feedback which is received from the current customers. The method is also seen as valuable to look in other markets, and try to look further than the known paths and known solutions.

The people within Company X are concerned that the method will not work when there is no structure. When concepts are not fitting the strategy they are useless. Responsibilities and tasks must be defined and people must get time to work on this method and finding trends and Lead Users. When this method is introduced and people have to do it next to their daily jobs as it now is, it will not become a success. So when it is introduced well and time is available to do it right people are willing to participate in a method like this.

The pitfalls that people see in a method like this is the sharing of information, people who are invited for the workshop can use and share the information that is generated in the workshop. Next to that it is important that ideas must fit in your strategy and those products that seem quite similar can be different and are for other markets. The final danger is to decide which information is from whom? It is not unlikely that ideas that are found by Lead Users are the same as intern at Company X.

When looking at the research question:

How can Lead User method contribute to a more effective front end of innovation of Company X?

First after the interviews it can be concluded that people are willing use a more structured way of innovation and use the Lead User method, they find it important to look at information from the outside world and share this with other people. The Lead User method can contribute to a more effective way of innovation by dividing the roles in the new concept development process. With the multidisciplinary team people must share information and no information is lost in the departments. The value of the method is in the workshop were people from Company X, Experts and Lead Users come together and can discuss the new developed concepts, those people combined can deliver the best possible concepts and can take a lot of uncertainties from the front end of innovation.

5.2 THEORETICAL IMPLICATIONS

Technology push is a method which is often used by technology firms like Company X, but after some products that are less successful or did not meet the needs of the customers Company X also sees that it is getting more and more important to listen to the outside world and to cooperate with other parties.

The most important theoretical implication for this research is the relation between the Lead User method, absorptive capacity and the front end of innovation. From the literature it became clear the absorptive capacity and the Lead User method have a positive relation with the front end of innovation. Both are focused on the external world and provide the company more information to reduce the uncertainties in the front end of innovation.

The relation between the Lead User method and absorptive capacity did not come clear during the literature study. During the research it is supposed that that there is a relation between the two topics, there must be a certain level of absorptive capacity before a company is suitable for implementing the Lead User method, in the questionnaire of this research the score Company X gets was a 3,1. Because

this questionnaire is not used before it is hard to determine if this score is high enough to sucesfull implement the Lead User method. After the interviews it became clear that Company X is actively looking for information and think that a structured method like the Lead User method can be valuable, so it is concluded that this method can be implemented. The score for the absorptive capacity is not useless; it can be used for future research and act as a zero measurement.

5.3 PRACTICAL IMPLICATIONS

The problems of Company X which is the development of products which do not always meet the demands of the customers caused by innovating inside the company without listen carefully to the outside world. Finding a more structured way to innovate and make products that are meeting the needs of the customers was the goal. The practical implications give an overview on how to come to a more structured way of innovating and listen carefully to the outside world.

The practical implications of this research are in the first place the manual, which is written for Unit 1, and can be used as a tool to implement Lead User method in the new concept development within the business unit. The second implications are the results of the questionnaire and the interviews, the testing of the potential and the realized absorptive capacity showed that Company X as organization think that it's valuable and important to use external information and that users of your product can be valuable in improving current products and the development of new concepts.

The first step in more structuring the front end of innovation is a better relation and integration of the Marketing/Sales and the R&D department. More information sharing between these departments will lead to a better understanding of the market needs and the technological possibilities. The first step can be a periodical meeting with people from the different departments. In these meetings people can keep each other up to date and new ideas and concepts can be discussed. Due strengthen the ties between the departments it is also getting easier for people to share information between the meetings. People know what is going on and where people are working on. Such meeting should be planned monthly or once in two months.

This kind of meetings can be valuable in business units between departments but can also be valuable between business units. All business units are working with software and hardware, sometimes there is an overlap. When it is necessary and people know that other business units are working on the same technology there is some interaction. But meetings between business units to keep each other up to

date and generate and vision for the future. This is currently only done by the software developers with symposia. This kind of meetings can be valuable, but only when the subjects are well defined and people are well prepared. Three of four times a year should be enough.

Because people see the value of the Lead User method and are willing to participate in the method, it is good to start with a pilot in two business units. Before starting the pilot some things must become clear. Full commitment of the director of the business unit is needed, because people need time and space to contribute to the pilot, this time needed for the project cannot be used for the daily business. When they do not get enough time, the quality of the outcomes will go down. Next to that the roles, tasks and responsibilities must be clear, and a project manager is chosen. It is important after each of the four steps that the results are discussed with the director and rest of the business unit.

There are two implications that came forth from the interviews and are not direct related to this research. The first is a kind of brainstorm session with the different business units to get a more overall view of the technology in the future. In this way the knowledge of the different markets is combined which can be useful for everyone and people know what the trends in other markets are. This will be the most valuable when these kinds of meetings are with people from the same departments, like all the engineers. This kind of meetings is only done with software engineers in the form of symposiums.

