Maximizing Product Innovation through Adaptive Application of User-Centered Methods for Defining Customer Value

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Abstract

Establishing deep understanding of customers is a prerequisite to improve success rates of innovations under today's transient business conditions. This paper summarizes methods and tools to increase customer understanding in new product development. A case study of developing an office chair was conducted, utilizing four such methods (web based survey, interview, observation and workshops) to provide directions for later application. Results indicate that methods revealing emotionally-related customer information (workshops and observation) are resource-intensive and provide less amount of information directly applicable to the product development team. The opposite is the case for methods providing more functionally-related information (web based survey and interview). The overall conclusion is that the latter methods are more suitable for product improvements, while the former may provide valuable information for creating more differentiated products.

Keywords: Product innovation; customer-focus; user involvement; methods; strategies; case study; web based survey; interview; observation; participatory design.

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Introduction

"...it takes all the running you can do to keep in the same place. If you want to get somewhere else, you must run at least twice as fast as that!"

This quote, from Lewis Carroll's children's book "Through the Looking-Glass" from 1871, can actually relate to the situation in today's business world: The marketplace is in constant change, sped up by globalization and new technologies, causing tougher competition than ever. Consequently, the extensional definition of the above quote becomes: Companies in today's marketplace need to move extremely fast just in order to sustain. Furthermore, it is widely agreed upon that innovation capability is any company's countermeasure against this outermost important challenge.

Innovation is explained by Carlson and Wilmot (2006) as: "the successful creation and delivery of a new or improved product or service in the marketplace ... Innovation is the process that turns an idea into value for the customer and results in sustainable profit for the enterprise." Hence, innovative products are needed and wanted because they provide new value to customers. Moreover, customer value, which is exclusively perceived by the customer, usually involves trade-offs between what is received (e.g. quality and benefits) and what is given up to acquire this (e.g. money and time) (Spiteri and Dion, 2004; Woodruff, 1997; Butz Jr. and Goodstein, 1996).

Although there is general agreement among researchers on what innovation and customer value is and that the creation of such are crucial today (e.g. emphasized by Bigliardi, Colacino and Dormio (2011), Wiktorsson and Groth (2011) and Sun, Yau and Suen (2010)), research has shown high failure rates for new product introductions. The Product Development & Management Association (PDMA) has conducted several studies of best practices in new product development and innovation. For example, the 2003 study suggests that more than 40% of innovations fail in the marketplace (Barczak, Griffin and Kahn, 2009). Also Carlson and Wilmot (2006) and Gordon (2006) report extremely high failure rates of new products in the marketplace. Moreover, research shows consistency in the root cause of these high failure rates: Cormican and O'Sullivan (2004), Woodruff (1997) and Sanders (1992) all draw attention to the uncertainty around, and lack of understanding of customer needs and values, and the fact that new products that failed in the marketplace did not meet any or enough unmet customer needs.

Barczak, Griffin and Kahn, (2009), Tidd and Bessant (2009), Carlson and Wilmot (2006), Cooper (2005) and Goldenberg, Lehmann and Mazursky (1999) have researched how best-performing companies deal with the problem. It was discovered that paying close attention to customers and their needs and emphasizing customer value in new products was a key success factor. Furthermore, numerous researchers have indicated that customer interaction during certain stages of the new product development process, especially the early ones, has a positive impact on new product success. However, simply involving customers in the innovation process is not a guarantee for success (e.g. Flint, Blocker and Boutin Jr., 2010; Alam, 2006; Gordon, 2006; Carlson and Wilmot, 2006; Enkel, Kausch and Gassmann, 2005; Kärkkäinen, Piippo and Tuominen, 2001; Gruner and Homburg, 2000). Wiktorsson and Groth (2011) even prove that product failures in the marketplace can be due to improper customer involvement. Thus, a systematic process for customer interaction, including a sound understanding of methods and tools to apply, along with a comprehension of how to create customer value, is vital. Companies need to manage the art of innovation through implementing successful innovation strategies, comprising methods and tools to reduce the uncertainty around customer value.

A myriad of researchers have studied methods and tools to gather customer information for use in the innovation process. Unfortunately, the literature has largely been limited to following either one of two directions. The first group of literature (e.g. McDaniel and Gates, 2006; Churchill and Brown, 2004; Kuniavsky, 2003) is characterized by a strong theoretical and quantitative approach, rather than being empirical, qualitative research. A large amount of methods are often investigated in a descriptive manner where knowledge gaps regarding applicability and execution are present. The second type of literature (e.g. Ulwick, 2005; Sanders, 2000) is generally characterized by considering a limited amount of methods, often only one type. The literature provides thorough information on the few methods of similar kind, but it is lacking comparisons between different methods.

Knowing what methods and tools exist for innovation, including their specific characteristics, is important, but equally important is knowing which ones to apply when and how. Besides, this knowledge has to be coupled with practices to interpret and structure the customer information gained into useful input for product concepts that can be realized. An imperative feature associated with such an approach is successfully aligning customer values; overall business and specific product development strategy; and project team members (e.g. designers and engineers), all as a basis for the development of more valuable products.

Aiming at combining the two directions of research within methods and tools to gather customer information, the work described herein is completed to develop richer insight into the challenges of utilizing customer value as a basis for innovation. More specifically and in a comparative manner, it seeks to enhance the understanding of several methods and tools applied in the product innovation process to gather customer information and to improve customer understanding, through experience-based research. This implies turning more conceptual works described in the literature into reality, through testing out methods and tools (e.g. Kuniavsky's (2003) observing of users, McDaniel and Gates' (2006) surveys, Huthwaite's (2007) and Ulwick's (2005) interviewing techniques and Sanders' (1999) emotional toolkits) in practice with the aim of achieving successful product innovation, hence providing guidelines for later practical application outside this project. Furthermore, the overall goal is to establish a framework for better managing the innovation process, accordingly reducing uncertainty with regard to the introduction of new products in the marketplace and thereby providing a basis for pre-competitive advantages and financial sustainability.

In summary, the objectives of this paper are as follows:
•To identify existing methods used to increase customer understanding in the innovation process.

•To apply a small selection of the methods in a case study to increase the understanding of their applicability and to provide directions for the application of the methods in later product development projects. This will be done through answering the following research questions:

•What types of information are the various methods capable of gaining?

•How 'effective' are the various methods rated according to resource demand (e.g. resources needed to plan and implement the method as well as resources needed to analyze and interpret the customer information gained) relative to amount and depth of information gained? (What should be noted is that in the context of this research, effectiveness is considered – right or wrong – as cost-efficiency or productivity, and favors quantity over quality in a short term perspective.)

