How to capture hidden customer needs in an industrial product development company

– A case study at Xylem

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	Xylem	Keith Lothian

Abstract

When product development is becoming more and more complex, development costs rising and shorter development times are demanded, it is becoming obvious that a good customer understanding is essential. Previous research has showed that those companies that wish to develop radically new products must work actively with the identification of their customers' hidden needs. The goal of this master thesis project has been to determine how an industrial product development company should proceed with the investigation of hidden customer needs. The purpose of the paper has been to evaluate existing processes, frameworks, and methods and then propose an optimal solution for the case company. The methodology for this master thesis has been a case study at Xylem where interviews with employees have been conducted in parallel with an examination of existing literature within the field. Xylem is an industrial product development company that develops water pumps for many different applications. Apart from interviews a workshop and field tests have been conducted to get a better picture of the case company's situation and to verify the proposed methods. The result was a proposed process in five steps, well integrated in Xylem's existing process for business development, together with methods which, taken from literature, have been developed especially for the identification of hidden customer needs. The proposal is based on barriers and constraints found in the empirical study. Many of the barriers were also identified in literature which led to the conclusion that similar companies will face many of the same problems. The result of the field tests showed that the proposed methods were successful according to the employees conducting them. They were perceived to be a good tool for Xylem to identify their customers' hidden needs and increase the innovative capability, thus increasing the chance of developing successful radically new products.

Keywords: hidden customer needs, customer oriented innovation, voice of the customer, radical product development

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Identifiering av outtalade kundbehov i industriella produktutvecklingsföretag – En fallstudie på Xylem

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Sammanfattning

När produktutveckling blir alltmer komplex och utvecklingskostnaderna ökar samtidigt som kortare utvecklingstider efterfrågas blir det alltmer påtagligt att en god kundförståelse är extremt viktig. Tidigare forskning har visat på att företag som vill utveckla radikalt nya produkter bör arbeta aktivt med att identifiera sina kunders outtalade behov. Detta examensarbete har haft för avsikt att undersöka hur ett produktutvecklande industriföretag bör arbeta med identifieringen av outtalade kundbehov. Syftet med arbetet har varit att utvärdera befintliga processer, metoder och verktyg för att sedan föreslå en optimal lösning för fallföretaget. Metodiken för detta examensarbete har varit en fallstudie på Xylem där intervjuer av personal på fallföretaget har genomförts parallellt med att befintlig litteratur inom området har undersökts. Xylem är ett industriellt produktutvecklingsföretag som tillverkar pumpar för bl.a. vattentransport. Utöver intervjuer har en workshop samt fälttester utförts för att få en bättre bild av Xylems situation samt att testa de föreslagna metoderna. Resultatet var en föreslagen process i fem steg, väl integrerad i Xylems befintliga affärsutvecklingsprocess, med tillhörande metoder, vilka hämtade ur litteraturen har tagits fram speciellt för att identifiera outtalade kundbehov. Förslaget har baserats på barriärer och begränsningar som identifierades i den empiriska undersökningen. Många av de barriärerna identifierades också i litteraturen vilket ledde till slutsatsen att företag av den här typen står inför liknande problem. Resultatet av fälttesterna visade på att de föreslagna metoderna föll väl ut hos utövarna och uppfattades som användbara för Xylem i deras mål att bli bättre på att identifiera outtalade kundbehov och på så sätt öka deras innovativa förmåga och därmed chansen att utveckla framgångsrika radikalt nya produkter.

Nyckelord: outtalade kundbehov, kundorienterad innovation, voice of the customer, radikal produktutveckling

FOREWORD

There are several people involved in this master thesis project that have been of great help, in this chapter the authors would like to acknowledge them.

First of all the authors would like to thank the supervisors of the project, Keith Lothian at Xylem for his valuable input and help throughout the project, and Jenny Janhager Stier and Lars Hagman from KTH for their time and input on especially the structure of the master thesis. The authors would also like to thank the R&D department at Xylem which has been very helpful and supportive. Moreover, special thanks are extended to the respondents to the interviews and the participants of the workshop which provided the project with their insights.

Finally, the authors would like to express their gratitude towards the reference company, the Xylem service workshops, and all of those who gave up their valuable time to contribute to this master thesis.

Henrik Ljungberg and Linnea Sahlin

Stockholm, June 2014

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1 INTRODUCTION

In this chapter the problem background, purpose of the thesis, its delimitations and a description of the case company, Xylem, will be described.

1.1 Background

When products are becoming increasingly more complex, development costs rising and R&D departments are pressured to reduce development time it is important to have a good customer understanding from the beginning (Bayus, 2008; Ulrich & Eppinger, 2012). Many companies are eager to find the best practice to new product development but studies have shown that as much as 90 % of new products fail to meet the expectation of the customer and predicted sales numbers (Barczak & Kahn, 2012; Goffin & Mitchell, 2010; Koners, Goffin, & Lemke, 2010). This is because many companies rely too much on what the customer says and what is captured in traditional market research techniques instead of focusing on the needs of the customer. To deliver a superior product it must excite the customer; offer something that the customer did not expect. To achieve that a company must concentrate on finding the hidden needs of its customer. According to Koners, et al. (2010, p. 8) hidden needs are defined as:

"*Issues and problems that customers face but have not yet realized"*

To have delighted customers is essential in the quality paradigm but few companies address the understanding of hidden customer needs (Carlgren, 2013). Hidden needs are very important to capture in order to develop radical, as opposed to incremental, products. A customer often has a difficulty of expressing their long term needs and rather talks about his or her short term problems, which is why the customer cannot be asked to express his or her wishes in a straight forward fashion. Therefore a deeper understanding of the customer's situation is necessary (Kärkkäinen, Piippo, Puumalainen, & Tuominen, 2001). A way to approach this is to adapt a more proactive market orientation, described by Narver and Slater (2004). A proactive market orientation attempts to understand the hidden needs of the customer rather than react to the expressed needs of the customers.

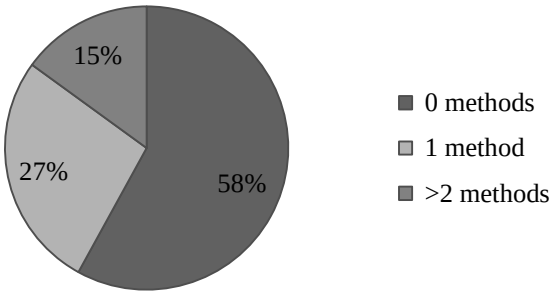

Figure 1. Use of methods for assessing hidden customer needs.

There are many methods for capturing those unexpressed or hidden needs of the customer but they are not widely used. A survey of 70 Finnish business-to-business companies, see Figure 1, reveals that very few companies use market research methods for assessing hidden customer needs; 58 % of the investigated companies did not use any method for assessing the

hidden needs of their customers and 27 % only used one method (Kärkkäinen, Piippo, Puumalainen, et al., 2001).

In the early stage of R&D management many companies run into different problems related to the identification process of customer needs which leads them into self-reinforcing loops, see Figure 2. Sales and marketing functions often provide the short term problems of the customer instead of the underlying needs (Szakonyi, 1988). This results in, due to the usually longer development cycle in industrial companies, that new requirements are introduced in the middle of the development cycle and therefore prolongs it even more which increase the likelihood of new requirements being introduced (Kärkkäinen & Elfvengren, 2002).

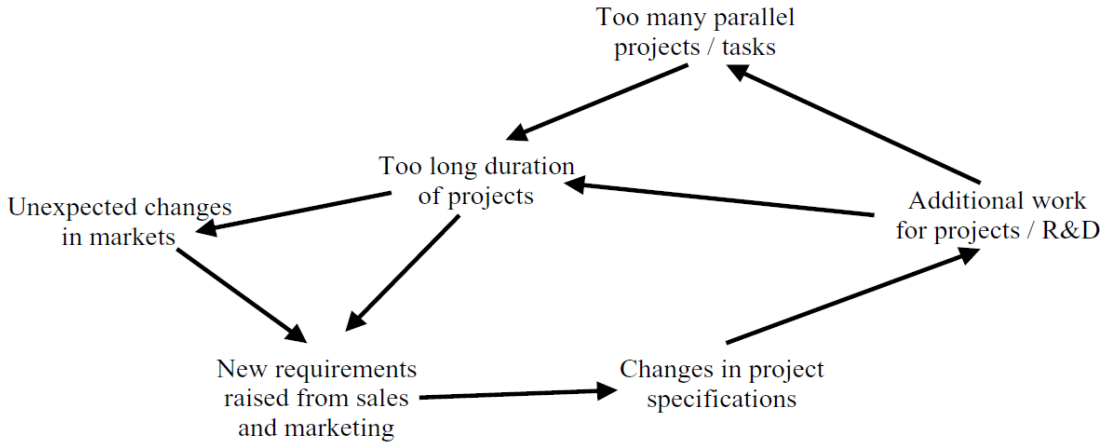

Figure 2. Self-reinforcing loops caused by focusing on short term customer problems (Kärkkäinen, Piippo, Puumalainen, et al., 2001).

Another reason for companies to determine the needs of their customers is that a need lasts much longer than any specific solution. Take the need to store computer data as an example, there have been many different technical solutions that addressed that particular need (punch cards, floppy discs, CD-ROMs etc.) but they all have been rendered obsolete when the next solution (USB-drives, cloud storage etc.) appears. If a company only think of itself as a provider of a solution they will only aim to perfect that particular solution and will, eventually, be overtaken by its competitors that are more need-oriented. (Patnaik & Becker, 1999)

It is clear that companies and industrial companies in particular need a systematic way of assessing its customers hidden needs and develop products accordingly in order to exceed the expectations of the customer and surpass their competitors (Kärkkäinen, Elfvengren, Tuominen, & Piippo, 2003).

1.2 Purpose

The purpose of this master thesis project was to, from existing literature, compile and analyse existing processes and methods for capturing and managing hidden customer needs and adjust them to a case company (described below) based on their current situation. The process developed was adjusted so that it was well integrated with the company's existing, adjacent processes, such as the product development and business development process. The process should include a toolbox with different methods for capturing and managing hidden needs that can be applied depending on the situation. The paper should give the reader an idea of which

methods and way of working is best suited for an industrial product development company. Questions that are answered in this report are:

- How should hidden customer needs best be addressed according to existing literature?
- What way of working and methods suits Xylem best in order to capture and manage hidden customer needs?
- What barriers exist when companies tries to implement a holistic process for capturing hidden customer needs?

1.3 Company description

Xylem was formed in October 2011 from a spin out of the ITT Corporation and is now a conglomerate of over 30 brands, including Flygt, Godwin, Lowara, Sanitaire and Grindex. Xylem is active in over 150 countries and their operations span over several industries, for example, agriculture, construction, public utilities, environmental and mining. Through its many different brands Xylem designs and produces products such as pumps for transportation of water and wastewater, dewatering of mines and constructions sites as well as complete pumping systems for water/wastewater treatment and analysis. With a turnover of 3,791 million USD (2012) it is one of the biggest companies in its business (Xylem, 2013, 2014). Xylem has divided its product range in four business units, called Growth Centres: *Transport, Dewatering, Applied water solutions* and, *Analytics and treatment.*

Xylem can be described as an industrial company which is defined as a company which acquires services and goods in order to produce other products that are then sold to others. Industrial markets have some characteristics that differ from consumer markets such as fewer and larger buyers, close supplier-customer relationship, geographically concentrated buyers, several buying influences and professional purchasing (Kotler, 1994).

1.4 Delimitations

This master thesis has been conducted at Xylem's offices in Stockholm over a course of 20 weeks. Hidden need analysis is often considered to be a part of the innovation management area but in this paper only methods and processes regarding hidden needs were scrutinized. The major focus was on methods for preparing the process and capturing hidden needs. Methods regarding idea generation or conceptualization were not touched, nor was the area of knowledge management investigated as a part of this master thesis project.

2 METHOD

The general approach and chosen method for the master thesis project will be described in this chapter together with the different forms of data collection used.

2.1 Choice of method

The chosen method for this master thesis project was a case study; information about the chosen case company was gathered and analysed then compared to previous research as well as a reference company, operating in a similar business and finally conclusions were drawn. To the possible extent, generalizations were made in order for readers to apply the conducted research on other cases as well. The general approach of the master thesis project was to gather information about existing methods and processes/frameworks regarding hidden customer needs from the literature and at the same time collect primary data about the case company. Throughout the project the methods from literature were sifted based on information obtained about the company.

2.2 Collecting data

There are several ways data can be collected and they can be divided into two different categories: primary and secondary data. Primary data is data that is produced by the researchers for the specific research topic whilst secondary data includes already published information, such as articles and books (Bryman, 2012). For this master thesis project both types of data have been collected; primary data in form of semi-structured interviews, a workshop, verification of methods, and a study visit at a reference company. Secondary data was collected in form of an extensive literature review.

2.2.1 Primary data

To get a better understanding of the current conditions at Xylem semi-structured interviews were conducted with 22 employees belonging to different functions of the company. From the three functions marketing, R&D and sales the following roles were interviewed: project managers, technical specialists, designers, business developers, product managers, sales and marketing directors. As a complement to the interviews a workshop, with 12 participants, was also conducted in order to discuss their situation further and gain a deeper understanding of possible barriers for implementing a process for capturing and managing hidden customer needs as well as current problems that could affect an implementation. The design of the workshop is presented in Appendix A: Workshop. To further increase the knowledge of existing solutions and ways of working a reference company was studied. The company operates under similar conditions as Xylem and they can both be classified as an industrial company. When the methods for capturing hidden needs had been chosen they were tested in order to verify their usefulness.

2.2.2 Secondary data

For secondary data an extensive literature review was conducted where information was gathered from journal articles, books and in some cases webpages. Sources for such publications were Google Scholar and the Royal Institute of Technology's online library,

Primo. Through ‘snowballing’ (Booth, Papaioannou, & Sutton, 2011) more articles were retrieved by examining the reference list of the previously read articles. Webpages were only used for acquiring information about the company, such as background and financial numbers.

2.2.3 Interview template

For the semi-structured interviews an interview template was constructed but was later abolished due to the vast difference in background of the respondents. Instead a more open interview approach, based on the original template, was used where the respondents talked freely about the specific topic (identification and managing of (hidden) customer needs). The original interview template is presented in Appendix B: Interview template.

2.2.4 Verification of proposal

As a means to verify that the proposed methods are indeed suitable for Xylem and its current situation, field tests were carried out. The aim of the tests was to determine if the methods resulted in a higher amount of elicited customer needs and how the methods were perceived by the employees in terms of effectiveness and complexity. Due to the limited time frame of the master thesis only two separate field tests were carried out without a return visit. For the same reason only the suggested methods were tested. The instructions provided to those conducting the methods, as well as the questions for evaluation are presented in Appendix C: Test instructions and Appendix D: Evaluation of test.

3 FRAME OF REFERENCE

In this chapter the result of the literature study conducted as a part of this master thesis will be presented. An introduction to hidden needs, organizational barriers, existing process, and methods will be presented.

