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NEED DRIVEN PRODUCT DEVELOPMENT IN TEAM-BASED PROJECTS

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ABSTRACT
In this paper, practical activities of Needfinding - an intertwined approach to identifying needs and to visualizing idea concepts in early design - are described and discussed. This is done primarily to gain an increased understanding of the various representations of user needs that are fed into the fuzzy front-end activities of team-based product innovation projects. The empirical basis comes from a study of an eight-month collaborative product development project, performed under realistic conditions by MSc students in close collaboration with their client.
Focusing closely on customers and their needs is encouraged within the conceptual framework of Integrated Product Development and is increasingly highlighted as a key enabler in the design of truly innovative products. Despite the fact that identified customer needs are considered as the initial and primary input into such an innovation process, it can be argued that the design teams do not commonly have a sufficient understanding of customer needs and they do not normally interact with customers in their environment. Besides focusing on measurable aspects of user behaviour and requirements, a traditional approach to identifying and managing customer needs usually includes several interpretive stages before being handed over to the design team. In the context of innovative products, the identification and definition of customers and their needs is a non-trivial and difficult exercise. It involves, we suggest, not only Needfinding but also the definition of 'those who might need the product', users and customers to co-evolve iteratively in the early phases of design.

Keywords: Product Development, innovation, Needfinding, engineering design

1 INTRODUCTION
The business environment is going through a shift towards service provision, which is likely to affect how products are designed and developed. Contemporary companies on a global market are experiencing constantly changing business demands and increased competition. The situation is described by a company as: *"There is fierce competition out there, which means we require the best supply chain, the strongest finance operation, the most creative deal-makers, the greatest customer focus and the finest engineers to help take us into the future"* [1].
To meet competition, companies invest a great deal of money and effort into the development of new products. Despite that investment, nearly nine out of ten products fail within two years of release [2]. One possible explanation for this is that the products do not actually solve a customer need [2]. An additional dimension to that situation is that failures in market uptake can actually have its explanation very early in the product development process; engineers lacking a profound knowledge concerning who might use the product they are developing: *"The engineers involved assumed that because they personally would like to own and use such state of the art devices, everyone would. They were wrong"* [3] (p.422). It can be argued that the engineers probably would describe themselves as customer focused, since they assumed that the customers preferred the same devices as they did. However, the attitude *'we know our customers'* is not the equivalent of focusing on customers [2]. Focusing on customer needs involves both *thinking* and *acting* activities [2].
A tendency to focus on a product that designers might want to use themselves often leads to a product that is too complex [4], as well as a focus on a particular product or solution in early design phases often hampers innovation and new product development. Finding and understanding people's needs

are at the heart of developing innovative products [5], and *Needfinding* is a needs-focused approach, which encourages designers to keep all possible solutions open for consideration and helps them avoid a premature delimitation of the design space [5]. The investigation of people's needs and designing activities should be seamless; this means that engineers have to be closely involved in the Needfinding activities to truly understand people and their needs. It is proposed that focusing on customer and their needs is a way to manage the fierce competition [2], but to design innovative products that actually meet people's needs the whole product development process has to be driven by those needs.
One task for a technical university is to educate and train future engineers to meet the companies' expectations, and to possibly even exceed those expectations by providing engineers that are particularly well equipped for need driven product development. Our university is no exception; in line with an earlier quote, we aim to provide the future engineers with a *greater customer focus* and make them the *finest engineers*. Our experiences are that applying a Needfinding approach in early phases of product development makes the engineers aware of that they are developing products for somebody else [6], and aids them in the transformation of that awareness and understanding into products that are better aligned with actual customer needs. In today's product development world, by tradition bound to deal with physical problems and hard facts, this approach has initially proven to be a rather hard sell. Zooming in on customer needs actually widens the scope of the product development domain, calling for multidisciplinary, team-based creativity and new methods for aligning design and development activities more closely and continuously to the outcome of an iterative Needfinding approach.

1.1 Purpose

The product development process which is put into practice by the students at Luleå University of Technology is named Participatory Product Innovation (P^2I). It supports the process in team-based product innovation projects and, we find, not only allows user needs to drive and affect the design activities, but actively encourages it [6]. The integration of Needfinding in P^2I is perceived as a virtue for the practice of need driven creative product development. However, dealing with people's needs in relation to innovations means that we are also dealing with fuzzy front end information. As the word 'fuzzy' implies, this is a phase of innovation projects where it is very difficult to find evidence concerning whether or not the project outcome will be a success or a failure. The activities when handling fuzzy front end information are normally not straightforwardly captured into guidelines or models, yet they are taught and promoted as a set of capabilities that professional designers and engineers should be able to put into practice. Identification of fuzzy front end information, such as peoples needs, might be a characteristic for innovation opportunities, since *"Needs are opportunities waiting to be exploited, not guesses at the future"* (p.38) [5].
The purpose in this paper is to describe practical activities of Needfinding in the early phases of a team-based product innovation project to gain insights into what the fuzzy front end is about and how designers and engineers can develop the adequate skills in performing need driven product development.

