Prototypes for new mobile services were developed according to a main principle of continuous user involvement within a frame of integrated product development. The designing of concepts and prototypes followed a development model that is grounded in an understanding of the users’ everyday lives. The purpose of the study is to uncover the experiences and views among participating development team members regarding the integration, and to uncover experiences and views of the users being involved. The work of the multidisciplinary development team was heavily dependent on continuous integrating communication to follow the main principle, which is guided by qualitative research methodology.

INTRODUCTION
The project “Integrated product development of mobile services” was carried out in collaboration with a partner in the mobile phone operations industry. According to the partner, the product development tradition in this industry is development of technology and hardware. The industrial purpose of this project was to integrate the customer perspective in the development process.

The research area ‘integrated product development’ focuses on development of hardware [1], [2], [3], [4]. The term product stands for something that is “...engineered, discrete, and physical” [2], (p.2). “It is an acknowledged fact that all products are manufactured...” [3], (p.148).

In this globally competing industry, the focus is shifting towards the market. This indicates a new orientation, where focus is on the customers and users of services. The research areas of services and relationship marketing have an explicit focus on the customer. According to the marketing concept, the customer should be at the centre of the company’s strategy; “the company should be seen from the point of view of its final result, that is, from the customer’s point of view” [5], (p.36). Campbell and Cooper [6] ask for more research on how customers can be involved in the process of product development. The issue is how to accomplish integrated product development driven by customer orientation.

From the perspective of relationship marketing, relationships are in focus. Relationship marketing literature discusses products, as either goods or services or a combination of the two [7], [8]. This means that the concept of product can be defined as whatever the customer demand is, i.e. an abstract product term. The definition of ‘product’ in this project considers new products, adopting the abstract product definition.

Today, 80 % of the working population in Sweden is employed in service industry. The situation in all the developed countries is very much the same. Services marketing
research identified this trend a few decades ago. This recognition is present today in literature on digital services. Dahlbom [9] argues for a perspective of a service society in the software industry, where the focus is "...on services and their consumption more than on goods and their production." (p.106).

The logic of services is different from the logic of hardware. "Whereas goods are manufactured, services are performed" [10], (p.65). Services are produced and consumed otherwise than hardware [7], [8], [11]. Services are "...produced, delivered and consumed in time and space where processes overlap..." [11], (p.920). Services are partly produced and consumed at the same time [7], [8]. According to services marketing, all products regardless what they offer, can be viewed as a service, that is, a solution of the customers’ problems [12]. It is in the activities that a service is developed in concurrence with the customers’ activities. The quality of a service is not only dependent on the results of the processes, but also of the processes themselves.

In our study, the development process is designed according to the main principle of continuous user involvement. The project is based on the premise that development of new mobile services benefit from being driven by a customer orientation. A central aspect in the project is the integration between competences in marketing, systems science and software technology. The strategy within the frame of integrated product development is to create a balance between two disciplines in the development team; the field of software technology and the field of systems science. The users do not participate on their own in collaboration with technicians.

The vision is mobile services development where needs and wants of users are integrated with possibilities and limitations of technology. The mission is to contribute to understanding of how technologically driven product development, labeled as customer orientated, can evolve into being driven by customer orientation within a holistic strategy.

Purpose

In the context of the project, we design a development model in order to visualize the process reflecting the status of our understanding in the beginning of the project. In order to advance integration in product development with continuous user involvement, we study the process.

The purpose of the study is to uncover the experiences and views among participating development team members regarding the integration, and to uncover experiences and views of the users being involved.

Disposition of the paper

In the following, we outline the frame of integrated product development. We discuss the shortcomings of using the methods suggested in traditional integrated product development literature in development of mobile services. We discuss product development literature with a customer orientation.

The qualitative approach guiding the project and the empirical study is presented, whereafter the design of the development model is visualised. Each phase is described, focusing on the tactics in creating continuous user involvement. The paper concludes by presenting empirical results, conclusions and managerial implications.

INTEGRATED PRODUCT DEVELOPMENT

Product development literature focuses on engineering areas, such as mechanical, electrical, software or construction areas [13]. A product development process is described as "... the sequence of steps or activities that an enterprise employs to
conceive, design, and commercialize a product” [2], (p.14). In an integrated product development process, the working tasks within the functions marketing, design and production, should be carried out concurrently in a parallel process [1], [4], [13], [14], [15]. The product development has through involving the whole business become integrated product development [1].

