

PAPER II

# **Practical model for user-driven innovation in agile software development**

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# Practical model for user-driven innovation in agile software development

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## Abstract

Social media provide new opportunities for user-driven innovation, since users can easily share ideas online and contribute to challenges launched by companies. However, companies are lacking models and practices for involving users in their innovation and software development process besides open idea generation campaigns. In this paper, we present a model for user-driven innovation and software development based on agile software development practices and online co-creation tools. The theory-based model has been validated in an empirical case study with 33 end users and four software developers that created a new online service based on the users' ideas. The case study proved that end-users can be integrated into agile software development, when using a structured process and online co-creation tools.

## Keywords

User-driven innovation, agile software development, online co-creation tools, social media, user involvement

## 1. Introduction

User-driven innovation has gained a lot of interest in companies that compete in developing new products and services that meet users' needs. Especially the rise of social media has provided companies with new opportunities for involving customers and end-users in innovation and product development. Online tools seem attractive especially in the field of consumer-oriented products and online services, since a large amount of geographically dispersed users can be reached easily, quickly and cost-efficiently. Virtual environments also support more interactive, flexible and frequent collaboration with users than when using traditional marketing research techniques [Sawhney et al. 2005]. Social media have been used especially for idea generation and feedback gathering via various crowdsourcing websites, e.g., Redesignme<sup>1</sup>, GetSatisfaction<sup>2</sup>, OpenIDEO<sup>3</sup>, My Starbucks Idea<sup>4</sup>, to name just a few.

However, user-driven innovation can be difficult to integrate with companies' innovation and software development processes. Companies do not have enough knowledge of utilizing users' input and social media-based interaction in their innovation and software development activities. Even if users' ideas are gathered via the company's own or an external innovation community service, it remains a challenge to organise and handle users' input so that it can be taken into

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<sup>1</sup> <https://www.redesignme.com/>

<sup>2</sup> <http://getsatisfaction.com/>

<sup>3</sup> <http://openideo.com/>

<sup>4</sup> <http://mystarbucksidea.force.com/>

account continuously in the software development process. There is need for practice-oriented models and procedures to utilize users' innovation potential via social media.

Agile software development practices have been widely used in software companies to enable iterative development and quick changes based on customer feedback during the whole development process [Larman 2003, Boehm and Turner 2003]. However, agile software development projects often lack interaction with the real end-users, whom the customers do not always represent [Hansson et al. 2006]. Therefore, it is important to complement the agile software development with user-driven design activities before and during the software development phase.

In this paper, we present a practical model for involving end-users in the innovation process and integrating users continuously into agile software development practices. The paper is structured as follows. First, we present existing research in the field of user involvement in agile software development and various forms of online user participation. After that, we define our approach to user-driven agile software development using online tools for co-creation. Then, we present a case study and the process model that was redefined based on the case study results. Finally, we discuss the implications for practice and future research.

## 2. Involving users in agile software development

Agile software development methods are lightweight processes for software development. The agile family consists of a number of different methods, but they all emphasize customer involvement and requirements prioritization and verification relying on tacit knowledge and communication as opposed to documentation [Boehm & Turner 2003]. A significant number of organizations utilize the practices of agile methods in their software development [Highsmith 2004].

Scrum is one example of the agile development method that consists of continuous planning, product backlog creation, and development with one month iterations [Schwaber & Beedle 2002]. Scrum practices are applicable in a context, where the customer is defined and can be physically present in the face-to-face Scrum meetings. However, the real end-users are not typically included in the agile software development process [Hansson et al. 2006], or only a small group of users interacts with the developers in face-to-face meetings and possibly some ICT tools [Kautz 2010, Hansson et al. 2003].

Chamberlain et al. [2006] have identified three different tactics of integrating user-centred design with agile software development. According to them the integration can be done by doing large scale user studies before the actual development cycles ("iteration zero" or business analysis phase) or by conducting user studies independently of the agile development cycles and involving user representatives in the development team. All of these approaches have some limitations. For example fixing user requirements before the development is contradictory to the principles of agile development [Agile manifesto 2001], and user representatives in the typical agile project are often not the real end-users.

Continuous user collaboration with developers is one option to achieve software products that better correspond to the actual market needs. According to the agile principles, "the most efficient and effective method of conveying information to and within a development team is face-to-face conversation" [Agile manifesto 2001]. According to this principle, continuous user involvement in agile development projects would work, if the developers and users work in the same organization or users can be otherwise easily reached. Most often, especially in distributed settings, users cannot participate constantly in the development process face-to-face. Especially, in the context of consumer-oriented business, it is hard to involve customers directly, since they are spread all over the world. In this context, online tools and easy-to-use social media services offer new opportunities.