•How and when in the innovation process can the various methods best be utilized (e.g. strategies to implement customer value)?

Concepts from the literature

It is widely recognized that a variety of methods to gather customer information for application in product development exist. In this section, a selection of such methods will be described and discussed based on a literature review.

Traditionally, the methods of interview and observation have been used to gather customer information, i.e. creating new products based on what users say or based on what users do, respectively (e.g. McDaniel and Gates, 2006; Ulwick, 2005; Churchill and Brown, 2004; Kuniavsky, 2003). Interviews involve communication between researchers and users (e.g. single person conversation or multiple person conversation (e.g. focus group), in oral or in written form (e.g. surveys)) in order to learn about the users and their desired outcomes of the product, and their opinions, attitudes and behaviors. It is emphasized by Flores (1993) that when listening to what users say, one have to go beyond the stated wants and needs and also pay attention to body language, facial expressions, tone of voice, etc. What remains unspoken is often the most important part of the conversation.

Observations are often related to in-person interviews to reveal the users' actual behavior in given settings, perhaps in connection with a product. Several approaches for conducting observations are mentioned by Kuniavsky (2003). These include contextual inquiry, task analysis and usability tests.

A major problem with the traditional methods is that the main focus has a tendency to emphasize the past and the present. Huthwaite (2007) writes that one have to be very

careful when listening to what users say about their wants concerning a product, because the users do not realize their real wants. For example, a customer who expresses the want of car wax, does in reality just want a shiny car.

Another shortcoming with the traditional methods is their lack of focus on emotional aspects. As new technologies have emerged and modern societies developed, people have gained access to more products. What has become evident, especially since the 1990s, is that products should not only provide desirable features and functions (functions represent the product's 'answer' to some tasks that the users need to fulfill, while the features are the tools used to perform the functions), but also relate to people at a higher level through (emotional) experience (Kahlid and Helander, 2006; Stappers and Sanders, 2003; McDonagh, Bruseberg and Haslam, 2002; Sanders, 2000; Sanders, 1999). Markowitz's hierarchy (Carlson and Wilmot, 2006), developed from Maslow's hierarchy of needs, visualizes this (see Figure 1). At the bottom of Markowitz's pyramid, the 'hard' parameters of the product in terms of features and functions are found. Moving upwards, there is a shift to 'softer' parameters in the form of user experience, emotions, and deeper meaning at the top.
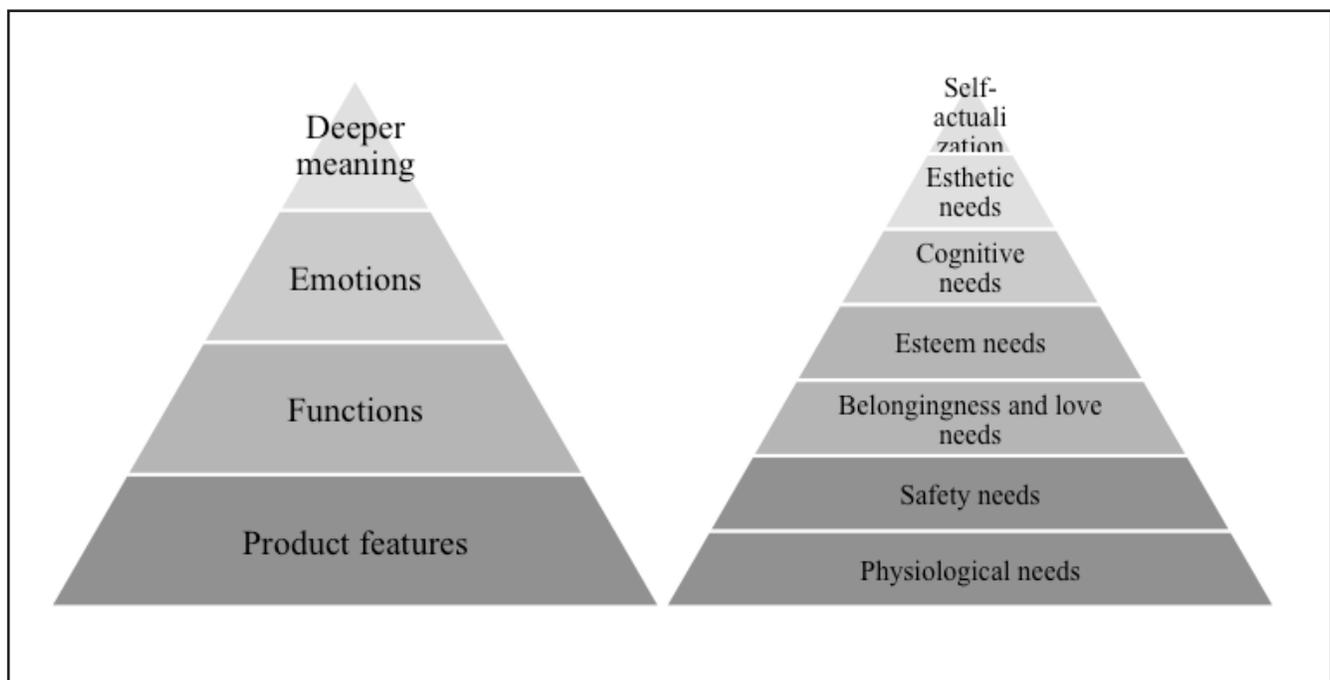

Figure 1. Left: Markowitz's hierarchy (Carlson and Wilmot, 2006); Right: Maslow's hierarchy of needs (Sanders, 1992).

