

Customer Involvement in the Scaled Agile Framework

Results from a Case Study in an Industrial Company

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Abstract: The Scaled Agile Framework (SAFe) has emerged over the last years as an approach which supports the improvement of software and systems development. SAFe claims solutions for business challenges, such as shortening cycle's times, improving product quality, increasing team members' satisfaction, and involving the customer in product development. However, regarding customer involvement, there is limited research, both in SAFe and in real-life agile software development projects. In previous work we developed an initial conceptual customer involvement model for the SAFe domain in Philips Medical Systems. In this paper this initial model will be extended and enriched on the basis of a case study in an industrial company.

1 INTRODUCTION

As customer involvement is an essential factor for developing successful software products (Sauvola et al, 2015), companies are often not supported in identifying and selecting the right customer types and the customer skills that are needed. Consequently, customers cannot be assigned appropriately in development processes, and their performance cannot be measured (Ghobadi and Mathiassen, 2013). For instance, a customer can have essential knowledge of a product, but can lack authority in development processes to decide for particular product features (Olson and Bakke, 2001). This can cause declining customer motivation and loss of customer interest to get or stay involved in software development. In our previous work we showed that limited research has been done in the SAFe domain on how to involve customers in real-life agile projects (Trienekens et al, 2017). SAFe considers user feedback and the usage of intrinsic customer knowledge as key for a successful application (Laanti, 2014). Customers are considered as having a critical role in the various aspects of SAFe implementations (SAFe, 2016). However, although SAFe addresses customer involvement issues in its framework, there is limited research done on how to determine and evaluate customer involvement. In Philips Medical Systems, the case study environment of our research, medical embedded software development is carried out in

large evolutionary software development projects (Turetken et al, 2016). Currently SAFe is being implemented in this company in various projects in different departments and business units. Customer involvement is considered in this company as a challenging and promising area in SAFe implementations.

In Section 2, some related work will be discussed, and we will refer to our initial conceptual customer involvement model. Section 3 will discuss the methodology that we followed to extend and enrich the initial model in a case study in the company. In Section 4 the case study results will be presented. Section 5 will cover validation issues, and Section 6 will finalise the paper with conclusions.

2 RELATED WORK

The SAFe framework covers both organizational levels and processes for agile development practices, see the "4-level view" in <http://www.scaledagileframework.com/>. Four organizational levels can be recognized, respectively the Team Level, the Program Level, the Value Stream, and the Portfolio Level. Although SAFe states that customers should be empowered in processes such as requirements management, defining solutions, planning, demonstration, and

product evaluations (Leffingwell, 2010), it does not provide explicit guidance for defining and implementing customer involvement, for example with respect to the type of customer to be involved, in what specific activities, and the customer's barriers to overcome (Laage-Hellman et al, 2014). Three research domains provided a basis for our initial conceptual customer involvement model, see Figure 1. This figure shows the Scaled Agile Framework domain as the main research area, and the highly relevant intersections between the three domains.

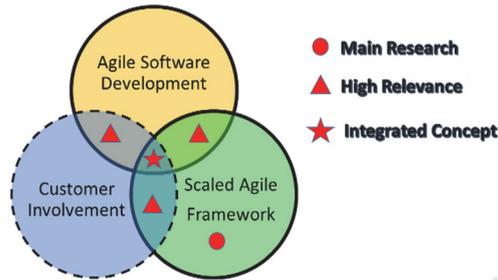


Figure 1: Research domains.

Table I is a result of investigating customer involvement in the SAFe domain. It shows customer involvement activities on the different levels of the SAFe framework. The Program level and the Value Stream are merged in this table because customers have similar activities on these levels, and/or activities are closely linked. Customer activities on these levels are related to contributing in planning and verification and validation and feedback. On the Team level customers should contribute to operational development activities such as user story development and functional testing. On the Portfolio Level no particular customer involvement has been defined. In agile software development, the structured evolution of agile methods has been investigated (Abrahamsson, 2003). Customers should have an important role in software development processes, e.g., as product owner with critical tasks, such as defining product features, reviewing features, and providing feedback (Schwaber and Beedle, 2002). In our previous work we identified customer involvement concepts such as: customer involvement level, customer specification, customer selection and customer value optimization (Trienekens et al, 2017). With developed an initial customer involvement model to provide a basis for a case study. The goal of the company was to establish customer involvement in order to improve product quality and to reduce uncertainty in projects. A first stage in our initial model addresses project risk identification. In stage 2, the results of project risk identification are used to determine the customer involvement level in the

Table 1: Customer involvement activities in SAFe.