The second implication, and more a recommendation from the people that are interviewed, when you are working on a problem or want to use a new technology it would be valuable that it is easy to find if people within Company X have the knowledge you need. The database on BijCompany X.net, where all employees are listed can be expanding with the question what are your expertise? When this is easy to find it is less likely that people within Company X are working on the same problem. And try to invent the wheel for the second or even the third time.

6. LIMITATIONS & FUTURE RESEARCH

This chapter gives an overview of the limitations in this research, and also provides some improvements for future research for Company X but also when this research is done at other organizations.

6.1 LIMITATIONS

Before the research started the Lead User method is chosen as the method to structure the front end of innovation at Company X. Due the vagueness of the fuzzy front end and the different approaches of authors there are no best practices which are applicable for every organization (Reinertsen, 1999), but next to this method there are other ways to structure this part of the new product development. The most alternatives are based on a better integration and sharing of information between the different departments to reduce the uncertainties (Verworn & Herstatt, 2000). For services it is recommended to interact more with customers to remove the fuzziness out of the front-end (Alam, 2005).

The biggest limitation is the lack of comparison with other companies on the absorptive capacity. The questionnaire used in this research is not used in this form before and there are no articles found which made a comparison between the absorptive capacity of Company X and the absorptive capacity of other (technical) organizations possible.

The limitation in the data collection part of this research is the small amount of data which is collected in some of the business units with the questionnaire. The response rate on the questionnaire was sufficient but in absolute data it is for some business units based on four or five respondents. Because it is also divided over different departments this amount of respondents is even lower and sometimes based on one or two respondents per department for one business unit. This could have led to wrong understandings.

People that are interviewed and asked for their opinion about and the value of the Lead User method did not know about the method before the interviews. Their answers are based on the short introduction that is giving during the interviews which means that they do not had a full understanding of the method and what they answered is a feeling about the method. Next to that they also cannot compare this method to other methods, because the current process is not based on a method but just ad hoc policy.

6.2 FUTURE RESEARCH

After defining the limitations of the research some improvements and new ideas for future research can be given.

The most valuable for Company X in future research is the research to check the relationship between the absorptive capacity and the Lead User method. In this research it is supposed that a level of absorptive capacity is needed before the Lead User method can be implemented, and after implementing the Lead User method this absorptive capacity will get higher. This can be tested with the same questionnaire and using the score of this research as a zero measurement. This research can be done after some time when different business units make use of the method. When not all business units use the Lead User method, the differences can also be interesting.

Another follow up on this research is the execution of a pilot project with two or three business units at Company X. In this way, they can see if this method is really a valuable addition to the new product development process. When this is the case the Lead User method can be implemented in the strategy of Company X.

Because there are different ways in which concepts can be developed and also different ways of structuring the “fuzzy” front end of innovation, it can be valuable in future research to see if other methods are more suitable for Company X. When a pilot is done after this research it is easier for employees to see if structuring the front end and the Lead User method can add value and if other methods can be better or fit better in the philosophy and vision of Company X.

To see if the Lead User method leads to more valuable products which are needed at the market a longitudinal study over a couple of years must be done. Because there is no data on how many innovations over the last years were introduced and which part of that was successful, this research is only possible when a part of Company X starts with this method, and all data is stored.

In this research the focus was on sharing information within the business units; the sharing and relations between the marketing and the R&D department. The sharing between business units passed by during the interviews, employees think that more cooperation with other business units can be valuable but this goes beyond the scope of this research.

6.3 REFLECTION

The start of the research was a bit messy, things were unclear and I was in the position between Company X and the University. Company X wanted a market research and advice about what could be for them new product concepts, and for the University that was not enough for a master thesis. The research started without a clear problem definition and research question, with a research on the Dutch energy market and the future of energy. After this two month research with a lot of talks with people from Company X Unit 1, grid operators and visiting seminars and presentations I had a good view on the market where Unit 1 was operating in.

Things became clearer after a meeting with Rik van Reekum and my supervisor at Company X, after this meeting the focus of this research was determined. Looking at the possibilities of the Lead User method to structure the front end of innovation of Company X, to find the most valuable new product concepts. This meeting was very valuable and brought everyone on the same page. Next time this kind of meeting should be done in front of the whole research, before looking to literature or other information. The first two months were fun and I learned a lot about the Dutch energy market and all the changes that are coming, but with the current research question in mind, this was no longer valuable.

The cooperation of the Company X employees for the questionnaire as for the interviews was very well. The online questionnaire which was answered by 42 of the 66 people is quite well. For the interviews everyone I wanted to interview was willing to cooperate and made some time within two weeks. Selecting the people for the questionnaire is mostly done by my supervisor and for the interviews a combination of my supervisor and me. I think it is hard for a student who does not know the organization well to find the right people but that the selecting by the company can lead to biased outcomes.