With the emerging focus on experience, the traditional methods for user research are insufficient. Design for experience takes user research to another level through participatory design, where the users become part of the product development team (Sanders, 2002; Sanders, 1999). Through the artifacts the users make by applying tools and toolkits given to them by the researchers, the researchers aim at accessing the users' thoughts, feelings, dreams and experiences (past, present and potential), as a source for the development of products. Examples of tools used in participatory design are:

• Cultural probes (Gaver, Boucher and Pennington, 2004)
• Generative tools with emotional toolkits (Stappers and Sanders, 2003; Sanders, 1999), e.g.:
• Collages and moodboards
• Diaries
• Generative tools with cognitive toolkits (Sanders, 1999), e.g.:
• 3-D models of functionality (e.g. Velcro models)
• Diagrams of relationships and process flow charts

It is believed that the ultimate innovative product touches the customers' needs at multiple levels. Therefore, to maximize customer benefits and thus perception of value, other product elements than the tangible ones (functions and features) – like user experience, emotion, and deeper meanings – are equally important. In fact, all the levels of Markowitz's hierarchy (see Figure 1) should generally be considered as part of the developed product; the relative focus on each individual element depends on various factors. Sanders (1992) explains that this can be achieved through a converging perspective where what people say (e.g. interviews or surveys), what people do (e.g. observations) and what people make (e.g. workshops where the users, through participatory design, are given tasks to solve and tools to solve them with) are explored simultaneously (see Figure 2).

disadvantageous. Moreover, they are suitable of revealing different types of information at various knowledge depth levels, from quantitative (e.g. what functions and features a product should hold) to qualitative (e.g. emotions and deeper meanings in relation to a product). Choosing the most suitable method(s) to gather the necessary customer information for a specific product development project is vital for success in innovation. In the next section, a selection of the methods explained in the literature will be applied in a case study to get a more exhaustive, experience-based understanding of their applicability.
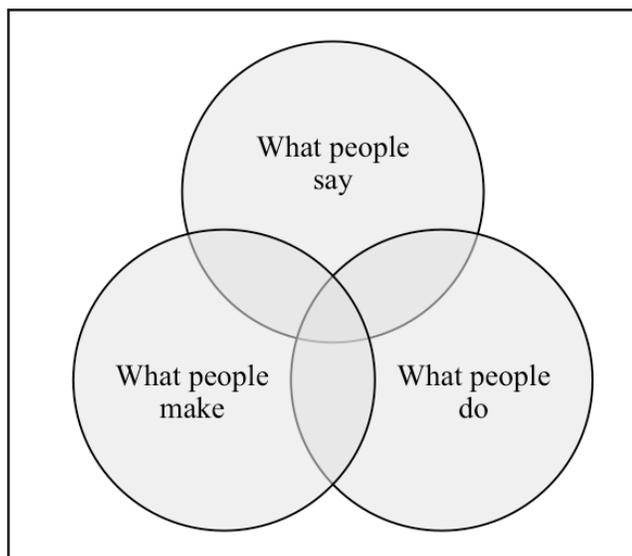

Figure 2. Converging perspective (Sanders, 1992).

In addition to what people say, do and make, it is possible to obtain customer information without any form of interaction with the customers. This can for example be done by trusting own intuition and understanding of customers. An alternative is to use data and research material published by others (e.g. marketing reports).

In summary, the methods in use for gaining customer insight and identifying customer needs are numerous. Figure 3 gives an overview of important methods for identifying customer needs. Each individual method possesses different characteristics, both advantageous and
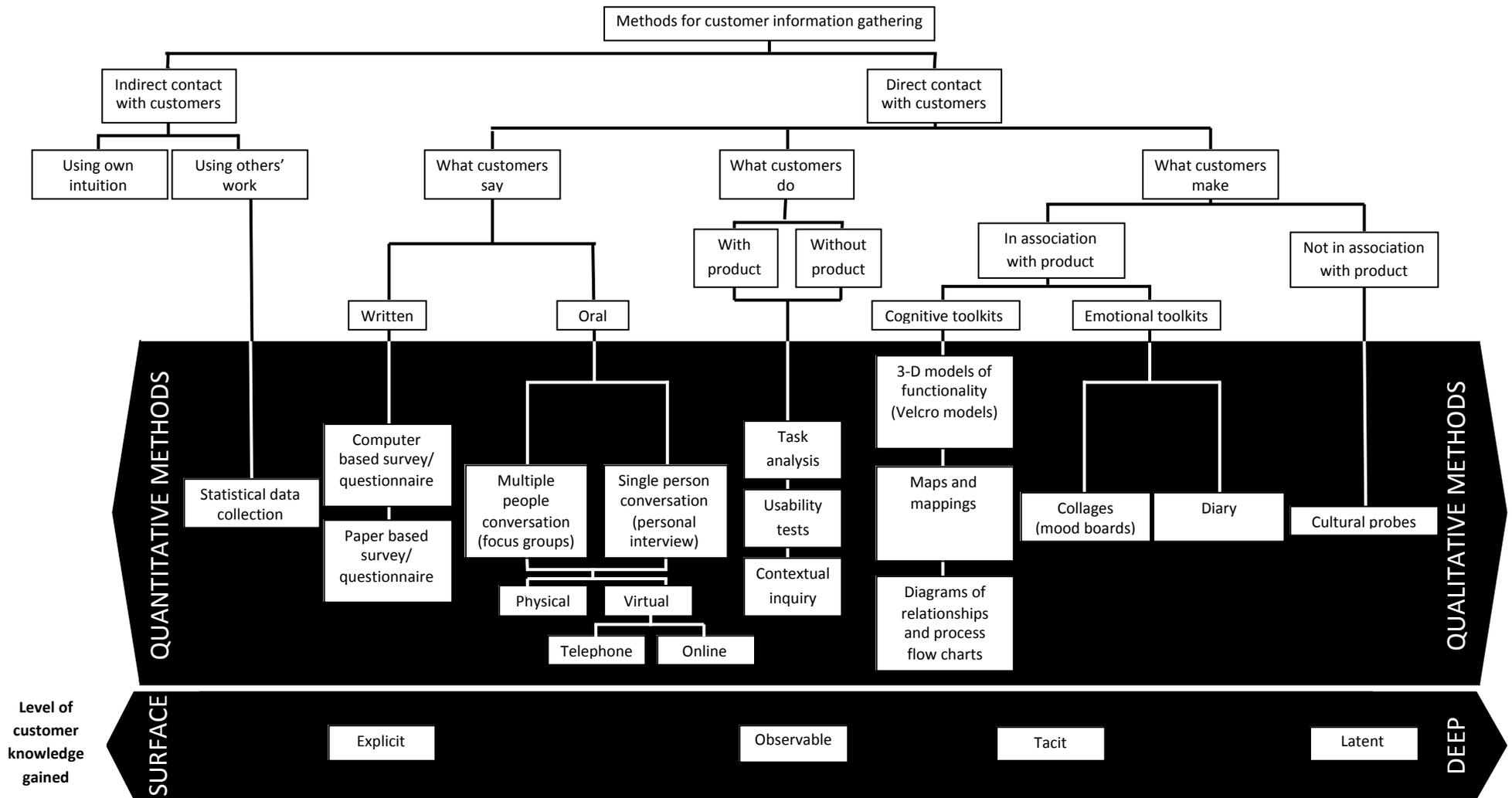
Figure 3. An overview of methods for gaining customer information.

