Introducing Support for Release Planning of Quality Requirements – An Industrial Evaluation of the QUPER Model

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Abstract

In market-driven product development and release planning, it is important to market success to find the right balance among competing quality requirements. To address this issue, a conceptual model that incorporates quality as a dimension in addition to the cost and value dimensions used in prioritisation approaches for functional requirements has been developed. In this paper, we present an industrial evaluation of the model. The results indicate that the quality performance model provides helpful information about quality requirements in release planning. All subjects stated that the most difficult estimations may be more accurate by using the quality performance model.

1. Introduction

Market-driven product development and release planning is becoming increasingly common in the software industry [15] [2]. As market-driven product development gains greater acceptance [1], a new role within software companies emerged, namely that of product manager [16]. Product management is rather complex where the product manager has several important tasks, such as requirements management, release planning, and launching products [16]. Release planning is a process applying various types of upstream decision-making that combine market considerations with implementation concerns [11]. Release planning involves aspects such as selecting what features and requirements should be in a certain release, when it should be released, and at what cost [15]. According to [15], lacking of good release planning practices may results in unsatisfied customers and market loss, which makes release planning a major determinant of the success of a product.

Models that address requirements prioritization in a market-driven context often emphasize functional aspects, for example, the cost-value approach for requirements prioritization [8]. Other methods are based on release planning and software product management [4] [16]. However, to the best of our knowledge very little research has looked into prioritization of quality requirements in release planning, despite that quality requirements are of major importance in market-driven requirements engineering, as reported e.g. in a case study in the telecommunication domain [5].

Would slightly better performance be significantly more valuable from a market perspective? Would significantly better performance be just slightly more expensive to implement? When dealing with performance, usability, reliability and so forth, we often end up in a difficult trade-off analysis. Aspects such as release targets, end-user experience, and business opportunities must be taken into account. To support release planning and roadmapping of quality requirements, we developed the quality performance (QUPER) model [11], while applying QUPER in practice is reported in [9].

This paper presents one case of QUPER tailoring, implementation, and most important evaluation, conducted at Sony Ericsson, one of the leading mobile handset developers. The main purpose is to investigate the implementation of QUPER in industry. The very large-scale industry [10] trials allow us to validate the QUPER model's usefulness in a non-simulated environment in real projects using real requirements. The main objective and contribution of the paper is to show how QUPER can be used in one company and in particular the focus is on an evaluation of the industrial introduction of the model.

The paper is structured as follows: Section 2 gives a short introduction to the QUPER model. In section 3, the tailoring of the QUPER model is presented. In section 4, the company and its product development situation where QUPER is used is presented. Section 5 presents the research methodology while the results

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from the evaluation are presented in section 6. Related work is presented in section 7 and section 8 gives a summary of the main conclusions.

2. QUPER

The development of QUPER was carried out at two case companies in the mobile handset domain with a supplier-integrator relationship. Industry needs and possibilities for improvement were identified. The QUPER model was developed in three main steps [11]:

Step 1: *Problem definition*. The goal was to understand different requirement decision scenarios by focusing on the interface between the two case companies. The result of this work is reported in [12]. In addition, the need for a cost-benefit model including quality aspects to support roadmapping and scoping was identified.

Step 2: *Model definition*. The model definition was based on the input from step 1. The QUPER model was defined comprising three views: a benefit view, a cost view, a roadmap view, and the concepts of benefit breakpoints and cost barriers.

Step 3: *Model validation*. An evaluation of the model was carried out in six cases of selected sub-domains through interviews with experts.

The quality performance model is a feature prioritization model that includes a third dimension related to quality, as a complement to the two dimension cost and value that are used in prioritization of functional requirements [8]. The model aims to support prioritization and roadmapping of quality requirements at early stages of release planning when making high-level scoping decisions and creating roadmaps.