To get a better understanding of the absorptive capacity of Company X in comparison with other technology firms it could have been better to use a different method or questionnaire which was used before. Most of the questionnaires found online were very time consuming and therefore not suitable for this research.

The research at Company X was quite independent, when I needed help this was always available but otherwise I was working quite alone. Next time I would prefer a more practical research were you also work on some current projects to get a good feeling with the other employees and working for a company.

After the meeting at Company X with Rik and my supervisor, there were only 3 or 4 feedback moments till the end of the research. Those meetings were often quite time consuming and with a lot of feedback. Perhaps it is better to just meet every two weeks to give an update and some feedback so things keep on track and the meetings are less time consuming. The outcome from the research can be better when people from Company X and the University are more involved. On the other hand the freedom to do my own research and find my own way is also very instructive and is training for my further career.

Some final remarks, people from Company X where very open and wanted to help me when I needed something, I had nice colleagues the last couple of months and got a better understanding in working for a company which is constantly working on innovations and new product development.

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APPENDIX A: LITERATURE ON THE ENERGY MARKET

This chapter contains an overview about the Dutch Energy market, the future of energy and the developments of smart grids and smart metering. This information is needed for the manual which will be written for Company X Unit 1.

THE DUTCH ELECTRICITY GRID

During the late nineties there are a lot of changes in the Dutch electricity grid. Under pressure of some giant European companies the liberalization of the European electricity grids started. The changes in the Netherlands started with the electricity law in 1998 (Veraart, 2010). This liberalization is performed in three stages. In 1998 it was possible for the large consumers like the industrial sector and large companies to choose their own energy supplier. In 2002 the same was possible for the middle to large companies and in 2004 for small companies and consumers (PwC, 2012). The reasons for this liberalization are the three main aspects which are important in the energy sector: Sustainable, reliable and affordable energy (Klooster, Schillemans, & Warringa, 2005).

There are three main levels in the current Dutch electricity grid, the high, middle and low voltage grid. On these levels there are different parties. Tennet is the national electricity transmission system operator. Tennet has a monopoly and is responsible for the high voltage grid in the Netherlands. There are eight grid operators which are responsible for the middle and low voltage grid. And there are twenty four energy suppliers; these suppliers are responsible for the delivery of electricity to Dutch households. In the figures below you can see how the electricity grid looks like and the distribution of the grid operators.

Figure 4: The electricity grid in the Netherlands

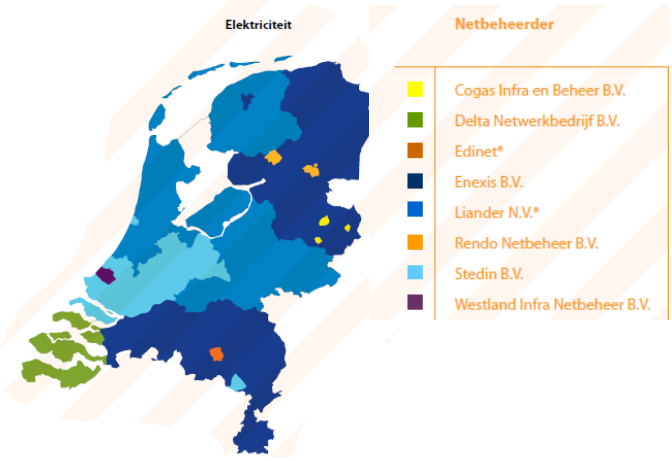

Figure 5: Grid operators in the Netherlands

There are changes in the electricity distribution grids in the Netherlands and other European Countries. Where the traditional grid is only used in one way; from the producer to the consumer, the changes that are occurring making the grid dynamic with multiple flows on the grid. People are installing PV systems (solar panels) on their roofs and producing their own energy. Most of the energy is produced when people are not at home and so this produced energy is send back to the grid which leads to over loading the grids (CE delft & KEMA, 2012). Next to these PV systems, electric vehicles and heat pumps are emerging. Changes are needed in the grid to adapt those developments. To keep the grid stable we have to make the grid more intelligent or new and thicker cables with more capacity have to be dug in. According to a grid operator this last solution is an investment for the next forty years and not the solution for the problems (Scharrenberg, 2013).

At this moment there are some legislations in the Netherlands that are stimulating decentralized energy production, there are subsidies on solar panels and it is possible for household to send the electricity back to the grid and use it when they need it. This is called net metering or in Dutch ''salderen'' in this way people can use the grid as a giant battery. According to the energy suppliers net metering is just a temporary solution because it causes problems for the grid operators. So new ways of energy storage and sharing must be found (Eijgelaar, 2013).

The price of the electricity today is determined by the amount that is needed and from which sources it is coming from. When it is sunny and windy outside wind turbines and solar panels deliver a lot of energy which is not expensive to make compared to gas and coal plants. The price of energy is getting lower when more people install PV installations and more wind turbines are placed. The disadvantage of these sources is that they are more unpredictable, you are dependent on the weather for your energy, therefore we need coal and oil plants as a backup for our energy supply (Bakker, 2013). Next to the price a household pays for the ''real energy'' there are a lot of taxes and other costs. The price of the real energy is about € 0,07,- per KWh. A household pays about € 0,23,- per KWh. So more than two third of our energy costs are in taxes (Milieu Centraal).