Design is vital to product development; hence it is also vital to product development research. Design is a generic term and is applied to a vast spectrum of areas. In spite of the focus on design in product development, commonly accepted definitions of the term does not exist [16]. From the viewpoint of information systems design, however, design is everything from the skill and ability of the individual designer to the overall strategic issues in the organisation [17]. Consequently, it is not possible to generate a unifying definition. To do so, is in itself an activity of design. Every design process needs to be designed [17]. The design process as such, is defined by Ullman [13] as “...the organization and management of people and the information they develop in the evolution of a product” (p.8).

Traditionally, the specific way to design hardware is known as the ‘over-the-wall’ design process [13] or ‘over-the fence’ engineering [15]. The engineering design process was walled off from other product development functions. Information or one-way communication was ‘thrown over the wall’. Marketing people informed design engineers about a perceived market need in a simple, written request or often even orally [13]. Design engineers interpreted the information and transformed it into a manufacturing specification. The specification was ‘thrown over the wall’ to the production units, which interpreted the information and built what they thought the design engineers wanted [13].

Due to the increasing complexity in modern technology it is today rarely possible for an individual to design and develop a major new product by him or herself [13], [15]. A design team or development team is required and this introduces problems of organisation and communication [1]. These design teams are recommended to be multi-disciplinary [1], [3], [4] and covering sufficient diversity of knowledge [2]. Working in design teams adds a social aspect to the design process. The design problems as such will be solved in the same way as individuals do, but each team member interprets the problem differently, has different suggestions for solving it, and has different knowledge [13].

The transition from individual design into design teams has also an effect on the product development process. The traditional product development process, conducted in a sequential manner, where the user needs were handed over from marketing to design to production, seems not to be adapted to its purpose when design teams are involved. Baxter [4] sees two reasons for carrying out the product development concurrently. Firstly, it will shorten lead times. “Secondly, and probably more important, working together jointly ensures that the product does everything it must to be a commercial success.” (p.18).

Customer orientation in product development

Representations of integrated product development processes are customer-oriented [1], [2], [3]. The designer must be fanatically customer-oriented and comfortable in marketing, design and engineering disciplines [4]. Investigation of the user needs is indicated as the first step and therefore the models can be labelled as being user oriented. This does not automatically mean that the development is driven by customer orientation.
The product development process can be triggered by for example the development of a new technology or a market opportunity [2]. A technology-driven product builds its core benefits on its technology and a user-driven product obtains its core benefits from its interface and/or its aesthetic appeal. A mobile phone is classified as a product that is a combination of the two categories [2].

Regardless of what initiates the process, some kind of market research or customer analysis is suggested to be the starting point in integrated product development models [1], [2], [3]. There are some criticisms of market research, made by product designers [4]. They claim that market research limits design opportunities to the lowest common characteristic of customer taste. And furthermore, product designers say that customers can not express that “they want a truly innovative product that they have never ever imagined before” [4], (p.156). To Baxter [4] this is a criticism of poor or unimaginative market research, not of the market research as such.

The techniques for investigation of customer needs brought forward by Baxter [4] are quantitative surveys and qualitative surveys. Ulrich and Eppinger [2] state that identifying customer needs is in itself a process. They suggest a six-step methodology, which they in turn suggest should be seen as a starting point for continuous improvement and refinement. The six steps are (1) define the scope of the effort, (2) gather raw data from customers, (3) interpret the raw data in terms of customer needs, (4) organize the needs into a hierarchy of needs, (5) establish the relative importance of the needs and (6) reflect on the results and the process (p.35). Gathering raw data from customers involves contact with customers and meetings with the customers in their environment. This “...interaction with customers in the target market will help the development team develop a personal understanding of the user’s environment and point of view” (p.36). Furthermore, Ulrich and Eppinger [2] give some general hints for effective interaction with customers. One of the hints is to go with the flow, to let the customer provide you with interesting information and not to worry about the interview guide. “The goal is to gather interesting and important data on customer needs, not to complete the interview guide in the allotted time” (p.41).

