Applying Kano model into goal/requirements elicitation for crossplatform mobile content technology

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Abstract. In this paper authors discuss the problem of requirements prioritization as a part of requirements elicitation, addressing the problem in agile software development methodologies. Related work in the field is enumerated, together with most important concepts and their strengths and weaknesses; Kano model of customer satisfaction is discussed as non-complete solution to the problem; then the proposed approach, which modifies the process, is researched and explained in order to present actual analysis of presented case study.

Authors' approach assumes that MoSCoW rules could be useful for requirements elicitation process, this approach also extends a couple functionalities further. Conclusions and observations for future work are presented as well.

Keywords: Requirements, features, Kano model of satisfaction, Relative weighting, MoSCoW, Agile development.

JEL Classification: D2

1 Introduction

Requirements elicitation in software development aims to uncover, create, and structure the needs of the users and other stakeholders, and communicate and discuss with other parties (e.g. development team, sponsors) to reach an agreement (Dongmo, 2014).

The process is continuous and iterative in nature, since it is during the subsequent development phase that user needs are well understood and, therefore, susceptible to change. In practice (Aranda et al, 2008), the main activities of this process include:

1) preliminary data collection,
2) requirements gathering,
3) requirements evaluation and rationalization,
4) requirements prioritization,
5) requirements integration and validation.

This paper focuses on requirements prioritization and is based on a case-study of technology development for SPINE project, which is titled "Cross-platform content sharing for mobile network games, co-created by users technology" and funded by polish National Centre for

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Research and Development within INNOTECH program (project number INNOTECH-K3/HI3/20/228040/NCBR/14). Different methodologies were assessed and applied in order to deliver unique process of goal/requirements elicitation. We describe practical use of Kano model for agile managed cross-platform mobile content technology, together with several available alternatives, used to verify Kano model outcome. Relative Weighting is also introduced as a possible supplement. Then, the results of feature prioritization performed for SPINE project with these methods are presented, allowing for analyzing the process together with differences and similarities in the outcome.

The paper is organized as follows: related work in the field is enumerated together with most important concepts and their strengths and weaknesses; then the proposed approach is researched, shown and explained in order to perform actual analysis of presented case study. Finally, conclusions are drawn and further observations are given for future work.

2 Selected prioritization factors and methodologies - related work

There is quite popular opinion, that one of the foundations of development is the idea stated first in (Brooks, 1987): to draw forth and analyze the requirements is the most difficult and critical step in the software development. Intense studies are undertaken everyday in order to improve on the requirements shaping techniques.

Quoting Leffingwell: “Migration to more rapidly exploratory and lighter-weight processes has been constistent theme over time, from predictive processes, through iterative, up to adaptive (agile) processes” (Leffingwell, 2011). So, one of the more important challenges is to keep up with the ever-changing requirements and the need to constant introduce, scale, modify and review of the product features.

Beck and Fowler (Beck and Fowler, 2001) consider software feature to be equal with agile user story „A user story is a chunk of functionality (some people use the word feature) that is of value to the customer. It provides a simple way for developers and customers to chop up what the system needs to do so the system can be delivered in pieces.” This is also confirmed by Cohn (Cohn, 2004) and North (North, 2014).

However, several sources point out that there are several differences – for example, large features can span several user stories and therefore should be considered epics (large stories) or themes (collections of stories) in Agile terms. Therefore, the presented case study should (1) serve as an example of an IT project related to mobile content delivery for multiple platforms, and (2) provide an opportunity to observe and conclude how presented methodologies (with own modification) can be applied and modified in similar circumstances.

As Cohn states in (Cohn, 2005), four factors must be considered when prioritizing the development of new capabilities:

1) the financial value of the features,
2) developing and supporting cost of new features,
3) the value of new knowledge created by feature development,
4) the amount of risk removed by developing the features.

For purposes of this paper, two of those factors are interesting in particular: risk and value. A typical problem with designing requirements could be described as a struggle between high-risk and high-value features of a project. High-risk related approach is based of course on making decisions in favor of avoiding risks (Relich and Jakabova, 2013), high-value oriented team would prefer completely different approach - design decisions should generate maximum highest value to the project.