The QUPER model is based on the observations that quality is *continuous* and *non-linear*. The quality level is typically not viewed as either good or bad, but rather as something with different shades of goodness on a sliding scale. In addition, we assume that a change in quality level may result in non-linear changes to both cost and benefit, and that this non-linearity is of interest to release planning and roadmapping. Based on these observations, the following goals for QUPER were selected as a guide to the development step:

- *Robust to uncertainties*, concentrating on principal properties rather than precise predictions.
- *Easy to use*, the model should include only a few concepts that are easy to learn, remember, and understand by practitioners.
- *Domain relevant*, the model must be possible to combine with existing practice and possible to tailor to a particular domain.

The QUPER *benefit view* (figure 1) includes three breakpoints indicating principal changes in the benefit level with respect to user experience and market value. A breakpoint is an important aspect of non-linear relation between quality and benefit. The *utility breakpoint* represents the border between a quality level useless and useful quality. Useless means that the quality is so low that the product is not accepted on the market. The *differentiation breakpoint* represents the shift from useful to competitive quality, which makes them have a *competitive* market proposition. The saturation breakpoint imply a change in quality level from competitive to *excessive* quality, where higher quality levels have no practical impact on the benefit in the particular usage context considered.

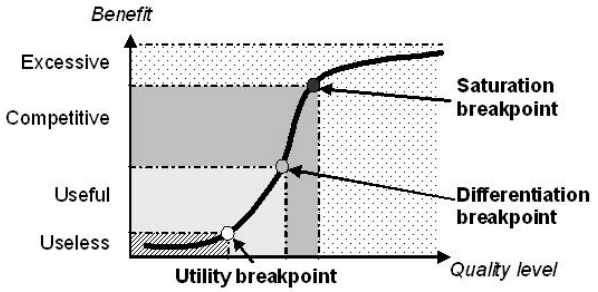

Figure 1. The QUPER benefit view

The QUPER *cost view* (figure 2) includes the notation of cost barriers that represents the non-linear relation between quality and costs. For a specific quality aspect in a specific context, we approximate the quality-cost relation to have two different steepness ranges. A typical cost barrier may be the result of that a quality increases is not feasible without a large reconstruction of the product architecture, while a typical cost plateau is exemplified by the case where comparatively inexpensive software optimizations may result in high gains of performance.

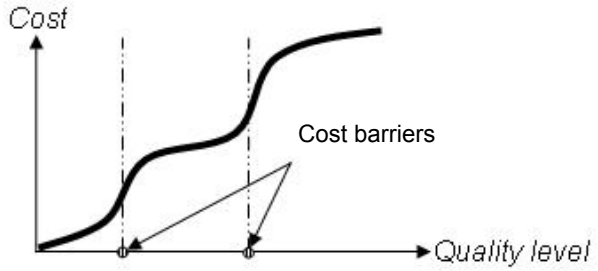

Figure 2. The QUPER cost view

The QUPER *roadmap view* (figure 3) combines the benefit and cost views by position the breakpoints and barrier together ordered on the same scale. This view enables visualization of benefit breakpoints and cost

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barriers in relation to the current quality level of a product and the qualities of competing products. This view also combines the notation of targets for coming releases with the aim of supporting roadmapping.

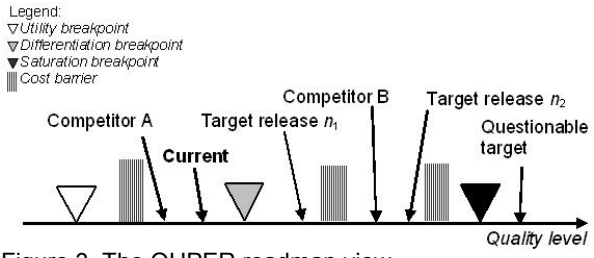

Figure 3. The QUPER roadmap view

3. QUPER tailoring

QUPER as presented in section 2 is generic in nature, therefore an adaption of the six steps in applying QUPER in practice [9] needs to be addressed prior to the model being set into operation at Sony Ericsson. This evaluation of QUPER only includes the QUPER benefit view (figure 1) because it is considered the most important part of the QUPER model for Sony Ericsson to start with. We envision the following four steps of how to use the QUPER benefit view at Sony Ericsson:

1. Define quality aspects.
2. Estimate your product's current quality (for a given release) and the competing products' quality (at present or envisioned).
3. For each quality aspect and for each relevant qualifier, estimate the breakpoints.
4. Estimate candidate targets and discuss and decide on actual targets for coming releases.