Implementation through a real-world case study

Background

The methodology for this research project is shown in Figure 4. The project started off with a literature review on methods and tools to identify customer needs for input to the innovation process. Based on the literature review, a strategy for research on the application of the methods from the literature was established. A selection of the methodological concepts was turned into reality through a case study of developing an office chair. The case study was implemented as part of a collaborative research project between the Norwegian University of Science and Technology and a Scandinavian manufacturer of premium brand office furniture (the coordinator). It was carried out as a systematic analysis of the front-end innovation process to assess strategies for implementation of customer value. Focus was placed on methods and tools to gather customer information and techniques to analyze it and use it to create innovative products. Eventually, the applicability of the selected and separately implemented methods was determined, before the conduct of practical implications.

Figure 4. Research methodology.

Research planning and field work

The goal of the user research within the case study was to gain maximum insight into the desires of office chair users through a multi-method strategy. The outcome was going to be used as input for the creation of a new generation products (outside this research project), and to compare the applicability of the different methods.

The four methods implemented through the case study were:
• Web based survey
• Interview
• Observation
• Workshops where users are given tasks to solve (participatory design) in the form of:
• Moodboard creation
• Card sorting

The selection of methods was done based on two criteria; available resources (time frame, as well as people and budget resources) and the diversification of type of methods (according to Figure 3). The methods were implemented separately, except for observations, which, for practical reasons, were combined with interviews. Three different teams were responsible for the execution of the methods on assorted groups of office chair users. To provide transparency between the different field activities, one researcher participated in all activities. Important details associated with the implementation of each of the selected methods are summarized in Table 1.

Interviews were conducted in the office chair users' working environment where it was possible to observe their interaction with the office chair as well. The workshops were completed outside the users' normal working environment. Here, they were either given the task of creating a moodboard of their ideal workspace using given pictures and adjectives, or they participated in card sorting where they were given a large amount of both abstract and non-abstract pictures – mostly of seating solutions, but also lamps, cars, textiles and materials, etc. – that they were asked to sort into four predefined categories (discomfort; comfort and attractiveness; lumpy and heavy; slender and thin). The web based survey included both open-ended and close-ended (multiple choice) questions where the office chair users were asked to describe their ideal office chair.

Table 1. Case study and method implementation details.

Method		Research Topics	Duration	Output
			Participants/ Conductors	Interpretation and use of information
Web based survey		The office chair	10 days	Computer files
		What is an office chair with a functional appearance	175/1	Coding and sorting of data from open ended questions, construction of frequency tables and bar charts, calculation of means, medians and standard deviations, correlation and significance analysis
Interview		Workspace and work tasks	30 minutes	Notes
		The office chair and how it is used	30/2	Coding and sorting of notes, creating frequency tables to anticipate general trends among office chair users
		Advantages/disadvantages with it		
Observation		How the office chair is used intentionally and unintentionally	30 minutes	Notes and photographs
			30/2	Discussing, studying and interpreting pictures and notes to anticipate difficulties with current solutions and general trends among office chair users
Workshop	Mood boards	Ideal workspace	45 minutes	Moodboards, video recordings and photographs
			10/2	
	Card sorting	Perceptions of comfort, discomfort, slender, and lumpy	25 minutes	Discussion and inspiration
			10/2	

Source: Researchers' work.

Analysis and summary of findings

It was clear that the analysis of the information gathered from the various methods demanded different techniques. The web based survey employed software to produce statistical data in the form of means and medians, frequency tables and graphs, as well as correlation and significance analyses. The interpretation of the less quantitative type of information from interviews, observations and workshops was more difficult and time consuming. The interviews and observations resulted in notes and photographs which were discussed, studied and interpreted to determine common trends among the office chair users. The output from the workshops, in the form of moodboards, video recordings and photographs of the users solving given tasks, was more difficult to interpret. How the information was analyzed, interpreted and used is also summarized in Table 1.

In order to compare the applicability of the different methods, a collated table was created (see Table 2). It presents each method in a separate column, with the most important output (i.e. user needs, desires and relations, explicitly or implicitly expressed by the users during the user studies, thereafter analyzed and interpreted by the researchers). This information has been grouped in four main rows, each one representing different knowledge depth levels, according to Markowitz's hierarchy in Figure 1.

To better visualize the differences between the methods in capturing various types of information, the last row of Table 2 contains 'design palettes' representing each method. A design palette (see Figure 5) is a tool to organize, visualize and communicate research findings (i.e. the user information gained) in a business context. In the center of the palette, the overall business strategy is defined. Related to this is the design strategy of the specific product development project, which must be in alignment with the business strategy (Cooper, 2005). Furthermore, the palette is divided into multiple circle sectors, each representing one of the core elements in the company's design strategy. Hence, these are the foundation pillars of any given project and product solution brought to the marketplace by the company. The Scandinavian company in this case study has a design strategy with four key elements that it aims at expressing through its products:

• Visual Design (D)
• Function and Performance (FP)
• Health and Environment (HE)
• Quality (Q)

Moving outwards from the strategy in the center of the palette, the exterior circles display a shift from product features and functions (hard, tangible parameters), to user experience and emotions, and deeper meanings (softer, intangible parameters) towards the outside of the diagram. This visualization is in accordance with Markowitz's hierarchy (see Figure 1).