With this new trend of decentralized production and overloading the grid we need a new way of using, supplying and distributing the electricity grid. The new grid must be more intelligent, and is called a ''smart grid'' (ECN & netbeheer Nederland, 2012). The Dutch government has started a taskforce on this topic which is called taskforce smart grid, they see the following new possibilities with smart grids (CE delft & KEMA, 2012):

- Some demand management to control the demand of energy in households
- Decentralized production and storage of energy
- Keep the reliability of the grid
- Reduce investments in infrastructure
- More use of sustainable energy

Grid operators in the Netherlands started pilots to see how smart grids can be used and how people can change their energy use to save money and make it easier for the grid operators to keep balance on the grid (Universiteit van Amsterdam, Universiteit Utrecht & TNO, 2011).

The first point on demand management, is about the change of human behavior. Is it possible to change the routines people have in their energy use to balance the electricity grid? Grid operator Enexis started a pilot to see if people want to change their routines in electricity use when they get a financial incentive. The pilot ends in one year from now, but the first results show that the peaks in the grid are shaved and the people changed their behavior (Kobus, 2013).

The decentralized production and storage of electricity is also seen as valuable in the electricity grid of the future. According to Nykamp (2013), storage is needed to shave peaks in electricity use and the implementation of renewable energy. At this moment it is not profitable to invest in batteries. The price of storage of one kWh is between 600 and 3.000 €. Nykamp states that this has to lie between 200 and 400 € before it gets interesting. Of course this price depends on the lifetime of the battery and the costs of the other solution, dig in new cables.

The vision of Eurelectric about the new way of energy distribution: ''DSOs consider that Smart Grids is aiming to support the take-off of a demand response market with smart meters, where suppliers will be able to offer innovative services and products based on customers' real consumption and more advanced price offers and will at the same time allow for a smarter network management by DSOs.'' (Eulectric, 2013 p. 6)

TenneT, the Dutch national electricity transmission system operator has wrote her own vision on the future of the electricity grid. They developed four scenarios for the grid in 2030 (TenneT TSO, 2010).

- *Sustainable Transition*: More centralized solutions for their energy but it has to be sustainable. Bio-oil will be the biggest resource for the Netherlands but also more solar panels will be installed.
- *Green Revolution*: More solar and wind energy will be produced and people are dependent on these resources. To control the grid, storage systems will be developed
- *New Strongholds*: The delivery from fossil fuels from the Middle East and Russia is getting under pressure. The Netherlands will be a producer and seller of energy due the great location.
- *Money rules*: Sustainability is getting less important, there is a growing demand for energy in Asia and more nuclear energy is used. The Netherlands will be importers of energy.

The grid operators are united in ''netbeheer Nederland'', they wrote also a plan how the energy grid will look like in 2030. They summarize the electricity grid 2030 in five bullet points:

- Energy production is more decentralized
- Customers want privacy and more space to choose in different service levels
- Grid operators facilitating for the new parties on the energy market
- There is no difference between electricity and gas grid, it will be called the energy grid
- ICT solutions are more used in satisfying the customers

SMART METERING AND PRIVACY

When talking about smart grids, it is a small step to smart metering. In the Netherlands the goal is to install a smart meter in 80% of the households by 2018. This smart meter is able to send data about energy use to the grid operator and energy supplier. Due legislation a grid operator has permission to get access to this data six times a year unless a customer give them permission to do it more often. There are social benefits of this smart meter, it can communicate with your home electricity system and can anticipate on price changes which will lead to a lower electricity bill (Neenan & Hemphill, 2008). Next to the advantages of the smart meter, this sharing of data leads also to protest of customers who are concerned about their privacy. It is important that this data is not accessible by other parties (Rial & Danezis, 2010). To overcome part of this privacy issue it is possible to make the data these meters collect anonymous. This is not the whole solution for the privacy problems of smart metering but it can contribute to a part of this (Efthymiou & Kalogridis, 2010).

APPENDIX B: QUESTIONNAIRE

Lead User Method at Company X

Dear Company X employee,

Thanks for participating in this study. The aim of this study is getting a better understanding about the knowledge sharing within Company X and the sharing of information from the external world.

The answers of the questionnaire will be treated confidentially and people stay anonymous.

Please answer all the questions.