In step 1, when defining quality aspects, it is important to identify relevant qualifiers and consider their consequences. For example, different mobile phones offered to different market segments have different requirements for image quality. Furthermore, today's hardware is not the same as tomorrows. This has implications for performance requirements, as software features might run much faster.

In step 2, after identifying quality aspects, identify reference levels based on actual products, your own and competitors'. These reference levels further calibrate the estimations to provide objective measures to relate to the breakpoints.

In step 3, define the current *market expectations* in terms of breakpoints (figure 1). First, determine the utility breakpoint – the lowest acceptable value on the current market. Then, determine the saturation breakpoint, which represents quality levels considered excessive in the current market. Finally, determine the differentiation breakpoint; values above this level give market advantages.

In step 4, targets are requirements with potential quality commitments. The actual requirement is an interval that is specified by two targets, *min (*the lowest acceptable quality) and *max* (the highest needed quality). Different quality aspects may have different number of relevant targets.

4. Case study description

Sony Ericsson develops mobile handsets for a global market. Sony Ericsson employs more than 5,000 people. In total, Sony Ericsson has more than 20,000 requirements. A modern mobile phone contains a complex set of features, ranging from traditional voice calls and SMS to multimedia usage and personal organizer. Compared to general purpose computers, user interfaces are much more limited as well as computing power and memory. Therefore, user interfaces need to be tailored to the device and performance needs to be optimized for the hardware constraints. Hence, in addition to scoping functional features, qualities of features are important and a large part of the effort invested.

Sony Ericsson employs a platform development process. Based on the platform, a number of products are developed. The first part of the platform process is the roadmap extraction. Each technology area has roadmaps. Based on the market and planned launch date of the first product on the platform, a selection of features on the roadmap is selected. The different technology areas are individually prioritized in terms of market value. For each area, based on the available resources, an initial scope is defined. Then the different technology areas are prioritized by different stakeholders to get their priorities. Finally, a project priority for the platform project in question is compiled by merging the different stakeholder views into a project feature list. Based on the project priority, the scope is adjusted to ensure that the features with highest return of investment are part of the project scope. Both the market value estimation and cost estimation is performed on high-level features.

Once the project scope is established, the high-level features are refined into requirements. The refinement of features includes both functional as well as quality requirements. Once the features are refined, cost estimations are redone. Also, if there have been any changes to the market, impacting either market value estimations or selection of features, market value estimations are also redone. Using the updated and more accurate estimations, the return of investment is

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recalculated and the project priority reanalyzed, to ensure that the most important features are part of the project scope.

5. Evaluation methodology

The research was carried out in cooperation between Lund University and Sony Ericsson. The study was carried out using an action research [13] approach. Action research aims to influence or change some aspects of the research focus. Furthermore, action research involves the improvement of: practice, the understanding of practitioners, and the situation in which the practice takes place [13]. In this research, we are involved in improving the practice of release planning of quality requirements by introducing the QUPER model at Sony Ericcson. In addition, we improve the understanding of how practitioners use the QUPER model and its environment where the practice takes place. The general objectives of the research are to evaluate:

- The QUPER model in an industrial setting
- How easy the model adapts to existing processes
- What value the QUPER model may bring to release planning.

Four interview subjects were chosen to represent four areas (one from each area) to give a rich picture. The areas were selected to include differences with respect to level of dependencies to hardware. The interview subjects are leaders for the selected areas. The study consists of the following three steps.

5.1. Step 1 – Interview (part 1)

Planning: Step 1 involved a brainstorming and planning meeting to plan the study and to identify different areas of interests for the evaluation. The interview instrument was designed with respect to the different areas of interests. To test the interview instrument, three pilot interviews with experts from Sony Ericsson were carried out to adapt and improve the instrument. A summary of the used interview instrument[1] is presented in table 1.