For each of the methods, a design palette is presented at the bottom of Table 2. The data that the corresponding method produced (found in the other rows of the table) is referenced with a number, thereafter plotted in the design palette according to company focus area and level of knowledge. It should be noted that the reference number is uniquely related to each method, and is not serving as a cross-reference between the particular methods.
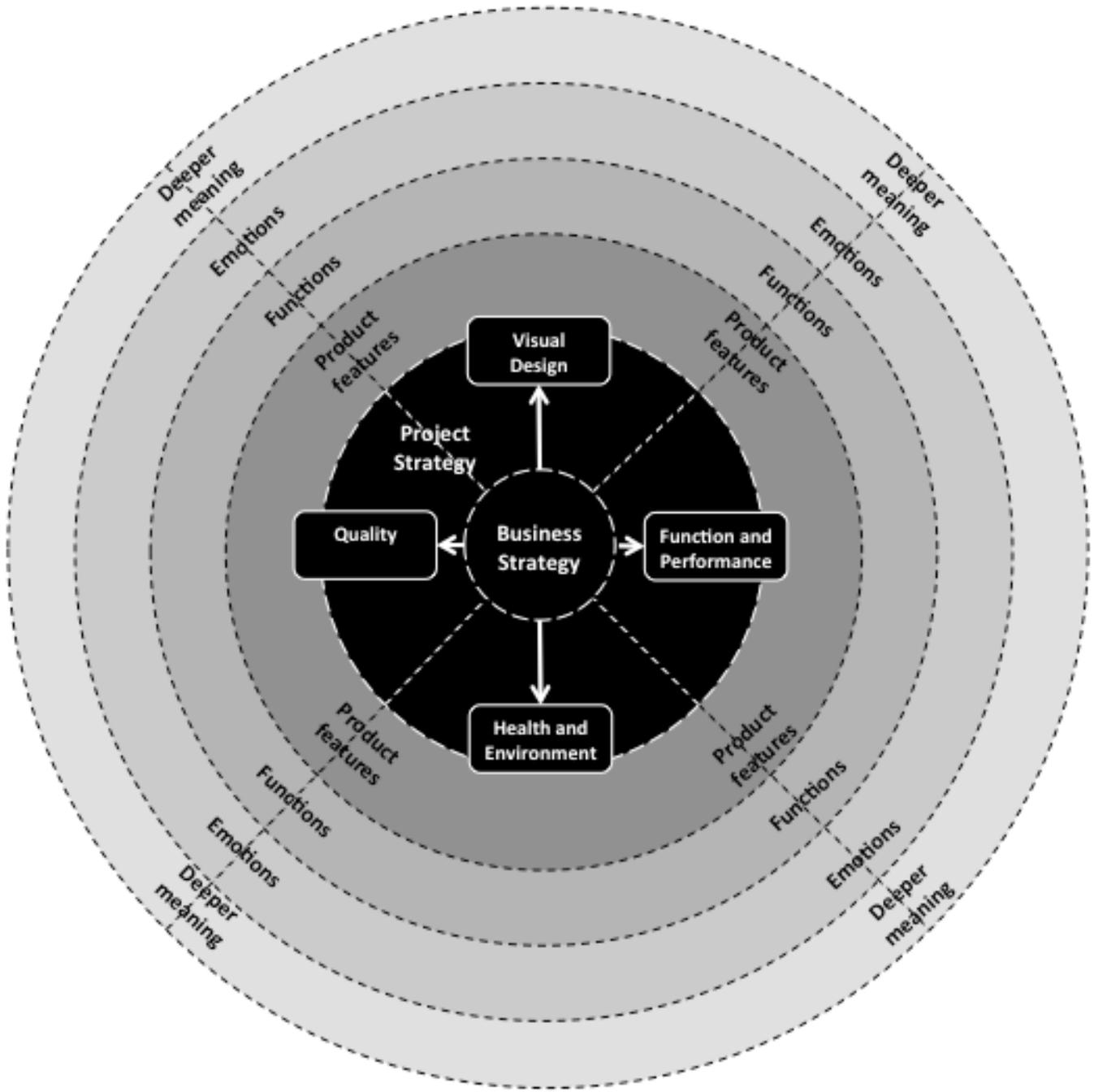
Figure 5. Design palette to present user information and align strategy, user values and product solution.

	Web based survey	Interview	Observation	Workshops
Product features	1. Adjustment possibilities FP 2. Arm rests FP 3. Tall backrest FP 4. Wheels FP 5. Head rest FP 6. Tilting system FP 7. Simple design D 8. Neutral colors D 9. Shaped after the body HE 10. Soft cushions, padded look HE, D 11. Large seat HE, D 12. Colorful D 13. Traditional D	1. Necessary to have wheels FP 2. Comfortable armrests that are not in the way FP, HE 3. Soft, but not too soft cushion HE, D 4. Show modernity and quality Q, D 5. Neutral/traditional/simple/ conservative/practical/colorful/ unique/functional look D		
Functions	14. Good support for lumbar regions/back/thighs/head HE 15. Robust, sturdy, steady Q 16. Easy to clean Q 17. Possibility to adjust sitting posture HE 18. Natural sitting posture HE 19. Fit in with the furnishings D	6. Good support for body parts (bottom, back, thighs) HE 7. Look sturdy, robust, steady Q, D 8. Avoid strain injury, exhaustion HE 9. Promote relaxation HE 10. Promote hard working HE, FP 11. Fit in with the furnishings D 12. Encourage variation in sitting posture FP 13. Contribute to flexibility and greater reach of the user FP 14. Easy, understandable and quick adjustment interface FP, HE 15. Non-clammy and comfortable cushion material FP 16. Functionality and comfort matters more than looks FP, HE 17. Increasing efficiency while working FP	1. Flexibility (users stay in the chair and roll or turn when reaching for someone/-thing close by) FP 2. Easy (simple and understandable) to adjust often FP, HE 3. Allow for easy and correct variation in sitting posture, from resting to concentrated work FP, HE 4. Clever solutions for arm and foot rest that does not interact with the surroundings, take up too much space and hinder the most suitable sitting posture FP, HE	1. Aesthetic looking products are not ergonomic D 2. Many and visible adjustment possibilities and features gives the impression of a thought-through and sensible product D, FP