Hyysalo [18] brings forward some critique towards the product development literature and particularly towards methods to investigate and gather user requirements and needs: firstly, there is an emphasis on the quantitative approach, that is, the user need should be measured and transformed into characteristics of the emerging product. The dilemma is that all user needs can not be measured. Secondly, the term ‘user need’ is applied without a clear definition. And thirdly, “the standard view takes user preferences and needs as something given or pre-existing that can be recognized and met” (p.120). Hyysalo concludes that “... user investigations may not guide product development, but rather tend to inform it in minor ways...” (p.135). Further, he suggests the creation of “temporary extended collaborative relationships with potential users instead of snapshot inquires, whatever their kind. Repeating the exploratory sessions with some users may be warranted to enable them to articulate, in depth, their emerging needs in relation to the new technology” (p.135). Baxter [4] suggests that “The best way, by far, to discover customer needs is to go out and talk to customers” (p.156).

Von Hippel [19] introduces the user-dominated innovation process, where the user is the primary actor. The user dominates the process in all the first stages of the process; identifying needs, research and development, prototype building. It is only in the last stage that the manufacturer is the primary actor, applying, commercializing and diffusing the product.
Kaulio [20], in his review of product development literature with a customer involvement, makes three clusters of methods depending on the depth of customer involvement. For the clustering, he uses a classification depending on if the design is for, with or by the user. In the ‘design by’ strategy, he mentions the lead user method by von Hippel, consumer idealized design and participatory ergonomics.

For the design of the development model in this project, we make use of our frame of integrated product development, the customer oriented approaches reviewed in the section above, together with an understanding of the marketing concept.

**METHODOLOGY**

The project was guided by a qualitative approach. Qualitative methodology assumes that every phenomenon is a complex combination of qualities. It is the combination of qualities that distinguishes it from other phenomena. As a comparison, it can be mentioned that the underlying assumption of quantitative methodology is that the distinguishable aspect is the quantity of a certain quality [21].

Qualitative methods accordingly seek to understand the combination of qualities of phenomena under study and to “get access to reality” [22]. In this study, empirical material was generated with a holistic interest in the phenomenon being studied.

We use the concept “generate material” in order to highlight the substance of the work that the qualitative researcher performs. The concepts ‘gather/collect/record/get data’ are deliberately avoided because of the associations they may give rise to. ‘Collection of data’ may lead one to think that it is actually possible to go out and collect data, as if data was waiting to be collected [23]. This is however possible if you have a quantitative purpose of wanting to measure, count or weigh something.

With the concept of ‘generating material’ we have two purposes. First, we want to highlight that relevant empirical material for distinguishing a phenomenon is not easily accessible, it requires much work to acquire a holistic access to it. Second, we want to highlight the fact that the researcher interacts with the interviewee, who then is not a respondent answering to questions. The art of listening is of greater value than the art of asking questions when generating material. [24].

Figure 1 visualizes the design of the project. The frame is the research area, i.e. product development with a customer orientation. In order to accomplish this orientation, the users are in the core of the project. The middle level is the development team, which is the multidisciplinary student team.

The qualitative approach guided all three levels depicted in figure 1. The research level, which is the framework of the project, warrants that the qualitative methodology used is in harmony throughout all levels.

![Figure 1: The three substance levels of the project](image-url)
On the levels of the development work, the qualitative methodology has been used, with group interviewing as the method used. On the research level, group interviewing was conducted for uncovering experiences and views of both users and the development team. The users were interviewed after having tested the prototypes. The development team was interviewed twice, after the second and the third phase. The development team was interviewed as a team and they were also split up into the two competence groups.

Group interviewing creates another type of access and interaction than individual interviewing. The researcher interacts with many interviewees at the same time as they interact among each other. The participants must be familiar with the studied phenomenon and willing to participate in a group interview. [22]

INTEGRATED PRODUCT DEVELOPMENT WITH A CONTINUOUS USER INVOLVEMENT

The integrated development team was multidisciplinary in its setting, in order to integrate competence in user involvement with software technology competence. The team consisted of five students from two different disciplines studying for two different exams; master of science in systems science and civil engineer in software technology.