1.2 Innovation

The word innovation is used and interpreted in a plethora of ways and applied in many areas. We are not attempting to define the word here, yet a short explanation could be useful to better understand what the team-based project actors are striving to achieve. In the setting presented in this paper, innovations can range from new physical artefacts, i.e., *new things*, to more intangible products, e.g., *new ideas, new processes*. The word *new* can here be interpreted as in beforehand 'poorly understood' or 'unknown', and as a fact, exceeding what was intended from the beginning [7].
In innovation processes, the desired qualities to manage can be the actors' capabilities to create visions, new ideas, mutual learning and understanding [8]. The metaphor of a jazz group can be used to describe the support of such a process, *"The orchestration of a design group needs to support the group's imaginative thinking, handling and synthesizing competence and well-being, as well as giving overall managerial support that also addresses the production aspects of the design process"* (p.289) [8]. From our perspective, product development processes which aim for innovations have to address these issues by being sensitive to the task at hand, by enabling creativity and by supporting the social processes in the design team.

2 METHODOLOGY

The empirical basis for this study is found within a global team-based product innovation project conducted by students in the final-year course in the Mechanical Engineering MSc degree programme, SIRIUS, at Luleå University of Technology, Sweden. The Swedish students have collaborated with students from the ME310 course, 'Team Based Design with Corporate Partners, at Stanford University, USA. The study reported on in this paper is based on a perspective of the Swedish student team's data generation phases and Needfinding efforts.

The students in the SIRIUS course run their project in a setting as close to real world development projects as possible, e.g., close collaboration with affiliated companies, interaction with people in society, and being 'owners' of the process and its result. Access to the student project for generation of data has taken place by being coaches for the students. The course runs for about 8 months and the Needfinding activities mainly take place during the first 4-5 months. Data has been continuously generated during these months. A second effort for data generation has been performed in the last month of the project where the students have had the opportunity to reflect on the Needfinding activities in relation to what they have achieved.

Main data generation methods have been observations and interviews, i.e., dialogues. Written documents, e.g., log books and reports, from the students have also provided useful data. The students' collaborative activities in early phases have been videotaped. Field notes have been taken from the videos to provide additional data to this study. All data is qualitative in its nature.

2.1 The student project

Based on the initial information provided to the students, the project studied here was called *Future Elderly Environment* (FEE). The students got the information that they were going to develop 'something' that would help increase the wellbeing of elderly persons. The theme of wellbeing was initially introduced into the SIRIUS setting as an approach towards increased wellbeing for people with physical limitations and/or people facing other constraints. However, wellbeing as a concept has more to offer than merely remedying problems of specific disability [7]. One basic element is to provide added value for people, enabling them to increase their active participation in society.

The initial information given to the students is intentionally kept as broad and general as possible, providing just enough information to stimulate the Needfinding activities in question. For example, no further directions about the target group were given; the students had to decide for whom they were going to develop the product. Increased wellbeing for elderly persons can be achieved by providing innovative products for, e.g., next generation elderly, elderly themselves or people in the elderly persons' surroundings. A European Commission-funded project called *NeedInn* (from needs to innovations) has served as the client for the student project. The innovative product designed by the students has been further developed by one of the students after finishing the course. The product is going to be implemented in a new and high-tech enabled elderly home and is planned to be commercialized.

The FEE project had a close collaboration with students from USA. Four students from Sweden and four students from USA formed the global design team. Due to the fact that the students have participated in organizationally separated courses, the SIRIUS course in Sweden and the ME310 course in USA, the students had to develop prototypes and products respectively. The search for data about needs have been performed in Sweden and in USA by the respective student team. Interpretation of that data has been performed in collaboration, as well as the early design phases. Hence, the products that have been developed are based on the collaboratively identified needs. The geographical and communicative distance has been partly reduced by using videoconferencing technology, shared online workspaces, email etc. The design teams have also visited each other, so the collaboration in early phases was also performed in face-to-face meetings and workshops.

