Making Innovation Happen: Tool-Support for Software Related Communities for Innovations

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Abstract. "Crowdsourcing" is currently one of the most discussed key words among IS and innovation researchers. The major question for both research and business is how to find and lever the enormous potential of the "collective brain" to broaden the scope of "open R&D". Thus, Communities for Innovations seem to be a promising way for integrating customers into innovation processes. But what are necessary and suitable functionalities and tools concerning a virtual Community for Innovation? Based on the principles of theory driven design, in this article we identify creativity supporting functionalities and tools that can be systematically selected and implemented for a virtual Community for Innovations in the field of Software development. Being deduced from theory on creativity support tools, these components foster the successful collaborative creation of ideas, thus leading to promising innovations.

Introduction

The Potential of Open Innovation for Software Companies

Innovative strength in Germany compared to other countries can be found in the domain of engineering and industrial commodities. A prominent example is the German automobile industry (Holl et al., 2006). However, this can not be stated for German software producers, which are only average compared to other leading European countries or the US. According to a survey by the German Federal

Ministry of Education and Research, German software producers lack a business culture fostering systematic innovation activities. There is no systematic brainstorming in order to generate innovative ideas and ideation takes place informally without sustainability and is often driven by coincidence (Holl et al., 2006, p. 118). Furthermore, software producers' management of innovation is not using the innovative potential of its stakeholders consisting of for example its own staff, sub-contractors and end-users. These stakeholders are often rather seen as sources of need-information than of solution-information. Solution information represents not only the customer's needs and wishes but also customer based suggestions that describe how to transfer these ideas into marketable products (E. von Hippel, 1994). As a consequence, German software producers generate fewer "real" innovations compared to software producers from other countries. As they are often organised as a one-man as well as one-product business, they usually generate incremental innovations, improving their existing software products over a long period of time without generating disruptive or radical innovations. However, this situation will endanger software producers' future perspectives in the highly competitive software market.

A chance for software companies to overcome these problems lies on opening up the innovation activities to external resources. Thus, customer and stakeholder integration into innovation activities are seen as an important competitive strategy, especially for small and medium sized software producers. This approach often is referred to as "Open Innovation" (Chesbrough, 2003; E. von Hippel, 2006; E. von Hippel & Katz, 2002). Literature describes the integration of customers and other stakeholders as one of the biggest resources for innovations (Tidd, Bessant, & Pavitt, 1997; Wagner & Prasarnphanich, 2007). The underlying idea is: The integration of stakeholders will open up the company's innovation funnel – more potential perspectives or ideas for creating innovations come to the innovation process. Or in other words: the amount of innovation potential that can be poured into the innovation funnel is rising because more actors are actively involved. Therefore, the company gains more ideas for innovations. Thus, the principle of collective intelligence or wisdom of crowds is the underlying assumption of Open Innovation (Libert & Spector, 2007; Surowiecki, 2005).

Communities for Innovations for Software Companies

These so-called Open Innovation Systems require communication and interaction between all parties involved, namely the company's internal actors as well as its external stakeholders. Therefore, a couple of methods and instruments exist and are used in practice. They allow stakeholder integration into the early stages of the innovation process. Literature describes three core-methods: the Lead-User-Method, Internet-Toolkits, and Ideas Competitions. (1) The Lead-User-Method

implies systematic identification of single innovative customers - so-called lead users - and their integration into workshops in order to generate ideas and concepts for new products or services together with companies' employees (Eric von Hippel, 1988). (2) With the help of User-Toolkits, customers are asked to design concepts for new products via the Internet or a standalone software application (E. von Hippel & Katz, 2002). (3) By conducting Ideas Competitions, companies attempt to collect innovative ideas from customers (Walcher, 2007).

The problem with existing methods and practices is that they exclusively focus on integrating a single individual into the innovation process and none of them fosters collaboration amongst involved parties. In Ideas Competitions, even competitive situations are induced preventing collaboration among idea contributors. But collaboration has been identified as a great potential of stakeholder integration (Gascó-Hernández & Torres-Coronas, 2004). Research shows that most innovations are not the result of a single inventor but rather of collaboration processes where many individuals contribute their individual knowledge, experiences, and strengths (Franke & Shah, 2003; Gascó-Hernández & Torres-Coronas, 2004; Nemiro, 2001; Sawhney, Verona, & Prandelli, 2005). Furthermore, established methods and practices solely serve the early stages of the innovation process where ideas for innovations are generated. There are no practices or methods available that allow involved parties to enhance or elaborate collected ideas into innovation concepts or even prototypes.

Collaboration can often be found in virtual communities, e.g. in the context of Open Source Software (E. von Hippel & von Krogh, 2003). Therefore, Bretschneider et al. (2008) introduced the concept of a company induced virtual Community for Innovations consisting of the stakeholders of a software company, especially customers and company members. Previous work on community building in other domains has shown that to a certain extend it is possible to influence building and establishing virtual communities according to specified goals (Leimeister & Krcmar, 2005, 2006).