Please indicate your age *

- ○ Up to 20 years
- ○ From 21 till 30 years
- ○ From 31 till 40 years
- ○ From 41 till 50 years
- ○ From 51 till 60 years
- ○ 61 years and more

How many years have you been working at Nedap *

- ○ Less than 1 year
- ○ Between 1 and 3 years
- ○ Between 3 and 5 years
- ○ Between 5 and 10 years
- ○ Between 10 and 15 years
- ○ More than 15 years

Please indicate your business unit *
multiple answers possible

- ☐ AVI
- ☐ Energy Systems
- ☐ Library Solutions
- ☐ Light Controls
- ☐ Livestock Management
- ☐ Pep
- ☐ Retail
- ☐ Security Management

Please indicate your department *
multiple answers possible

- ☐ ICT
- ☐ Finance
- ☐ Marketing
- ☐ Sales
- ☐ Engineering
- ☐ R&D
- ☐ Logistics

Questions about use of knowledge and information

Please give one answer per question
the scores: 1= strongly disagree, 2= disagree, 3= neutral, 4 =agree, 5= strongly agree

	1	2	3	4	5
P- I am always actively looking for new knowledge for my job	◯	◯	◯	◯	◯
P- To search for new information for my job, I regularly read newspapers, magazines and trade publications that are focused on my target market	◯	◯	◯	◯	◯
R- I often apply new acquired knowledge from newspapers, magazines and trade publications to my work	◯	◯	◯	◯	◯
R- I use patent databases to find new knowledge for my work and improving our product	◯	◯	◯	◯	◯
P- I share new acquired information with colleagues from my department	◯	◯	◯	◯	◯
P- I share new acquired information with colleagues from other departments within my business unit	◯	◯	◯	◯	◯
P- I am looking for new knowledge in other areas than my target product / market	◯	◯	◯	◯	◯
P- I often meet with colleagues from my business unit to come up with good ideas	◯	◯	◯	◯	◯
P- I take part in meetings with people from different business units to come up with new ideas	◯	◯	◯	◯	◯
I think users of our product are helpful for improving our products	◯	◯	◯	◯	◯
I think users of our product are helpful for developing new product concepts	◯	◯	◯	◯	◯
I think more guidance from experts can be valuable for market research	◯	◯	◯	◯	◯
I think more guidance from experts can be valuable for our innovation management	◯	◯	◯	◯	◯

Questions about using and sharing knowledge in your business unit

Please give one answer per question
the scores: 1= strongly disagree, 2= disagree, 3= neutral, 4 =agree, 5= strongly agree

	1	2	3	4	5
P- In our business unit people are motivated to capture and transfer knowledge amongst themselves	◯	◯	◯	◯	◯
P- In our business unit employees are encouraged to discuss their work with other business units	◯	◯	◯	◯	◯
P- Our business unit frequently scans the environment for new knowledge	◯	◯	◯	◯	◯
P- Our business unit observes new trends in our target market	◯	◯	◯	◯	◯
The Marketing and Sales department are involved in new product development	◯	◯	◯	◯	◯
R- In our business unit new opportunities to serve our clients are quickly understood	◯	◯	◯	◯	◯
R- Complaints of clients fall on deaf ears in our business unit	◯	◯	◯	◯	◯
R- Our business unit periodically organizes panel meetings with users or other third parties to acquire new knowledge	◯	◯	◯	◯	◯
R- In our department employees record and store newly acquired knowledge for future reference	◯	◯	◯	◯	◯
R- Our business unit quickly analyzes and interpret changing external conditions	◯	◯	◯	◯	◯
R- When our business unit finds out something important about competitors, it is slow to alert colleagues	◯	◯	◯	◯	◯
R- In our business unit we meet with users at least once a year to find out what products or services they will need in the future	◯	◯	◯	◯	◯
R- During periodically meetings, market changes are discussed to find new products or improve our products	◯	◯	◯	◯	◯
R- Employees of our business unit give little consideration to new and alternative methods and procedures for doing their work	◯	◯	◯	◯	◯
R- Employees of our business unit often implement new ideas to improve the quality of our products and services	◯	◯	◯	◯	◯

APPENDIX C: RESULTS QUESTIONNAIRE

In this Appendix an overview of the results of the questionnaire are given. The first two tables show the results from Company X as a whole and Company X Unit 1. The other tables show an overview of the results about absorptive capacity, divided in potential and realized absorptive capacity, and shows the differences between business units and departments.

GENERAL OVERVIEW RESULTS

Descriptive Statistics					
Results Company X as a whole	N	Minimum	Maximum	Mean	Std. Deviation
I am always actively looking for new knowledge for my job	42	3	5	4,19	,740
To search for new information for my job, I regularly read newspapers, magazines and trade publications that are focused on my target market	42	2	5	3,55	1,064
I often apply new acquired knowledge from newspapers, magazines and trade publications to my work	42	2	5	3,02	,950
I use patent databases to find new knowledge for my work and improving our product	42	1	4	1,83	,908
I share new acquired information with colleagues from my department	42	3	5	3,93	,640
I share new acquired information with colleagues from other departments within my business unit	42	1	5	3,12	1,173
I am looking for new knowledge in other areas than my target product / market	42	1	5	3,71	,995
I often meet with colleagues from my business unit to come up with good ideas	42	1	5	3,52	1,065
I take part in meetings with people from different business units to come up with new ideas	42	1	5	2,36	1,186
I think users of our product are helpful for improving our products	41	3	5	4,59	,547
I think users of our product are helpful for developing new product concepts	42	2	5	4,12	,861
I think more guidance from experts can be valuable for market research	42	2	5	3,81	,773