3 PARTICIPATORY PRODUCT INNOVATION

A generic master plan consisting of a timeline and a number of sequences to go through, guides the SIRIUS students in both running the project and the product development activities. The master plan does not point out activities in detail and the purpose is to provide the students with an overview tool to estimate the efforts required for the whole project, as well as a map to keywords that can be useful when searching for relevant literature.

The P²I process is included in the master plan. P²I can be best described as a hybrid of Needfinding [3], [5],[9] and the product development process suggested by Ulrich and Eppinger [10]. The underpinning logic and methodological philosophy for P²I is inspired by an approach to creative product development [9], [11]. The P²I process has an emphasis on the use of qualitative research methods to identify needs and an emphasis on the use of a variety of creative methods, especially to express need statements and to generate idea concepts. Designers' direct work with identifying user needs is important, since 'users are not designers' [7].
An integration of what can be viewed as qualitative Needfinding issues and quantitative product development issues is a challenging task, so P²I is continuously developing. The P²I process provides guidelines rather than entailing a stepwise model, thereby the students are encouraged to enhance and develop the process. At the moment, the whole master plan includes seven overall sequences (1) Planning, (2) Design space exploration, (3) Roadmap, (4) Concept design and prototyping, (5) Detail design and manufacturing, (6) Pre-launch and (7) Product launch. Needfinding activities are a main part of the second sequence. Besides Needfinding, this phase includes scoping of the project, benchmarking of competing products, and a state-of-the-art review of related knowledge or technologies that might be found in other domains. All these activities are performed in an iterative manner. The students are guided through this phase by questions, for example: Who are the actors? How can you find out more about them? Where? What are they doing? Why? What can you learn from other domains? These activities prepare the teams for the next sequence, the roadmap, which has been identified as a boundary or interface mediating between Needfinding and more traditional product development activities [6].

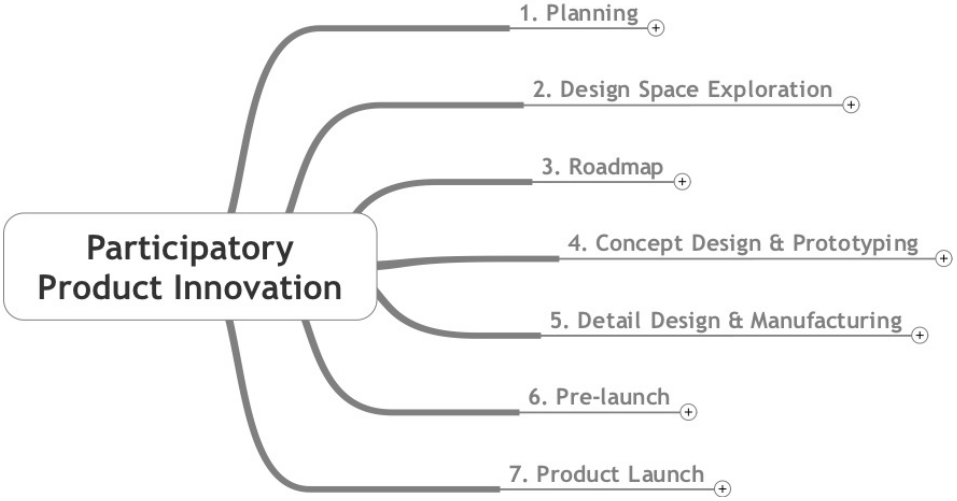

Figure 1. The overall sequences in P²I.

4 A CUSTOMER-CENTRIC VIEW

A customer-centric view begins, logically, at the customer and it begins before the development process gets started [2]. From this strand, product development companies are often criticised for short-circuiting the process in the rush to launch new products to the market. By doing this, it is argued, eight vital steps of the product definition process are ignored [2]. These steps are; (1) develop image diagrams, (2) translate voices into requirements, (3) provide requirements diagrams, (4) develop metrics, (5) design the survey, (6) administer the survey, (7) analyse existing solutions and (8) analyse results of the survey.
Mello [2], advocates a market-driven product definition, and discusses what is commonly referred to as the fuzzy front end in product development. She argues that a product-centric view results in a fuzzy product definition since the views from different functional groups are varying, see left in Figure 2. As an alternative way to minimize fuzziness in product development, a customer-centric view is recommended. This view is, according to Mello, likely to lead to one unified view of the product definition since all functional groups build the product definition on an understanding of the customer, see right in Figure 2.
Visits to the targeted customer segments and customers are planned in the beginning of a market-driven project. Early on planning concerns, for example, identification of lead users [12], specification

of key individuals who will influence, purchase or use the product and selection of key customers [2]. A common image of the customer is developed after visits to customers. The importance of using different criteria than traditionally when segmenting customers for the purpose of understanding the customer image is present in the customer-centric view [2].