Telephones, videoconferencing, email and wikis have already been used for customer participation in agile software development in distributed contexts [Sharp 2008, Korkala et al. 2009]. This kind of tools can be used in a virtual team work, where the participants are known. However, there are only few examples of involving end-users in agile software development. Hansson et al. [2003] report user support (by telephone), face-to-face user meetings, courses and newsletter as tools for contacting users in an agile software development project.

In Open Source Software (OSS) context, there is a long tradition of involving users in the development process via online tools. Users have been involved in the development via email lists [Barcellini et al. 2008] and developer forums. However, in the OSS context, the "users" that participate in the development projects are often also developers or otherwise very active contributors [Barcellini et al. 2008]. The developer tools are not very attractive and easily approachable for those end-users, who are not software developers themselves.

"Open It" approach introduced by Hagen and Robertson [2009] combines the commitment of participatory design [Schuler & Namioka 1993] with the transparent and community driven approach embodied in the open source software movement. One example of open community-driven design is the Drupal 7 User Experience project. In that project wire-framing and usability testing were crowdsourced using various online tools, namely YouTube, Flickr, Twitter, and multiple blogs [Reichelt 2009]. Wire-frame designs were asked from users during the Iteration zero, and usability tests were conducted by the users themselves throughout the project.

### 3. Combining user-driven innovation and agile software development

We define user-driven innovation as an approach in which users are the sources of the ideas, drivers of the design, and decision makers throughout the design process. When companies want to utilize the user-driven innovation approach, they need systematic procedures to involve users in their innovation and software development processes. Scrum software development practices offer a standardised structure for iterative software development based on users' ideas and feedback, but are seldom used with distributed end-users. Therefore, we propose a model in which continuous user involvement in software innovation and agile development process is enabled by using online co-creation tools (see Figure 1).

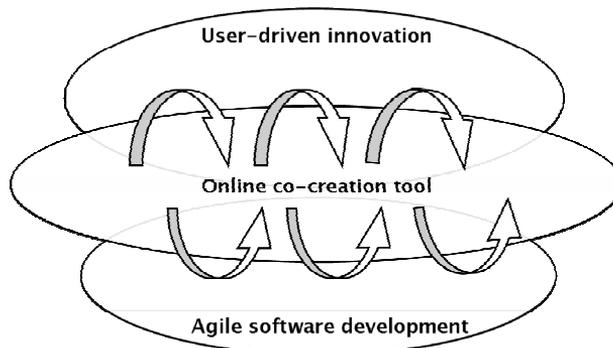


Figure 1. User-driven innovation can be integrated into agile software development using online co-creation tools.

Online co-creation tools enable more active role of users and still does not require full-time commitment. Users can be involved to the project and considered as team members even if they use only a little time for the software development project. Social media mechanisms (liking, commenting, voting, personal profiles, activity points, news feeds) make participation easy and fun for the users and can therefore motivate to make bigger contributions, as well.

When combining user-driven innovation with agile software development practices, facilitation is needed for translating the user input into system requirements and mediating it into system

development. However, as distinct to human-centred design [ISO 13407 1999], in our approach researchers do not study users but facilitate them in the process of analyzing their own needs and communicating them to the developers.

In order to find innovative and motivated end-users to participate in the innovation process, we used the lead-user approach, introduced by von Hippel [1986]. Lead users are defined as individuals, who are at the leading edge of an important trend in a marketplace under study and anticipate relatively high benefits from obtaining a solution to their needs [von Hippel 2005]. Hence, lead users experience needs earlier than rest of the market and are more likely to innovate, if they will not find a ready-made solution for their needs [von Hippel 1986]. Usually user involvement is seen most valuable in the idea generation phase of the innovation process, but more recent findings imply that especially lead users can be valuable to companies beyond the fuzzy front end of creating radical new product and service innovations [Schreier & Prügl 2008].

A preliminary framework of the lead-user driven innovation in software intensive companies has been presented in Koskela et al. [2009]. The model consists of four phases, namely lead user identification, idea generation based on user needs, collaborative concept design, and agile software development with quick iteration cycles. Lead users participate in all phases via online co-creation tools. Online tools are the key enabler for continuous communication and collaboration between lead users, software developers and facilitators (user researchers and/or designers).

#### 4. Results from the case study

We further developed the model for user-driven agile software development in a case study with real end-users and a software developer team consisting of four students. The aim of the study was to implement a prototype of a new social media service based on the end-users' needs and ideas. In this study, two researchers facilitated the process and acted as product owners together with two company representatives. The case company was interested in getting a functional prototype for demonstration purposes, but the software development was carried out in a student project and was thus a research project without a purpose to develop a commercial social media application.

The key enabler of the user-driven agile software development model is the online co-creation tool. In our case, we used a social media-based tool called Owela<sup>5</sup> that enables continuous collaboration and user involvement in the form of, e.g., idea posts, diaries, chats, commenting, voting, and user profiles [Näkki & Virtanen 2008]. For the case study purposes, a separate project area was created on the Owela platform and all stakeholders created user accounts there.