SAFe Level	Customer Involvement Activities
Portfolio	-
Program & Value Stream	Evaluating the full system produced, including feedback
	Contributing in estimating scope, time, and other constraints
	Attending program increment planning to create plans
	Contributing in defining a roadmap, milestones, and releases
	Participating in inspection and adaptation to improve product performance
Team	Contributing in creating user stories. Performing functional & system acceptance testing.

project. To support this stage, customer involvement concepts, such as customer roles (i.e., resource, co-creator, user) (Nambisan, 2002), and customer knowledge issues can be applied. Subsequently, the next three stages of our initial model followed an approach for involving external parties, as developed in (Van Weele, 2009). These are respectively, a specification, a selection, and a customer value optimization stage. The initial model appeared to be a quite generic model for the company, on a quite high level of abstraction. Contradictive opinions appeared to exist regarding the identified customer involvement concepts, as mentioned in the foregoing. For instance for program managers customers should be involved in SAFe projects independent from risks involved, or risk determination should be supported with clear guidelines for characterising projects and their risks. Product managers considered concepts such as customer involvement level and customer specification as not being elaborated sufficiently and hesitated to involve, on that basis, customers in their projects. To extend and enrich the concepts in our initial model, and to increase the acceptability and applicability of the model it was decided to do a case study project, in close collaboration with well-selected experts from different business units in the company.

3 METHODOLOGY

The methodology of the research project consisted of three steps.

Step 1: Data collection and analysis.

In this step the customer involvement concepts as identified in our previous research have been taken as a basis for our case study. The objective was to extend and enrich these concepts in order to improve their understandability. For the case study representative experts of different business units have been selected. We made a distinction between a first data collection preparation phase and a second 'Delphi-based' data collection phase (Mingers, 2001). Preparation of the data collection was aimed at ensuring the right interpretation and relevance of the concepts in the company, e.g. the understandability and the clarity of the interview questions to be used in the Delphi study. In this way also the willingness of representative experts to be interviewed in the Delphi sessions, would be increased. In the preparation phase the research team consisted of four persons, respectively two scientific researchers and two experts from the company, respectively a well-selected SAFe expert and the director Quality Management of the company.

In the second phase the Delphi method was applied, a.o. because of its suitability to facilitate distributed data collection in a company. Five experts have been selected from different business units of the company, respectively a Product Manager Director, a Clinical Science Director, a Program Manager, a Program Implementation Manager and a Senior Product Manager. All experts were selected because of their roles and tasks regarding the communication with customers and their involvement in SAFe projects in the company. Each expert participates in Delphi sessions independently from the other representatives. As such the Delphi method eliminates undesirable group effects, such as destructive dominance of a more powerful and influential participant, and conformance pressure within a group. Delphi refers to a structured process with flexible iteration rounds with controlled feedbacks aimed at obtaining reliable judgments and opinions of a group of participants anonymously. In our case study a two-round Delphi study was carried out. The first Delphi round was used for individual brainstorming on the customer involvement concepts as identified in our previous research and as prepared in the first phase. The second round was used for a verification of the results of the first round, a confrontation of the different results of the experts, and for a justification of expert's suggestions, all based on controlled feedback. For each of the two Delphi rounds, a well-elaborated set of questions was defined in accordance with Delphi guidelines and protocols.

Step 2: Extending the model (and linking findings to the SAFe levels)

In this step information gained from the Delphi study has been used to extend and enrich the initial customer involvement concepts. Where possible, links between the extended concepts and the SAFe levels, see Table 1, have been suggested.

Step 3: Validation

In the validation step all the experts, two from the preparation phase and five from the Delphi-based phase, have been asked individually in a focused validation interview a small number of questions (Wieringa and Morali, 2012). These questions were of the type "will the extended conceptual model work in the day-to-day practice of the company? Why? And: will the model satisfy the goals of the users? Why"? Subsequently the individual results were collected, analysed and combined and the total result was fed back to the respondents for validation.

4 RESULTS FROM THE CASE STUDY

In this section the results of the three steps in our case study will be presented and discussed. These results cover both an improved understanding of the existing concepts as well as the identification and definition of new customer involvement (sub)concept in the company. In the following first the preparation phase of the data collection will be addressed briefly. Subsequently the results of the diagnosis and analysis of each of the identified (sub)concepts will be discussed, in connection with validation aspects.

The preparation phase of the Delphi data collection resulted in information about the way the company deals with customer involvement in SAFe projects. Information was obtained about the goals of involving customers (i.e. improving product acceptance and product quality), the stages in that customers could be involved (i.e. to be decided by project manager and product managers), and how to involve customers in SAFe projects (i.e. via personal invitations or scheduled company visits). In particular a suitable terminology for implementing customer involvement concepts in the company has been identified. Concepts identified, partly redefined from our initial study, are respectively: project risk identification, customer involvement level, customer product utilization and competence, and customer motivation. Based on this information a two-round Delphi study has been executed, of which the results

will be discussed in section 5.1. Section 5.2 will address validation aspects.