Table 2. User data (wants, needs and desires) produced by the four methods, as well as design palettes. (The user data from each method is sorted according to what type of information it provides (i.e. information on product features, functions, emotions or deeper meanings), numbered (note that there is no correlation between the numbers of the different methods), and tagged according to which of the four business focal areas it belongs to (i.e. FP = function and performance, HE = health and environment, Q = quality, and D = visual design). The numbered user data is thereafter plotted in design palettes.)
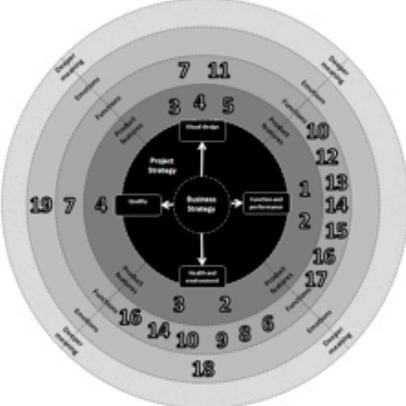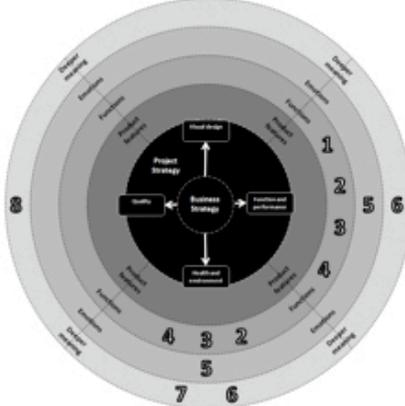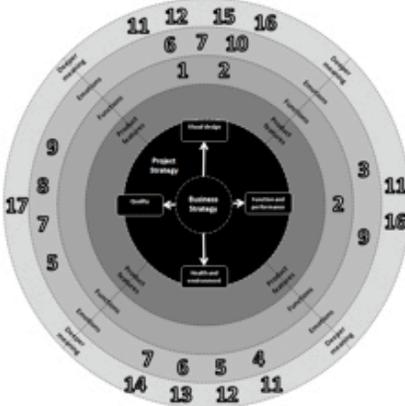
Emotions	20. Pleasant and comfortable HE	18. Comfortable during long term use HE 19. Feeling of being stable, sturdy, robust, and steady Q	5. Quietness when working on difficult and demanding tasks (users apply head phones) FP, HE	3. Inspiration and efficiency FP 4. Relaxation and quietness HE 5. Cleanness and tidiness HE, Q 6. Comfort and pleasure is related to curved shapes, shaped after the body, padded and soft cushions HE, D 7. Discomfort, fragility and hardness is related to slender and thin structures HE, D, Q 8. Quality Q 9. Functionality, practicality Q, FP 10. Modernity, simplicity D
Deeper meaning			6. Privacy (users use PC-screen for visual protection) FP, HE 7. Personal belonging (users put name tag on their own chair) HE 8. Safety (users do not want the feeling of falling off the chair) Q	11. Personal belonging / personality D, FP, HE 12. The natural is much appreciated and recognized as beautiful, comfortable and pleasurable (i.e. shaped after the human body, pictures of nature, large windows and view of nature, plants in the office (green and fresh to create life and a healthy environment), natural lighting, colors from nature) D, HE 13. Light/bright rooms HE 14. Openness in the office (large open spaces, spacious, not crowded) HE 15. Work pleasure/zest, love of working D 16. Efficiency D, FP 17. Appreciation and care (from the employer to the employee) Q

Design palettes	 Web based survey	 Interview	 Observation	 Workshops

Table 2. Continued/ Source: Researchers' own work.

Discussion of findings

From the design palettes in Table 2, it is evident that the various methods were capable of revealing different information types (from hard, tangible characteristics to softer, intangible characteristics) and varying amount of information at different knowledge depths, ranging from explicit information (more quantitative type) through observable and tacit information to latent (more qualitative type).

The interview method captured in general only tangible user information related to functions and features of the office chair. Also the web based survey turned out to be more suitable of revealing surface type information rather than of revealing emotional characteristics. Statements like: "I need an office chair with wheels, armrests and many adjustment possibilities!" were common output from both the web based survey and the interviews. It seemed like the users had difficulties expressing their emotional needs. Furthermore, it was discovered that the users were engrossed with the past and present and lack foresight when attempting to express their needs and desires through the application of these methods. Nevertheless, when it comes to the amount of information provided by the four different methods, the web based survey and the interview scored the highest. They were also the most 'effective' methods (as defined herein) in terms of amount of information created relative to resource demand. The reason may be that these methods provide information that is easy for researchers to understand, interpret and use in concrete product solutions. Despite of this, the user needs and desires discovered from the implementation of these methods seem to be more applicable for creating product improvements than in creating novel, differentiated products.

The method of observation, on the other hand, demanded more resources for planning, implementing, and interpretation of the output. Additionally, it delved deeper and was capable of revealing information related to product functions, emotions, as well as deeper meanings. According to the interpretations in Table 2, however, few discoveries were made when applying this method. Firstly, this may be caused by the fact that observation was done during interviews and the researchers were more focused on the interviewing and what the users say, rather than observing what the users do. Secondly, interpreting what users do in terms of their needs turned out to be more difficult than interpreting what they expressed through interviews and surveys. Nevertheless, it was discovered that the information gained on emotions and deeper meanings can work as an inspirational source for the creation of more novel products.

The method of applying workshops revealed the deepest and most emotionally-related user information, but not in large amounts. However, it was extremely resource-intensive when it came to planning and implementation. Also, interpreting what the users produced during the workshops in terms of needs related to an office chair proved to be very difficult and in many cases impossible. Moreover, the interpretations may easily be influenced (unconsciously) by the researchers' subjective opinions. Consequently, it was deduced that the information captured with this method was mainly suitable as a source of inspiration for the project team aiming to drive the design in the direction of breakthrough products. A summary of the characteristics of the four methods is listed in Table 3, including what type of information they provide and the amount of resources demanded, as well as advantages and disadvantages, and recommendations for application.

	Type and amount of customer information and utilization	Resource demand	Advantages	Disadvantages	Application strategies based on experience
Web based survey	• *Very concrete information*, to a very large degree about *functional aspects* of the product • Best used to generalize and get an overall understanding of the users • Provides *large amount* of information	• *Low resource demand: (Very 'effective' method)* • Large amount of users necessary in order to generalize the results • Small amount of conductors necessary when creating and implementing the method • Computer software simplifies the implementation and interpretation of the results	• Covers a large group of people • Can be measured statistically (quantitative type of research), and when done correctly this gives very certain data • Suitable for generalization and revealing target audience makeup • Easy and quick to implement when in possession of the right computer software	• Requires very thorough, clear and well prepared questions • People can easily lie and exaggerate • Difficult to discover latent needs and perceptions • Gives seldom data on extreme cases, only the general • The data might be subject to bias	• Applicable when information to undergo *product improvements* is needed - Suitable when a given specific and narrow topic needs more information
Interview	• *Concrete information*, mainly related to *functional aspects* of the product (what the product should offer in terms of features and functions) • Best used to anticipate trends among the users in relation to the product • Provides *large amount* of information	• *Fairly low resource demand: ('Effective' method)* • Quite a large amount of users are necessary to get varied enough information to anticipate trends • Not too much effort is required from the users and the researchers in preparing the implementation • Resources like tape recorders and notes may be helpful in recording the findings • Interpreting the findings is more difficult and resource demanding than for web based surveys, but generally easier than observations and workshops	• Easy to implement • When done in person, the participants' behavior may tell as much as the spoken words • Possible to gather a lot of thorough and varied information right from the source (the users) • Possible to dig deeper on interview topics where necessary	• Usually only one person at a time • Requires the right questions to be asked in order to obtain the right information • Users may answer what they think is the most correct or desired answer • They might feel time pressure, causing uncertainty in the answers • Users may lack technical knowledge • People generally struggle to verbally express latent needs, and cannot imagine the future • The data needs to be interpreted in the end, leading to possible uncertainty	• Applicable throughout the whole innovation process, but especially when aiming at creating *product improvements* rather than novel products - Gives improved results when combined with observation or conducted in-person in the context of the product

Table 3. Summary of the characteristics of the methods from the case study.