The process used in the case study is illustrated in Figure 2. The upper part of the picture presents the tasks in which the users participate via the online co-creation tool. The user tasks have been applied based on the user-centred new product development process as described by Salovaara and Mannonen [2005]. Idea generation is followed by concept design in the form of mock-ups that are refined with users. Both users and business people participate in concept evaluation. After concept selection, users are involved in requirements gathering, user interface design, and testing.

The lower part of Figure 2 shows the tasks that the company performs. Facilitators' role is to coordinate the tasks and ensure that user input is taken into account in the agile software development process. The actual software development occurs in the last phase, and in our case, we followed the Scrum method with iteration planning, software development, review, retrospective and demo release.

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<sup>5</sup> <http://owela.vtt.fi/>

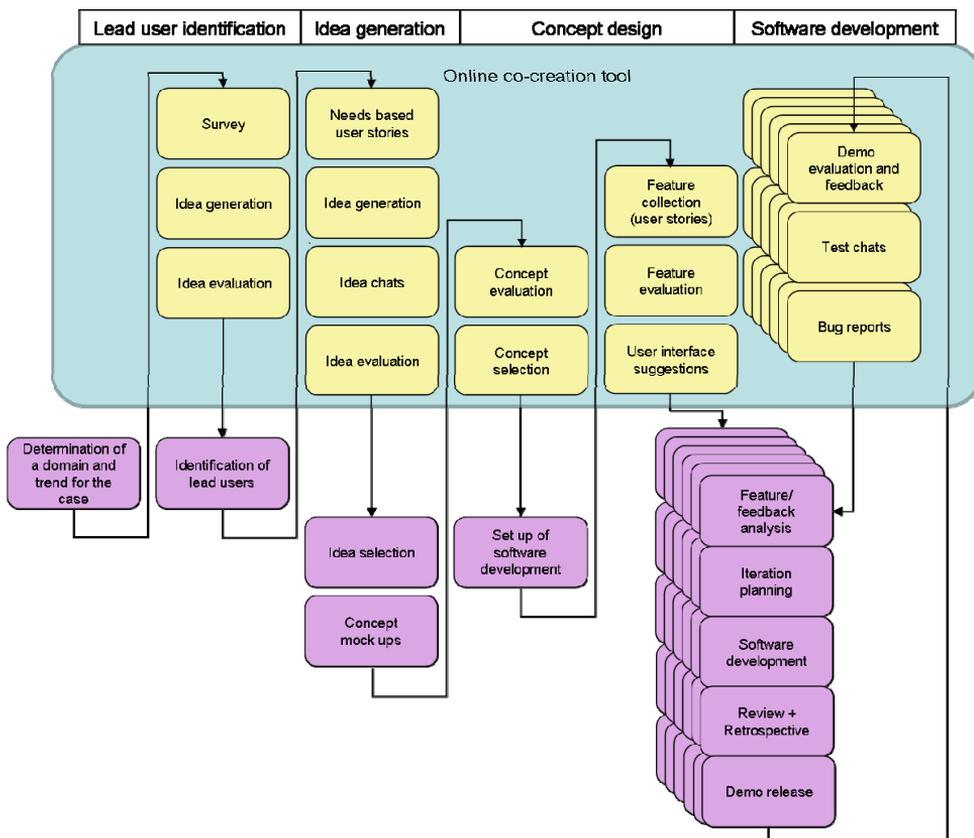


Figure 2: Model for combining user-driven innovation and agile software development

The case process started by choosing the innovation domain that, in our case, was social media. The more specific trend studied in the case was the use social media services via mobile devices. The first phase of the process was lead-user identification. It started with a large online survey of 600 Internet users and initial idea collection round in Owela in which 200 of the survey respondents registered. Based on the quality of the gathered ideas and lead user characteristics measured in the survey, facilitators identified a group of possible lead users and invited them to participate in the six months long concept design and software development project via an online innovation workspace Owela.

With the selected group of 33 users, the actual idea generation phase started in Owela by first collecting the users' everyday needs and challenges with current mobile social media services in a form of stories that were posted in Owela's blog. Altogether, the users wrote 42 stories and commented them 185 times. Based on the stories, users generated ideas for new social media services individually by posting them in Owela as well as by discussing together in four idea chat sessions that were moderated by the two facilitators. Users continued to comment and evaluate each others' ideas and develop them further in Owela. As a result, we got 30 new service ideas and 120 comments on them.