3.1 Introduction to hidden need analysis

In order for a company to secure survival and growth on today's highly competitive markets, new, successful products are essential. (Ericson, Larsson, Larsson, & Larsson, 2007; Holt, 1985, 1987)

An innovation has been defined differently over the years but the essential factors are that it should include changes to what already exists regarding technology and fulfilment of customer needs (Chandy & Tellis, 1998; Goffin & Mitchell, 2010). Although, an innovation is a combination of technology possibilities and customer's needs (Holt, 1987), there is a general consensus that the latter is the key factor to new product success (Bayus, 2008; Carlgren, 2013; Desouza et al., 2008; Ericson, et al., 2007; Goffin & Mitchell, 2010; Holt, 1987; Koners, et al., 2010; Kärkkäinen, Piippo, & Tuominen, 2001).

To gather these needs, businesses commonly practice what they claim to be a Voice of the customer (VOC) in the early stages of new product development. A VOC is a set of customer needs, categorized and prioritized by the customer (Belliveau, Griffin, & Somermeyer, 2004; Griffin & Hauser, 1993; van Kleef, van Trijp, & Luning, 2005). According to Belliveau, et al., the goal of conducting a VOC is to "understand the most minute details of an underlying need…" (Belliveau, et al., 2004, p. 184). In contradiction, case studies reveal that market research is not performed properly by companies as new product development often fails due to poor customer understanding and lack of identified needs (Barczak & Kahn, 2012; Goffin & Mitchell, 2010; Koners, et al., 2010; Szakonyi, 1988).

To identify customer needs companies often perform a traditional market research consisting of methods such as surveys, focus groups, and direct questioning. However, there is a general consensus that traditional market research needs to be combined with new market research methods that probe deeper and reveal what customers really need. (Belliveau, et al., 2004; Cooper & Edgett, 2008; Goffin & Mitchell, 2010; Koners, et al., 2010; Kärkkäinen, Piippo, & Tuominen, 2001) The fundamental limitations of the traditional methods are that they are too direct and focus on existing markets and products. Using a survey, quantitative data of short customer answers are provided, giving no room for further explanations. Using a focus group, the scope of the discussion is limited by the knowledge customers have about current products. In addition, focus groups are located outside the customer's environment preventing designers to assimilate the context (Koners, et al., 2010). Accordingly, the result of these methods is only needs that the customer is able to articulate, such as expressed solutions and performance requirements, which are already known. What is desired by companies is customer's hidden needs in order to differentiate from competitors.

There are several expressions of customer needs and types of needs that may be necessary to sort out. First, there is a difference between wants and needs. A common assumption is that customers do not know what they want, which is wrong. Customers do very well know what they want, however, they have difficulties articulate what they really need (Belliveau, et al.,

2004). Bayus (2008) highlights the importance of separating needs and wants where customer needs are described as long-term in nature and cannot always be recognized or verbally described by a customer whereas wants are attributes that a customer believes will fulfil a known need, short-term and temporary in nature. Griffin and Hauser define a customer need as "a description of the benefit to be fulfilled by the product or service" (Griffin & Hauser, 1993, p. 4).

Second, customers' needs can be categorized as articulated and unarticulated. Articulated needs involve what the customer is able to express directly with words. These needs often include technical features and solutions to a short-term problem instead of the long-term underlying need. Therefore, traditional market research methods are suitable for collecting these needs (Bayus, 2008; Carlgren, 2013; Koners, et al., 2010). However, a direct translation of what customers express is not adequate; unarticulated needs must also be considered (Koners, et al., 2010). Other designations for these needs are hidden or latent needs. In this study, hidden needs will be the term used. Kärkkäinen, et al. (2001) define hidden needs as needs that customers are not able to or will not express. Koners, et al. (2010) mean that hidden needs are problems the customer have not yet realized. Carlgren (2013) add that customers may forget to mention some needs as they are perceived as basic product attributes.

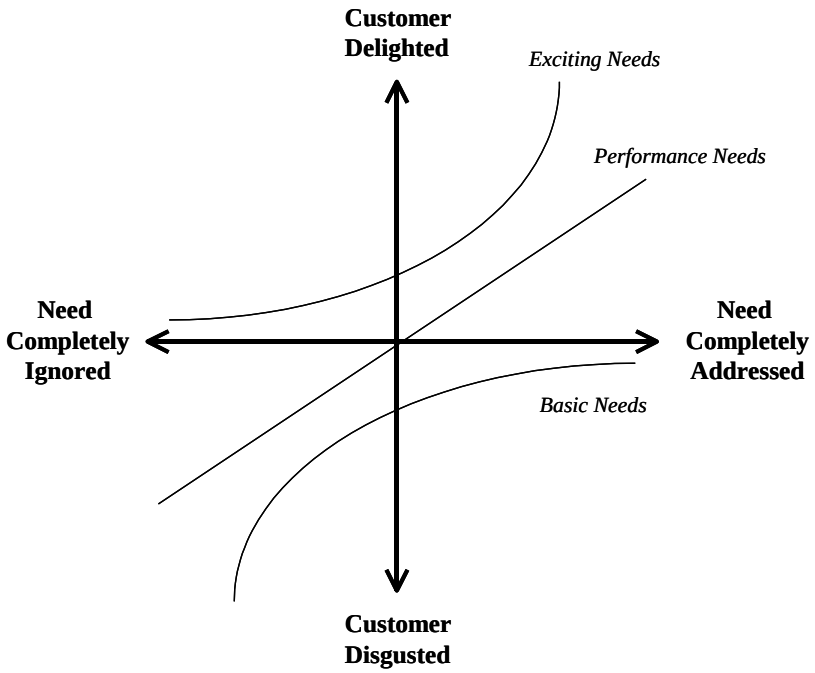

Figure 3. Kano diagram (Bayus, 2008).

There is a distinction between the descriptions by Koners, et al. and Carlgren. The basic needs will not make any significant differences in customer satisfaction if fulfilled by the product as it is expected, but will have an extremely negative effect if not fulfilled. On the contrary, if a need that the customer has not yet realised is fulfilled the product will not only satisfy but excite the customer. If they are not fulfilled, the customer will not miss those features as the customer have not yet thought of them. What is described here originates in a theory by Kano, Kano's model, which categorizes needs according to the degree of fulfilment and customer satisfaction. Researchers describes Kano's model differently but the fundamentals involve a determination whether a need is basic, performance, or exciting, where the latter is related to hidden needs that generates innovative, breakthrough products, see Figure 3. Time is an

important factor as when a hidden need is addressed customers will expect it to be fulfilled from that point. Thus, companies must continually be updated on customer' needs in order to be competitive. (Bayus, 2008)

There is a third point of view, presented by Ulwick (2005) who argues that the "voice of the customer" should be ignored. According to Ulwick, companies usually collect the wrong type of information, which he categorizes in four categories: *solutions, specifications, needs* and *benefits*. A solution is described as the "physical or tangible features they [customers] want to see in the products or service they use". This will only lead to so called 'me-too' products rather than highly innovative products. A specification could be different design characteristics such as weight, colour, size or look. A need is described as an imprecise statement that is easy to be misinterpreted by the development team such as 'reliable', 'effective' or 'robust'. A benefit is somewhat similar to a need; it is an imprecise statement that is very ambiguous. This is a somewhat different view compared to the other two but the essence is the same.

Despite the knowledge of the importance of a deep customer understanding most companies still rely on a traditional market research approach (Carlgren, 2013; Koners, et al., 2010). Koners, et al. (2010) and Goffin and Mitchell (2010) have identified the underlying reasons. First, companies do not have the resources to execute a comprehensive market research with traditional and new methods. Second, companies lack knowledge about new methods. Finally, companies find it difficult to collect and analyse customer needs.

Studying best practice companies, Barczak and Kahn (2012) shows that a common denominator is that they find the research stage (and strategy) most important in new product development. Therefore they provide sufficient resources to conduct a comprehensive market research study to learn their customers' needs. Their study also showed a general behaviour by poor practice companies including incomplete market research and no customer/user involvement. Davenport et al. (2001) add that the best practice companies have a process and supporting tools. There are several researchers that agree on the latter claiming that need assessment is a systematic process, and that industrial companies are in great need of one in order to develop successful new products. (Carlgren, 2013; Holt, 1987; Kärkkäinen, Piippo, Puumalainen, et al., 2001; Kärkkäinen, Piippo, & Tuominen, 2001)

3.2 Organizational barriers

Companies might want to improve their processes for capturing and managing their customers' hidden needs but there are often barriers in the organizational structure that prevents them from doing so. Kärkkäinen, et al. (2001) investigated 70 Finnish business-to-business companies and identified several problems that companies face when trying to address their customers' hidden needs. 45 % or more of the studied companies found these problems significant (rated 4 or 5 on a 1 – 5 scale):

- Insufficient resources for assessing new customer needs.
- Information about new needs not documented in an easily exploitable form
- Information concerning new customer needs is not systematically gathered as a natural part of customer visits.
- No common, systematic approach has been determined for documentation of information concerning new customer needs.
- Difficult to hinder customers from thinking in terms of present products and product attributes.

- Customer need assessment focuses too much on short-term customer satisfaction; the hidden and future needs are forgotten.
- Customers' operation and processes are not understood well enough.
- Customer wants same technical solutions that exist in competing product; background needs not revealed.
- Individual customers' representatives' (e.g. buyer's) opinions become too dominant when assessing customer needs.
- Information concerning customer's new needs gets biased or changes on the way to R&D.

Another study, in the field of medical technology, was conducted by Lettl (2007) where he brings up two different, more general barriers of customer involvement in radical product development: *barrier of not knowing* and *barrier of not wanting*. For the barrier of not knowing, Lettl identifies three underlying reasons: (1) users are too fixated on the current product and/or technical solution; (2) it is difficult for users to evaluate concepts when there is no reference product; and (3) the technology is too complex for the user to comprehend. There are two main reasons why users might be unwilling to contribute to radical innovation: (1) the fear that their existing knowledge within the field will become obsolete and; (2) that there will be high costs for implementing the new technique.

Koners, et al. (2010) makes a different distinction and identifies two barriers: (1) *intention of use* and (2) *effective usage.* Factors that hinder the use of hidden need techniques are: it is common that companies rely too much on internally generated ideas; the approach of hidden need analysis is not commonly known; the culture of the company does not support new ways of working and; the overall company strategy is not focusing on creating breakthrough products. Just because an organization decides to implement new techniques it is not guaranteed that they will succeed. The barrier of effective usage has four contributing factors: the absence of leaders that are familiar with the methods; lack of knowledge about the techniques within the organization; not enough time is put aside to learn the new methods and; many companies lack a natural cross-functionality within the organization to begin with, which is essential for these techniques to deliver expected results.

It is also important for companies to have a correct market orientation. There are two different orientations: a responsive market orientation, which reacts to customer input is better suited when developing incremental products. If a firm wants to develop more radical products it is recommended to have a more proactive market orientation which aims to foresee the future and hidden needs of the customers. (Narver, et al., 2004)

3.3 Managing the voice of the customer process

According to Kärkkäinen, et al. (2001) and Ulrich and Eppinger (2012) it is important that the need assessment process is well integrated with the product development process. The need assessment should obviously occur before the product development process so that the information can be used to make decisions about concepts and product attributes.

There is a wide consensus in the literature that the cooperation between marketing and R&D departments increase the success rate of new product development projects (Ebrahimi, McGowan, & Chung, 2006; Griffin & Hauser, 1996; Moenaert & Souder, 1990). It is crucial for the two departments to work together when acquiring customer needs since they need information from each other; R&D need information about the current customer needs and marketing needs information about the technical information about the products. The

marketing department should however be responsible for the acquisition of customer needs and R&D for new technologies, competition and resources. If a product is initiated from a member of the R&D department the chance that it will succeed is smaller since R&D personnel may be reacting to a new technology rather than an actual customer need. With that being said, technical expertise still correlates significantly with new product success. (Moenaert & Souder, 1990)

Due to the great loss of information in verbal handovers it is even more important to ensure that cross-functionality is achieved. A study showed that up to 70 % of the information may disappear in each handover (Bhabra, Mackeith, Monteiro, & Pothier, 2007).

To execute a good voice of the customer research study a framework must be in place so that the work can be carried out in a structured manner. In the following chapters existing processes and methods for identifying and analysing hidden customer needs will be presented.

3.3.1 Frameworks for managing customer needs

Several researchers have tried to develop a holistic process or framework for working with hidden customer needs. Some of them have been outlined in the following chapter.

Ulrich and Eppinger

Ulrich and Eppinger (2012) presents a process for comprehensively identifying both expressed and hidden customer needs. The goals of the process are to:

- Ensure a product is developed around customer needs.
- Identify both expressed and hidden needs.
- Provide a factual basis for justifying the requirements.
- Document the process.
- Ensure that all critical customers' needs are heard.
- Develop a common mindset regarding customer needs in the development team.

The underlying philosophy is to create an information sharing channel between the customer and the developers. That is to make sure that everyone involved in the project get a chance to experience the use environment of the product. Identifying the customer needs must be a part of the bigger development process and is therefore closely related to activities such as concept generation and selection, competitive benchmarking, and the establishment of product specifications. Ulrich and Eppinger make the distinction between a customer need and a product specification, a customer need is not bound to any specific solution whereas a product specification is very much depended on the concept chosen.

The process of identifying customer needs is divided into five steps:

1. Gather raw data from customers.
2. Interpret the raw data in terms of customer needs.
3. Organize the needs into a hierarchy of primary, secondary, and (if necessary) tertiary needs.
4. Establish the relative importance of the needs.
5. Reflect on the results and the process.

Before starting a project a so called mission statement is written which includes information about the business case and what stakeholders are involved. When the raw data should be collected several methods can be used, for example interviews, focus groups and observations. A further exposition of different methods will be discussed in chapter 3.3.3.

From the previous steps somewhere between 50 and 300 need statements should have been elicited, therefore they need to be categorized into primary and secondary needs (sometimes even into tertiary needs). The primary needs serve as a head line of the lower level needs. Before categorizing, be sure to remove any redundant statements. The categorization process can be done in two ways, either by the development team or by customers. The development team must bear in mind that it is often advantageous to categorize the statements based on how the customer views the product. In order to establish which statements that are the most important they are ranked by the customers. Ulrich and Eppinger suggests a straight forward questionnaire where the customer ranks the statements by assigning a number between 1 and 5 to each statement together with a checkbox which they are asked to check if that particular statement is unique, exciting and/or unexpected. The last step in this process is to reflect on the result and ask a couple of questions to make sure that all steps have been executed correctly. (Ulrich & Eppinger, 2012)

Outcome-driven innovation

Ulwick (2005) describes a systematic approach to innovation which he names outcome-driven innovation. In this approach there are three pillars on which he builds his theory: jobs, outcomes and constraints. He argues that to fully understand the innovation process a company must realize what jobs the customer is trying to get done, what metrics the customer uses to determine if the job is done satisfactory or not and what constrains hinders the customer to perform the job. Ulwick defines eight stages in the outcome-driven innovation process:

1. Formulate innovation strategy
2. Capture customer inputs
3. Identify opportunities
4. Segment the market
5. Define targeting strategy
6. Position current offerings
7. Prioritize development pipeline
8. Define breakthrough concepts

Due to the scope of this paper only stage 2 and 3 will be scrutinized.