Table 1. The interview instrument

Link to table 2	Question(s)
About the previous process	
Did PR exist?	Did performance requirements exist?
How are PR handled?	In what way are PR handled?
Challenges with PR	What challenges do you face when working with PR? What has been difficult?
Deciding relevant metrics	How did you decide relevant metrics?
About the QUPER model	
General view	What is your general view of QUPER?
Challenges and difficulties	What challenges did you face when working with QUPER? What was difficult?
Using QUPER	Would you like to use QUPER?
Decision-making	Does QUPER lead to better decision making? (why, why not)
Time spent	How much time did it take to use QUPER?
Estimation accuracy	Do you think the estimates will be more accurate with QUPER? (why, why not)
Other issues	Can you think of any challenges that we have not covered?

PR: Performance Requirements

Data collection: The study uses a semi-structured interview strategy [13]. All interviews were carried out individually by the first author. First, the purpose of the study was presented and then questions about their previous process were discussed in detail. All interviews were recorded and varied between 20 and 40 minutes in length. Transcripts of all interviews were made in order to facilitate and improve the analysis process.

Analysis step 1: The content analysis [13] involved creating categories where interesting parts from the transcripts were added and discussed. The first author examined the categories from different perspectives and search for explicitly stated or concealed pros and cons with their current process of handling performance requirements.

5.2. Step 2 – Workshop

Presentation: QUPER and how to use QUPER in practice was presented in a workshop. During the workshop, a selection of requirement engineers and managers (including the subjects that participated in interview – part 1) were present. These representatives are selected based on their roles and expertise by the local managers. As they were invited, they were asked to prepare for the workshop by reading requirements from their real projects. In total, six workshops were conducted at different geographical locations and varied between 60 and 90 minutes in length. During the workshop, the first author provided help and feedback to the subjects about applying QUPER on their requirements.

Apply QUPER in real projects: As the workshop is concluded, the main goal is to achieve an understanding of how to use QUPER on real requirements in coming projects. The evaluations of the QUPER model were conducted about 3 months after the QUPER model and its practical application were introduced at Sony Ericsson. The reason for the

[1] http://serg.cs.lth.se/research/packages/

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time delay was that we wanted the subjects to use QUPER in their projects prior to the evaluation.

5.3. Step 3 – Interview (part 2)

Data collection: The semi-structured interview approach was continued. All interviews were carried out individually by the first author. Questions about the QUPER model were discussed in detail. The interview subjects were the same subjects as participated in step 1. All interviews were recorded and varied between 25 and 35 minutes in length. Transcripts of all interviews were made in order to facilitate and improve the analysis process.

Final analysis of all data: Since we sought a comprehensive view of the complete data set, the data from step 1 was analyzed together with the data from step 3. The interview transcripts were coded by the first author. The transcripts were analyzed and interesting quotations were marked. For the analysis, all transcript files with quotations were complied and printed. The results from the analysis are found in section 6.

5.4. Validity evaluation

In this section, we discuss the threats to validity in research projects presented in Wohlin et al. [17], and the measures taken in the presented study to increase validity.

Conclusion validity: The conclusion validity is concerned with the ability to draw correct conclusions. The interviews were conducted at different departments and different geographical locations within the company and each interview part was done in one work session. Thus, answers were not influenced by internal discussions. The subjects selected may not be representative of the role they represent at the company. To minimize this misrepresentation, subjects were selected in cooperation with senior managers.

Internal validity: This threat may have a negative effect on the casual relationship between treatment and outcome. As the evaluations of QUPER were performed with different interview subjects, they expressed their opinions and views regarding the current process of working with performance requirements and about QUPER. As their answers were recorded by the researcher this may have constrained people in their answers. Recorded answers were only to be used by the researcher, i.e. not to be showed or used by any other party. To avoid evaluation apprehension, complete anonymity from other participants was guaranteed.

External validity: The external validity is concerned with the ability to generalize the results, in this case the applicability of QUPER in industry at companies other than Sony Ericsson. Some of the problems introduced as a motivation behind QUPER could, to some extent be general for organizations faced with developing products for markets. However, it is not possible to generalize the results from this evaluation based on the case study of Sony Ericsson; although the concepts and the practical application of the QUPER model as described in this paper and in Regnell et al. [9] [11], makes it possible for any organization to adapt the concepts behind QUPER to fit their organization.