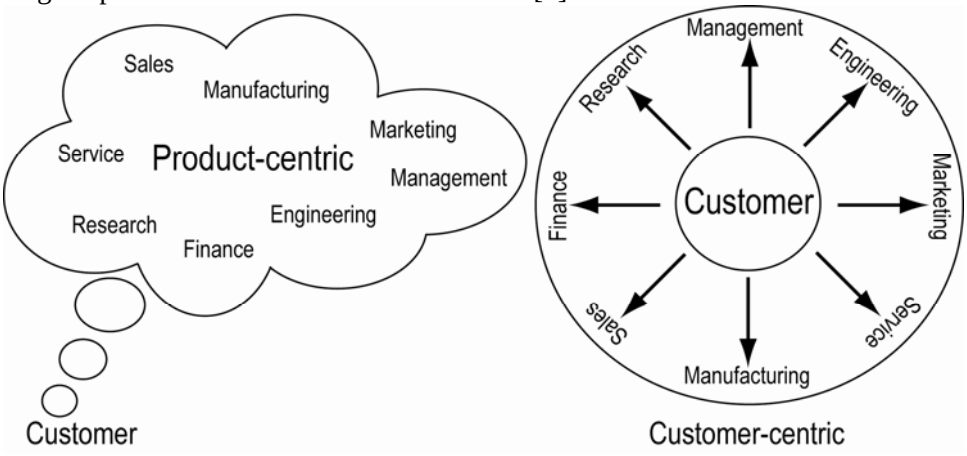

Figure 2. Product-centric view vs. Customer-centric view. After [2].

Emphasizing that *use* is the criterion for identifying customers, it is suggested that companies should *"… determine which of the traditional segments have uniquely different uses of the product. The difference in the use of the product or service by various groups of customers is the qualifying question when selecting customers to visit"* (p.46) [2]. An advice to keep the input information manageable is that an increased number of visits to nonusers of the equipment would not reveal any new concepts, problems, or opportunities [2]. However, Mello also gives the advice to think hard about which customers to visit. It is far from obvious, even though the companies think that they know the customer [2]. A distinction between customers and users can be that customers are those who pay for the product and users are those who actually use the product [13].

5 A NEEDFINDING VIEW

In general, understanding needs is considered important for the design of innovative products [5], [14]. The idea to listen to the 'voice of the customer' is not new [2], [15]. Over thirty years ago, Robert McKim, at the time head of Stanford University's product design program, discovered that people who found problems to work on and those who were going to solve them were not necessarily the same. To get designers closer to end users he introduced Needfinding as an approach [5]. The approach depends heavily on qualitative research methods and, as a response to a growing understanding of such methods, Needfinding have been further articulated and extended [5]. Methods which are similar to Needfinding have been used in, for example, software development [16].

Still, only a few design and development firms seem to fully embrace and apply the approach. One example is IDEO, a leading design firm in the US [9]. Besides the fact that qualitative methods have not historically been either well-understood or used, a further explanation for the limited use by product development firms can be that Needfinding focuses on people's needs which are often difficult to articulate and, accordingly, the effort to uncover them might be perceived as too extensive. Further, a focus on user needs includes ambiguity and contradiction [15].

It is crucial to note that *"Solutions come in and out of favor faster than the needs they serve"*, and that a closer focus on needs can *"…encourage companies to continue innovating better ways to serve those needs, independent of current solutions"* (p.38) [5]. Basic ideas such as *"look for needs, not solutions"* and *"look beyond the immediately solvable problem"* (p.40) [5] are at the heart of a Needfinding approach. In practice, this means that the Needfinding team should gather a lot more information than what seems to be necessary for the initial scope of the project at hand. Furthermore, the team should keep all possible solutions open for consideration and to avoid prematurely limiting the design space. Such an approach is a direct opposite of how information is commonly managed in traditional product development, where the main objective is to narrow down (converge) the information by reducing ambiguity as early as possible [8], [17]. This kind of controlled process may

hamper new thinking, because it makes the designers act in accordance with a paradigm-preserving style [8].