Observation	• *Little concrete* information, but both *functional and emotional* information • Best used to anticipate difficulties with current solutions, and trends among office chair users (in relation product usage) • Provides *lesser amount* of information	• *Fairly high resource demand:* (Little' effective' method) • Like interviews, quite a large amount of users are necessary to get varied enough information to anticipate trends • Iit might be difficult to recruit participants due to the fact that observations require large amount of effort and time from them • Not too much preparations are required from the conductors • Resources like video camera or photo camera may help record the findings • Such recordings can be difficult to interpret	• People's actual behavior can be revealed and the product can be seen in use • May reveal latent needs and hidden and unspoken wants • Possibility of the observer asking questions directly to the user while the product is in use • Creates a wide understanding of the problem that is being addressed	• Requires thorough planning and setup • Usually only one person is observed at a time, and often only a small sample of user are involved • Requires dedicated users that are willing to participate in a demanding process • The observer may seem importunate to the user, possibly hindering natural behavior • Interpretation of data is needed after the process, and may lead to variability in data	• Applicable throughout the whole innovation process, for aiming at *both novel and less innovative products (product improvements)* - In the early stages of the product development process, observations can reveal dissatisfaction with current products leading to product improvements, or the users may use the product in a special way that may trigger the researchers' imagination and ideas and eventually germinate into a novel product - In the later stages, observations of user and prototype interface can give necessary indication of whether the product is well received by the users.
Workshops	• *Extremely little concrete* information, to a very large degree information about users' *feelings, perceptions and dreams* • Best used as inspiration for the project team throughout the whole product development process • Provides *lesser amount* of information	• *High resource demand:* (Little' effective' method) • Tasks and tools need to be well prepared by the researchers • The tasks generally take a fairly large amount of time and effort from the participants • Usually, only a limited amount of users are involved, but on the other hand, these need to be dedicated to solving the given tasks • The results are difficult, at times even impossible, to interpret	• Useful for revealing thoughts, feelings, dreams, perceptions and other things that are hard to express using words • Can uncover latent needs	• Difficult, sometimes impossible, to interpret • Less focus on the functionality of the product • Demanding process both for the user doing the tasks and the designers or product developers who are creating the tools • Thorough preparation is necessary • Usually only conducted on a small sample of users	• Applicable in the early stages of the product development process of creating *innovative and novel products*

Table 3. Continued/ Source: Researchers' own work, also based on Sanders (1999), Sanders (2000) and Kuniavsky (2003)

In summary, the deeper the method delves, the more resources are needed to generate information, and less amount of information is produced (i.e. the 'efficiency' of the method decreases). On the other hand, such methods may provide softer, more emotional type, qualitative information as an important source for the creation of novel and differentiated products. It can therefore be asserted that the quality of the information the method provides in terms of type and uniqueness is a much more relevant metric than the quantity of information. Figure 6 and Figure 7 supplement the findings listed in Table 3 by visually showing the discoveries made through the case study in terms of:

• What types of information the four methods are capable of gaining; from surface level information (i.e. generally quantitative information on features and functions) to deep level information (i.e. generally qualitative information on emotions and deeper meanings) (see Figure 6).

• How 'effective' the four methods are (see Figure 6). Efficiency is herein and as previously stated measured as resource demand relative to the amount of information gained, i.e. it is considered as cost-efficiency or productivity and favors quantity over quality. Resource demand is understood as the resources needed for planning and implementing the methodology as well as interpreting and analyzing the information gained.

• How and when in the innovation process the four methods (and the information they provide) can best be utilized (see Figure 7):

• Web based survey: provides information that is particularly useful during the middle stages of the innovation process (i.e. concept or define phase), when the overall problem or general needs have been discovered, but information to specify them more closely is needed.

• Interview: provides information that is useful during all stages of the innovation process, but is most suitable for providing information that can be used to improve current products or physical prototypes (i.e. during the development phase).

• Observation: provides information that is useful during all stages of the innovation process. During the very early stages (i.e. front-end and discovery stages), this method can be applied to discover needs that ultimately can germinate into a novel product, while during the later stages this method is capable of identifying information for improvement of current products or prototypes.

• Workshops: provide information that is useful in the very early stages of the innovation process to discover needs that ultimately can germinate into a novel product.
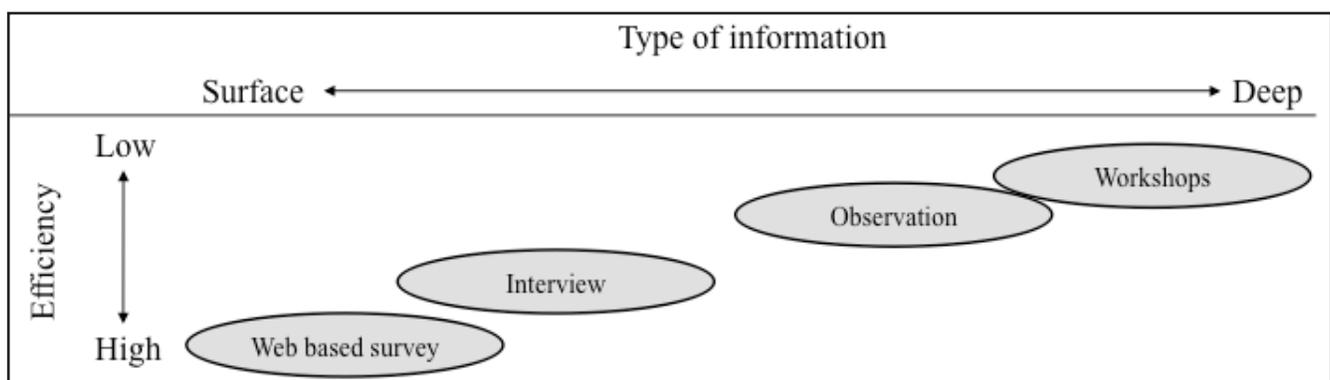

Figure 6. Methods rated according to 'efficiency' and the type of information they produce.