A customer job can be divided into three categories: functional, personal or social jobs. All of them should be considered in the development process in order to achieve the highest customer satisfaction. An outcome, or customer metric, is a way that the customer measures how well a job is being done, it is paramount for the development team to determine those outcomes; they are not always realized by the customer itself. For every product there are usually somewhere between 50 and 150 different outcomes. The outcomes should be structured in a specific way to make it as easy as possible for the developers. A customer outcome should have a direction (minimize/increase), a unit of measure (time/frequency/likelihood), and an object of control. When it comes to methods for acquiring this customer data Ulwick does not propose any specific methods and argues that the method is not important as long as the type of information needed (jobs, outcomes and constraints) is known.

In order to prioritize the desired customer outcomes Ulwick introduces a new term: *opportunity*. Three common mistakes when prioritizing customer need are identified: (1) making improvements in areas that already are satisfied, (2) making improvements that satisfy unimportant outcomes, and (3) making improvements that negatively impact other outcomes. To determine what outcomes that have the highest opportunity the customer is asked to rate

(between 1 and 10) the elicited outcomes in terms of importance and satisfaction; how important is the outcome and how well is it satisfied today? The opportunity is then calculated as shown in Equation 1.

$$Opportuniy = Importance + \max(Importance - Satifaction, 0) \quad (1)$$

The higher the opportunity score, the more focus that outcome should get in the development. Ulwick claims that if an outcome gets an opportunity score of 15 or higher it represents an area of extreme opportunity and should not be ignored. Scores below 10 are considered unattractive and should not be pursued. (Ulwick, 2005)

Needfinding

The needfinding process was coined by McKim and is described by Patnaik and Becker (1999). The paradigm of needfinding is that traditional market research techniques are not adequate since they are often focused around solutions. Instead the market researcher should focus on capturing the needs of the customer, since a need last longer than any specific solution. Patnaik and Becker suggest an iterative four-stage process when capturing and interpreting customer needs.

- Frame and prepare
- Watch and record
- Ask and record
- Interpret and reframe

In the first stage the scope of the study is decided, which customers or customer groups that should be targeted, what sites should be visited etc. By being prepared the researcher knows what types of questions he should ask and what information to look for. The following things are good to reflect upon before starting the research:

- Frame the research question. The goal of the study should be decided; a couple of questions can be formulated in order to make sure that the purpose of the study is fulfilled.
- Define the needer group. The target segment must be identified; consideration must also be taken to sub-groups such as extreme users that can have completely different needs than the mainstream part of the segment. However, the research team must be cautious to not over-design the product. It must suit the majority of the customer segment.
- Study established data for grounding in the subject. Before engaging in the following stages it is important that secondary sources and previous studies are well understood, there is no need to do work that is already done.

The second stage is about discovering people's behaviours and what problems they face that themselves are accustomed to and therefore do not realize or perceive as a problem at all. Things to think about when observing other people:

- Immerse oneself in the needer group. In order to fully understand the customer, the researcher must expose himself to the needer's situation.
- Avoid intrusions to keep the behaviour natural. People alter their behaviour when they are observed and the impact of the researchers should therefore be kept to a minimum.
- Use appropriate recording media. Sometimes it is hard to describe in words what people are doing and not doing, other ways of documenting must be considered, such as video and audio recordings.

Since observations alone cannot capture the complete picture of a customer and his behaviours it is also necessary to ask questions. Asking questions give the researcher a deeper understanding of the customer's emotions and thoughts of his/her current situation. The following things are good to consider when conducting interviews:

- Interview in the customer's own environment. The environment can trigger the customer to recognize previously hidden needs.
- Record information in the customer's terms. It is important to capture the customer's opinions in his own words as important information can be lost when translated.

In the last stage the information from the two previous stages are interpreted and processed in order to prepare for the next iteration. The product development process can go on in parallel with the needfinding process. Always have in mind what problems need to be solved in order to improve the customer's situation:

- Create need statements. Although much data will still exist as tacit knowledge in the head of the researchers it is important to write down as many need statements as possible.
- Classify and prioritize the needs. Patnaik and Becker suggest the same method as proposed by Ulrich and Eppinger.
- Reframe the research. After conducting some interviews and observations, one might find that the research question should be changed or that the customer segment should be divided into smaller segments with different needs.

Each of these stages should be repeated in order to get a clear understanding of the customer. Each step may seem quite similar but as the process moves along the designers' certainty and knowledge of his customer increases. (Patnaik & Becker, 1999)

Hidden need analysis

Goffin and Mitchell (2010) presents a range of methods, consisting of both traditional and new market research methods that they collectively call Hidden need analysis (HNA). The first step in order to conduct a hidden need analysis is for the organization to realize that it wants to develop not only incremental products but radical products as well. When that goal is set the market research is designed; it could be a combination of traditional and new methods but if the aim is to develop a truly radical product the focus should be on the new methods. Such methods are*:* repertory grid analysis, empathic design, and lead users. The data is then collected when performing the methods and then analysed, from the analysis user needs and need statements are identified, if necessary the needs will be prioritized. The outcome of the process should be defined product attributes that will ensure a radical product.

3.3.2 Preparing the voice of the customer process

Before starting to capture customer needs it is important to know which customers to target, especially in an industrial company since they tend to have more complex business chains. The customers must be chosen carefully, in many cases companies ask their sales force which customers that should be included. The result is often that the most satisfied customers are interviewed rather than customers that are unhappy or have chosen a competitor. The unhappy customers are more likely to provide useful information on what the product is missing. Another source of such knowledge can be those customers or potential customers who are early adopters, which are those who are the first to adopt a new technology. Since they are more likely to adopt a new technology they can provide valuable feedback before the product is launched to the mainstream market. There are several methods to analyse a company's

customers and which should be targeted, some of them will be presented in this chapter. However, it is not only what customer to target, it is also important to know what to study. If the goal of the study is not clearly defined, it is hard to know what questions to ask and what to observe. (Belliveau, et al., 2004)

Customer value chain analysis

Customer value chain analysis (CVCA) is a tool that outlines the stakeholders of a company and how they interact with each other. Stakeholders may range from distant raw material suppliers to retailers, and end users. Typical interactions between stakeholders can be change of money, information or products. When launching a new product it is important to have a clear strategic goal and the CVCA can be of assistance in that matter. By outlining all relevant stakeholders and how they interact with each other the product development team get a good basic understanding of how the product will be used and whose needs and requirements they need to take into account. Basically, the method can be divided into seven steps:

Step 1: Determine the business model for the product

Step 2: Delineate pertinent parties involved with the product's life cycle

Step 3: Determine how the product's customers are related to each other

Step 4: Identify the value propositions of the product's customers and define the flows between them

Step 5: Analyse the customer chain to determine the product's critical customers and their value propositions

Step 6: Input the information into product definition assessment

Step 7: Use the CVCA results downstream in the product design process

Performing a CVCA can prevent that certain customer groups are missed out in the market analysis and it might also unearth customer needs or requirements. However, it is important to execute the method on a proper level; a balance must be kept in how many stakeholders that are taken into account. (Donaldson, Ishii, & Sheppard, 2006)

Trend matrix

This tool is specifically developed for business-to-business companies with the aim to address trends in the business. The core of the tool is a diagonal matrix where the stakeholders included in the process are presented on the diagonal. The order of the different stakeholders is usually based on the flow of material and goods. An overview of the matrix can be seen in Figure 4.

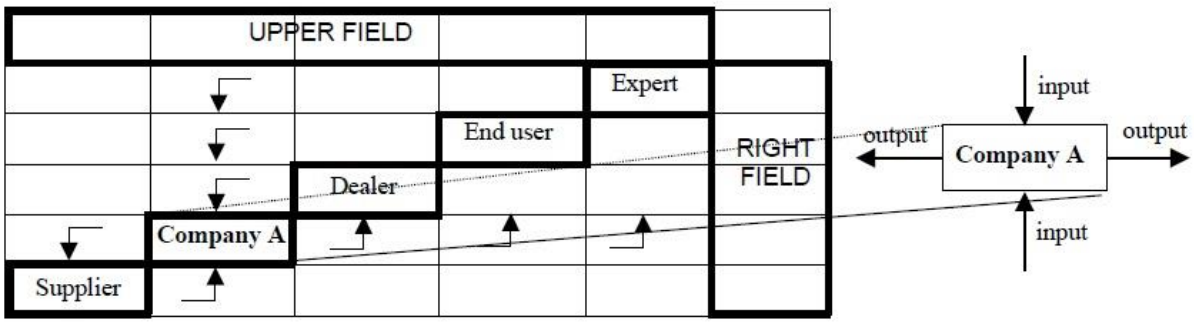

Figure 4. Trend matrix (Kärkkäinen, et al., 2003).

The arrows indicates inputs in form of flow of information (requirements, needs etc.), materials, monetary funds and finished goods. The upper field contains information affecting the stakeholders below but is not originated directly from any of them. The right field is used to present information regarding competitors' solutions or potential superiority.

The tool helps the company to understand which stakeholders that are affecting the customer needs and how their relationship with the company looks like. It is not always clear to everyone that are involved in the R&D-process which stakeholders that are or may be affecting the product requirements. This method is a good tool to use when the business chain is long and complex and it needs to be clarified who the customers are and how they impact each other. (Kärkkäinen, et al., 2003; Kärkkäinen, Piippo, & Tuominen, 2001)

Lead users

Usually this method is associated with capturing hidden needs but here the focus will be on the identification process of lead users. Lead users can be described as users who fulfil two criteria: (1) they are at the leading edge of important market trends and; (2) they have a strong incentive to find solutions for the novel needs they encounter at the leading edge (von Hippel, 1986).

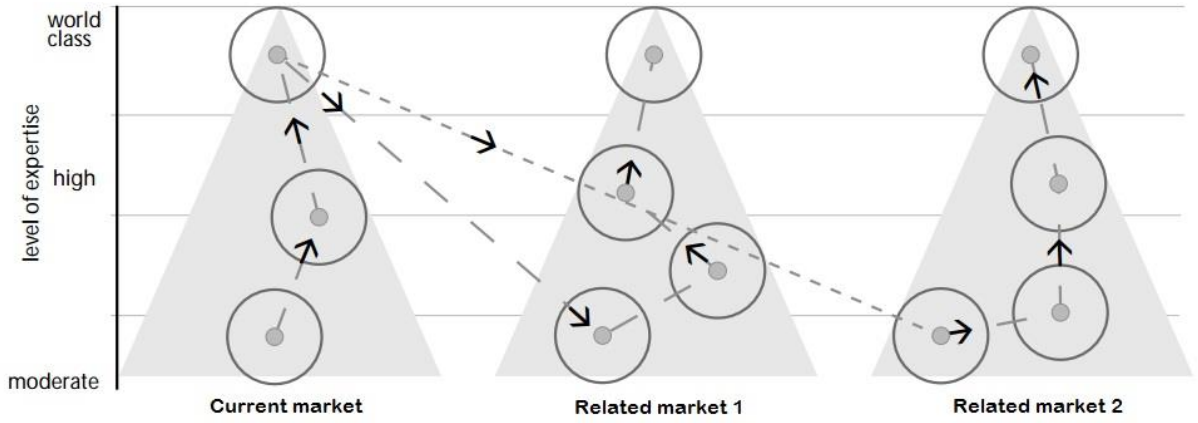

Figure 5. Lead user networking technique (Von Hippel, Thomke, & Sonnack, 1999).

To identify lead users a broad perspective must be considered; lead users will in many cases be found in different yet related industries. To come in contact with lead users it is suggested to network; ask the first person who he or she thinks knows more about this subject. When a lead user has been encountered in the current market, that person might refer to actors in related markets. Such a networking methodology is illustrated in Figure 5. (von Hippel, 1986; Von Hippel, et al., 1999) Using this method will allow the development team to identify leading customers and users that are suitable to include in the process of identifying hidden customer needs.

3.3.3 Methods for capturing hidden customer needs

The meaning of capture is to collect and analyse raw data to generate insights and identify hidden needs. In the literature several methods for capturing customer needs were found. However, just a selection of them is presented in this chapter; the ones with a strong connection to hidden need assessment. These are:

1. Ethnographic research
    a. Contextual interview
    b. Systematic observation

    c. Empathy building
2. Empathic lead user
3. Repertory grid analysis
4. Zaltman Metaphor Elicitation Technique

When collecting raw data to uncover hidden needs a combination of methods is frequently recommended in the literature, mainly because of two reasons: it enhances the chance of capturing hidden needs, and a comparison of data enhances the reliability of the result (Belliveau, et al., 2004; Goffin & Mitchell, 2010; Koners, et al., 2010); triangulation is often recommended when analysing qualitative data (Goffin & Mitchell, 2010; Koners, et al., 2010). A second factor affecting the amount of captured needs and the reliability is the number of customers involved in the study, i.e. how many times methods are performed. There are few studies investigating this factor but researchers frequently mentioned are Griffin and Hauser (1993) and their study of interviews. The result shows that somewhere between 20 and 30 one hour one-on-one interviews capture around 90 % of the needs. However, they do not consider whether it is articulated needs or hidden needs. Belliveau, et al. (2004) claims that when performing ethnographic research it is not necessary to have as many customer visits in order to get a good understanding of the customer's situation; somewhere between 9 and 20 in depth customer visits would suffice.

Ethnographic research

One approach more popular in literature, which stem from anthropology, is to empathize with the customer; not only search for needs but to develop a deeper customer understanding by spending time with the customer, thus, this method is appropriate for radically new products (Belliveau, et al., 2004; Koners, et al., 2010; van Kleef, et al., 2005). This is mainly an observational approach and therefore it is, of some researchers, called Observational research. Another term is Empathic Design but the most common term is Ethnographic research.

Although the purpose is the same, to derive customer needs indirectly of what being observed, this approach is described differently by researchers. Belliveau, et al. (2004) and Koners, et al. (2010) describes it almost as a complete process, from the fuzzy front-end to post-launch. To capture the hidden needs a cross-functional team spend a lot of time in the customer's environment, gather different types of data (notes, video and audio recordings) which is then analysed. Being context focused is one of three characteristics of ethnographic research. According to Belliveau, et al. (2004) the second two are: being inductive, and holistic. Thus, a hypothesis of the real underlying customer needs is generated in the end, and the inquiry starts broad but since it is an iterative process it is narrowed down for each iteration. Goffin and Mitchell (2010) clarify this approach by presenting it not as a process but as a set of methods. These methods are the fundamental elements of ethnographic research consisting of *Systematic observation*, *Contextual Interviews*, and *Empathy Building*. Although it may be a complete process, Goffin and Mitchell have summarized a numerous of cases where companies are using the methods individually with a successful result of identifying hidden needs.

When analysing the raw data the key approach is to compare the different types of raw data in order to find similarities and contradictions, such as in what customer say they do and what they really do. In that way, their underlying needs can be uncovered. (Koners, et al., 2010)

Although this approach is highly recommended, as it is perceived very effective in hidden need assessment, it is seldom applied in businesses (Cooper & Edgett, 2008; Koners, et al., 2010). In Cooper's study of 106 firms (70% business-to-business companies), ethnography was rated most effective of several VOC methods, but the popularity was low. Probable

reasons may be that the whole process is time-consuming and complex, especially the analysis as a large amount of qualitative data is generated. Therefore, essential training is needed to perform a complete ethnographic research. (Goffin & Mitchell, 2010; Koners, et al., 2010; van Kleef, et al., 2005) An important aspect in ethnographic research is to determine who shall perform the methods. Leonard (1995) suggests that the ones who have a good understanding of the company's technological competencies should be conducting the research.