A Needfinding approach builds on viewing needs as different from requirements. Investigation of user needs is in general indicated as an input to the first steps in representations of integrated product development processes [10][18]. Due to this, these models can be labelled as being user oriented, but this does not necessarily mean that the *development* is driven by needs. The product development process can be triggered by, for example, the development of a new technology [10], and quantitative and qualitative surveys can be performed by the marketing department to identify a market opportunity [19]. Market research has received some criticisms from product designers [19], who often claim that market research limits design opportunities to the lowest common characteristic of customer taste. Furthermore, product designers often say that customers can not express that *"...they want a truly innovative product that they have never ever imagined before"* (p.156) [19]. This criticism might indicate some problems with traditional market research, e.g., that it focuses on customer segments and that it merely identifies requirements and 'wants', which can be expressed in relation to already existing products. Users can often be more precise in their articulation of their requirements when a solution is in use [20]. Hence, it can be argued that what people have more difficulties to express is a *need*, yet it is experienced as a problematic situation lacking satisfying solutions [3].

Further critique of the traditional market research is that it usually treats needs as something waiting to be collected. Thus, there is an emphasis on a quantitative approach where the needs should be measured and transformed into characteristics of the emerging product [21]. Such a market research approach searches for and identifies *requirements*. In this way, needs are likely to remain uncovered. *"Needs are obvious after the fact, not before"* (p. 39) [5], i.e., only when they are identified and can be expressed as requirements will they also be available for measurement. Due to the difficulty for people to express needs and the unfamiliarity for the design team to identify them – and to truly bring them into the development cycle – a different approach than traditional market surveys is suggested.

A wide range of creative ways to identify needs and allow them to drive the development of innovative products is applied by those design firms which base their design and development processes on Needfinding. A focus on diversity rather than on consistency is a basic concept, where unfocused groups rather than focus groups are preferred [9]. The understanding that *'people are human'* is seen as a source of creativity, not a problem to be solved [9]. Crazy users and rule breakers are seen as invaluable sources for information. For example, an artist, a bodybuilder, a podiatrist and a shoe fetishist were engaged in the design of a sandal [9]. This can be compared to involving lead users [12], whose needs can help indicate the needs of a general user in a future market situation. Lead users try to develop solutions on their own to meet their need and, hence, they can provide useful information to the Needfinding team [12]. The balance between the varieties of people providing data to identify needs is important. Studying only lead users might result in overbuilt product specifications, so general users should also be involved to get an understanding of and cater to mainstream needs [5]. When striving to identify needs, it is important to understand people and the constraints they perceive, not to judge or correct them. Instead, the information generation activities should be seen as exploratory learning lessons in support of product development [2].

5.1 Carrying out Needfinding

The principles of Needfinding are manifested in a four-stage process for studying people. These stages are [5]:

1. *Frame and prepare* – involves decisions about e.g., the scope or coverage of the project, the goal of the study and the definition of the people to be studied (i.e., Needers).
2. *Watch and record* – observing people in their own environment.
3. *Ask and record* – talking with people in their own environment.
4. *Interpret and reframe* – translate the information into need statements. Based on the findings, reframe which people and what to study. Unexpected issues might have been found which must be answered to advance the design.

Quick iterations between the stages are encouraged rather than one long effort. A draft, outlining the identified user needs, is provided after each pass and preliminary design work can begin based on the current understanding [5].

Since what are sought after are needs which are difficult for people to articulate, the use of a variety of techniques applied in real-life situations is important [9]. Observing people gives information about *how* they act, however it does not provide answers to *why* they are acting in a certain way; it is also necessary to ask them that important 'why question' [9]. Asking a 'why question' makes the context and people's priorities understandable. Asking a '*what* question' highlights details in the people's daily activities and goals. It is suggested that it is within the interplay between observations and these questions that people's needs can be more carefully discerned [6]. Talking to people or asking people these questions is not about interviewing, it is rather about prompting people to tell personal stories about their experiences [9]. This insists on being keenly alive to both text and subtexts [11]. In fact, contradictions may denote unrecognised or unarticulated needs [5].

Having a focus on identifying needs means that a wide range of information about people is of interest, and such information naturally comes in many forms [5]. Thus, the Needfinding team has to pay attention to e.g., facial expression which might express a person's emotions better than words, and keepsakes in an office area that might reveal information about a person's relation to their work [5]. A Needfinding approach generates large amounts of various data in short time. All these forms of data have to be recorded for later study and analysis away from the studied site. Additional recording media, for instance video, audio, photos and drawings, is recommended to capture the richness of information in the needer's natural environment [5]. In this way, representing the results in a tangible form allows for making people's needs real to those who have not been involved in the Needfinding activities and make the design efforts to meet these needs smoother [5], [9], [11].