I think more guidance from experts can be valuable for our innovation management	42	2	5	3,83	,881
In our business unit people are motivated to capture and transfer knowledge amongst themselves	42	1	5	3,33	,928
In our business unit employees are encouraged to discuss their work with other business units	42	1	4	2,43	,859
Our business unit frequently scans the environment for new knowledge	42	1	4	2,81	,890
Our business unit observes new trends in our target market	42	1	5	3,45	,993
The Marketing and Sales department are involved in new product development	42	1	5	3,48	1,131
In our business unit new opportunities to serve our clients are quickly understood	42	1	5	3,00	,883
Complaints of clients fall on deaf ears in our business unit	42	1	5	2,24	1,055
Our business unit periodically organizes panel meetings with end users or other third parties to acquire new knowledge	42	1	4	2,17	1,102
In our department employees record and store newly acquired knowledge for future reference	42	1	5	2,71	,944
Our business unit quickly analyzes and interpret changing external conditions	42	1	5	2,90	,906
When our business unit finds out something important about competitors, it is slow to alert colleagues	41	1	5	2,78	1,013
In our business unit we meet with users at least once a year to find out what products or services they will need in the future	41	1	5	3,27	1,184
During periodically meetings, market changes are discussed to find new products or improve our products	41	1	5	3,00	1,072
Employees of our business unit give little consideration to new and alternative methods and procedures for doing their work	42	1	5	2,69	1,047
Employees of our business unit often implement new ideas to improve the quality of our products and services	42	1	5	3,52	,890

Results Company X Unit 1	N	Minimum	Maximum	Mean	Std. Deviation
I am always actively looking for new knowledge for my job	14	3	5	4,14	,770
To search for new information for my job, I regularly read newspapers, magazines and trade publications that are focused on my target market	14	2	5	3,29	1,139
I often apply new acquired knowledge from newspapers, magazines and trade publications to my work	14	2	4	2,86	,770
I use patent databases to find new knowledge for my work and improving our product	14	1	4	1,64	,929
I share new acquired information with colleagues from my department	14	3	5	3,86	,663
I share new acquired information with colleagues from other departments within my business unit	14	1	4	2,71	1,139
I am looking for new knowledge in other areas than my target product / market	14	1	5	3,43	1,158
I often meet with colleagues from my business unit to come up with good ideas	14	1	5	3,21	1,122
I take part in meetings with people from different business units to come up with new ideas	14	1	3	2,07	,917
I think users of our product are helpfull for improving our products	13	4	5	4,62	,506
I think users of our product are helpful for developing new product concepts	14	3	5	4,07	,730
I think more guidance from experts can be valuable for market research	14	3	5	3,79	,579
I think more guidance from experts can be valuable for our innovation management	14	3	5	4,00	,555
In our business unit people are motivated to capture and transfer knowledge amongst themselves	14	1	5	3,07	1,141
In our business unit employees are encouraged to discuss their work with other business units	14	1	3	2,00	,679
Our business unit frequently scans the environment for new knowledge	14	1	4	2,50	,855

Our business unit observes new trends in our target market	14	1	5	3,07	1,072
The Marketing and Sales department are involved in new product development	14	2	5	3,21	1,051
In our business unit new opportunities to serve our clients are quickly understood	14	1	4	2,71	,825
Complaints of clients fall on deaf ears in our business unit	14	1	5	2,57	1,158
Our business unit periodically organizes panel meetings with end users or other third parties to acquire new knowledge	14	1	3	1,57	,852
In our department employees record and store newly acquired knowledge for future reference	14	1	4	2,57	1,016
Our business unit quickly analyzes and interpret changing external conditions	14	1	4	2,71	1,139
When our business unit finds out something important about competitors, it is slow to alert colleagues	14	1	4	3,07	,997
In our business unit we meet with users at least once a year to find out what products or services they will need in the future	13	1	5	2,62	1,193
During periodically meetings, market changes are discussed to find new products or improve our products	14	1	5	2,93	1,072
Employees of our business unit give little consideration to new and alternative methods and procedures for doing their work	14	1	5	2,93	1,207
Employees of our business unit often implement new ideas to improve the quality of our products and services	14	2	5	3,50	1,019
BU = 2 (FILTER)	14	1	1	1,00	,000