The facilitators, company representatives and software developers selected and combined the ideas into five main concept ideas. The evaluation and selection of the ideas was based on the users' evaluations and comments, but the technical feasibility and business potential of the ideas were also considered. The five selected concept ideas were further developed into visual mock-ups. The concept mock-ups were then posted in Owela so that the users' could comment on them and vote for their favourite concept. The final decision of the concept to be implemented was

made by the votes of the lead user group. The selected concept was a mobile web application for locating services and people based on user-generated content.

The concept design phase continued with creating a list of wished features to the service. Features were collected both via general questions and user stories that described short WHO, WHAT and WHY scenarios [Cohn 2004]. Most of the user stories in the feature list were written by the facilitators based on users' earlier ideas and comments. Some users also posted new feature suggestions. The main task for the users at this point, however, was to comment and rate the features in order to help the prioritization of the features in the software design. In the concept design phase the users also had the chance to post user interface suggestions for the service in Owela by using an additional online tool called Mockingbird<sup>6</sup>.

The final phase of the process was the actual software development. It was done in an agile manner in two weeks' iterations and following the Scrum practices. After each iteration (or "sprint"), a demo version of the service prototype was released in Owela. The users were able to test the demo and give feedback to the developers either by commenting in the Owela workspace or by participating in test chat sessions where the users were able to discuss directly with the developers. Through Owela, the users also had the change to report bugs they encountered when testing the demo. The facilitators analysed the user feedback and discussed it with the software developers in the iteration planning sessions that were held in the beginning of each of the software iterations.

After each iteration there was a review session, in which the developers and facilitators evaluated the progress. Review was normally held face-to-face, but in the last two iterations, a test chat session was used for the review. Users, facilitators and developers discussed and tested the new features collaboratively. The software developers also participated actively in the Owela discussions wrote a blog of their progress and joined the test chat sessions to get direct feedback from the users. The developers also commented users' feature suggestions and bug reports in Owela.

## 5. Discussion

Our results show that it is possible to integrate users even in a quick agile software development process, almost in a daily basis. Users participated actively in the design process and had decision-making power regarding the solution. Both users and developers were satisfied with the process. Online workspace proved to be an effective and pleasant way to involve users into the new software development process. Users liked the social aspect of the idea generation; being able to share their own wishes and possibly influence future products. Eight months development process was not considered too long or burdening, since the contributions could be done in small pieces whenever the users had time for that.

Although the software was refined throughout the agile development process based on the user feedback, it was important that the main concept idea was clearly defined before the actual programming work started. The users had the possibility to invent new features to the concept also later on, but it was important that they had a shared the vision of the product that was being developed. Otherwise, the feature suggestions could have been contradictory and not aiming at the same end result.

Because of the continuous user involvement and iterative software development, the users actually witnessed how their feedback impacted the development of service prototype when the next demo version was released. This kept them motivated to participate. Users appreciated especially the chat sessions, in which they could interact directly with the software developers and each others. Other people's ideas motivated them, and developers could take the feedback

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<sup>6</sup> <https://gomockingbird.com/>

immediately into account. This suggests that synchronous communication tools are still needed, although real-time sessions are more difficult to organize. Asynchronous tools, like commenting and voting, provide still the means for continuous user involvement. Using the Owela tool, developers and facilitators could ask user feedback even in a short notice. As all discussions remained online, users were able to participate in the discussion whenever they had time for it.

Direct user interaction changes the way how the developer and facilitator team sees the product and makes decisions. Users' goals become the basis for decision making much more than in a "traditional" product development. Users should not be asked to develop technical details, but instead they should be given questions and tasks that they can complete based on their own experiences and opinions.

The roles of the participants will change in the development and especially in the research team. Although users can influence the software innovation and development process more directly, facilitators are still needed in translating the semi-formal and need-driven user data into software requirements. Facilitators have to be conscious of their role and the possible influence they might have so that user needs are interpreted correctly.

The most important findings of the case study were:

- Agile software development provides a suitable framework for user involvement.
- A motivated lead user group can be involved even in a long term innovation process.
- The basic product concept must be designed before the software development.
- Both asynchronous and synchronous communication with users is needed.
- Online co-creation needs continuous facilitation.

## 6. Implications

The presented model for user-driven innovation appeared to be applicable in agile software development, but it could be applied also in the innovation and development of other consumer-targeted products and services as well. Especially the first three phases of the user-driven agile software innovation, namely lead-user identification, idea generation and concept design are applicable for any kind of product or service concept. Users can participate in the innovation process via online co-creation tools, if there is a direct link to their everyday life and the level of knowledge. In order to develop product or service concepts online, it needs to be possible to visualise them, e.g., with pictures, videos or storyboards.

If the product or service can be developed in small iterations, users can participate also during the development phase. If the product or service cannot be tested online, a more slowly user-driven innovation process may be applicable. Material products and real-life services can be tested in face-to-face sessions or in use after their launch. In that case the cycles of user feedback are more slowly than in the agile software development case. All in all, the application of the model to other areas needs further research.

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