6. Evaluation results

Table 2 illustrates the result from this study. All areas, except email, had specified performance requirements. A general tendency observed is that performance requirements were indirectly controlled by standards or hardware components and/or suppliers. There are three main reasons why the email area did not have any performance requirements: (1) performance was continuously tested by the testing department, (2) the operating system supplier performed performance testing, and (3) no structured process of how to handle performance requirements existed. However, internal performance requirements are now introduced in the email area. One reason is the introduction of the QUPER model, which provides a structured process of handling performance requirements, and more control over the requirements in terms of understanding why a particular quality level is needed and the relation to the competitors.

In general, the areas handled performance requirements in two ways: (1) looked at different standards stated performance and (2) the performance was provided by either hardware suppliers or the market department. Those quality levels were accepted without an understanding of why they were important. The acceptance of provided quality levels is one of three major challenges that were identified by the subjects. One subject stated:

"We wrote use cases [for a particular feature] based on what the user expected and needed from the new feature. We did not release this feature because the hardware could not deliver what we thought was good enough quality. We did not know if this quality level was acceptable in the market or how good our competitors' quality level was."

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Table 2. Evaluation results

Area	*Network access*	*Email*	*Video systems*	*Positioning*
Number of requirements	>1000 system requirements	~1000 system requirements	~500 system requirements	~40 use cases
Number of PR	~10%	None	~10%	Unknown
About the previous process				
Did PR exist?	(1) Yes, related to network access and references to standards that include PR	(1) No, it is something new (2) PR were continuously tested by the testing department, therefore not specified	Yes, mainly low level PR	(1) A few loosely defined (2) indirectly controlled by hardware suppliers
How are PR handled?	(1) Meetings with 4-5 people, for major problems, meetings could last for several weeks or months	Not applicable	(1) Looked at codec's to see what we could handle (2) input from the market department	Accepted what the hardware suppliers promised to deliver
Challenges with PR	(1) Specify the right conditions for PR (2) representative PR of the real world	No structured process for handling PR, therefore did we not have any PR	Not possible to specify an interval for the PR, what is good enough?	No understanding of what is acceptable on the market, have to trust the hardware suppliers
Deciding relevant metrics	(1) refer to different standards (2) operators provided metrics	Not applicable	Decided by hardware and standards	(1) Considered the user (2) rely on technology restrictions and hardware suppliers
About the QUPER model				
General view	(1) Saturation breakpoint important input: valuable to know when to stop improving the quality (2) like the concept of breakpoints	(1) Extensive work with competitor analysis (2) good first impression (3) takes time to identify relevant metrics	(1) Performance beyond saturation makes no difference, good to know when to stop (2) not only for PR, QUPER is applicable for all quality requirements (3) good to have a structured process	(1) An important idea (2) good to know when to stop improving the quality (3) good model for hardware PR
Challenges and difficulties	**(1) Difficult to identify differentiation and saturation breakpoints** (2) what value should the breakpoints have? **(3) easy to understand, not a complicated model**	**(1) People may interpret the breakpoints differently** (2) what value should the breakpoints have? (3) no major problems	(1) Identifying the different breakpoints **(2) is the time spent really worth it?** (3) easy to understand and apply	(1) QUPER comes natural **(2) easy to learn** (3) very pedagogical
Using QUPER?	(1) QUPER recognizes that real mobile networks do not necessarily have clean conditions that standards assume (2) relates to the real world (3) already using QUPER in real projects	(1) A more extensive view **(2) benefit of comparing our products against our competitors** (3) may feel it is too much work to do (4) we are using QUPER	**Using QUPER in real projects not only for more accurate PR, but also to understand the advantages of competitors**	(1) Provides better basis for PR (2) already using QUPER in real projects
Decision-making	(1) In sense of understanding our position on the **market (2) QUPER may be used as input for decisions about introduction of new product to the market**	**The roadmap view provides a good overview of the current market, which helps in decision making**	**(1) More informed decisions in sense of breakpoints and competitors** (2) better backing when stated as market leaders	**(1) More knowledge of the market situation** (2) not totally rely on hardware suppliers
Time spent	It took more time to use QUPER compared to the previous process. However, all subjects stated it will be less time consuming when QUPER has been used for a while. All new processes and models takes longer time to use in the beginning			
Estimation accuracy	**All subjects stated that the most difficult and insecure PR estimations may be more accurate by using QUPER**			
Other issues	No	No	(1) Cost view of competitors (2) evolution over time, a static snapshot of the current market is not enough, how does the market looks like in 2 years?	A mathematical equation that describes the benefit curve.