TABLE 1: RESULTS UNIT 1

Descriptive Statistics/ potential absorptive capacity					
	N	Minimum	Maximum	Mean	Std. Deviation
I am always actively looking for new knowledge for my job	42	3	5	4,19	,740
To search for new information for my job, I regularly read newspapers, magazines and trade publications that are focused on my target market	42	2	5	3,55	1,064
I share new acquired information with colleagues from my department	42	3	5	3,93	,640
I share new acquired information with colleagues from other departments within my business unit	42	1	5	3,12	1,173
I am looking for new knowledge in other areas than my target product / market	42	1	5	3,71	,995
I often meet with colleagues from my business unit to come up with good ideas	42	1	5	3,52	1,065
I take part in meetings with people from different business units to come up with new ideas	42	1	5	2,36	1,186
In our business unit people are motivated to capture and transfer knowledge amongst themselves	42	1	5	3,33	,928
In our business unit employees are encouraged to discuss their work with other business units	42	1	4	2,43	,859
Our business unit frequently scans the environment for new knowledge	42	1	4	2,81	,890
Our business unit observes new trends in our target market	42	1	5	3,45	,993

Descriptive Statistics/ realized absorptive capacity					
	N	Minimum	Maximum	Mean	Std. Deviation
I often apply new acquired knowledge from newspapers, magazines and trade publications to my work	42	2	5	3,02	,950
In our business unit new opportunities to serve our clients are quickly understood	42	1	5	3,00	,883
Complaints of clients fall on deaf ears in our business unit	42	1	5	2,24	1,055
In our department employees record and store newly acquired knowledge for future reference	42	1	5	2,71	,944
Our business unit quickly analyzes and interpret changing external conditions	42	1	5	2,90	,906
I use patent databases to find new knowledge for my work and improving our product	42	1	4	1,83	,908
When our business unit finds out something important about competitors, it is slow to alert colleagues	41	1	5	2,78	1,013
In our business unit we meet with users at least once a year to find out what products or services they will need in the future	41	1	5	3,27	1,184
Our business unit periodically organizes panel meetings with end users or other third parties to acquire new knowledge	42	1	4	2,17	1,102
During periodically meetings, market changes are discussed to find new products or improve our products	41	1	5	3,00	1,072
Employees of our business unit give little consideration to new and alternative methods and procedures for doing their work	42	1	5	2,69	1,047
Employees of our business unit often implement new ideas to improve the quality of our products and services	42	1	5	3,52	,890

POTENTIAL AND REALIZED ABSORPTIVE CAPACITY PER BU

	Potential absorptive capacity			Realized absorptive capacity		
	N	Mean	Std Deviation	N	Mean	Std Deviation
Unit 1	14	3,03	0,626	14	2,72	0,569
Unit 2	4	2,91	0,458	4	2,91	0,640
Unit 3	4	2,93	0,537	4	3,15	,0219
Unit 4	7	3,46	0,231	7	2,84	0,485
Unit 5	5	3,90	0,321	5	3,35	0,388
Unit 6	8	3,67	0,466	8	3,67	0,251

ONE WAY ANOVA TEST ABSORTIVE CAPACITY

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
Potential Absorptive capacity	Between Groups	5,301	5	1,060	4,313	,004
	Within Groups	8,849	36	,246		
	Total	14,150	41			
Realized Absorptive capacity	Between Groups	2,600	5	,520	2,331	,062
	Within Groups	8,030	36	,223		
	Total	10,630	41			

ONE-WAY ANOVA TEST BY BUSINESS UNIT

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
I am always actively looking for new knowledge for my job	Between Groups	5,848	5	1,170	2,532	,046
	Within Groups	16,629	36	,462		
	Total	22,476	41			
To search for new information for my job, I regularly read newspapers, magazines and trade publications that are focused on my target market	Between Groups	6,294	5	1,259	1,130	,362
	Within Groups	40,111	36	1,114		
	Total	46,405	41			
I often apply new acquired knowledge from newspapers, magazines and trade publications to my work	Between Groups	15,123	5	3,025	4,982	,001
	Within Groups	21,854	36	,607		
	Total	36,976	41			
I use patent databases to find new knowledge for my work and improving our product	Between Groups	6,765	5	1,353	1,800	,138
	Within Groups	27,068	36	,752		
	Total	33,833	41			
I share new acquired information with colleagues from my department	Between Groups	3,193	5	,639	1,691	,162
	Within Groups	13,593	36	,378		
	Total	16,786	41			
I share new acquired information with colleagues from other departments within my business unit	Between Groups	15,615	5	3,123	2,756	,033
	Within Groups	40,789	36	1,133		
	Total	56,405	41			
I am looking for new knowledge in other areas than my target product / market	Between Groups	16,479	5	3,296	4,925	,002
	Within Groups	24,093	36	,669		
	Total	40,571	41			
I often meet with colleagues from my business unit to come up with good ideas	Between Groups	13,562	5	2,712	2,967	,024
	Within Groups	32,914	36	,914		
	Total	46,476	41			
I take part in meetings with people from different business units to come up with new ideas	Between Groups	8,111	5	1,622	1,179	,339
	Within Groups	49,532	36	1,376		
	Total	57,643	41			
I think users of our product are helpful for improving our products	Between Groups	1,946	5	,389	1,361	,262
	Within Groups	10,005	35	,286		
	Total	11,951	40			
I think users of our product are helpful for developing new product concepts	Between Groups	7,119	5	1,424	2,201	,076
	Within Groups	23,286	36	,647		
	Total	30,405	41			