The seamless approach between finding needs and performing design activities means that members in a design team should be involved in both studying people's behaviour *and* in visualising idea concepts, as well as in visualising those who will ultimately use the solution [9]. This insists on creative methods that empower Needfinders, designers and Needers in a participatory product innovation process. Besides brainstorming, which is frequently used for many kinds of design tasks, different ways to visualise the design ideas are applied [9]. The creation of a creative environment relies on people feeling comfortable and an informal context is essential to make people more open to share ideas and thoughts [5], [11]. In relation to traditional product development processes, the IDEO process – they admit – might seem totally chaotic. Still, there is in fact a well-developed and continuously refined methodology guiding the work, *"…it's just that we interpret that methodology very differently according to the nature of the task at hand"* (p.6) [9].

6 NEEDFINDING AS PRACTICED IN THE STUDENT PROJECT

The project was perceived as being very ill-structured; the FEE students said *"it is frustrating to have such a fuzzy task"*. The task of developing something to increase the wellbeing of elderly persons was discussed with the students, but no detailed direction was given. The students were encouraged to do observations and to talk with elderly people. The decision which those people were and what to talk about was to be made by the students. Firstly, the students started with a brainstorming session to find out what they as a group meant by 'wellbeing'. They found wellbeing as a combination of physical, mental and social health.

Secondly, the students talked to older relatives, visited several elderly care homes and visited home service personnel. They used shadowing, i.e., followed staff members around for a whole day and observing them doing their work. Further, they used detailed observations, i.e., logging all activities needed to achieve a goal; for example, an elderly person getting out of bed. During these first visits, the students had gathered a lot of information about assistive devices, such as alarms, lift systems for beds or bathtubs, or special furniture as shower chairs and nursing care beds. This product focus was talked about with the students at the end of the project. A student explained this view, *"as an engineer, I like to take a thing, a product, look at it, twist and turn it, and then improve it or make it better"*.

The students also focused on the buildings, the ground plans for the rooms and so forth. The first building was not built for the purpose of being an elderly home, so the students found a lot of problems in relation to how the house was built. Accordingly, they decided to visit a newly built elderly home and came back rather disappointed concluding that the new home did not have any of the previously identified problems.

At this time, the students were very frustrated and they were even discussing if they were going to stop the Needfinding activities here. They compared their open-ended project with other student projects

which embarked from a requirement specification and hence, these students were already in concept evaluation phases. It seemed to the FEE students as if they had not made any progress. They wanted to start developing 'something', but could not agree on which needs they had identified, if any at all. Furthermore, the students were not comfortable with the lack of a 'real method', a method that they could apply in a direct way and just follow the steps. One student said, *"It would be nice if there was a method that we could use without changing it"*. However, it turned out that the students already had categorized elderly people into four groups. These groups were: those who could take care of themselves, those who needed limited help from partners or relatives, those who needed help from home service and those who lived in elderly homes. The students decided that the people who lived in elderly homes were likely to provide valuable information about needs for increased wellbeing. Based on these efforts the students could decide that they should study people and define what people to be studied. Again, the students were encouraged to do more observations and talking in the elderly home.
In this iteration, in a real-life elderly context, the students started to talk with the residents in elderly homes. The students concluded that it was rather difficult to find topics of conversations with the elderly people. *"It seems to us as if the elderly talk a lot about the homes that they have left and of course miss a lot. They show photos and talk about it when given a chance"*, the students told us. They asked the elderly about their needs and the answer was – we have it really nice here, we don't need anything. Thereby, the students concluded that the elderly were satisfied and that this drawback in expressing needs made the task of Needfinding difficult. The students decided to place a 'need box' at a strategic place in the elderly home so that the residents and the staff could write down their needs, ideas or problems directly. *"In this way,"* the students said, *"they do not need to keep them in mind until our next visit"*. However, the 'need box' did not meet their expectations; they found only one idea in the box. *"What are we going to do? Nothing really happens when we visit the elderly care home! The elderly just sit there in their wheelchairs waiting for… I don't know what they are waiting for"*. The students had talked with the staff about this matter, and they found that the staff had too little time to activate the elderly. Furthermore, the students had heard the staff telling stories, for example after a 'sing and dance' session an elderly man continued playing on his accordion during that evening. In the reflection of these visits and dialogues, the students started to focus on activity and stimulation to increase wellbeing for elderly people. They reframed wellbeing to encompass talking and thinking activities, and that each person should be treated as an individual. At first, the student team identified a number of needs and they stated that they would like to *"cover as many of these needs as possible and fulfill each need as strongly as possible"*. Over time, as they worked with the interpretation of their data, they decided to focus on keywords which were considered as representing identified needs of most importance – activity and stimulation from both a social and individual perspective. However, they still claimed that *"hopefully we can include some of the other needs as well"*.
Based on the keywords, the students started brainstorming sessions to visualize idea concepts, the context, the user and the problems. The students discussed ideas during one local brainstorming session (the US students visited the Swedish team) and during one distributed brainstorming session supported by video conferencing technology. The prototypes that were built were tested and evaluated with groups of elderly people. After the student project was finished, the students appreciated the project as a learning opportunity where they had developed capabilities to run need driven projects. Even though many of the needs actually remained tacit within the student teams, they evidently affected their product development.