2.1 MoSCoW methodology

Among methodologies for feature prioritization there is MoSCoW - the quickest and simplest feature prioritization technique, very popular, especially for smaller Agile projects. Simplicity is often mentioned as one of its biggest advantages. MoSCoW is described in (Stapleton, 2003). Main weakness of this technique is relying only on management decisions. There is perfect example in (Appelo, 2008): “after having tried the MoSCoW method for about a year, the feedback I got from our consultants is this: ‘It doesn't work because all features are being assigned the *Must Have* priority. Our customers are of the opinion that everything is essential.’ “. There are papers that are trying to extend MoSCoW functionality – for example a proposal of modifying MoSCow rules to add time boxes and buffering (Miranda, 2011).

2.2 Kano model of customer satisfaction

Other known methodology is Kano model of customer satisfaction (Kano et al. 1984), futher extended in literature (Llosa, 1999), (Bartikowski and Llosa, 2003) or (Witell, 2013). According to Kano or Llosa, the three categories, or qualities, the features can be separated into, are: Must-be ("Basic"), One-dimensional ("Plus") and Attractive ("Key").

A *must-be* quality, sometimes referred to as *'threshold'*, means that feature's presence is required. If this attribute is overlooked, the product is simply incomplete. This is the first and most important characteristic of the Kano model, as stated in (Jacobs, 1999). Any improvements to the feature or its amounts will not bring greater impact on customer's satisfaction, and thus, feature value.

One-dimensional quality may be referred to as *'linear feature'*. This means that customer satisfaction is linearly correlated with the quantity of the feature. As a consequence companies tend to compete on these attributes, differentiating their product by spending more (or less) than their competitors on certain performance attributes (Holst, 2012).

Attractive quality is the feature granting great satisfaction of the customer (hence the name *'exciter'* or *'delighter')*. As Kano suggests, ‘*delight’* attributes represent the unexpected – when the customer is delighted by over-delivering or doing something out of the ordinary. Like the ‘*basic’* attributes, when dealing with delight attributes there’s no linear relationship between customer satisfaction and the degree of achievement.

One of the most important aspects of Kano model is time-dependency. It means that customer expectations tend to rise and features once perceived as exciters tend to become mandatory over time. This is presented on Fig. 1 – in time, quality ‘attractiveness’ diminishes – something that was ‘attractive’ once, becomes linear, and in time, basic quality for customers.

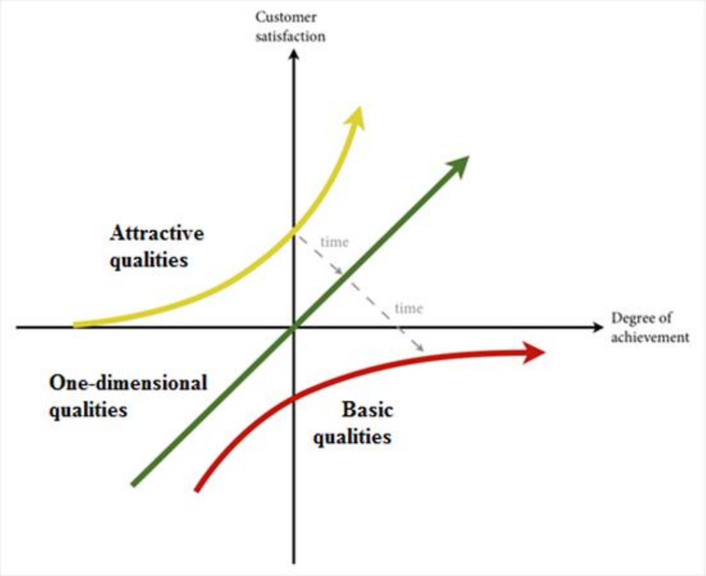

Figure 1 Kano model of satisfaction and qualities' decrease over time (Holst, 2012)

2.3 Relative Weighting

For another approach, Wiegers proposed Relative Weighting method as an alternative to customer feedback-based prioritization (Wiegers, 1999). Relative weighting is similar to Kano model, but relies on expert opinion – for example, team members led by product owner. This allows to consider product as a whole, feature interactions and features importance not for actual customers, but project stakeholders, or other entities important for legal reasons (Cohn, 2005). Relative benefits of having certain feature and penalties of not having it are used to create Value parameter, which is then divided by Cost (based on agile story estimation) to create Priority value.