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By introducing QUPER, an overview of the markets and the competitors' current quality level is visible in the roadmap view, which has helped to understand what good enough quality is. This is confirmed by one subject:

"With the QUPER model we would have had an understanding of what is good enough quality in the market and how good our competitors are. Maybe the quality level we had would have been good enough at this particular time and we could have released it."

The second identified challenge was related to specification of performance requirements. The subjects identified a need to be able to have an interval for the specified quality level. However, even if this was possible, one subject asked what is good enough. The concept behind QUPER is to identify the current market situation (breakpoints and analyzing the competitors) and then specify the performance requirements. By specifying performance requirements according to the QUPER model, a richer picture and understanding of what is good enough are provided. This was confirmed by one subject by stating that the QUPER model provides a more extensive view to work after.

The third challenge was how to specify performance requirements that are quantifiable, representative of the "real world", and under what conditions they should be fulfilled.

In the first step of applying QUPER in practice (section 3), relevant market segment and hardware platforms needs to be considered as well as the consequences for the performance requirement, and thereby consider under what conditions the requirements should be fulfilled. This was inline with one subject that stated:

"QUPER recognizes the fact that in a real mobile network you do not necessarily have the clean conditions that the standards specify."

The subjects liked the concept of the QUPER model, especially the breakpoints. The main benefit of the breakpoints was the saturation breakpoint, where the quality level changes from competitive to excessive quality, meaning that higher quality levels have no practical impact on the benefit in the particular usage context considered. However, one problem was identified related to the saturation breakpoint. One subject stated:

"Do not only look at the saturation breakpoint and stop improving the performance just because QUPER says stop. If we can go beyond this breakpoint without increasing the cost and time spent, why should we not improve the performance?"

This indicates that evolution of the saturation breakpoint over time should be considered when revising breakpoints regularly.

Another interesting point made by one subject was that QUPER is not only applicable to performance requirements, but also can be applied to all quality requirements.

One goal with the QUPER model was that it should be easy to learn. All subjects confirmed that the QUPER model is easy to understand and learn, and is a straight forward model that is not complicated. According to one subject, QUPER is very pedagogical and makes it easy to explain and discuss with others. In addition, a common terminology among the staff improves the communication. The QUPER model is introduced at Sony Ericsson and will be used as the process for handling performance requirements.

In general, estimations of performance requirements may be more accurate when using the QUPER model according to all subjects. The most difficult and insecure performance estimations will have the highest increase of accuracy. However, none of the subjects believed that their best estimations (the easiest performance requirements to estimate) will be more accurate when using QUPER. However, using the QUPER model takes more time and requires more effort than the previous process of handling performance requirements. The difference is related to competitor analysis and identification of the breakpoints. On the other hand, the subjects believe they have more control of the performance requirements and understand why a particular metrics is used in one market segment. One reason is the introduction of breakpoints and competitor analysis. By identifying all breakpoints and the competitors' quality level, and visualize all information in the roadmap view, the subjects experienced more control of both the performance requirements as well as the current market segment.

The evaluation of the QUPER model indicates improvements in decision making, especially in release planning. All subjects agreed that the richer the understanding of the market with identified breakpoints, the quality level of their own and their competitors' products, the more accurate the decisions are. The subjects believe the QUPER model will be of major help in release planning, which was stated by one subject:

"The QUPER model can be used as input for release planning and decision making; and when we should introduce a product to a particular market segment"

Another subject stated when asked if the QUPER model may help in decision making:

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"Yes because you know more about the market and you are not 100% controlled by the hardware suppliers."