Systematic observations: Instead of relying on what the customers are saying this method aims to, in a systematic way, observe how they actually use the product without interfering. While observing the observer will video-record the customers in action which will generate a lot of raw data. Therefore it is important to limit what will be observed to for instance one activity. In order to succeed it is important to have a good coding scheme, i.e. a list of things to look for. This list can consist of extra linguistic signals, such as (non-articulated) frustration and body language. (Goffin & Mitchell, 2010; Koners, et al., 2010)

Another approach when analysing video-recordings is to determine time sequences or investigate distances between actors or to key objects (Koners, et al., 2010). In addition, the analysis focuses on typical scenarios or events and how often they occur (Goffin & Mitchell, 2010). It is also very common that the observers identify misuse of products or modified products and systems (Cooper & Edgett, 2008).

Even if it is time-consuming and the data is complex to analyse the method is very effective in discovering hidden customer needs (Goffin & Lemke, 2004). Cooper (2008) even believes that this may be the best method.

Contextual interviews: A viable complement to systematic observations is contextual interviews, which are interviews conducted in the customer's environment in order to get a good understanding of how the product is used. While the customer operates the product the researcher can ask questions to investigate why the customer do some things in a certain way, having them do so reveal their tacit knowledge which is very precious for a researcher (Koners, et al., 2010). The interview is usually conducted by two researchers, one taking notes and one following an interview guide with semi-structured interview questions. The interview guide should be carefully designed with key questions related to the activity. However, the guide is not a script and additional questions to drill deeper should be asked (Goffin & Mitchell, 2010; Koners, et al., 2010; Ulrich & Eppinger, 2012). Koners, et al. (2010) have constructed a general guide which can be used as an starting point when developing questions for contextual interviews.

Together with systematic observations contextual interviews is a very effective method for revealing hidden customer needs. The amount of data is large, consisting of notes and audio recordings, but is often easier to analyse than video recordings. (Cooper & Edgett, 2008; Goffin & Mitchell, 2010; Koners, et al., 2010)

There are several approaches how to analyse such data from contextual interviews. Belliveau, et al. (2004) keep a general approach suggesting that anything that indicates a need should be highlighted; it could be an important factor or a quote providing an insight. Note that it is important to search for needs and not elicit expressed solutions. (Belliveau, et al., 2004)

According to Koners, et al. (2010) there are more specific approaches to analyse the raw data. The first suggestion is to use a coding scheme, a list of categories and questions of what to search for, as mentioned earlier. Another approach is to identify typical scenarios and or to search for contradictions such as what interviewees say and do, if explanations are misleading

in terms of being simplified or expressed as unusual and special when not. Interviewees may also put a positive tone on events and how often mistakes occur. (Koners, et al., 2010)

There are some challenges with this method though; conducting interviews requires training and there are many recommendations regarding interview technique. Koners, et al. (2010) emphasize the importance of not making assumptions and that the interviewer should adopt the role of a somewhat naïve outsider. Ulrich and Eppinger (2012) agree whilst adding that the interviewer should be receptive to information and avoid confrontation or defensive posturing. Belliveau, et al. (2004) recommend asking 'why' five times in order to understand what the customers really mean when they for instance use nonspecific adjectives (good, flexible, convenient etc.).

The result of the analysis can be a set of unique phrases or a summary of what has been observed and conclusions from the data.

Empathy building: A final supplement to really empathize with the customer is to be the customer, to step into the customers' shoes. Koners, et al. (2010) call this method empathy building and recommend it as a successful method for identifying hidden needs. Thomas and McDonagh (2013) term it Empathic modelling but the purpose is the same; to experience with your own body the physical situation of others. There is however no formal methodology for how to execute this method. The methodology for this approach depends on the customer, activity, and product or service which is in focus (Goffin & Mitchell, 2010). Some businesses have their designers practice an activity out with the customers and some rebuilds a similar environment of an activity in their own facility. For instance, when developing Ford Focus, product designers worn a thick suit to simulate problems that elderly people face when climbing into their cars, which generated valuable insights (Koners, et al., 2010).

Empathic lead users

The empathic lead user method is a way to transform the product designer or a customer into a lead user by experiencing the product in new ways in order to identify latent customer needs. This can be done by letting ordinary users or designers use the product with, for instance, impaired senses or movement or altering the usage environment. When users are involved in the development of a new product they are often limited by their previous experiences and lack the ability to "think outside the box". This method is an approach to enable users (and designers) to come up with more radically new products. Following is a five step guide for how to conduct the empathic lead user method.

Step 1: Identify the product that should be redesigned.

Step 2: Define the typical customer, application and usage environment.

Step 3: Identify circumstances and user experiences that are likely to occur and that deviates from the typical customer and usage environments.

Step 4: Create ways to simulate extraordinary user experiences, such as impairing the participants' movement or senses.

Step 5: Conduct interviews while the participants are experiencing the extraordinary user experiences.

The participants' statements are analysed based on their depth and breadth to see if they met the pre-defined criteria of a latent need. Using this method, compared to only using interviews resulted in a twentyfold increase of discovered latent needs. However, there is one drawback and that is the requirement of a physical product that can be used in its real (or simulated) environment and means to transform regular users into lead users. (Lin & Seepersad, 2007)

To the authors knowledge has there only been one study conducted with this method and the result cannot be confirmed. However, this method is in many ways similar to other methods in the ethnographic research field and was therefore considered interesting.

Repertory grid analysis

Repertory grid analysis (RGA) is a method that has its origins in the field of psychology and is a potent method for identifying hidden customer needs. Despite its proven usefulness and effectiveness it is not used very often which is probably due to the skill the interviewer has to possess in order to execute the method properly. Although many studies and researchers are positive that RGA actually elicits hidden customer needs, there are those who say otherwise. Van Kleef, et al. (2005) claim that RGA is only a method for discovering incremental improvements of a product.

The way the method works is that the interviewee is asked to name five or more products or services that he or she is familiar with and write them on cards. The interviewer then presents the interviewee with three cards at a time, the interviewee is then asked to explain in what way two of the products are different from the third. The product is rated on a scale from 1 to 5 based on the attribute that differentiated the products. This is repeated with new combinations until all possible combinations have been presented.

Analysing interview transcripts generates insights and an understanding of the chosen attributes. The ratings on the other hand reveal the importance of an attribute by how widely spread the products are on the scale. In addition, hidden needs tend to be identified when low ratings for all elements. (Goffin & Mitchell, 2010; Koners, et al., 2010)

To analyse several matrices the analysis becomes relatively complex and requires the aid of special software. The data can be analysed in two ways, quantitative and qualitative. The qualitative analysis consists of transcripts from the interviews and the quantitative is based on the grid and a cognitive map. There is however software for analysing the data and drawing cognitive maps which is a two-dimensional visualization of the relationships between products and attributes based on customer perception. (Goffin, 2002; Goffin & Mitchell, 2010; Koners, et al., 2010)

Zaltman Metaphor Elicitation Technique

The Zaltman Metaphor Elicitation Technique, or ZMET, is a way to gain a deeper understanding of how the customer thinks and feels about a certain product, brand or service. This is done by letting certain customers, during a week, collect pictures from any source that they think represents the product or how they think about the product. When the week has passed they are interviewed in a two hour session where they describe their pictures and why they chose them. The interview is conducted in nine steps where the overall goal is to understand, by letting the customer explain the pictures, how the customer thinks about the product or brand. (Zaltman & Coulter, 1995)

To identify hidden needs from the transcribed audio recordings and notes, Zaltman and Coulter (1995) and Koners, et al. (2010) suggest three main steps: (1) identify recurring, key themes, by categorization; (2) analyse the frequency of statements and opinions and; (3) identify important constructs and construct relationships. Such a relationship can be a connection between a product feature and a feeling. In order to perform this analysis Zaltman and Coulter recommend constructing a consensus map, a tool to visualize relationships among constructs and validate the consensus regarding constructs among participants.

3.3.4 Methods for analysing customer needs

The rather broad term ‘analyse’ opens up for a lot of different methods to be investigated, such as methods for categorization, prioritization and other methods for managing and presenting the data in a comprehensively manner. Customer needs can either be prioritized by the customers or by the development team. Belliveau, et al. (2004) claims that the prioritization as well as the categorization should be conducted by the customers since they tend to reason quite differently about the product than the development team; they categorize the product after different features and functions rather than how it is manufactured and/or designed. This will result in a more accurate description of the customers’ needs. Griffin and Hauser (1993) suggests that several people, preferably of different background, should do the analysis of the VOC data in order to get a richer understanding of the customer.

In order to conduct a valuable analysis the raw data must be translated into need statements. A need statement is a clear and precise statement from a customer or customer group that addresses a certain need. When constructing need statements it is important to make sure that they are unbiased and based on facts. Ulrich and Eppinger (2012) describes a few guidelines that should be kept in mind when constructing need statements. The need statement should be written in terms of what a product should do, not how it should do it. The need statement should be as specific as the raw data to avoid loss of information. As often as it is possible the need statement should be described as an attribute of the product to facilitate the translation into a product specification. As a general rule, the words ‘must’ and ‘should’ should be avoided since they imply a level of importance which is to be avoided until the needs will be prioritized. A strong recommendation is, to the greatest possible extent, keep the customers own language when creating need statements (Belliveau, et al., 2004). Moreover, Belliveau, et al. make a distinction between writing an explicit and a latent customer need statement. An explicit need statement is often written as a description of needs to be done from the customer’s point of view and much focus is placed on the action verb. On the other hand, a latent need statement is formulated from the VOC or observations together with information about the customer’s situation. This realization is a result of a deep understanding of how different problems can be approached with technical solutions. (Belliveau, et al., 2004)

Categorization of customer needs

According to Ulrich and Eppinger (2012) a voice of the customer process will result in somewhere between 50 and 300 customer needs, Griffin and Hauser (1993) estimates that number to be between 200 and 400. Clearly, there is a need to organize the needs into a more manageable amount. Ulrich and Eppinger (2012) suggests a structure where the need is organized in primary, secondary and, if necessary, tertiary needs. Then a larger cluster of needs can be managed together. A similar method is called affinity diagram, where similar needs are clustered into bundles which are then managed as a single need (Belliveau, et al., 2004). There are not very many different methods to categorize customer needs; the methodology is very straight forward where several needs that are closely related to each other are clustered together.

Prioritization of customer needs

It is very important to give the customer needs a relative weight since a under- or overestimated customer need might result in customers find other products more appealing. There are many method used to prioritize customer needs, many of them are very simple but some are more complex. In general it is advantageous if the method force the customer to do trade-offs between different needs, otherwise too many needs will be scored as important.

Some methods that facilitate this are: Analytical hierarchy process (AHP), conjoint analysis and constant sum. Of these three constant sum is the simplest, it allows the customer to spend a fixed sum (usually 100) between the different needs and in that way it can be determined which customer need is the most important. The other two methods, AHP and conjoint analysis, are more complex and requires software utilization. Furthermore it is not recommended to compare more than nine different needs with the AHP-method and usually there are more needs that must be prioritized. (Tamayo Enríquez, Jaramillo Osuna, & González Bosch, 2004)

Another approach is described by Belliveau, et al. (2004) where the customer rates how important a need is and how well it is satisfied today. It is very similar to the opportunity-calculation that Ulwick proposes in chapter 3.2.1 but it is a simplified version where the calculation has been removed and the customer needs are instead placed in a quadrant with two axes: 'satisfaction' and 'importance'. Needs that receive a high rating on importance and low on satisfaction are those needs where efforts should be focused. The combination of low importance and low satisfaction may indicate that there are hidden opportunities that can be addressed. If a need is not considered to be important but is very well satisfied the company can save money by relocating resources to other features of the product. Needs that are rated high on both satisfaction and importance should be maintained at the current level.

Further analysis

For the company to get as much out of the customer need data as possible other methods to analyse the data can be necessary do utilize. Such methods can be to translate customer needs into technical requirements or a more structured way to look for focus areas. Yang (2005, 2013) proposes a modified version of the well-known Kano model. The Kano model can be used to categorize needs or attributes into five different categories: *attractive attributes, one-dimensional attributes, must-be attributes, reverse attributes* and *indifferent attributes.* The modification consists of introducing the aspect of importance and by doing so Yang ends up with eight categories which he claims give a more accurate picture of how customers perceive the product (Yang, 2005). Yang then introduces a diagram where the current level of fulfilment of the different customer needs is plotted against a general degree of fulfilment for the industry in order to identify where actions might be taken. Actions can be taken towards the aim of raising, enhancing, maintaining, reducing or eliminating the satisfaction levels of different customer needs depending on how well that customer need is fulfilled today and how important it is (Yang, 2013). Basically, Yang's model is similar to the model explained by Belliveau, et al. in the previous section except that Yang also considers the general degree of fulfilment in the rest of the industry. The Kano model and Yang's modified model may be a suitable approach to get a more holistic understanding of the customers' needs; which needs or attributes to focus in order to delight the customer.

A good complement to the Kano model can be to use Quality Function Deployment (QFD). The QFD have a more technical approach where the customer needs are linked to technical requirements. To have the link between a design specification and a customer need may result in a better understanding among designers why certain specifications exist (Ullman, 2010).

4 EMPIRICAL RESULTS

In this chapter the results that are obtained from the empirical research, described in the method chapter, are presented.

4.1 Organization

Xylem is organized into four different Growth centres (Transport, Dewatering, Applied water solutions and, Analytics and treatment). Each Growth centre has its own marketing department but there is only one main R&D-unit. The R&D-unit is divided into four product lines: *Transport*, *Mixers, Drainage* and *Monitoring and control* which designs products for all of the four Growth centres.

4.1.1 Processes

Customer needs are involved in two processes: the business development process and the product development process. Note that Xylem also has processes for developing IT, applications, and services; however, this master thesis focuses on products.

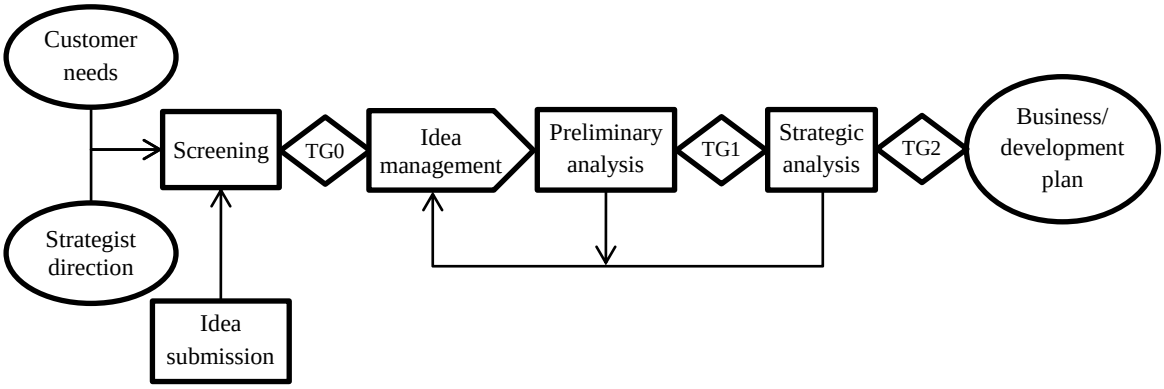

Figure 6. Xylem's Business development process (Xylem, 2014).