3 Proposed approach to features elicitation

Although Kano model has a strong support among both project managers and researchers several possible weaknesses requiring model adaptation or further research have been pointed out (Wittel et al., 2013). Even the original Kano study mentioned necessity of considering projects as a whole: "the correlation between the feeling of satisfaction for the product as whole ... is a subject left for future study." In certain cases, for example cultural works (concerts, movies) or advanced products (smartphones), overall satisfaction coming from experiencing or using the product is more important than experiencing its different attributes. This means that products consisting of highly desired features may not be satisfactory to customers as a whole, while on the other hand highly desirable products may lack features that considered separately would be perceived as mandatory. Other problem is, satisfaction and dissatisfaction may not actually be opposite and may depend on importance of each feature as seen from user perspective.

One can mention other problems as well - Kano methodology may for example proof problematic, when interaction between attributes has profound effects. Life cycle of quality attributes is hard to estimate, just as Brandt and Scharioth indicated in (Brand and Scharioth, 1998). There is very little knowledge about different life cycles characteristics, or quality ‘promotions’ (when and how mandatory quality becomes exciter again), both of which present a challenge on its own and will be a subject of another paper. There are now more than 10 different methodologies for classifying features – the verification whether which provide most reliable results is also a problem.

For those reasons, one could modify methodology just like Shahin did in (Shahin, 2004), propose the use of intelligent systems as suggested in (Relich and Muszynski, 2014) – or one could argue to further prioritize results of customer feedback-based methods like Kano. Our approach assumes that MoSCoW rules could be useful for this operation. Furthermore, we define entire operation as a process, because it has to be continuous and repetitive. Such process can be presented in various ways, like any business process, as shown in previous work (Rostanski, 2013). Here, the Event-Driven Process Chains notation was used (Fig. 2). Description of the process is as follows and can be put into three phases:

1) Gathering requirements first phase. Consists of preliminary interviews of:
    a) project stakeholders - this covers technical, legal and business goals;
    b) potential customers – for features and qualities to be researched;
    c) market and competition analysis – for the discovery and features review.
2) Surveying customers and project stakeholders using Kano model questionnaire (for users) and Relative Weighting (for stakeholders):
    a) Gathering opinions and results;
    b) Processing results – sorting into must-be, linear and exciter features.
3) Prioritizing phase with iterations:
    a) Using MoSCoW analysis to further prioritize requirements, initially prioritizing only must-have features;
    b) Repeating the analysis for each agile sprint and prioritize linear and exciter features after all must-be features are implemented;
    c) After each commercial release perform review of remaining features;
4) Return to gathering requirements phase if environment has changed (new customer or stakeholder demands).

4 Crossplatform mobile technology features elicitation - case study

According to process outlined in part 3, the initial step was the requirements gathering. Interviews with project stakeholders, designers and potential end customers were performed. The customers group was identified in analysis of market uses for SPINE project and identification of a target group for initial SPINE-based internal application – Createrria. Extensive analysis of existing market solutions and their performance was performed earlier, at project validation stage (feasibility study). Its outcome was used to verify and expand initial feature list.

