

# “We try to listen – but do we understand?” An explorative study about user involvement in technology-driven organisations

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## Abstract

Technology-driven organisations are facing new challenges to gain a competitive advantage. It becomes even more challenging to be a step ahead of the competition through technical advance while better addressing user needs may be a way to differentiate. When aiming to develop products that better address the user needs it becomes crucial to understand who are the users and what are their needs, what is the value of user information, and how the information can be used to design more desirable products that may lead to a competitive advantage.

We conducted a multiple case study at two technology-driven companies in the aviation and healthcare industry that are aiming to involve users more into the new product development (NPD) process. A series of 14 qualitative interviews revealed two main findings that are discussed: (1) there are different types of information needs according to the development stages and (2) the value of user involvement needs to be recognised from both, the company and its customers.

**Keywords:** *User involvement, new product development, key performance indicators*

## 1 Introduction

Technology-driven and highly regulated industries like aviation and healthcare tend to have certain key performance indicators (KPIs) in place according to which design prioritisations are set and decisions are made within product development processes. Such KPIs include safety, reliability, and operating cost, which ought to be measurable so they can be traced back systematically in order to verify that initial product intentions have been met, provide clients with numeric variables as sales arguments, and allow for documentation according to regulatory requirements. However, there is a general trend towards developing more user-oriented products and integrating the user perspective at the early stages of a new product development process in order to develop products that are actually needed and to avoid major and costly design changes at the later stages. This implies a necessity for companies to better understand who their users are, what they actually want, and how companies can make the

right design choices accordingly to deliver solutions that satisfy those needs. It therefore becomes interesting to explore if and how development processes of complex products and user involvement approaches are complementary to or conflicting with each other in the case of technology-driven and regulated industries.

Prior research suggests that companies involve users at different stages of a development process [1]. However, there are also challenges especially in the case of complex and technology-intense products due to scarce resources, technology-driven development processes, as well as limited access to end users [2], [3]. Acknowledging these challenges, this explorative study further builds on these findings and highlights the type of information that is required for making the right design choices during the development process and discusses the value of user information for technology-driven companies. The study presents an overview of the respective challenges and needs regarding user involvement based on the practical context of two companies' development processes within the aviation and healthcare industry.

In the following paragraph, we will explain the explorative nature of this study and our methodological approach. Then, we present the findings from both cases individually before discussing the results in terms of a cross-case analysis and linking them to our theoretical contribution. The conclusion summarises the discussion, provides practical implications, and gives recommendations for potential future research.

## **2 Methodology**

According to Eisenhardt [4], the case study method is suitable for theory-creating, exploratory investigations. Case studies are aiming to answer questions such as *how* certain phenomena occur [5] and therefore a multiple case-study approach was deemed appropriate given the exploratory nature of this study. Research validity was taken into account through a prior defined case study design that was followed throughout the study [5].

The cases were selected due to the high-tech nature of the products, suggesting a strong focus on technical capabilities. Both, medical devices and airplanes have long development cycles, operate in a strongly regulated environment and a business-to-business context. We selected our interviewees according to their position in the development process as our interest is to reveal the companies' needs for user information, their understanding of a user, the value of user involvement, challenges of user involvement, and how user information can be applied in their development process. This led to a selection of people working within the product development process as well as in the pre-development phases, which refer to the stages prior to project commitment. Interviewees include innovation managers, marketing managers, R&D managers and R&D engineers. Taking into account various levels of the organisation allowed us to include differing views on user involvement as proposed by Lassen & Nielsen [6].

The data was collected using a series of 14 qualitative semi-structured interviews, seven in each case company. Semi-structured interviews are useful when broad issues are understood by the researchers, but the range of reactions is not entirely known [7]. All interviews were recorded and lasted between 50 and 80 minutes with a mean of 60 minutes. Both authors were present at all interviews and took structured notes. One researcher led through the questions and the other one asked clarifying questions when needed. The data collection and analysis took place in a condensed format, allowing us to immerse into the cases. Informal, yet lengthy discussions in between the interviews as well as throughout the analysis helped us to capture

emerging topics. Overlapping data generation and data analysis allows to gain deeper insights by probing emergent themes and accelerates the analysis process [4]. While the latter was significant in this study, emergent themes were addressed during the interviews without changing the semi-structured interview approach.

First, the taken notes were analysed and digitalised individually. Key findings as well as further topics to explore were identified individually. In a second step, we discussed the interviews and the insights of both individual researchers and combined them. The seven interviews of each case were discussed first as proposed by Eisenhardt [4], followed by a subsequent within-case analysis, where key findings were mapped and topic clusters were built. These topic clusters were first structured according to the interview questions, but then iterated based on the insights from the cases.

Subsequently, after both within-case analyses the findings from both cases were combined. The scope of this combination was to find recurring themes and complement the insights following the exploratory nature of this paper. These combined findings formed the base for the discussion on user involvement in technological-driven companies.