Both of these processes have a traditional stage-gate design where each gate (tollgate) requires deliveries in order to make decision whether to go further or not. The business development process managed by the marketing department consists of four stages; see illustration in Figure 6. Based on strategic direction and gathered customer needs, the marketing function delivers a business plan, a direction for the product developers to follow.

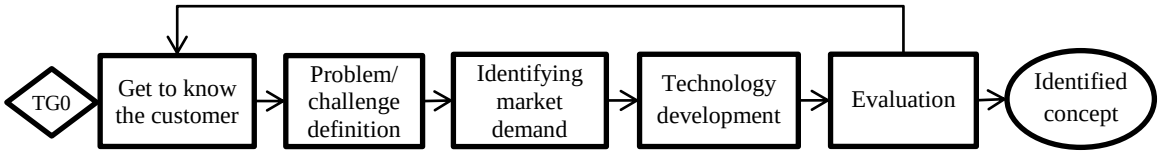

Figure 7. Xylem's Idea management process including the VOC in the first three steps (Xylem, 2014).

The VOC occurs directly after TG0, which controls that a screening of presented ideas has been made accurately and that there is a clear customer value. This is an iterative process

termed Idea management which includes five steps, where VOC is performed in the first three, see Figure 7. In the first step, marketing gets to know the customer by meeting them to observe and discuss. Based on the customer context in the former step a problem statement is defined. In the third step, a study is made of the market demand regarding this statement. If it is a common problem the right technology to resolve the problem is developed and when a concept is designed it is finally evaluated against predetermined criteria.

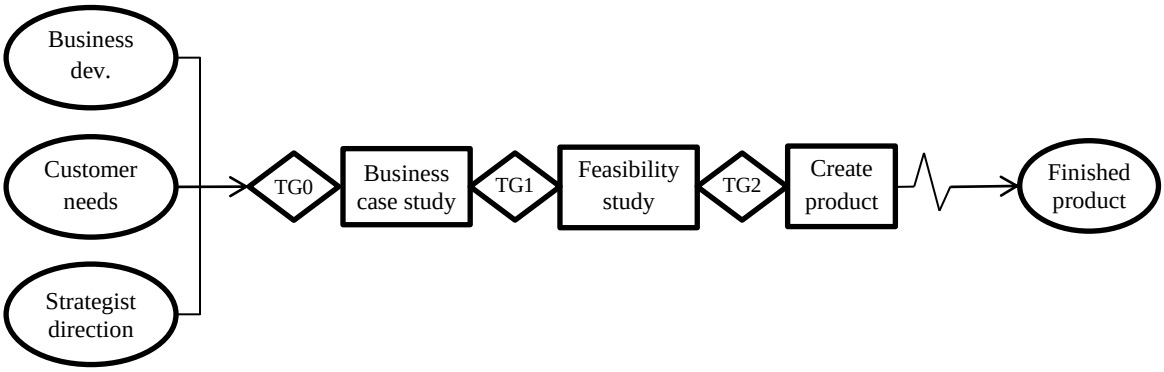

Figure 8. Xylem's product development process (Xylem, 2014).

In the product development process, see Figure 8, there are five fundamental stages starting with a business case study and a feasibility study and ends up with a review of the implementation. It is during the first two stages that product requirements are established. Before TG0, where a project manager is assigned, a business hypothesis is developed. This stage, which is a planning stage, is mainly managed by the program manager (manager for the product line) who together with marketing and engineers generates potential project ideas. These projects are then evaluated by representatives from the marketing, product development, and operational function, which decide what project to go further with based on the business hypothesis.

It is in TG2 in the product development process where the final decision is made whether to proceed with a concept or not. This means that a concept has been approved and ready for being developed for manufacturing.

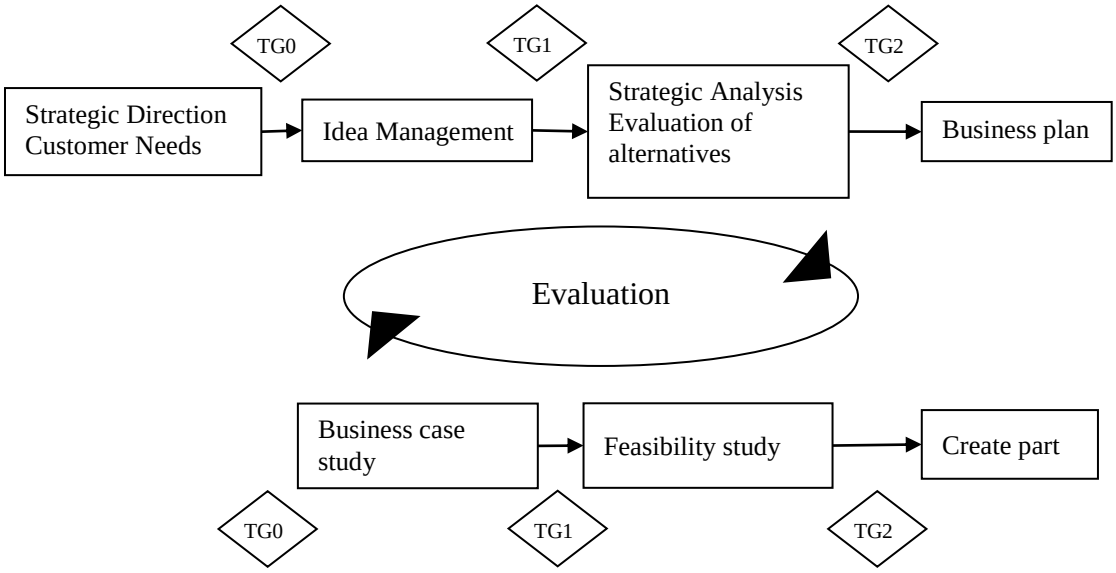

Figure 9. The new process, where the business and product development processes are merged (Xylem, 2014).

To generate more breakthrough products some changes are about to be made in GC Transport. Instead of implementing a new process, these two processes shall be merged, timing the tollgates TG0 to TG2 for the two processes, Figure 9. The goals for these changes are to: 1) increase information flow between the marketing and R&D departments to improve a cross-functional cooperation; 2) gather detailed customer knowledge; 3) refine the concept by iterations to improve the reliability of developing breakthrough products by an accurate and consistent evaluation of concepts. An essential requirement when developing this process was not to add another process, but to minimize the amount of processes; they want to use existing processes and decision groups to effectively integrate within the company. This is not the final process as further development is in progress to merge them completely.

4.2 Current methodology

Today Xylem only performs what is referred to as traditional market research, meaning that they use methods usually associated with a responsive market orientation. Such methods are surveys, interviews, analysis of sales figures, information from the sales force and, to some extent, focus groups. Most of the customer interactions are a result of an initiation from the customer who has a problem with their product or application; it is not Xylem who proactively seeks up customers to learn more about their situation.

All of the respondents answered that Xylem lacks a structured way to assess the hidden needs of their customers and instead have a focus on the explicit wishes and requirements of their customers. Many of the respondents also claimed that they already have a good understanding of their customers and what they want. Moreover, several respondents pointed out that the industry itself is very conservative, which makes it difficult to introduce new technical solutions if they are not considerably better than the predecessor.

There are some activities that are performed sporadically in order to get a better understanding of the customers' situation and ultimately design more innovative products. Such activities are working for a longer period of time together with the customer, testing the products in the field and, meeting the customer face to face and ask questions about the product and in some cases workshops with customers. However, these activities are not performed in a structured manner and the results are seldom communicated and actively used in the development of new products. Even if employees at Xylem are not used to work with the identification of hidden needs they are familiar with some elements of the general approach, for instance working in cross-functional teams and they also have potential information channels for acquiring information about their customers' situation. However, the majority of the respondents asked for a more frequent communication between the R&D and marketing department. A discrepancy was identified between the R&D department and the sales and marketing departments; the latter had a more short-term focus, to get products quickly out to the market. R&D on the other hand usually has a longer timeframe when they develop products.

4.3 Barriers for identifying hidden needs

Many respondents from the R&D-department said that they are limited by the company's, temporarily, low prioritization of traveling costs. Even if that is a barrier for those who actually want to meet and listen to the customer themselves, many designers do not think that it is important to actually meet the customer. It is not embedded in the company culture to do so.

There were several comments related to the complicity of visiting customers. When the marketing and/or R&D department actually meet customers, it is mainly loyal customers who already are buying Xylem products and they often cannot dedicate more than an hour or two. Also, there was a perception that wrong persons go on those trips and that the trips are not exploit to full extent. The cause for the latter may depend on lack of knowledge about methods that can be used or that methods are too complex. Some respondents mentioned that methods have been implemented but no longer are used, some of them due to being too time-consuming and complex.

Often it is only the marketing department that have the ability to do customer visit trips, the result is that the information received by the R&D department is often heavily filtered and the quality of the information is quite low. R&D expressed a desire to be provided with more information about the underlying customer need, and not only a demand on technical solutions. It is very similar to the information acquired from surveys; often formulated around specific technical solutions instead of the underlying needs and the customer's language is not preserved. Furthermore, the information gathered from customer visits are poorly documented and disseminated in the organization which makes it difficult for other employees to use the information in a different project. When documented it is then very individual dependent whether they use the information or not, in most cases not. This results in that knowledge already gathered is lost and not used in later projects. Some respondents claimed that this is because they lack a structured way of working, every customer interaction is different and it is not clear what the goal with each interaction is. In addition, many respondents claimed that they do not have a sufficient understanding of all the stakeholders in the customer value chain.

Regarding communication, there was a general consensus that all existing channels of information were not used, e.g. warranty issues. In addition, the lack of communication between the R&D and marketing department was also shown by a discrepancy between respective objectives. The marketing department tend to be more short-sighted which limits R&D and the development of radically new products.

There is another factor preventing radical new products. Some of the respondents admitted that the current product development process does not allow a long research phase in order to identify the hidden needs of the customer. The result is a process that is not suitable for highly innovative projects where the final result is not known on beforehand.

4.4 Reference case

In order to get a greater understanding of the problem with identifying hidden needs and what methods are used in other, similar companies a reference case was analysed. In the following section the reference company's way of working will be presented.

The reason for the reference company to introduce a new way of working with customer needs derives from knowledge and experiences of common pitfalls among industrial companies.

- When being market leaders there is a tendency to act as there are no competitors.
- Larger companies tend to focus internally and rely on traditions when the focus always should be on the customer.
- There is an unwanted gap between Marketing and R&D, their mindset should be homogenous.

- Usually it is more natural to focus on ‘how’ instead of ‘what’ (looking for technical solutions instead of the customer needs).
- The process is usually sequential resulting in a loss of information in each step where a deliverable is passed forward.

To overcome these pitfalls the reference company focuses on mindset, methods and culture based on two models: the Kano model and the Value model. Note that a process is not proposed as a solution. According to the company, innovation requires freedom, not a process which is too strict and may therefore worsen the situation. Even so, an innovation process is usually the result when companies want to enhance their innovation capability. Instead, the reference company has the approach of continuously enlarging their knowledge base of customers’ needs, both articulated and hidden. This approach constitutes of three parts: a VOC, observations and to be the customer themselves; the first one capturing articulated needs and the second two focusing on hidden needs.

Even though the methods for capturing and processing articulated and hidden needs differ, the goal is the same – to create customer value. Their definition of customer value is customer satisfaction in relation to the resources required by the customer. Customer satisfaction is based on how the product eliminates pains (problems), generates gains (results), and energizes brains (feelings), in other words fulfil the customer’s needs. However, the customer satisfaction is affected by the amount of time, money and effort the customer must invest.

This way of working with articulated and hidden needs requires a lot of homework before getting into action. The reference company educates the marketing, R&D and sales department in interview techniques and observations, but most of all the mindset of customer value.

4.4.1 Articulated needs

The first step in their method for articulated needs, so called the VOC, is to determine an interesting area to investigate. By mapping the value chain for a product considering the flow of information, money and the product, interesting stakeholders are identified thus an area of interest.

To capture the needs from that specific area contextual interviews are conducted in pairs of representatives from both marketing and R&D. These needs are then written down in the customers own language on post-it notes, which are clustered into a categories representing those needs, by the reference company.

The next step is to perform a SWOT analysis, an investigation of importance in relation to satisfaction. To prioritize the needs by importance customers are provided with a deck of cards representing each category. The prioritization is performed in two steps: (1) if the need on the card is irrelevant, decisive or desirable; (2) which card is most important in respective group. The same cards are also used in a benchmarking activity where the customer compares the reference company against a competitor by ranking how satisfying their products are.

Each deck is then inserted in a database structured so that the needs and their priority are visualized for different segments. Thereby, this database not only presents what to focus on in each segment but works as a tool to identify new types of segments by the prioritization.

By performing this method continuously and focusing on different areas this database will expand into a comprehensive knowledge base of customers’ needs.

4.4.2 Hidden needs

When focusing on hidden needs the methods used by the reference company consist of observations and ‘to be the customer’. They also combine the observations with interviews using open-ended questions. During a visit by marketing and R&D employees document the observation by film and photos. These are then analysed regarding different aspects based on the aim of the study; searching for any insight that can generate new customer needs. Thus, the analysis is performed relative unstructured.

To clearly define the scope of the research is vital in order to perform the study with good results. The scope determines what to observe and helps the interviewer to guide the respondent in the right direction.

In order to be the customer themselves the reference company is about to construct a working environment in their own building, similar to a manufacturing facility they studied. Also, some employees have a possibility to actually work for a month in a customer’s facility.

The knowledge from these visits is disseminated among employees by a meeting room covered in pictures and descriptions of the studied companies. By using a common meeting room they can have spontaneous meetings about the visits. In addition, when using the room employees are unconsciously affected by the pictures.

5 ANALYSIS AND RECOMMENDATIONS

In this chapter the results from the previous two chapters will be analysed and recommendations for the case company outlined.

5.1 Analysis

There are several researchers who talk about barriers regarding the implementation of methods and processes for customer involvement and hidden customer need assessments. This was something that was confirmed doing the empirical research at the case company; many barriers regarding how they worked with assessing their customers' needs were identified. From the literature and the empirical findings it was determined that there are two types of barriers, those who can be solved by implementing a framework or process with methods that targets those barriers. The second type of barriers, hereafter referred to as constrains, are barriers that cannot be solved by such a framework but must instead be taken into consideration when choosing methods and designing the process. In Table 1 the different barriers and constrains that was found in empirical study are presented. The notation indicates that this barrier was also identified in the literature study. These barriers are clusters of several problems identified. A more complete set of barriers can be seen in Appendix E: Identified barriers.

Table 1. Barriers and constrains identified from the empirical study.