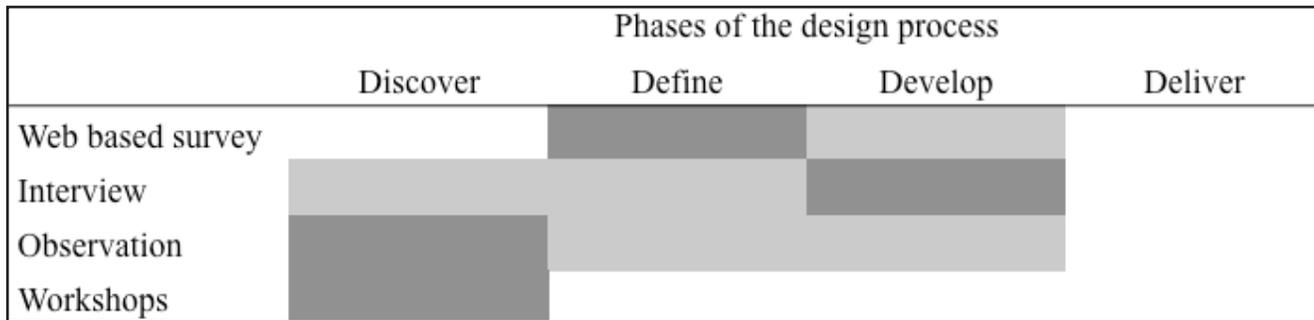|	Discover	Define	Develop	Deliver
Web based survey		▓	░	
Interview	░	░	▓	
Observation	▓	░	░	
Workshops	▓			

Phases of the design process

Figure 7. Methods rated according to where in the design process they are most suitable (the darker the color is, the more suitable the method is).

It should be noted that the recommendations given above are based on the researchers' interpretations from a single case study, and that further research is necessary to confirm the results. Nevertheless, there is little doubt that a converging perspective (Sanders, 1992), i.e. combining the different types of methods, provides the most complete understanding of the customers, but usually at the expense of a higher resource demand. This approach becomes a countermeasure to customers' struggle of orally expressing feelings. Also, it levels out the lack of futuristic perspective customers hold when orally expressing needs and desires. This is a topic that has been widely discussed over the years (e.g. Huthwaite, 2007; Alam, 2006; Enkel, Kausch and Gassmann 2005; Johne and Snelson, 1988), and it is well-known through Henry Ford's famous quote: "If I had asked my customers what they wanted, they would have said a faster horse."

Despite of the effectiveness of such a strategy in increasing understanding of customers, implementation of findings related to customer desires into concepts that ultimately could lead to successful products is strongly dependent on establishing alignment between customers, product development team members, product attributes, and finally the company (as emphasized through the design palette introduced herein). Moreover, a mixed perspective on customer involvement in the innovation process, applying so-called 'design-thinking' to combine outside-in (e.g. customer and competitor focus) and inside-out (e.g. focus on company's internal capabilities) approaches is an important strategy for succeeding in today's marketplace (Barczak, Griffin and Kahn, 2009; Brown, 2009; Martin, 2009; Verganti, 2009; Kelley 2005).

Concluding remarks

Defining and implementing customer value in order to develop innovative products is a key principle for companies to survive and thrive in today's global and rapidly changing marketplace. However, truly understanding the customers is extremely complicated. The literature presents numerous methods and tools with the purpose of helping companies understand customers' needs and desires in relation to product development. Nevertheless, lack of knowledge has been discovered when it comes to their applicability in practice.

This paper contributes to a deeper comprehension, beyond the descriptive literature and into the reality-based experience, of methods and tools to gain customer information in the innovation process. Through the real-world case study of developing an office chair described herein, a selection of methods from the literature (web based survey, interview, observation and workshops) have been implemented. This is to increase the understanding of the methods and their applicability, and to provide directions for the application of each particular method in product development projects. By practical use of the results and recommendations provided in this paper, designers, engineers, managers and business executives can improve their innovation processes, creating financial sustainability and pre-competitive advantage in the marketplace.

Based on the present research, the following conclusions can be drawn:

• Numerous methods applicable to increase customer understanding in the innovation process have been discovered through a literature review, including web based survey, interview, observation and workshops where the users participate in solving given tasks.

• These four methods were implemented through a case study aiming at   increasing the understanding of their applicability and to provide directions for later application in product development projects:

• Especially the method of web based survey, and also to some extent interviews, do generally not provide much more than surface information. This is quantitative information on what functions and features a product should possess, i.e. hard and tangible parameters. These methods are usually capable of revealing large amount of information with a low resource demand, meaning that they are fairly easy to plan and implement, and the information gained is not too difficult to interpret and analyze (i.e. 'effective' methods). A strategy to implement customer value would be to apply such methods during the later stages of the innovation process as a source of input when improving current products or prototypes.

• Especially the method of implementing workshops, but also observation, delve more deeply into the customers' minds, and are better at providing qualitative information on customers' emotions and deeper meanings in relation to a product, i.e. soft and intangible parameters. They usually demand a large amount of resources for planning and implementation, and interpreting and analyzing the information gained is difficult or, at times, impossible. Additionally, such methods provide less amount of information (i.e. less 'effective' methods). A strategy to implement customer value would be to apply such methods in the early stages of the innovation process as a source of input when aiming at creating truly novel and differentiated products.

Overall, a combination of different methods, as well as applying both an outside-in (e.g. customer and competitor focus) and an inside-out (e.g. focus on the company's internal capabilities) innovation approach is generally recommended. When at the same time aligning the customer output with the product development team members' understanding, the product attributes and finally the company's strategy (as emphasized through the design palette), a more effective innovation strategy for implementation of customer value may be accomplished. This approach should provide the broadest understanding of the customers, balancing the customers' focus on past and present with the company's capabilities of having a more visionary, futuristic perspective, as well as helping customers express their feelings, dreams and perceptions. However, creating such a pre-competitive capability to succeed in today's marketplace is done at the expense of higher resource demand, but with a much higher expected return on that investment over time.

About Authors

Tonje Overvik Olsen newly received her Master of Science in Mechanical Engineering from The Norwegian University of Science and Technology (NTNU). Her specialization was Product Development and Materials Engineering. Recently she has been working as a research assistant at NTNU, Department of Engineering Design and Materials, focusing on the investigation of product innovation processes and the maximizing of customer value, in accordance with lean principles.

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