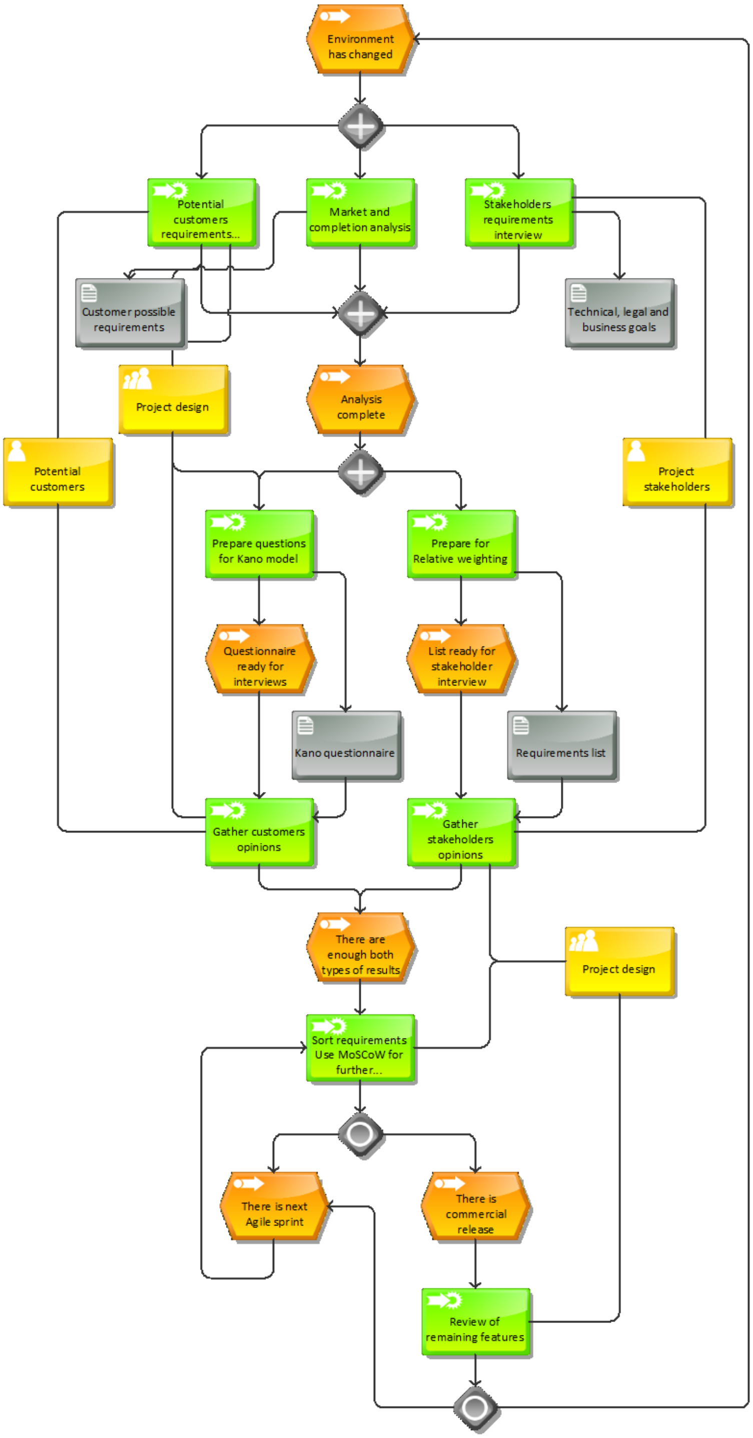
Environment has changed
Potential customers requirements...
Market and completion analysis
Stakeholders requirements interview
Customer possible requirements
Technical, legal and business goals
Project design
Analysis complete
Potential customers
Project stakeholders
Prepare questions for Kano model
Prepare for Relative weighting
Questionnaire ready for interviews
List ready for stakeholder interview
Kano questionnaire
Requirements list
Gather customers opinions
Gather stakeholders opinions
There are enough both types of results
Project design
Sort requirements Use MoSCoW for further...
There is next Agile sprint
There is commercial release
Review of remaining features

Figure 2 Event-driven Process Chain model of requirements elicitation process.
Source: own work

At this stage it become apparent that it’s necessary to combine requirements considered important by project stakeholders and end customers. An example of this would be “administrative console” – mandatory to stakeholder group, while indifferent at best for end customers. Requirements were split into two groups:

- Requirements relevant for project stakeholders;
- Requirements relevant for end users.

First group was analyzed using Relative Weighting, while second group was analyzed using Kano model. Expert decision approach is better fitting for prioritizing professional requirements - project stakeholders can be considered experts in their field, while using it for customer-relevant features would not reflect customer priorities at all.