### **3 Findings**

#### **3.1 Information needs**

The type of information that was seen crucial by the interviewees is mostly workflow-related as well as the context of use. The information needs vary according to the area of responsibility of the interviewee. We identified two main categories of information needs in the two case studies: unspecific, general information and more specific information within the development process.

The unspecific, general information mentioned is to understand the overall use situation of the product. This unspecific information was reported to have motivational qualities as well as helps engineers to understand user values on a general level. In this category, big ideas from users that may serve as a challenge for engineers working in the pre-development phase were also mentioned.

Within the development process, the information needs change according to the stages from unspecific, high-level information in the beginning of the process to more specific, detailed information in later stages. Furthermore, information about the users is required at specific timings in the development process, especially when making decisions. In the beginning of the development process, fast iterations on top-level requirements of a project demand instant user feedback. There, the amount of information needed is concentrated to fit the top-level requirements. User information was often mentioned as means to prioritise which features should be developed. There are differences in user needs concerned to the customer segments.

Regulatory requirements demand for testing the usability to avoid risks. Risk-related factors were reported to imply a high level of priority for further development and are addressed immediately.

Besides getting information from users, the documentation of user feedback has been seen crucial in order to codify tacit knowledge and evaluate afterwards whether the feedback has been addressed or not. Furthermore, information how things are perceived and accepted by users is desired. This information may be challenging to include in the development process

due to the intangible, emotional nature of the information and the resulting difficulty to codify this information.

### **3.2 Information format**

Concerning the information format, a difference could be observed in the type of user information required: more specific feedback in the development process was desired in form of text, with a possibility to be specified in requirements for the product-to-be in order to be applied in practice. User information on specific issues should be available in a standardised format and applicable to the development process, possible to quantify while still describing the issue at hand.

However, general feedback about the context of use in which the company's product is situated was often requested as visual input, using storyboards, video, scenarios, role-plays, and cartoons to communicate how the device is used. Two interviewees mentioned the motivational aspects of user events, where a user shares insights and anecdotes as well as visions. The most desired information format is direct interaction with users. The interviewees perceived indirect information as potentially biased and pre-filtered beforehand, thus a challenge may be how to improve the reliability of the information collected. While talking about the direct exchange, one interviewee with previous experience in direct user involvement highlighted the necessity to emphasise mutual learning of both the user and the company. Furthermore, it was mentioned that it is "hard to ask the right questions and get the right answers" when not interacting with the user personally. However, having a high level of personal user involvement inside the company may lead to a burden for users. Visual input as well as face-to-face communication happens currently seldom in the case companies.

### **3.3 Information usage**

We found it interesting to observe that the usage of information is different in both case companies. While the interviewees in the first case company mentioned concrete applications for user information, the interviewees in the second case company had a more vague idea of how the user information can be used. In the first case company, the information is used mainly two-fold: for setting development priorities (what should be developed) and for the implementation (how something is developed). Applying user information for setting development priorities aims to ensure that those features are implemented, that are most important for the users.

During implementation, the responsible engineer designer or developer needs to make choices concerning how a feature is implemented. In order to make the right choices, the engineer designer and developer need to understand how the device is used. Feedback from users is desired to evaluate whether the right choices are made. However, currently there is a lack of usable feedback and systematic approach. Thus, this evaluation would need to be improved in the eyes of the interviewees. Despite the lack of a systematic approach, important decisions are often based on usability.

Lastly, integrating the user perspective into NPD is perceived by the interviewees to open up new challenges and opportunities through usability that pushes the development forward as the organisation has been very technology-driven. Another interviewee's opinion is that especially for product owners direct user contact is important in order to detect new opportunities and understand real user needs.

Some of the the interviewees only sparsely identified potential applications for user information. In one case company, it was mentioned that user information is used as legitimising factor for changing requirements. This application of user information was perceived very powerful, especially as the user may belong to a customer organisation, resulting in outside pressure on the case company. Further, user information is used to develop clusters of users according to shared characteristics, which can be subsequently addressed for user involvement.

### **3.4 Main challenges**

One challenge that was frequently mentioned is to design for the wrong users, as the most active and accessible users are advanced research users whose needs might differ to the standard users. Designing for the wrong users was seen even as disadvantageous by one interviewee because development priorities are set wrong. The interviewee highlighted that the emphasis on advanced users most likely will not become business opportunities soon, as the spread of a new technology into an industry standard takes very long time. Scarce R&D resources in combination with faulty prioritisation implies that other features, which may be important for standard users are not addressed. A method to include the standard user perspective is to have user proxies as an integral part of the development team since they have previously been working in the context of use, meaning they were actual users. However, these user proxies are also criticised for being biased through their constant involvement in R&D processes.