7 TOWARDS NEED DRIVEN PRODUCT DEVELOPMENT

Archetypically, in product development, needs are interpreted and put together into requirements specifications by the sales and marketing functions. In this way, designers commonly do not interact directly with potential customers and do not take part in the interpretation of customer needs. Having this mode of operation, it is likely that designers do not have an understanding of the users' environment and points of view when the design process starts. Despite this, such understanding is emphasized as an initial step in integrated product development processes.
In Figure 3, starting from the left side, the marketing function is responsible for performing market research activities to gather the voice of the customer and translate it into needs and/or image statements and further into a requirement specification. The design function, right side in Figure 3, translates requirements into product specification. Handling needs in this way can be described as an

over-the-wall approach to needs. The 'wall' prevents designers to gain an understanding of people and their needs. The 'wall' might consist of organizational issues, e.g., the company structure can prevent boundary crossing collaboration. Or, the 'wall' might consist of cultural issues, such as when designers might prefer to focus on physical objects, or when designers prefer dealing with measurable aspects of both user and product behaviour. As we have noticed in the FEE project, the students felt more comfortable improving on already existing things and they applied a quantitative approach when they would like to focus on as many needs as possible and fulfil them as strongly as possible.

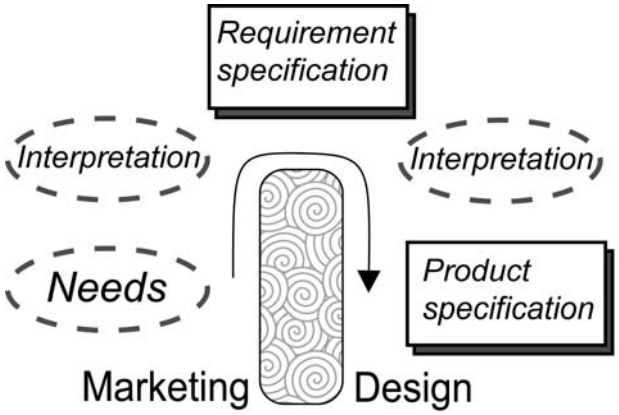

Figure 3. Interpretations of needs based on a traditional market research.

The customer-centric strand criticizes a product-centric view, since the latter view results in diverging perspectives affecting the product definition [2]. In Figure 2 (previous in section 5), the two views are represented. In a product-centric view the product is in the middle and in a customer-centric view the customer is in the middle. This customer focus is proposed to lead to a unified view and give the whole company a customer point of view. However, it can be argued that a unified customer view also might lead to fuzzy product definition since who the customer is is not a straightforward matter. Furthermore, customers might not be those who actually use the product [13]. In the FEE project, the users are elderly people and any people that interact with them on a daily basis, e.g., relatives, visitors, care givers. The customer in this case was the County Council who, it turned out does not have a direct contact with the product. However, this understanding was not available before the Needfinding/design process started.

Dealing with innovations, as in the student project, means that designers do not know the product beforehand, nor can they predict who the user/s and/or the customer/s are. These aspects have to co-evolve iteratively in the design process. Thus, neither a product-centric view, nor a customer-centric view does adequately support that co-evolution.