4.1 Data Collection, Analysis And Model Development

4.1.1 Project Risk Identification

The need for project risk identification, in relation to customer involvement, was based on the need to avoid or reduce project uncertainty. Uncertainty (and risk) were caused by the lack of an approach (in SAFe) to characterise a project in relation to customer involvement. Clear concepts and terminology were lacking as well as measures for characterising projects. In accordance with (Applegate et al, 1996) it was suggested to consider project risk as being influenced by three project dimensions, respectively technology, project size, and project structure. Based on the usage of a 7-points scale (from a very low via an average, to a very high risk), a project typology has been developed. The responding experts accepted to handle this typology for their projects. Two respondents stated that their projects were sometimes of medium risk, and that as a consequence customer involvement could be marginal, but that motivating these customers should be a focus point. However, four out of five respondents identified their projects as often being of a very high risk, mainly because of the high technology and the size of the projects. In these cases customer involvement had to focus in particular on the competence of customers to be involved. Another discussion point was the responsibility to involve customers. Should this be done by project managers or product managers? In the second round of the Delphi study it was unanimously agreed that the reduction of risks regarding customer involvement could be best reached by making product managers responsible, because of their close contacts with and knowledge of customers. These kind of results showed that project risk identification could be a promising step to reduce uncertainty in the collaboration with customers. However it was stated by all participants that extra measures for project characterisation were needed to make project risk identification operational.

Regarding the position of risk identification in the SAFe framework (see table 1), it was suggested by the respondents to position this on the Program and Value stream level (in relation to e.g. project management issues such as increment planning and defining a roadmap).

4.1.2 Customer Involvement level

Regarding customer involvement level two sub-concepts have been identified by three out of five of the respondents in the first round of the Delphi study, respectively customer position and customer contribution.

Regarding the customer position, from a program manager point of view, the customers are funders of a project. When a customer is within the organization, then the customer is identified as an internal customer. Two of the responding experts defined their customers as internal funders. However, external customers, and e.g. a customer group, can also be recognized as funders. These are customers engaged in projects that build specific solutions, and as mentioned by one of the respondents, in these projects, customers are engaged deeply in the project, and they have the authority to define project requirements and specifications. In this case they should be treated, and involved as 'internal' customers/funders, since they have a similar authority as the customers who are from inside the organization. The respondents agreed that it was most common that the customer's position was that of a main project funder. Besides these 'internal' positions, general development projects were mentioned by three out of five respondents, in that customers have an external position.

Regarding customer contribution in product development it appeared from the interviews that a customer was authorised in two ways, respectively for interpreting and deciding on project data, and on contributing as a source of information. In literature this is considered as contribution as a subject or as an object (Holtzblatt and Beyer, 1993). Two of the five responding experts allow involved customers to interpret and decide on project data and to determine the direction of a project (so contribution as a subject). On the other hand three respondents stated that their customers don't have this authority. Customers can only give input and feedback to a product manager, so they act as an object. This contribution can be very limited.

Figure 2 summarises the concept of customer involvement level on the basis of position in the organization and customer contribution. In general solutions projects, i.e. with customers as objects, the customer authority and contribution should be very limited. In these projects, the product managers limit customer involvement since requirements are completely 'frozen' at the beginning of product development.

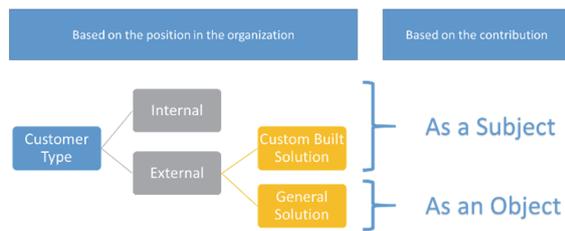


Figure 2: Customer involvement level based on position and contribution.

SAFe doesn't recognize customers as subjects or objects, but from the interviews it became clear that projects in Philips use this subject and object concept implicitly.

Determination of the customer involvement level was suggested by the respondents to be positioned on the Program and Value level as well as the Team level of the SAFe framework. The position of a customer can influence in particular the planning and control of projects, while a particular customer contribution can both influence verification and validation activities (on the Program and Value level) as well as the collaboration in development, e.g. the creation of user stories (on the Team level).

4.1.3 Product Utilization and Customer Competence

Regarding product utilization the business units in the company appeared to make use of three types of so-called 'user persona', implicitly or explicitly, respectively first degree (direct use), second degree (as provided by the direct user), and third degree user (people who install, deploy or monetize the product). This typology aims to give guidance to the project manager to determine whose and what kind of needs should be accommodated and prioritized. It appeared that the first and the second degree user are the most important customers (they directly make use the product, and the company has to satisfy them). Nevertheless, it also appeared that the third degree user can be an important stakeholder because of their authority to decide to invest in infrastructure or to buy product components or not. Although the concept of user persona is recognized in the Philips environment, it is not applied explicitly, in a formal way, in the business units.