Barriers	**Constraints**
Information filtering[1]	Lack of resources[1]
Lack of communication between business areas	Takes time to learn new methods[1]
Focus on solutions rather than needs[1]	Little belief in new methods[1]
Customers not susceptible to need-discussions[1]	Customers have little time to partake in need discussions
Complicated to visit customers	
Wrong persons travelling	
Does not exploit existing knowledge	
Does not use existing channels of information	
Lack of structure[1]	
Shortsightedness[1]	
Unclear and complex value chains[1]	
Conservative market	
Information poorly documented and disseminated[1]	

[1] These barriers and constraints have been identified both in theory and empirical data.

The main focus was to overcome the barriers and the most obvious one was the lack of structure. By solving this it was believed that other, related barriers would be solved as a consequence. These related barriers are: information filtering, lack of documentation and communication of information, focus on solutions, and the preservation the customer's language. If a clear structure, with a process and methods is implemented it will come more naturally what to do, who should do it, and how to do it. How the information should be documented and disseminated in the organization was not a part of this master thesis since it is considered to be a task in itself. Another barrier that was identified and was found rather easy to resolve was that Xylem are not using their existing channels of information to full extent; for instance they are not involving all of their stakeholders in the value chain and they sometimes send the wrong people to a customer which may not always make the most of the visit. Furthermore, it was found that some stakeholders, for instance the service technicians, are not given the chance to articulate their opinion on new products until the project has gone too far making it difficult to change the design. That barrier is also resolved by having a clearly defined framework in place that helps employees work structurally in this matter. Xylem already have several channels of possible customer need information but they are not used to their full extent, by proposing methods that allows Xylem to utilize these channels much can be gained with little effort.

In terms of a conservative market, Xylem's perception stands alone. This barrier could not be found in any literature. Neither did the reference company experience problems related to that. It could be questioned whether there actually is a conservative market or if Xylem just has a conservative approach.

Xylem's situation has many similarities with the situation of the reference company presented in chapter 4.2. They are both leaders in their respective businesses and therefore face many of the same pitfalls. As a market leader Xylem has recognized that they should not be comfortable in their role and must always try to bring new, exciting products to the market. From the interviews it was clear that Xylem rely heavily on internal ideas and that they, and their customers, are bound by tradition. This may result in only incremental improvements of their products as customers can be reluctant to new, radical technical solutions that they do not fully understand. The reference company addresses this problem by targeting early adopters in the research phase in order to get valuable input on radically new concepts. Just as the reference company previously struggled with, the marketing and R&D department at Xylem does not always share the same goal regarding customer needs and a more common mindset is needed.

Xylem's goal is to have an iterative process when it comes to customer need identification but compared to what is recommended in the literature, they have too long cycles. In the Idea management process they start evaluating developed concepts before going back to the customer again. According to researchers, e.g. Patnaik and Becker (1999), the process regarding identification of customer needs should have shorter cycles. It is important to reframe the scope of the voice of the customer process in order to increase the knowledge of the customer.

When it comes to the constraints they were not something that the authors believed that could be changed as a result of this project so they worked as limiting factors for what methods and approaches that was considered. For instance, if a method that required a lot of expenditures or took a lot of time from the customer it was considered to be a less attractive method.

Process

The main barrier at Xylem was the lack of a systematic process. A systematic process should perhaps rather be termed as a requirement as the frame of references clearly express that a successful VOC for identifying hidden customer needs requires a systematic process. Even though the reference company claims working more freely, their way of working resembles the process designs for VOC mentioned in this report. In order to develop an effective process for identifying hidden needs these existing processes have been analysed regarding their similarities. Then, to optimize it for Xylem's situation and the barriers they encounter the focus of the analysis has been on the, by the researchers, emphasized essentialities.

Table 2. Overview of distinctive stages identified in presented process in chapter 3.3.1.

Process/ Stages	**Ulrich & Eppinger**	**Outcome-driven innovation**	**Needfinding**	**Hidden needs analysis**
Prepare	Mission statement Involved stakeholders		Define scope Choose customers Study established data	Set goal
Collect	Gather raw data from customers	Capture customer inputs	Watch and record Ask and record	Collect data
Interpret	Interpret data in terms of needs		Interpret and create need statements	Analyse
Organize	Organize the needs into a hierarchy	Structure the needs	Organize need statements	
Prioritize	Establish relative importance	Identify opportunities	Prioritize	Prioritize

The main problems related to lack of structure concerned continuity of the VOC and clarity. There is only one way of performing a VOC process regarding the first point and that is proactively. Xylem should be the one to take the first step, and be curious about customers. The reactive process currently managed is a result of a solution oriented approach instead of need oriented. The processes presented in the frame of references all promote the latter. A lack of clarity results in discontinuous and individual-depended execution of methods. Therefore, distinctive stages and tasks are essential for the process.

By studying the four frameworks in chapter 3.3.1, five distinctive stages were detected. One exception to this insight was the Outcome-driven innovation process that differs in its approach as it focuses mainly on the goal, what to search for, but do not consider the process to reach it. To illustrate this insight Table 2 presents the four processes and the workflow for each.

A majority of the authors initiate their process by a preparation stage where the scope and goal are defined, also termed a mission statement. Other proposed tasks during this stage are: study of established data, stakeholder analysis, choice of target segment, and an execution plan. Thus, as any planning stage, all tasks that is found necessary for a comprehensive plan should be considered. Xylem's TG0 initiates their VOC but no planning stage is emphasized. Hence, the lack of structure takes place already in the beginning. The first task suggested, study of established data, has to be improved at Xylem as there is a low level of exploiting existing knowledge. By implementing it in the process as a task with a clear purpose this barrier will be addressed. Another barrier related to this stage is the lack of usage of existing

channels of information. In the planning stage, all potential sources of information should be addressed.

In the succeeding stage, termed collect, the planned market research is conducted. This is where customers are contacted and the raw data captured using proper methods for identifying hidden needs. This raw data, whether it is notes, transcripts or video recordings, are then analysed in order to identify the needs. This stage is termed interpret as an interpretation of customers' language and behaviour into customer need statements is just what it is.

The last two stages are to organize and prioritize the customer need statements. As, the interpretation may result in hundreds of needs, duplications need to be sorted out and resembling statements clustered into suitable categorise in order to make it manageable. Outcome-driven innovation do not use 'organize' but to 'structure the needs'. However, the purpose is the same: to facilitate management of the customer needs. To prioritize the needs is vital. Prioritizing is a reassurance that there is a wider market demand of a certain need statement, and opportunities are identified. Needfinding adds a task to this stage, to reframe the research. In case the result shows that the focus of the research question or the scope is inaccurate it has to be reframed. Also, it is important narrowing the scope of the VOC process in order to get deeper knowledge of the customer. Therefore, this process should be perceived as iterative, reframing or narrowing the scope each iteration based on previously results from the analysis. This is the approach also used in Ethnographic research, and by the reference company; initiate with a wide but clear inquiry that ends up in a defined hypothesis of the real underlying customer needs due to iterations. Xylem's goal is to have an iterative process when it comes to customer need identification but compared to what is recommended in the literature, they have too long cycles. In the Idea management process they go all the way to concept development before going back to the customer again. An iterative process may be perceived negatively from the resource perspective, however, comprehensive knowledge earlier in the process increases the possibility to develop a successful new product to lower costs.

The VOC in the Idea management process only consists of three stages, however, the purpose of these stages resemble the ones proposed in literature. 'Get to know the customer' address the collection stage, 'Define a problem' correlates with the interpret stage, and 'Define a market demand' are exactly what the prioritization aims to do. The process needs some modifications but the authors of this thesis believed that preserving the denominations of the process and the overall appearance facilitates the implementation. If too many changes are made, the process may seem unfamiliar and complex which affect the performance negatively.

The next step in the analysis considers the process in relation to other processes. A requirement by Xylem was not to add a separate process as they are trying to minimize the amount of current processes, merging the business and product development process. This requirement is in accordance with research, for instance Ulrich and Eppinger (2012) claim that VOC must be integrated in the product development process. The reference company has another approach where the VOC for hidden customer needs is performed separately. In Xylem's case though, a more project specific VOC process, integrated in the main process, may have a positive effect on the resource restrictions.

The Needfinding approach, emphasize that this process can go on in parallel with the product development process. This should not be interpreted as there are two separate processes. As the VOC is a time-consuming and an iterative process, it is appropriate to simultaneously perform idea generation and concept development. Thus, Xylem's ongoing changes regarding

the business and product development processes are in the right direction. However, it is important not to manage the process as sequential.

The last step that the research emphasizes is whom should be involved in this process, and there is a wide consensus that cross-functionality is the correct solution. This collaboration concerns the market and R&D department. Although the market department should be responsible for the process both departments should be involved in executing it. Xylem encounters many barriers related to this topic. Firstly, there is a perception that wrong persons are sent for customer visits, and as mentioned cross-functional teams is the solution. Secondly, there is a lack of communication, an information filter, between these two departments regarding customer knowledge. The market department is responsible for the process but they are also the ones performing it. Consequently, the R&D department lack information of the actual customer need which affects the development of a product negatively. Finally, the marketing department tends to be short-sighted which do not promote radical product development, when R&D has the right approach of thinking long-term. An enhanced collaboration would align their different perspectives and enhance the chance of performing a successful VOC, and develop more radically new products.

The short-sightedness of the marketing department is not the only factor for incremental product development though. The current process and the conservative attitude are two additional factors. The process promotes incremental product development by too long iterations, as mentioned. Also, the initial scope is too narrow which delimits creative thinking. The conservative attitude is more difficult to address. However, by implementing this process the awareness of the importance of customer needs may increase and with time finally change the attitude.

An overview of which barriers that are addressed by a process designed in accordance to this analysis is illustrated in Table 3.

Methods

The methods outlined in chapter 3 were analysed in order to determine which methods that would suit this particular case. Many researchers advocate the combination of different methods to achieve the best result. This was something that was discovered by the empirical research as well; Xylem has many different types of customers and therefore they will face many different situations that require different methods.

When preparing a VOC process it is important to know which customers to target. It turned out that Xylem was not always aware of all their external stakeholders in different projects. When they actually talked to a customer it was almost always a loyal customer that was already buying Xylem products. That is why it is suggested that they use methods both for identifying key customers and for mapping how they impact each other and the product requirements. Therefore, it is suggested that a CVCA is conducted to determine what stakeholders there are and how they interact with Xylem. Trend matrix is not a suitable method for this as it only considers customers from the perspective of a certain trend. In addition, in order to execute a trend matrix a trend needs to be identified in beforehand.

Second, when looking for customers and/or users to talk to a lead user networking methodology is suggested where the aim is to look for the lead users or early adopters in the business and use them when performing the other methods. This approach is considered a good way for Xylem to address the problem of a conservative market that might be slightly reluctant to radically new products. By using these two methods it is believed that Xylem will be well prepared and get a good view of how the VOC process should be outlined.

For identifying hidden needs several methods were presented but not all of them were deemed fit for Xylem's conditions or did not solve the barriers previously identified. The choice was based on what the theory said about the method in terms of common usage, effectiveness, and their pros and cons, as well as what findings the empirical study revealed. Common usage is a way to determine a method's level of complexity as well as how effective it is. A method used by several businesses and recommended by several authors is assumed to be simple and effective. An overview of the main methods mentioned in chapter 3 and their pros and cons is presented in Appendix F: Overview of methods.

The result was a set of four methods where the idea was for them to complement each other to cover all of the different situations that will arise. Three of the methods are recommended as a primary way to access hidden customer needs and the fourth as a complement in certain situations. The three methods are: contextual interviews, systematic observations and empathy building. Contextual interviews and systematic observations are a good complement to each other and are also convenient to use together; interviews may be conducted at same time as observations are made. The benefits with these methods are well proven in practice and the reference company have been using them with great results. These three methods are only a part of the complete ethnographic research approach but it is believed that the mindset from that approach will be imbued in the methods and therefore still deliver that deeper customer understanding that is sought after when working with ethnographic research. The reason for not using the complete ethnographic approach was to make it easier to use the individual methods and avoiding unnecessary complexity. Although empathy building is a very effective method to gain a deeper understanding of the customer's situation it is highly time-consuming. However, some employees at Xylem are already familiar with this method since they have done similar activities when they have worked with customers for a longer period of time and used the products on a daily basis. Therefore it is suitable to include that method; not only for its effectiveness but also that the familiarity might result in a smoother implementation. Empathic lead user has been mentioned by authors and resembles empathy building. However, the method is more complex as it addresses lead users and their situations.

As a complement to these three methods, one other method is suggested: RGA. This method can be used on a more situational basis where the market research team sees fit since it is not always applicable. RGA's biggest disadvantages are that the method requires knowledge about at least five similar products in order to do comparisons and that the data is difficult to analyse. In this industry, a pump can run for a decade. However, the products do not have to, and should not, be too similar and therefore this method is perceived as suitable. It is believed that RGA can still be performed with positive results even if some of the more complex parts of the analysis are left out. In this case, it is not suggested that Xylem use software during the analysis but instead focus on the more qualitative parts, like analysing the transcripts and the grid (manually). RGA is a good way to get an understanding of how the customer sees and thinks about different products. It necessarily does not have to be one type of product that is compared. In many cases the customer views the pump as a utility tool that is not part of their primary business; RGA can then be used to compare different utility tools that the customer uses in order to determine what role they play in that customer's business and what is wished for in such a product.

ZMET was also recommended by several researchers. However, this method fails in two categories. Firstly, it demands a lot of engagement by customers which were identified as a constraint. Secondly, using metaphors is complex especially as Xylem, and probably customers, is unfamiliar with the technique. Finally, the method requires extensive training.

When the methods presented above have been executed the research team will have a lot of data that needs to be analysed. Each method has their own way of analysing the data and that is brought up in chapter 3. When the data have been analysed and need statements have been elicited it will be necessary to categorize and prioritize the data since the amount of need statements can be very high. It is suggested that an affinity diagram is used where the needs statements are clustered and arranged into a hierarchy. However, another method can work as well. To cluster need statement is not the most essential part or especially difficult no matter what method used.

When the need statements have been clustered into a more manageable amount they should be prioritized by the customers in order to get an accurate picture as possible. An easy way to do this is by sending out surveys with clear instructions to the customers. As mentioned, simplicity is highly prioritized; therefore conjoint analysis is not an option. Conjoint analysis requires software which is assumed to be unnecessary for this kind of activity. Depending on the situation further analysis may be utilized in order to maximize the outcome of the voice of the customer process (see examples in chapter 3.2.4).

The result when using the methods for identifying needs is a set of need statements. As recommended in the literature the aim is to preserve the customer's language as much as possible. Since this is a task included in the methods the barrier of filtering is addressed. Providing R&D with correctly formulated need statements will generate a better customer understanding. In addition, using these methods the focus of solutions will be diverted to needs, and eventually a need oriented mindset will become natural. An overview of all the proposed methods and which barriers they resolve can be seen in Table 3.

In terms of the constraint regarding simplicity, the set of methods recommended by this analysis are not completely unfamiliar for Xylem which will have a positive effect on the implementation. Also, as mentioned earlier, the proposed methods are recommended by several other researchers. Being familiar also have a positive effect on Xylem's conservative approach regarding the use of new methods. A difficult constraint is the resources. For the recommended methods there is no demand of any software or expensive items. They have to be conducted in the customer environment though, but that is fundamental for identifying hidden needs, and therefore cannot be avoided.