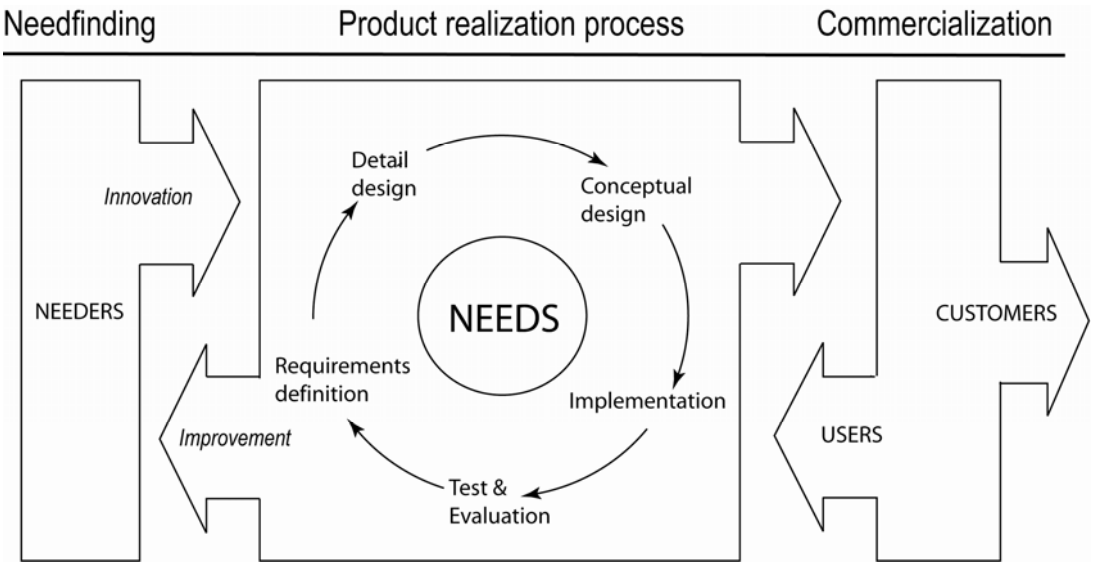

Figure 4. Need driven product development

An interest in people, their activities, their goals and their context, i.e., a focus on needs, seems useful to find opportunities for new products and innovations. A focus on needs to drive the product development process for innovations is suggested in Figure 4. Starting from the left, designers and, for example, marketing people apply a Needfinding approach to frame and prepare the project. By direct interaction in the area of concern, the people to be studied are identified ('Needers' in Figure 4). Needfinding activities, i.e., observations, 'interviews', are performed in quick iterations. Firstly, needs are identified and translated into need statements which in turn, frame and prepare the project [5]. The potential users and finally, the customers co-evolve in these participative and iterative activities, too.
The involvement of designers in these activities makes it possible to visualize idea concepts *and* users, since potential users become 'alive' and understandable in relation to the evolving new concept. Furthermore, a unified view of the product is likely to occur due to a collaborative effort in identifying needs *and* visualizing idea concepts. The efficiency of such a process is dependent on the designers' training and experiences in qualitative Needfinding activities, as well as being confident in the flexibility of the process. Designers and engineers can be trained to deal with needs in fuzzy front end activities, where the aim is to keep as much fuzziness as needed for the creative process to support the design of innovative products. Innovation opportunities might be discovered by designers being 'purposefully fuzzy', that is, having capabilities to avoid delimiting the design space and exploiting innovation opportunities grounded in peoples needs.
The middle section in Figure 4 represents a product realization process focusing on needs identified by applying Needfinding. On the right, the identified users and customers are involved in testing and evaluation of the product to improve it according to stated requirements. In this way, the product development process is framed by a Needfinding approach and can be seen as need driven.

8 CONCLUDING REMARK

In this paper, practical activities of Needfinding – an intertwined approach to identify needs and to visualize idea concepts in early design – are described and discussed. This is done to gain insights into what are currently perceived as fuzzy front end activities in team-based product innovation. Aiming for innovations, a limitation for applying a customer-centric view is that it is not possible to identify who the customer is at a planning stage before product development starts. Trying to do so, the design team is forced to make vital decisions on the basis of an insufficient understanding of people's needs.
In innovative projects, through the application of a Needfinding approach, Needers – those people who experience a lack of a solution to their problematic situation and thereby, 'own' the need – can be identified. Also, customers and/or users can be identified and the solution can be further detailed in compliance with the identified and thoroughly analysed needs. A need driven product development process is likely to support the co-evolvement of these issues in early phases of innovative projects.

9 FURTHER RESEARCH

Our study contributes in general to a customer-centric view, but in particular to a need driven product development process where Needfinding activities make the design team truly committed to needs and give needs high fidelity throughout the whole process. However, in our study we have found that some needs remained tacit within the design team. So, the transition of needs into product development activities still has to be further investigated. For example, how can identified needs (in this case only key words) be transferred to those who did not participate in the Needfinding activities?
From an engineering point of view, a process is preferably systematic. The IDEO process is perceived by them as an organized effort, but as they admit, it seems chaotic [9]. On one hand, being too organized can prevent innovation. On the other hand, being too flexible might increase confusion and disagreement. Further research is suggested concerning how designers apply creativity and deal with ambiguity in formal and systematic processes in their daily work.

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