Customers can be identified based on their competence, e.g. ordinary users, experts, and lead users (Magnusson, 2009). This specification helps the product managers to discuss and identify the abilities and knowledge of customers. The ordinary user is a customer who understands how the features of the product should be, but they don't understand the

technology that will be used. The experts understand the technology that will be used, but they don't understand how the features of the product should be. The lead users are customers who understand the features of the product as well as the technology to be used. From the interviews it appeared to be difficult to find lead users. In SAFe projects only ordinary users and experts were involved. Product managers make use of these distinct customer competences, although it was stated that experts are not involved as deeply as ordinary users.

The Delphi study revealed that the company has implemented the concept of customer competence implicitly. All respondents agree that user persona and customer competence are relevant concepts to be implemented in SAFe projects. Regarding the SAFe framework, it was suggested by the respondents to position product utilization and competence on the Program level, because of the importance of product utilization and competence of customers in evaluating systems and participations in inspections.

4.1.4 Customer Motivation

A company has to ensure that involved customers have a congruence of motivations and goals to achieve a successful product development. SAFe gives only limited information regarding how to attract the customers. Therefore, we adopted a concept formulated by (Fuller, 2010), who classifies extrinsic customer involvement motives, which are financial factors, social factors, and technological factors. Intrinsic motivation is recognised, as a condition when people enjoy to do something without expecting a compensation or rewarding. In this study intrinsic motivation is defined as consisting of psychological factors.

It appeared in our case study that although the mentioned concepts are relevant for the business units, the responding experts couldn't freely apply them in their daily work. For example, in some regions, the business units can't offer financial benefits to the customers because of local or governmental regulations. A financial benefit, such as the compensation or hospitality, can there be identified as bribery. Therefore, the company focuses in general at social, technological and psychological factors to attract the customers for getting involved. It appeared that the company also carries out preventive actions regarding customers who feel to be treated unfairly in case of different rewardings. From the Delphi study it became clear that in SAFe projects these motivation aspects are never addressed explicitly. It was suggested to adopt these concepts at

the Value and Program level due to the close interrelations with value issues.

Figure 3 shows the extended customer involvement model. On the main level four concepts are defined, respectively Project risk identification, Determining the customer involvement level, Customer specification, and Motivating the customer. As can be seen two sub-concepts, i.e. Project risk and involvement level play a role within more than one main concept.



Figure 3: The extended customer involvement model.

5 VALIDATION

Regarding the validation of the work done we refer to (Yin, 2013). We recognise four types of tests to establish the quality of the research, which are respectively construct validity, internal validity, external validity and reliability.

Construct validity focuses on the justification and correctness of the applied concepts and their interrelations. Internal validity addresses the understanding and the needs for new concepts (customer involvement). In this study a preparation phase for the data collection was executed with feedback and control loops with well-selected highly skilled company representatives. Customer involvement concepts from literature were discussed, eventually tuned to the characteristics of the company (e.g. terminology), and questions for semi-structured interviews in the Delphi study were developed. In the preparation study and the two-round Delphi study a chain of evidence has been established. In each round of interviews feedback has been given, so answers could be checked and eventually revised in case of misinterpretations. Regarding the external validity we can state that the resulting customer involvement model has been established with information from five experts from five different business units. So,

within the multinational company a particular level of generalisation of the model has been established.

Reliability focuses on ensuring that the result of the research is the same if the research should have been conducted by other people (Yin, 2013). According to this concern, this study performed a formal and structured way of a preparation and a two-round Delphi study with semi-structured interviews. According to the input and feedback from the respondents, the customer involvement model has been extended and enriched. This model has then been presented for discussion to the involved experts. In this final session the model was validated by all the involved experts, i.e. the SAFe agile expert, the Quality Manager, and the five selected experts from the business units.

6 CONCLUSIONS

This paper represents a partial achievement of a longer-term project, i.e., the development of an approach for customer involvement to improve SAFe implementations. An initial conceptual model, developed in previous research, was based on a structured literature review and analysis. This paper presented and discussed the extension and enrichment of the initial model. In our study we used an inductive approach, i.e. carrying out semi-structured interviews in the context of a two-round Delphi study. Based on the results we presented the extended customer involvement model. The responding experts, two groups of respectively two experts of the central organisation and five experts of representative business units, have validated the distinct elements of the model. In most cases the (sub)concepts have been recognized in practice although they were only applied in an incomplete and/or implicit way. For each of the discussed customer involvement concepts, suggestions have been given to implement them at the distinct levels of the SAFe framework.

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