According to another subject, the QUPER model is especially an important input when making decisions about what time a product with a certain quality level should be released. In addition, the QUPER model helps to understand when the market has matured over time, which is when the breakpoints have changed, and the test results show lower performance than expected. It is still possible to know that we are better than our competitors and therefore release the product, stated one subject. Another important feature of the QUPER model in decision making was the roadmap view, which provides the decision makers with a good overview of the market.

During the interviews, one main challenge of applying QUPER was identified, difficulties to identify the values of the differentiation and saturation breakpoints. When to stop calibrating those breakpoints? One subject relied on a measurement report that was conducted by an industrial organization together with the expertise within the area. However, by using QUPER over a longer period of time, all subjects believed this will not be a challenge. The first time a new model is used is always difficult before knowing what to do and how to do it. In addition, another challenge was raised by one subject; different people may have different understanding and opinion of the breakpoints value. This will be a smaller problem in the future when the staff has used QUPER for a longer period of time, which was confirmed by all subjects.

7. Related work

Several models related to requirements prioritization and cost-benefit analysis may help product managers select requirements for a certain release. The contributions in this area include: Kano [6], planguage [3], quality function deployment (QFD) [7], and a cost-benefit approach [8] based on the analytical hierarchical process (AHP) [14]. Kano et al. [6] developed a model for evaluating patterns of quality. Similar to the QUPER model, Kano's approach views quality relationships as non-linear. The Kano model, however, does not include a cost dimension as in the QUPER model. In addition, Kano's model is not related to roadmapping, benefit breakpoints, or cost barriers to indicate important aspects of quality relations.

Gilb's planguage [3] has roadmap related concepts such as past, record, and trend in templates for quality requirements. QUPER could be used together with planguage to express breakpoints, barriers, and targets related to, for example, competing products in different market segments.

QFD [7] is a comprehensive, customer and user oriented approach to product development. To fully implement QFD, customers and users need to be visible; however, not all market-driven projects have access to customers and users [7]. Furthermore, QFD measures quality attributes using a scale where no clear distinctions between the values are provided. While QFD is a complex and comprehensive methodology that may require a complete change of current practice, QUPER is a simple reference model to be used in combination with current practice to support communication of quality attributes using a few, easy concepts.

Karlsson and Ryan [8] suggested using a cost-value approach for requirements prioritization based on the AHP [14]. This approach is mainly used for functional requirements; however, quality requirements can of course be included as objects of prioritization in AHP. The QUPER model thus goes further by introducing a third dimension related to the continuous nature of quality attributes.

8. Conclusions

In this article we have tailored, implemented, and evaluated the QUPER model at Sony Ericsson by applying it in real projects, using real requirements, by industry professionals. The overall result indicates that the QUPER model is relevant in high-level decision-making for quality requirements in an activity such as release planning. The concepts of breakpoints, competitor analysis, and identification of own products quality level provides a greater understanding of the current market segment and why a certain quality level is needed in a particular release. The goal of the model is to be useful by being simple and it must be possible to combine QUPER with current practices. The conducted evaluation shows that QUPER is easy to understand and learn, straight forward, and not complicated to apply in Sony Ericsson's current practice. In fact, all subjects stated that they are and will use QUPER. In addition, the concepts behind QUPER improve the communication among staff regarding requirements prioritization.

The main identified challenge was difficulties to identify and specify the values for the differentiation and saturation breakpoints. Furthermore, different understanding of the breakpoints value among the staff was raised as a challenge.

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The evaluation indicates that QUPER is feasible and relevant to the selected domain. We also believe that the general concepts of QUPER are transferable to release planning for other domains of market-oriented product development, but this needs to be investigated in further research. Further research also includes, an additional evaluation of the QUPER model involving more areas and subjects with different roles. Furthermore, a practical application and evaluation of the QUPER cost view will be investigated. In addition, evolution of the market needs to be investigated, how to use a snapshot of today's market when predicting future quality levels.

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