Table 3. Overview of barriers addressed by implementing a process and methods, a checkmark indicates that the barrier is addressed by either the process or methods.

Barriers/Methods	CVCA	Lead users	Empathy building	Contextual interviews	Systematic observations	RGA	Process[1]
Information filtering[2]			✓	✓	✓	✓	
Lack of communication between business areas[2]							✓
Focus on solutions rather than needs[2]			✓	✓	✓	✓	
Complicated to visit customers	✓	✓	✓	✓	✓	✓	
Wrong persons travelling							✓
Does not exploit existing knowledge							✓
Does not use existing channels of information	✓						✓
Lack of structure[2]							✓
Short-sightedness[2]							✓
Unclear and complex value chains[2]	✓						
Conservative market		✓					✓
Customers not susceptible to need-discussions[2]			✓	✓	✓	✓	

[1] 'Process' is used as a collective term to describe everything that is related to structure, way of working and increased communication between involved parties, see chapter 5.2.1.

[2] These barriers have been identified both in theory and empirical data.

5.2 Recommendations

The recommendations presented in this chapter are based on the analysis presented in the previous chapter. The recommendations are concise and specific in order to demonstrate a clear structure of the workflow.

The VOC process for identifying hidden customer needs is a process for radical new product development, integrated in the Idea management phase. This process is not suitable for all projects; the process should only be initiated if the knowledge about a market is very low or if it needs to be re-evaluated, for instance when launching a new generation of products. The process of collecting hidden customer needs should serve as a complement to a traditional market research strategy, not to replace it. The process' steps are distributed in the three first stages of the idea management phase, illustrated in Figure 10. Following is an outline of the different steps:

Step 1: *Prepare*

The purpose of this step is to establish a comprehensive plan of how the work should be outlined; which customers that are affected, which that should be chosen to participate, what is already known, and what methods to use in the next step. The methods that should be used in this step are CVCA in order to map all the stake holders and Lead user networking technique to find the early adopters among customers. The number of customers to be involved depends on the study but theory suggests that somewhere between 9 and 20 in-depth customer visits are required in order to get a good understanding of the customer's situation. These numbers work only as a guideline, when new needs are no longer identified the process can move on.

Step 2: *Collect*

In this step the methods chosen previously are executed and depending on what methods chosen this step can take somewhere between a few weeks to a couple of months. The methods that can be used are: systematic observations, contextual interviews, RGA, and empathy building. Best result is achieved when all the methods are combined. It is important that employees from both market and R&D departments are equally involved; working in pairs allows one to take the lead in the interview and the other to take notes and add supplementary questions. When asking questions there are some general rules that should be obliged. When explaining the purpose it is important to state what is going to happen and why; the goal of the visit is not to sell but to understand how they are using the product. To identify the hidden needs an understanding of why customers do certain things in a certain way is required. To achieve that the interviewers can ask 'why' several times to make sure that the true, underlying reason is discovered.

Step 3: *Interpret*

The results from the previous step will be a set of transcribed interviews, video and audio recordings, and personal notes. From this an analysis team should identify customer needs by going through all of the material. The analysis team should consist of four to six people with different backgrounds and the result of this step might be somewhere between 50 and 400 need statements captured in one sentence.

Step 4: *Categorize*

When the need statements have been written down they should be categorized in order to reduce the amount and make the data more manageable. Theory has shown that this process may benefit from customer input but as it tends to require a lot of time it is recommended that the analysis team does it. There are not many ways this can be done; one way is to use an affinity diagram where the needs are arranged in clusters and a collective need statement will serve as a head line for that group of needs. The result from this clustering can differ but somewhere around 20 clusters is manageable.

Step 5: *Prioritize*

It is only the head line need statement that should be used in the prioritization process. The need statements are sent out to a large amount of customers using a survey where they will rate how important a certain need is and how well it is fulfilled today, in order to determine if there is a market opportunity. When deciding what type of scale to use it is recommended to use a method where the customer will have to do trade-offs, for instance a constant sum method. This mainly applies when rating the importance and not fulfilment.

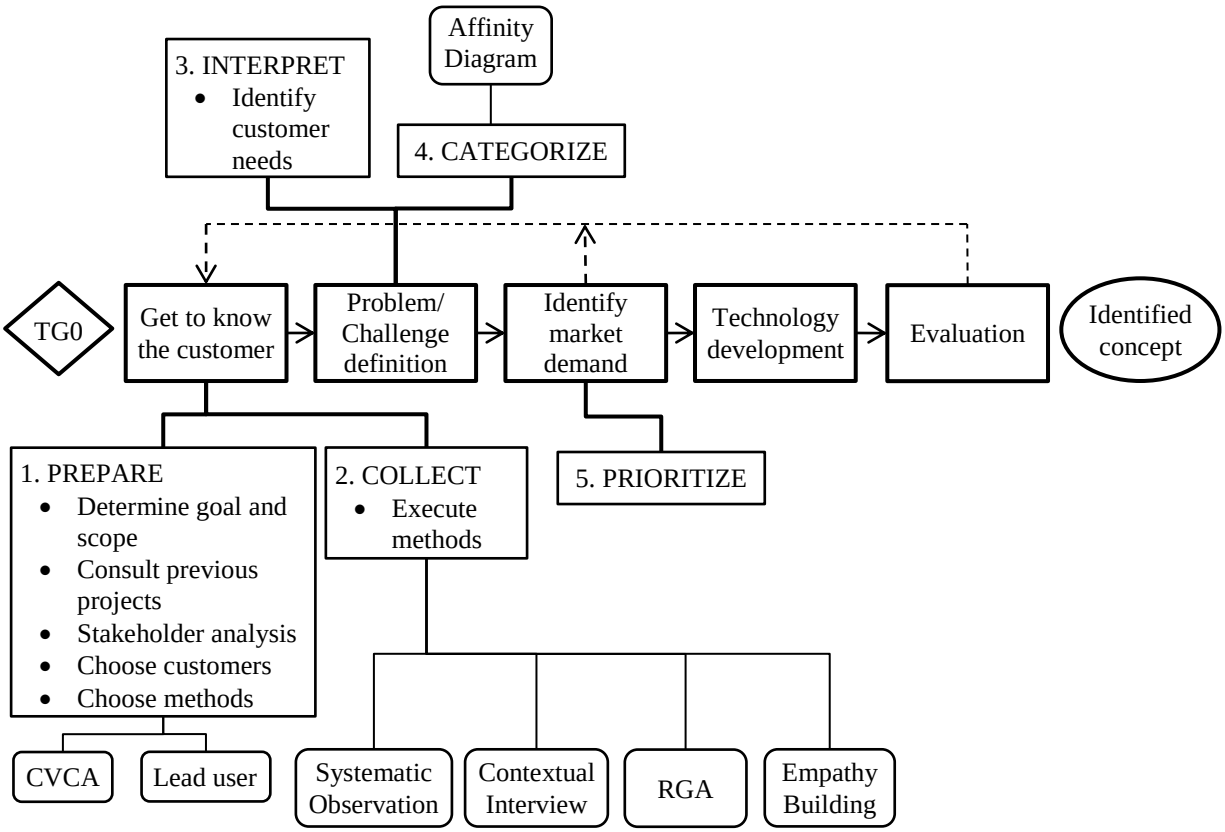

Figure 10. Overview of the process and methods recommended.

It should be noted that some changes have been made to the Idea management phase; it is suggested that a second loop is introduced between the 'Identify market demand' and 'Get to know the customer'. This is done in order to narrow the scope in the VOC process, it should not be necessary to start technology development before a sufficient customer understanding is achieved. Although the market department is responsible for the process, both the market and R&D departments should be involved in the execution. The result of the above outlined process is a set of prioritized customer need statements which is used in the development of

new products. No recommendations regarding the further analysis of the needs are presented since it is highly dependent on the situation and what the goal of the VOC is.

5.3 Field tests

In order to verify that the methods chosen was suitable to use in Xylem's situation tests were conducted at two different service workshops. At each site two employees from Xylem, one from R&D and one from marketing, were performing three different methods: observations, contextual interviews and RGA. The aim of the test was to get feedback, primarily from the Xylem employees, what they thought about the methods in terms of performance and suitability. The focus of the field tests was the identification part of the process, to see if the methods resulted in elicited hidden customer needs. Another aspect in the selection process was that it should fit in well with current projects and that employees had the possibility to participate.

The focus of the tests was serviceability of Xylem's products and the subjects of investigation were a wastewater pump, model 3153 and a drainage pump, model 2610. The contextual interviews and observations were conducted simultaneously when the product was disassembled and re-assembled and everything was recorded on film. An interview template was prepared for the interviewers on beforehand where they were asked to be observant of a number of things. For instance operations that required a lot of time, signs of frustration and use of specific tools. The template was based on theory from several authors e.g. Koners et al., (2010) and Ulrich and Eppinger (2012). The interviewers were also instructed to ask 'why' several times to get a deeper understanding of why certain things were done. As a part of the systematic observations a coding scheme, adopted from Goffin and Mitchell (2010), was used in order to detect hidden needs. After the observations a RGA interview was conducted which was audio recorded for later analysis.

After the visit at the service workshop the video and audio recordings were analysed in order to identify any new customer needs. The analysis was performed by the two interviewers together with one more person from R&D. First they looked at the video recording which was divided into two sections, disassembly and assembly, with a break for discussion in between. During the sessions they were asked to take notes individually of problems and potential improvements regarding the serviceability of the product which was the subject for the discussion.

As a result of the analysis it can be concluded that all of the barriers that the methods aimed to target, was in fact resolved. The interviewers answered that they felt more need-oriented rather than focusing on solutions and thanks to the video and audio recordings the customer's language was kept intact. Having methods that can be used in a structured way allows Xylem to more efficiently use their existing channels of information. Due to the nature of the methods it forces the customer to reason in terms of needs rather than specific solutions. When it comes to the constraints the participants expressed that they felt that the methods were somewhat complicated and they require practice before they could be utilized to their full extent. The tests proved to be highly time consuming, just as theory suggested but the participants showed no reluctance towards using new methods. Furthermore, the field tests revealed some unexpressed needs in terms of quality assurance and serviceability. It was realized that improvements can be made in order to improve the handling of the product during service and the frequency of which recurring problems are reported. Due to observed frustration among the service technicians more improvements could be realized in terms of time reduction for certain operations when disassembling the product.

The major part of the negative critique that they participants expressed towards the methods was the time required and the difficulty of asking the right questions. However, they believed that the combination of techniques was adequate and that they got a good customer understanding. Since the result of the field tests was overall positive no changes to the original proposal are therefore suggested.

6 DISSUSSION AND CONCLUSIONS

A discussion of the results from the literature review and the empirical study are presented in this chapter. The conclusions are based from the analysis with the intention to answer the questions that is presented in chapter 1.

6.1 Discussion

The methods used in this master thesis have been interviews, a literature review, a workshop, and verification of the methods proposed in form of field tests. The literature review was extensive and with the use of many different databases and 'snowballing' it was believed that it was done in an adequate manner. The selection and amount of respondents for the interviews and workshop was determined to be satisfactory; the different areas of the company were represented by several key roles from those areas. On the other hand the verification of the methods had some limits. According to the authors and practitioners of the methods proposed it is not enough to do just one field study, the process should be conducted in an iterative manner and many different customers need to be visited in order to be able to draw conclusions. A correct analysis cannot be made out the limited data provided by the field tests but it gave the involved employees at Xylem an understanding of how the methods worked and if they felt that it would suit them or not. The reason to not test all of the methods was the limited timeframe of the project, with more time more methods could have been evaluated. Empathy building for instance, is highly time consuming and was not a realistic alternative. Further weaknesses in the execution of the field tests can be identified in the number of persons analysing the results; according to theory at least four analysts should partake and preferably with different backgrounds. In this case only three persons partook where two of them had very similar background. A more thorough training in the different methods before doing the field tests would have been preferred but due to lack of time it was not possible. What could be seen from the field tests was that the involved participants felt that they got a better understanding of the customer's situation which is a prerequisite for identifying hidden needs. They also expressed a positive attitude towards the combination of the techniques, that they complemented each other well.

A clear consistency could be seen between the barriers found in literature and those identified in the empirical research; many of the barriers and constraints that the authors identified from the empirical data had also been identified by other researchers. This reveals that this is a common problem, particularly in business-to-business companies. However, as pointed out in chapter 4.1.3, it is hard for Xylem (and other companies facing the same problem) to come around some of these barriers and constraints. They require much devotion from top management since the constraints requires a lot of resources in terms of time and money, together with an expressed wish from management that this is the way to work. At a first glance there seemed to be many barriers that needed to be overcome but in fact many of them are closely connected and if one is solved the others will disappear as a consequence.

This master thesis had an aim to tailor a process with methods for capturing hidden customer needs. The approach has been to first find suitable methods and ways of working in literature together with information about common barriers and problems regarding implementation and then compare those findings with the findings of the empirical study. Much focus has been on selecting the most appropriate methods for Xylem's situation but it can be discussed whether

the type of method matter or not. According to Ulwick, companies should not spend time on deciding what methods to use but focusing on collecting the right kind of information instead: "… the method used for gathering customer requirements is not as important as knowing what type of information you want from customers […] and working to obtain them" (Ulwick, 2005, p. 33). However, there are several researchers arguing that novel market research methods are needed and are presenting specific methods for hidden need elicitation (Belliveau, et al., 2004; Goffin & Mitchell, 2010; Koners, et al., 2010; Zaltman & Coulter, 1995), as well as studies of their appropriateness (van Kleef, et al., 2005). The authors of this master thesis disagree with Ulwick in the way that they believe that some methods are better in some situations than others and that, they in fact produce different results. However, a clear defined aim of the research and the value of knowing what to look for should not be discarded or trivialized. According to the reference case company a process is not a solution to this kind of problem; instead a rather more open approach is suggested to get a better customer understanding. The authors believed that it is in fact necessary to have a structured way of working that is common for all employees in order to make sure that a certain standard is kept regarding the collection of customer need data. It is important that the methods used, whether it is interviews, surveys or observations, have an established place in the product or business development process to ensure that it is carried out. Furthermore, the authors agreed with the reference company that the process itself is not a solution and the work must be carried out by individuals with the right mindset.

The use of these methods results in a lot of qualitative data that is very cumbersome to manage and how that should be done is not a trivial task. However, due to the scope of this master thesis that has been left out which can be a threshold for Xylem when they shall implement the proposed process.

An essential aspect of this research was to determine if the proposed methods actually produce hidden customer needs and not just articulated needs. Due to the limited field tests it can be discussed whether or not these methods actually provide a higher amount of elicited hidden needs. However, it is certain that traditional market research methods do not provide the development team with hidden customer needs. Although the field tests had their limits it could be concluded that needs that were not articulated by the interviewees were in fact elicited, in this case by the interviewers and analysts. Since they were not evaluated with, for instance, the Kano model it could not be determined if they were true hidden needs or not. Furthermore, all of these methods have been collected from literature where their usefulness has been proven in several cases which made the authors confident of their effectiveness.