Currently, users are involved on a case-by-case basis and many interviewees mentioned that it would be preferred to have a more systematic and methodological approach regarding the involvement of users or understanding their needs.

Another main challenge is to set the expectations of users involved as well as the methods to get usable feedback as users have difficulties imagining future systems. In order to provide relevant feedback, users need to be put into the position to imagine their use situation in the future. Asking about radical concepts provides hardly usable information, thus methods are needed to get users into a future mindset as well as to evaluate radical new concepts.

It was frequently mentioned that it is necessary to “show something” to get feedback. However, it was criticised that the users do not understand the stage of the R&D process and the level of detail of the prototype and thus face difficulties to give valuable feedback. This leads to the challenge that information obtained from users might not be applicable to the development process.

Information distributed by supporting departments is not constantly used in new product development projects. One explanation given by the interviewees is that user needs are often tacit and on an emotional level. Thus, it is perceived challenging to translate these needs into functional requirements, which form the basis of the development process. Without documenting the user needs, the decision whether user information is applied becomes highly dependent on key persons such as project managers and their view on the importance of user involvement. One opportunity to include user information was mentioned as the concept of envelopes, opening corridors of what is acceptable for users, in which development engineers can make design choices.

### **3.5 Emerging thoughts**

One aspect that became evident to us during the interviews is that much importance is given to usability. It was said that user involvement potentially increases the usability of the products under development, which in turn can become a competitive advantage since standard users have more demand for usability and it is hard to compete on technological system aspects in such a technology-driven industry according to the responses.

Usability is also becoming more important in terms of standards and regulations, which means that usability has a direct link also to risk management, hence is given higher priority in the development process. It was also mentioned that in order to actually design for usability and maintain it as driver in the design decisions, it was recommended that usability aspects should have a link to more traditional KPIs, such as reliability, safety, and operating cost. This fits also the comments from two interviewees about the compromises between user-specific needs and developing a technically safe product that need to be made eventually when developing complex products. In terms of getting a better user understanding, it was mentioned that it would be good to know what are the user requests that are negotiable and which ones are crucial and have to be implemented.

In order to have an impact on processes and design choices, such KPIs need to be considered and possibly linked to when talking about more user- and usability-related aspects. However, it is also the case that usability for example can be contradictory to traditional KPIs if for example the cost of deployment would have to increase in order to enhance the ease of maintainability. It was said to be difficult to compete on cutting edge technology in both cases since high technological standards are taken for granted and without it one cannot exist in the market at all according to one interviewee. Therefore it was recommended to think about factors other than technology to differentiate from the competition. However, these differentiators would need to be linked to the mentioned KPIs in order to make a convincing argument and get prioritised in the mentioned compromises that need to be made.

Another topic that emerged during the interviews is that there is a difference in the value of insights obtained from users based on whether the inquiries made are within the problem-identification or solution-finding space of the development process. Problem space refers to the part when people are asked to provide feedback on specific issues or detect problems in the proposed concepts, whereas solution space is looking for recommendations and ideas that could be applied in the further development process. It was recognized by respondents that different user types are required for each of the two phases and that giving feedback about certain problems and raising specific issues is easier for users in general.

## **4 Discussion**

### **4.1 Designing according to user needs**

One of the main findings is that the amount and depth of information required to make the right design choices according to user needs changes depending on the product development stage. In the pre-development phases and early stages of the development process generic information about user profiles and the context of use are required. In the following stages more detailed user input is requested in order to evaluate the product under development against specific user needs. Based on the generic product development steps, including idea generation, market and technical analysis, concept development, and technical development [8]-[11], the type of user information is required according to the different stages from broad to more specific.

After obtaining user insights, independently if on the generic or specific level, it remains unclear how and if they can be applied in practice with regards to technology-driven product manufacturers. The interviews showed that it is necessary to translate user needs into requirements if they ought to be included and followed up throughout the development process since engineers and designers work based on requirements in practice [12]. Kujala et al. [13] propose that gained user insights should be made available to the development team in form of descriptive use cases or compiled in use case tables so that designers can translate them into user requirements. In the cases of this study we found out that if the type of information obtained from users is on the perceptual or emotional level, translating it into specific requirements becomes difficult. Furthermore, it becomes challenging on the working level if developers need to abstract and interpret use cases before implementing them in a design since they are used to working with requirements and design-specifications in their daily work. User involvement may lead to more accurate user requirements [14] if the experiences and insights gained from users can be externalised and documented in a way that supports developers in their design rationale [15]. Otherwise, it is more likely that technologically predominant requirements are given priority if compromises need to be made between technical feasibility and user needs.