The development model is visualized in figure 2. The design of the development model is a follow-up of the abstraction in figure 1. The circular form of figure 1 is stretched out, as shown in the figure below. There are two levels in the model, where the basic loop line represents the continuous user involvement. The upper line represents the integrated development work. Depending on focus in each phase of the process, the dominating competence varies. The model consists of three phases; needfinding, concepting and prototyping. The project ends with testing of prototypes. In the needfinding phase, the students of systems science dominate. In the concepting phase, both competence groups were planned to have equal input. The prototyping phase was planned to be dominated by the students of software technology.

![Figure 2: The design of the development model ‘integrated product development with a continuous user involvement’](image)

**The needfinding phase**

On the development level, the systems science students - the ‘user involvement competence group’ - worked together with the researcher. The researcher, who has a Ph.D degree in marketing took an active part in the development team only in this phase. In the other phases, the role of the researcher was to generate material about the
process. The team work in this phase on the development level consisted of planning the activities on the user involvement level. Strategically chosen categories of the target group, young people aged 16-25, were interviewed. One category consisted of college students aged 16-18. The segment 19-25 was divided into two categories; university students and blue collar workers. The interviewees were chosen to hold certain qualities. They were opinion leaders in their category, extrovert and expressive. The judgement is that these qualities make it possible for the interviewees to communicate and to be critical and also to envision possibilities. Each category was divided into three groups; women, men and a mixed group.

The content of the user involvement level is group interviewing, represented by the user involvement group “going down” into the first user involvement loop. There were nine sessions, which lasted one and a half hours on average. The participants were served refreshments during the social gathering which took place prior to the interview. The interview was taped and transcribed. In each session, the interviewing was done by two moderators - one student of systems science and the researcher. The role of the moderators was to initiate the session and the interview, to ask questions and to make it possible for everyone to express themselves. The moderators strived for an informal atmosphere. The format of the interviews was semi structured in order to secure flexibility and to allow the users’ own thoughts and views to emerge.

The sessions consisted of three parts. The first part was an open-ended discussion about the life style and activities of the participating users, in relation to the theme of the session “mobility and habits of mobility”. In the second and the third part, two kinds of stimulus material was used; a film with a future scenario of mobile services usage and a document with two different stereotyped users of imaginary mobile services. This material was produced by the industry partner. After the film, the users where asked about their spontaneous thoughts. After the resulting discussion, the stereotypes were presented which was followed by a lively discussion about the pro’s and con’s of the proposed imaginary services.

In this phase, the overriding purpose was to generate material about the everyday lives of the users as well as material regarding their expressed and unexpressed ideas about new mobile services.

The concepting phase

On the development level, the plan was to integrate the two competences of the team according to an equal input. First, the software technology competence group received the transcribed interview material from the previous phase. Second, all participants in the development team took part in a brainstorming session, where the material from the previous phase formed the basis for creating ideas for service concepts. The third part on the development level of the concepting phase was to sort out and evaluate the generated ideas. After a few meetings where the two competence groups collaborated, concept ideas came out of the process. These were placed into three different user scenarios in order to serve as presentation material on the user involvement level. The reason for choosing scenarios was the possibility to visualize and present the service concepts in a user context so that the users would get a sense of when, where and how the services could be used.

On the user involvement level of this phase, the group interviews were much more structured, since the users were to respond to the presented service concepts within the scenario contexts. One person from each competence group constituted the pair of moderators. The interview sessions lasted 30-60 minutes and were tape recorded.
In this phase, the overriding purpose was to let the users interact with the generated service concepts and generate material on the basis of their comments. Concepts found relevant by the users would form the basis for prototypes. When involving the users, it was of great importance to find new functions on the basis of the proposed concepts, to come up with matching services and to discuss pro’s and con’s of the concepts being discussed.

The prototyping phase

The design work was based on the concepts generated and approved of in the previous phase. First, the technology group designed and programmed two prototypes without any substantial interaction with the user involvement group. The project management redesigned the development team after realizing the problems the team had to organize for integration. A person with a degree in human-machine interaction was hired to coordinate the development team. A decisive change that happened was that visualizations, documents of design propositions now were produced for the rest of the prototypes. The design propositions became the tool that helped the integration take place in the development team. All participants in the development team gave their view, which resulted in an evolvement of the design. When all team members were satisfied with the design, the implementation of the prototype started. When ready to test, the prototypes were tested internally in the team.