6.2 Conclusions

It is clear that any company that wish to implement a radically new way of collecting customer needs will have many barriers to overcome in the implementation process. Many of the barriers identified in this study will also be the same for a lot of other companies, especially industrial companies as previous studies reveal. However, it has been determined that many of them can be overcome by implementing a holistic framework with methods for capturing the hidden needs of the customers, as outlined in this paper. To be successful in this venture, companies must invest both time and resources, and as with all new process implementation it requires devotion from top management.

The framework proposed will be integrated in the business development process in order to reduce the number of processes. There are five steps in the framework which are all divided under the first three stages of the Idea management phase. The steps are: *prepare*, *collect*,

interpret, categorize, and *prioritize.* As a part of the framework methods are suggested for preparing the process, collecting hidden needs, and categorize them:

Prepare

- CVCA
- Lead users

Collect

- Systematic observations
- Contextual interviews
- Empathy building
- RGA

Categorize

- Affinity diagram

During the field tests presented in chapter 5.3 the authors have not been able to verify an increase in identified hidden needs but needs that were not articulated by the interviewees were elicited and the participants involved expressed that they had gained a deeper customer understanding, which is a prerequisite for identifying hidden customer needs. The framework and methods proposed in this master thesis are tailored for the needs and situation of Xylem but the authors believe that the results can be applied to any company which is in a similar situation.

7 FUTURE WORK

In this chapter, recommendations on future work both from an academic point of view as well as how Xylem should proceed are presented.

7.1 Academically

For future research it would be interesting to evaluate and compare more methods, especially in terms of field tests, in order to determine if a certain method is more effective. Moreover, it is interesting to determine if these types of methods actually generate hidden needs. In this research the field tests where quite limited and a more thorough evaluation process could reveal which methods that are the most effective for a given situation. Furthermore, the authors would find it interesting to look more deeply into how a knowledge management system could be applied when working with ethnographic methods that result in a lot of qualitative data; how the information would be documented and disseminated in an organisation.

7.2 Xylem

This master's thesis had a limited time frame and there were things that had to be omitted in order to finish in time. Therefore, Xylem must continue with this work in order to implement the changes proposed. There are practical issues that need to be resolved, like who is going to be responsible for the process and the methods and it is also recommended that Xylem seek help from outside the organisation in order to master the methods.

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Interviews & Workshop

Xylem

Respondent A: Application Manager

Respondent B: Technical Manager, Drainage Pumps

Respondent C: Senior Program Manager, Treatment

Respondent D: Sales/Market Development Manager

Respondent E: Program Manager

Respondent F: Manager Product Management

Respondent G: Product Manager, Flygt 2600

Respondent H: Manager, R&D & Product Ownership, Monitor & Control

Respondent I: Business Developer, Transport

Respondent J: Manager Hydraulic End Design, R&D

Respondent K: Marketing Director, Large Pumps

Respondent L: PMO Manager Product Development

Respondent M: Manager Technical Product Ownership

Respondent N: Manager, RPA Application

Respondent O: Marketing Manager Xylem Sweden

Respondent P: Managing Director Grindex

Respondent Q: Regional Director

Respondent R: Manager Mechanics & Materials

Respondent S: Project Manager, Product Development

Respondent T: Vice President and Director, Global Product Development

Respondent U: R&D Director

Respondent V: Product Development Designer

Respondent W: Marketing Manager Packaged Solutions

Respondent X: Technical Director M&C

Reference Company

Respondent A: R&D representative

Respondent B: R&D representative

APPENDIX A: WORKSHOP

This appendix presents the workshop, conducted with 12 participants from Xylem. The purpose of the workshop was to get a better perception of the current situation to be able to suggest a process and methods that consider those circumstances.

Exercise 1: What does structure mean?

In the interviews there was a general consensus that Xylem lack structure when working with VOC. Discuss in small groups, what do you mean with structure?

Exercise 2: Gains

Discuss in small groups, what benefits can you identify in the context of capturing hidden needs?

Exercise 3: Statements

Take a position on the following statements by placing yourself on a line where totally agree is to the right and disagree to the left.

- I/my team know all stakeholders in the value chain, and their needs.
- I the beginning of the product development process I/my team focus on customer needs rather than technical solutions.
- I/my team have a good understanding of which needs product requirements are based on.
- I/my team know which needs customers find most important.
- It is my/my team's responsibility to identify hidden needs.

Exercise 4: Barriers

Discuss in small groups, what barriers, internal or external, that exist for you to be able to get better at working with hidden customer needs? What problems do you encounter?

APPENDIX B: INTERVIEW TEMPLATE

This master thesis started with several interviews with employees at Xylem in order to determine how the current VOC looked like. Following, is the original interview template used for these interviews, divided in three sections: presentation, collecting, and managing.

Presentation of respondent

Collecting customer needs

- What are Xylem's drivers for radical new products?
- Who are your customers?
- Do you analyse your strengths and weaknesses from a customer perspective?
- Do you follow competitors' development and how their decisions affect Xylem and your customers?
- How is your department's contact with customers?
- How do you identify customers' current and future needs?
    - Methods?
    - How often?
    - Who is involved?
- Do you try to discover hidden needs?
- What customers do you often contact in a VOC?
- Are you satisfied with current way of collecting customer needs? Why/why not?

Managing/evaluating customer needs

- How are the customer information managed?
    - How does the complete VOC process look like?
    - Who is involved?
- Are there other external information channels?
- How is the information documented and disseminated?
- How is the information evaluated? Categorized/prioritized?
    - Methods?
    - Persons involved?
- Have there been any changes in the VOC?
- Are you satisfied with current way of managing customer needs? Why/why not?

- How many projects are incremental respective radical?
- How is a radical new product development project initiated?

- Can you illustrate the flow of information, regarding needs, between different customer segments and departments?
- Are you satisfied or do you want the exchange of information to be more or less between any actors?

APPENDIX C: TEST INSTRUCTIONS

This appendix presents the instructions provided to the Xylem employees conducting the methods for collecting and interpreting hidden customer needs. In order to suit this particular case, the interview guide and the coding scheme are modifications of the original ones by Koners, et al. (2010) and Goffin and Mitchell (2010). Interview techniques by Belliveau, et al. (2004) and Ulrich and Eppinger (2012) have been taken into consideration during the modification. The instructions for RGA are provided by Goffin (2002).

Instructions for participants – collecting needs

Interview guide for the contextual interview

Clarify the purpose: not to sell or to criticize their work but to increase the service-friendliness of products.

Ask the respondent to describe what he/she is doing and why, while performing the activity.

General questions that can be asked before/during/after:

- What is the purpose/aim of this particular service?
- What cause most problems?
- What is most time-consuming?

- Ask why x5

- What is most important when performing any service?
- What makes it easier for you to serve a product in general?
- What is the easiest part when serving the product?
- What is best/worst about the product?
- Describe your dream scenario, the ultimate product?

Follow up questions. Be aware of:

- Complex events that require special tools/several service technicians/much time/much force/induce frustration or confusion
  - Is this common?
  - Is it possible to do it in another way?
  - What makes this activity difficult?
- Objects/persons that complicate or simplify work
  - Is this common?
  - Is it possible to avoid?
- Nonspecific adjectives
  - What do you mean?
- Misuse
    - Why doing it like that?

Repertory grid analysis

Ask the respondent to write down five products. Present a triad and ask the respondent:

- How do two of these products differentiate from the third?

Write down the construct and its pole.

- On a range of 1 to 5, what do the three products get?
- What do the remaining products get?

Repeat for all combinations of products.

Instructions for participants – Interpreting needs

Anything that indicates a problem regarding serviceability should be identified and documented. Other insights except from service-friendliness should also be notified.

Coding scheme for interpreting the observation and interview

The coding scheme is a helping tool for what to look for.

	Data category	Events to look for	Observed?	Notes
1	Product usage	• What they say they do and really do differs • Typical scenarios with associated issues • Problematic events • Special made tools • Expressed satisfaction/ dissatisfaction with product • Wasted time • Doing things right/wrong • Misuse • Confusion • Dangerous situations (e.g. physical or data)		
2	Intangible aspects and unarticulated needs Behaviours associated with events	• Emotions • Frustration and wasted time • Fears and anxiety • Linguistic signals • Extralinguistic signals (e.g. body language, emphasis in speech) Spatial signals (e.g. the proximity of a user to others or objects)		
3	User customization	• User modifications of the product • User modifications of the (normal) process		

Repertory grid analysis

Use a marker to highlight any quotation or factors that provides an insight. Be aware of:

- How the constructs are described and graded.
- Why the products differs.
- What is being said about the products.

Study the grid:

- What constructs have widely spread scores?
- What constructs have low scores for every product?
- What constructs have high scores for every product?
- What products have particularly high/low scores?

The scores not only indicates how the respondent perceive the products; they provide information of constructs' importance by how widely spread the products are on the grading scale. A hidden need tend to be indicated by low scores for all products. A construct with high scores for every product is less important.

APPENDIX D: EVALUATION OF TEST

This appendix presents the questions for evaluating the methods used in the test. The questions are divided by the two occasions, when collecting and when interpreting.

Collecting

For Xylem personnel conducting the methods:

- How did it feel performing the methods?
- What was good/bad?
- What was complex/easy?
- Was any method better than the other?
- Did the methods provide with something new, any insights?
- Do you perceive these methods as suitable for Xylem to identify hidden needs?
- How was it to be one from R&D and one from the marketing department?
- How could this be done better?

For the customers:

- How was it to participate?
- Did you perceive the methods as helpful to convey your perspective?
- What was good/bad?
- Would you be willing to participate again?

Analysing

- Have the methods contributed with something new?
- Was any method better/worse? In what way?
- Was it easy to preserve the customer's language?
- How did this activity differ from an ordinary customer visit? Did it provide with more customer information?
- Did you get any insights, identified any customer needs? If so, what did you find?
- What was easy/difficult with the analysis?
- What was best/worst with the analysis?
- Have you been focusing on solutions or needs?

Additional comments:

APPENDIX E: IDENTIFIED BARRIERS

This appendix presents the barriers and constraints identified at Xylem. All barriers are not included as duplications have been sorted out. In addition, the barriers have been clustered into key categories.

Barriers

Complicated to visit customers

- Difficult to identify customers to visit
- Only visits loyal customers
- Difficult to visit competing companies customers
- Sales are afraid that R&D will sabotage current business
- Do not exploit every trip to full extent

Wrong persons travelling

Information filtering

- Needs not formulated in the customers language
- Sales provide low quality information

Little communication between different business areas

Focus on solutions rather than needs

- Requirements is not linked to a customer need
- Marketing often presents a solution rather than a need
- Difficult to realize the underlying need

Do not exploit existing knowledge

Does not use existing channels of information

- Lack of analysis of warranty issues

Lack of structure

- No continuously collection of customer needs
- Few customer visits, individually dependent

Short-sightedness

- Discrepancy between R&D and marketing/sales
- Product development process does not promote radical development

Unclear and complex value chains

- A lot of opinions from different stakeholders

Customers not susceptible to need discussions

Conservative market

- Rely heavily on internal ideas

Information poorly documented and disseminated

- No structure on how customer visits should be documented
- Travel reports are not actively shared

Constraints

Lack of resources

- Travel restrictions
- Takes a lot of time

Little belief in new methods

- Conservative business

Takes time to learn new methods

Customers have little time to partake

APPENDIX F: OVERVIEW OF METHODS

Presented in this appendix is an overview of the main VOC methods scrutinized in this master thesis, including purpose, a short description, and pros and cons. This overview was used in the choice of methods for the developed VOC process.

Method	Purpose	Approach	Advantages	Disadvantages	Source
Lead users	Prepare	Identification of lead users and early adopters of new technologies that could be used in the VOC-process	Lead users and early adopters face certain needs long before the bulk of the main customer segment and are often very open to new technologies and can be used to try out novel concepts which the mainstream customer might be reluctant to	Can be a difficult and time consuming process	(Goffin & Mitchell, 2010; Ulrich & Eppinger, 2012; von Hippel, 1986)
CVCA	Prepare	Map all stakeholders and how they interact in the company's value chain	Provides the development team with useful information about which stakeholders impact the requirements of the product	Can be tedious work if the value chain is very complex	(Donaldson, et al., 2006)
Trend matrix	Prepare	Analyses the company’s business chain in order to capture trends and development needs	Analyses how general trends in the society may impact the customer requirements further down the business chain	Only takes a part of the customer in consideration, only useful when a company have long, complicated business chains	(Kärkkäinen, et al., 2003)
Contextual Interviews	Collect/ Interpret	Semi-structured interviews in the customer's natural working environment	Gives insights into how the customer thinks and feels about a product or service; conducting interviews per video is a fast and, cost effective way to reach geographically dispersed respondents & body language	Large amounts of qualitative data that can be cumbersome to analyse	(Goffin & Mitchell, 2010; Koners, et al., 2010)

ZMET	Collect/ Interpret	The customer use pictures as metaphors to express opinions about the product	Captures the underlying feelings of a product or service and can therefore surface latent and emerging needs	Requires extensive training of the interviewer to be able to capture latent customer needs, very labour intense, the results are not generalizable to the public at large	(Koners, et al., 2010; Zaltman & Coulter, 1995)
Empathy building	Collect/ Interpret	The designer puts himself in the customers shoes and experience the product from his point of view	Results in a deep understanding of how a customer experience a product and can result in valuable insights	Highly time consuming, demands a lot of resources	(Goffin & Mitchell, 2010; Koners, et al., 2010)
RGA	Collect/ Interpret	The customer differentiate and rate products by specific constructs	Provides a deep understanding of how individual customers perceive and differentiate products; clear insights into what are the most important constructs in a particular market segment; can be combined effectively with other techniques	The interviewee needs knowledge about 5-6 similar products; time-consuming (typically 45-60 min per interview); may appear to be simple but is complex and requires experience	(Goffin & Mitchell, 2010; Koners, et al., 2010)
Systematic Observations	Collect/ Interpret	Observe how the customer uses the product or service	Results in information on how the customer uses the product and unarticulated needs; direct and does not rely on customer's reported perception	Time-consuming and requires extensive training. The data analysis is complex and difficult to learn; significant preparation is needed	(Goffin & Mitchell, 2010; Koners, et al., 2010)

Empathic lead users	Collect/ Interpret	Transform the designer or customer into a lead user by experiencing the product in new ways	Proven results of an increase in identified hidden customer needs	Redesigns an existing product; difficult to simulate an extraordinary customer experience and customers in this industry.	(Lin & Seepersad, 2007)
Conjoint analysis	Prioritize	Let the customer do trade-offs between different product characteristics in order to determine the importance	Can be done remotely through a software, provides a good picture of what requirements customers find most important	Relatively complex usually requires expert assistance to construct the questions; conjoint studies need to be linked to full hidden needs analysis; the complexity of the analysis grows with the number of attributes and levels; interviewees can become overwhelmed; does not capture group dynamics such as a decision making unit.	(Goffin & Mitchell, 2010; Koners, et al., 2010)
Interviews/ surveys	Prioritize	Let customers rate the importance of different product characteristics	Simple method that can be done remotely via phone, email or surveys	Very subjective and imprecise	(Chan, Kao, & Wu, 1999)