I think more guidance from experts can be valuable for market research	Between Groups	4,262	5	,852	1,518	,209
	Within Groups	20,214	36	,562		
	Total	24,476	41			
I think more guidance from experts can be valuable for our innovation management	Between Groups	9,980	5	1,996	3,288	,015
	Within Groups	21,854	36	,607		
	Total	31,833	41			
In our business unit people are motivated to capture and transfer knowledge amongst themselves	Between Groups	4,240	5	,848	,982	,442
	Within Groups	31,093	36	,864		
	Total	35,333	41			
In our business unit employees are encouraged to discuss their work with other business units	Between Groups	7,371	5	1,474	2,316	,064
	Within Groups	22,914	36	,637		
	Total	30,286	41			
Our business unit frequently scans the environment for new knowledge	Between Groups	4,598	5	,920	1,187	,335
	Within Groups	27,879	36	,774		
	Total	32,476	41			
Our business unit observes new trends in our target market	Between Groups	5,962	5	1,192	1,246	,308
	Within Groups	34,443	36	,957		
	Total	40,405	41			
The Marketing and Sales department are involved in new product development	Between Groups	9,544	5	1,909	1,601	,185
	Within Groups	42,932	36	1,193		
	Total	52,476	41			
In our business unit new opportunities to serve our clients are quickly understood	Between Groups	3,861	5	,772	,988	,439
	Within Groups	28,139	36	,782		
	Total	32,000	41			
Complaints of clients fall on deaf ears in our business unit	Between Groups	4,051	5	,810	,702	,626
	Within Groups	41,568	36	1,155		
	Total	45,619	41			
Our business unit periodically organizes panel meetings with end users or other third parties to acquire new knowledge	Between Groups	17,848	5	3,570	4,018	,005
	Within Groups	31,986	36	,888		
	Total	49,833	41			
In our department employees record and store newly acquired knowledge for future reference	Between Groups	1,986	5	,397	,413	,836
	Within Groups	34,586	36	,961		
	Total	36,571	41			

Our business unit quickly analyzes and interpret changing external conditions	Between Groups	3,158	5	,632	,747	,594
	Within Groups	30,461	36	,846		
	Total	33,619	41			
When our business unit finds out something important about competitors, it is slow to alert colleagues	Between Groups	7,967	5	1,593	1,687	,164
	Within Groups	33,057	35	,944		
	Total	41,024	40			
In our business unit we meet with users at least once a year to find out what products or services they will need in the future	Between Groups	13,522	5	2,704	2,226	,074
	Within Groups	42,527	35	1,215		
	Total	56,049	40			
During periodically meetings, market changes are discussed to find new products or improve our products	Between Groups	8,226	5	1,645	1,524	,207
	Within Groups	37,774	35	1,079		
	Total	46,000	40			
Employees of our business unit give little consideration to new and alternative methods and procedures for doing their work	Between Groups	7,169	5	1,434	1,365	,260
	Within Groups	37,807	36	1,050		
	Total	44,976	41			
Employees of our business unit often implement new ideas to improve the quality of our products and services	Between Groups	4,723	5	,945	1,225	,317
	Within Groups	27,754	36	,771		
	Total	32,476	41			

CRONBACH'S ALPHA

Reliability Statistics/ potential absorptive capacity		
Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
,827	,836	11

Reliability Statistics/ realized absorptive capacity		
Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
,737	,747	12

APPENDIX D: INTERVIEW PROTOCOL

The interview consists of two parts, the first part are questions about the current innovation process of Company X, where do new concepts come from? And in which way external information is used and shared in this process? What is the role of customers in this process? The second part is focused on Lead User method. After a short introduction about the method some questions will be asked. The goals of these questions are to see if employees think the Lead User method is a valuable method in structuring the new concept development, and to find out what dangers and pitfalls they see when using this method.

Questions part 1: The current innovation process

- When talking about the current innovation process of Company X, where do new ideas come from?
- The results of the questionnaire showed that people are looking for new knowledge in the target and external market, what kind of sources do you use? And is this knowledge coming back in the new product development?
- Are the different departments involved in the process of new product development?
- What is the role of customers and users of the current product in improving products and finding new product concepts?
- Not every new product is a success, why are things going wrong in the innovation process?

Questions part 2: Lead User method

- Do you have Lead Users for your business unit?
- What do you think about the method after the short introduction?
- Can this method be valuable for the innovation process at Company X?
- Will this method be useful within a business unit, or can this be used for Company X as a whole?
- What are the pitfalls for this method?