On the user involvement level, the work consisted of having the prototypes being tested by the users. This included a test of the prototype and a group interview about the experience of the service function.

In this phase, only university students participated as users, due to the industry partner’s request. Fifteen people took part, both women and men. The user group was divided into three mixed groups, where both technological fields and social fields were represented. There were four sessions and each lasted one and a half hour. Two people from the development team participated on the user involvement level; one person from the user involvement group together with the new team member. In the testing session, the purpose was first introduced, whereafter the moderators instructed the users about how to use the hardware used in the test. It was important that the users felt comfortable with the devices, even though they were informed about the actual irrelevance of the hardware in this project.

The overriding purpose of this phase was to generate material about the users’ experience with the service prototypes’ functions and the usability.

EMPIRICAL RESULTS

The results are twofold. First, understanding of how young consumers experience and view their own participation in the product development work, and second, how the participating team members from the two different disciplines experience their roles and integration with ‘the others’ in the development team.

The users’ experiences and views of being involved

The users who have been involved in the development process express a feeling of having been listened to, that they have gotten response on their input. It also seems to be important to give users a possibility to be part of more than just the first phase. For the group in this case, the most appealing for them was indeed the possibility to test the new prototypes of mobile services. A general view is that it has been fun, and the phase they tend to refer to is the last one, the prototype test.
Regarding the method used, group interviewing, all users see more positive aspects than negative with the method. Their impression is that the small group (approximately five users) is very good in the sense that more ideas come up which gives rise to more thoughts and comments. In short, group interviewing and group testing created synergy in this study.

The only negative aspect they can think of is that one doesn’t always explicitly express “the obvious”, which could easily be tracked with for example the method of diary keeping. Another possible danger of group interviewing and group testing is that group size can get too big.

In a future scenario, where these users are working people with families, they cannot say if they would put priority on involvement in product development similar to this case. The diary method would not be realistic in such a scenario according to the users interviewed.

The users who participated wanted to take part in possible coming development projects and also expressed an interest to participate in a project developing hardware according to the principle used in this project.

The participating team members’ experiences and views of the integration

The cultures of the two competence groups vary a lot. The members of the software technology group experienced the interaction in the two first phases as “chaotic”. The members of the user involvement group could sense their colleagues’ anxiety during the concepting phase, when the integration was planned to happen. For the researcher and the students of systems science, a meeting could very well be a discussion of two hours, whereas a meeting would mean a half hour decision meeting for the students of software technology. The students of systems science expected discussions about loosely defined issues that would be scrutinized from different angles, whereas the technology students expected well defined issues within the concept of meeting. The perspective of the technology students is that “the goal and the road to that goal should be clear”. The perspective of the user involvement group members is quite different, they want the previous expression to be exchanged for “vision”, which they think is enough as a guideline. The user involvement group has the experience of working “very interactively, back and forth, up and down, with no linear processes”.

An important issue mentioned by the user involvement group was that this development model would require social interaction prior to the project and also during the project, “It is always difficult to interact with someone you don’t know - if you don’t know their competence and their way of working”.

In the prototyping phase, there was confusion regarding the design process. Without distinct design documents, the team members did not interact in the prototyping phase. The development model contains no transactions of user requirements, all information is supposed to be shared in the integration. The understanding of who was the subject when the prototypes where tested differed among the groups. The vocabulary used by the software technology group, indicates that they regard the development team as the ‘subject’ testing the prototypes with the users as ‘objects’. The principle of continuous user involvement requires that the users are the subjects testing the prototypes.

The team members welcome more equal collaboration in all the three phases, not just in the concepiting phase. The technology students came actively into the development work after the needfing phase was finished. In the interviews, they expressed that they would have wanted to participate in some of the group interviews in the needfing phase, and not just in the concepiting phase. The students of systems science wanted to participate and have a greater impact in the prototyping phase. This
was partly corrected already in the project, due to the improved process regarding design documents. One expression about the collaboration:

"The collaboration in the concepting phase was valuable. All of us created a synergy effect due to the matching between our competences. When we systems science students became too creative and innovative, the technology students got us down to earth again. And the other way around; when they became restricted by today’s technology and the question of implementation, we urged them to relax. All coins have two sides, and sure, there were moments when we didn’t progress at all. Sometimes we locked up each other more than we created synergy. That felt frustrating and inefficient, but maybe most projects are like that once in a while. Research is a lot about definitions and finding precise meanings of words."