Important note is, during the preparation of Kano questionnaires the team noticed empirically what Wittel (Wittel et al, 2013) have observed during their analysis of Kano research – even slight changes to the wording of the questionnaire (a common practice), often resulting from translation from English to other language tend to influence answers. As a result, the original questions by Cohn (Cohn, 2005) like ‘I can live it that way’ or ‘I expect it to be that way’ were replaced by more emotional questions. More emphasis was given to like/dislike questions to broaden the scale of reflected feelings and “I can live with it that way” was formulated in a slightly more negative way to better distinguish from neutral answer. However these changes get lost to the point of being incomprehensive when translated back to English. Furthermore – the team felt that abovementioned changes were not needed for English version of the questionnaire.

Question how lingual (slightly different meaning of words) and cultural (way of expressing emotions and opinions) differences affect answers in Kano questionnaire is an interesting subject for future study in another field of science.

4.1 Kano questionnaire results analysis and chosen issues

Kano questionnaire was also divided into several sections, grouping questions based on functionality of their concern (content sharing, social network integration etc.). A relatively small group of 16 potential users was asked about 44 different features. After Kano questionnaire results were gathered and processed, result analysis was performed.

In many cases results confirmed initial team assumptions, there were also clear feature selections for most questions. However, several aberrations were observed:

1) In some cases, number of users whose answers suggested given feature as mandatory/linear/exciter was the same or very close to a number of answers suggesting it as Indifferent (a sample of such feature is possibility to ‘like’ published content, option often used and very popular in services like Facebook or Youtube). Project owner decided to accept more outright answers, although such features were added to the bottom of the list. A conclusion was made that there should be several groups of users distinguished, depending on expected use patterns – especially content consumers (casual users) and content producers (power users).

2) In one case, answers were spread almost equally among all options (mandatory, linear, exciter, indifferent). In this case it was assumed that the feature in question (possibility of seeing a preview of the published content) was not explained clearly enough and wording used led users to confusion.
3) Almost half (20) of the features had *indifferent* as a dominant answer.

In this case it was assumed, that their implementation is not necessary for the early stage of the system, but should be reviewed thoroughly after initial project release (according to flow diagram shown on Fig. 2).

Observations mentioned above stress the necessity of good understanding who product users are, and if they represent one or more usage patterns. During feature prioritization it should also be decided which user groups are most important for the project success. In case of SPINE project, this choice would be between large group of passive consumers and relatively small group of content creators. Also, features clear to development team may not be perceived as such by customers and close attention is needed when questionnaires are prepared and features explained. Finally, Kano results were grouped into three categories, which were assigned to three agile product releases. Some of the features were postponed after initial public release of the project. (Alpha – mandatory features, Beta – Linear features, Final - initial public release)

Next, features important to project stakeholders were processed using Relative Weighting method. This allowed to prepare two lists of prioritized features, which were then used in agile sprint planning. For each sprint, features were picked using MoSCoW methodology. For each feature top positions from both list were compared and the most important was chosen first.

5 Conclusions and summary

For requirements elicitation and feature discussion, there are many methodologies one can utilize or even combine. As presented here, in particular area there is always a potential for modifications and such own approach is presented in this paper with case-study for assessment. Our approach assumes that MoSCoW rules could be useful for discussed problem solution. Furthermore, we define entire operation as a process, because it has to be continuous and repetitive - such process is presented.

In general, the results of a modified approach to requirements elicitation is very promising, but it is important to point out that is was tested within a couple of case studies only. The next part of research shall focus on various actions to determine the stability of the approach, as it may become the method for such projects:

- Disseminating results for feedback;
- Collaborating with other partners and extensive study of the process;
- Determining factors of successful acquisition of the approach in different projects and areas.

Observations and results stress the necessity of good understanding who product users are, and if they represent one or more usage patterns. During feature prioritization it should also be decided which user groups are most important for the project success. Suggested alternatives is to further refine Kano results with relative weighting to consider cost and feature affection factors. Future work is going to be focused on alternative approaches comparison and the introduction of failure mode and effect analysis (FMEA) into user-concentric assessment of features.

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