The findings of this study highlight that it also depends on the mindset and philosophy of the individual project lead and the person in charge of the respective product design if the users and the information about their needs are given high importance. Therefore, in addition to translating user needs into requirements, another approach is to sensitise these lead developers to the user perspective and enable them to better understand user needs and context of product use. Enabling design leads to empathise with users, hence taking their needs into account when making design decisions, allows the organisation overall to better capitalise on the market insights and lowers the threshold for organisational learning [16]. It has been acknowledged that especially in technology-driven companies, there is a need for interacting with users and diffusing the obtained knowledge within the organisation [8].

Based on the findings of this study we realised there is a high awareness about the importance of involving users more and developing solutions according to their needs. Furthermore, it was mentioned that senior management has recognised the need for having a more user-oriented mindset but it has not yet been implemented on the working level, meaning the actual processes and daily practices. That means even if "in theory many projects start from a user- and pull-driven perspective, the mantra that 'innovation should start with the user and end with the user' is not always pursued." [8, p. 60] Therefore, implementing formal evaluation stages throughout the development process for obtaining feedback from users supports the intention of designing for user needs. That is according to our findings that user information and feedback are needed at specific stages of the development process, namely when a decision needs to be made with which concept or design to go ahead and which features to implement in the next design iteration.

#### **4.2 Value of user involvement**

A cluster of key findings emerged around the value of user involvement inside the company and the link towards a competitive advantage. Key performance indicators are factors constituting the success criteria [17] and thus reflect what is valuable for a company. The KPI system in place steers the development activities through prioritisation, which features of a product-to-be are important to allocate scarce resources, as the company reaches market performance through sales of products. In the case companies, we found that key characteristics of the products are linked to performance such as operating costs and quality.

In respect to quality, scholars argue that quality performance should consider besides engineering standards also customer opinions [18].

On the managerial level, we noticed statements from management that user-centeredness is desired in the case companies. In practice, we observed that user involvement activities and user needs uncovered through them are linked to traditional KPIs to justify and legitimise their inclusion into the requirements of the product-to-be. If for example user involvement helps to detect potential safety issues, the argumentation is in line with the KPI system in place, as safety issues had a high priority in both case companies. Scholarly, the discussion about the KPI of quality is addressing this issue. The term of quality can be defined as conformance to specifications as well as in relation to customer value and expectations [19], [20]. This wider interpretation of a traditional KPI may serve as legitimising factor. This indirect legitimisation may be due to measurement problems as pointed out by Barki & Hartwick [21, p. 53], who state that “measurement problems associated with involvement research prevent definitive conclusions regarding the benefits of user involvement”.

Another finding of our study is that cases exist, where involving the users cannot be indirectly legitimised, as the uncovered need conflicts with existing KPIs. One example may be that in order to improve the maintainability of an aircraft, the weight would need to be increased, resulting in higher operating costs of the aircraft. The question arising from this example is whether or not the organisation would choose the option serving the user needs. The internal foundations for successful user involvement thus need to address the value that is given to user involvement activities as well as the inclusion of user needs into new product development [22].

The second question arising is whether customers value the choice the company made. If the acceptance by the customer organisation exists, this acceptance might lead to an opportunity to differentiate and gain a competitive advantage through user involvement. In both cases it was mentioned that user-centeredness may lead to a competitive advantage, as competitors focus mainly on technological advance. Therefore, it is perceived difficult to gain a competitive advantage through technology as it is expected that priority is given to technological development when allocating scarce resources. Nevertheless, in both cases it became apparent, that the focus on technology cannot be neglected, however should be complemented by including user needs.

Setijono & Dahlgaard [19], building on the model of Kano et al. [23] point out that customer value consists in this model of performance or physical characteristics of the product that must be present (dissatisfiers), are expected to be present (satisfiers) and delight the customer if the characteristics are present (delighters). If user involvement and focus on soft factors can be a delighter in the perception of the customer, customer value may be the next source for competitive advantage [24].

## 5 Conclusion

This study highlights that there is an increased awareness of technology-driven companies to become more user-oriented and develop products accordingly. However, the complexity of the product under development, the difficulty to translate user insights into requirements that are meaningful to the developers, and the priorities given to traditional KPIs pose a challenge for the investigated organisations to put this change of mind into practice. In order to manage this shift, the following factors need to be considered:

- The type of information that is required from users changes along the development process from general to more specific.
- Punctual and evaluative feedback from users is needed right at the decision-making stage.
- Developers need to get exposure to users and their context in order to better understand their needs to make daily design choices more user-oriented.
- Linking user needs to predominant KPIs in a given industry legitimizes design-choices in favour of the user.
- Addressing user needs in the product design is an opportunity for companies to differentiate themselves in a technology-dominant industry.
- User selection is crucial in order to make design choices according to the intended user group.

An important avenue for further research is the value of user involvement for both a company as well as its customers. If the customer organisation values user-centered aspects such as usability over current KPIs, then the company may re-think the development priorities and seize the opportunity to differentiate itself from the competitors.

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