CONCLUSIONS

By advancing integration in product development with continuous user involvement, the goal is to contribute to product development driven by customer orientation. The purpose of the study is to uncover the experiences and views among development team members regarding the integration, and to uncover experiences and views of the users being involved.

The users involved in the development process clearly expressed a feeling of having been important actors and that they had gotten response on their input. A general view is that it has been fun being involved and part of developing something new.

A critical part for execution of the principle of continuous user involvement is the integration between team members from different competence areas. An important conclusion is that integration requires interaction and communication – and that it is of utmost importance that the communication has a positive effect on integration. One issue concerning interaction is that individuals with different backgrounds and competences need to have concrete tools for communication, like design documents.

The elements of communication are also very important. People from different competence areas and cultures use the same words for different concepts, which creates differing expectations. One example is the basic concept “meeting”, which may give rise to differing expectations regarding time and substance, depending on the educational and professional background of the team member.

The development model is modified due to the findings; that the team members want more integration throughout the whole process and that the communication is vital. The advanced model, in figure 3, contains a semi-level, in order to highlight the continuous integrating communication among team members representing different competence areas. This semi-level with the small loops is placed between the user involvement level and the development level - to show the integration between competence areas and that the integrating communication carries the development work. Through its communication substance, the line with the small loops indicates that no competence group has a total dominance in any phase of the process. All team members should have the possibility to get impressions and to impact through the continuous integrating communication.
In order for the communication to enhance integration, it must be grounded in a common understanding of the users’ needs and wants in relation to the services being developed.

Today, with the increasing pressure to develop services that satisfy customer needs, different kinds of competence are required in the development work. It becomes critical to understand the users’ behaviour and visions. In industry, the culture and tradition is development and engineering of physical products. Industry is by tradition also guided by a quantitative measurement approach. However, understanding of complex phenomena - such as users - requires a qualitative approach that never measures anything. A culture clash may often be the case when striving for integration between such different cultures and views. For example, the view regarding test of prototypes may be different; if the user is an actor testing prototypes or an object being exposed to prototypes being tested.

In an evolution towards product development driven by customer orientation, it is important to go beyond the customer concept. The quality ‘user’ of the customer is relevant in product development. It is in the usage that the customer benefits from the product, bought in his or her role as a customer. Consequently, a strategy for involving the user promotes product development driven by customer orientation. Customer orientation requires user involvement.

We argue that product development driven by customer orientation explicitly requires continuous integrating communication within multidisciplinary teams. A shift in focus, from technology to customer as user - within a holistic strategy - does not mean that neither hardware nor technique is neglected. A mobile service is not useful without being implemented on a hardware platform and vice versa. A service is nothing without users. The normative purpose of our model in figure 3 is to contribute to development of products that creates customers and satisfied users. The advanced development model ‘continuous integrating communication in product development with a user involvement’ benefits and supports the whole development process, of both hardware and services.

**MANAGERIAL IMPLICATIONS**

On a company level, the generated understanding may serve as one input to implementation of a customer orientation in development of new products. One concrete consequence may be to employ team members not only with technological knowledge, but also team members with adequate knowledge of user involvement. Both competence groups must have sophisticated communication skills.
On the project management level, when involving the user in the product development process, the results regarding the communication requirements and the possible difficulties between the different actors are critical.

Integrated development projects with a user involvement strategy need very clear project phases, in order not to go through the process without enough integrating discussions.

It is critical to create an initial phase for socializing, with follow-ups, with the purpose of getting to know the other team members.

The team members need education and training in qualitative approach and methodology.

The competence groups within the development team need education regarding the characteristics and basic assumptions in their respective cultures.

By making a difference between meetings for discussion and decision making, it is possible to get the team members to join meetings with the same expectations.

Specific meetings for discussing the project vocabulary and defining meanings of critical concepts are critical.

There has to be real incentives present in the development process in order to attract users with limited time resources.

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