The proposed Community for Innovations aims at supporting software companies at every stage of its innovation process. Acting via an internet-platform, the community members can generate ideas and collaborate with other community members. Each member of this community can submit ideas, connect with idea contributors that submitted similar or complementary ideas, and elaborate ideas in collaboration with matched members. Thus, the community enables forming various networks/teams that will collaboratively elaborate better, more meaningful, and relevant ideas compared to those initially submitted. Using this mechanism will help select the best ideas and will increase the benefit for the company significantly. The underlying, linear evolution process from the perspective of a single idea is shown in figure 1.
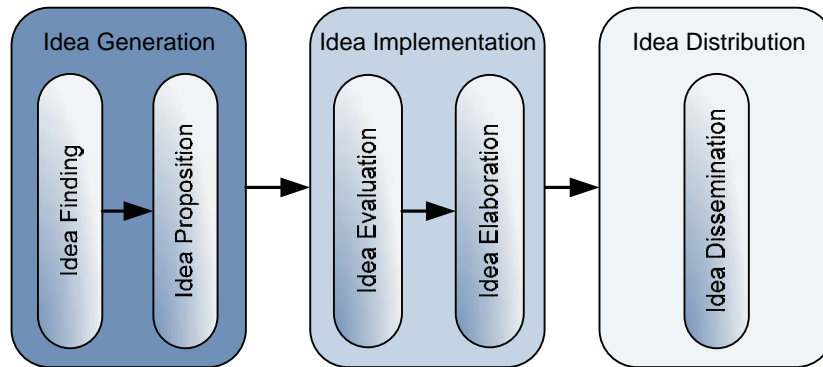
Figure 1: The idea evolution process of the concept of Communities for Innovations

Bretschneider et al. (2008) assume that ideas generated in this manner will likely carry much so-called solution-information. On the basis of those elaborated ideas the formed networks/teams can start developing innovative software prototypes collaboratively.

The proceeding of this paper is as follows: In section two we introduce theory on creativity supporting software-tools. Following, on the basis of the theoretical background, we derive an assembly of functionalities and tools for an internet based community of innovaiton which are suitable to support creative activities focusing on the area of software companies. Section four will conclude our work with a discussion on further research in this area.

Theoretical Background: Activities and Tasks of Creative Work

The activities of the members involved in innovation value creating are highly creative and activate an individual's creative process (Amabile, Conti, Coon, Lazenby, & Herron, 1996). The GENEX framework developed by Shneiderman (1999, 2000, 2002, 2007) proposes four activities and eight corresponding tasks in creative work as shown in figure 2. According to Shneiderman, this list does not make any claim to form a complete list, but it can act as a kind of checklist for the development of creativity supporting software tools (Shneiderman, 2002).

The activity *Collect* contains the tasks *Searching* and *Visualizing* for making existing existing information accessible and comprehensible. Thereby, information can be represented by various types of media such as photos, movies, sound files or plain text. The challenge for developers of creativity supporting tools is the choice or development of tools and functionalities which enable interpretation, representation and ascertainability of these heterogeneous formats and also their interrelations in an effective and efficient way.
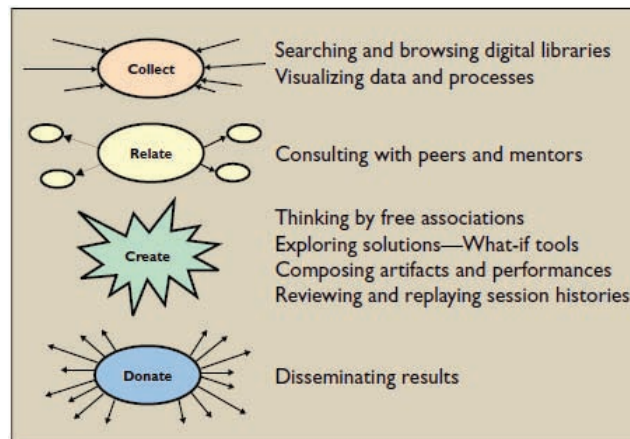
Figure 2: Activities and related tasks according to the GENEX framework (Shneiderman, 2002)

The activity *Relate* refers to consulting with other people such as peers and mentors. Consulting thereby can be supported by consultation tools which enable and support communication in consideration of the dimensions time, space and amount of participants. The dimension time contains the question whether the supported communication takes place in a synchronous (e.g. by chat, telephone or voice over ip) or asynchronous way (e.g. by mail). The dimension space deals with the question whether the communicating peers are located at the same place or separated from each other. The amount of participants affects the amount of communication channels which have to be provided in order to enable two or more participants to communicate (in consideration of the dimension time).

The activity *Create* contains overall four tasks namely *Thinking by free associations*, *Exploring solutions – what-if tools*, *Composing artefacts and performances* and *Reviewing and replaying session histories*. Thinking by free associations, sometimes also called *brainstorming* or *lateral thinking* (De Bono, 1971) covers a wide range of possible functionalities and tools as there are lots of ways to enable free association, for example Mind maps or Thesauri. *Exploring solutions- what if tools* refers to tools which implement functionalities to observe results when changing single values of a more or less complex experiment. Examples would be spreadsheets. Composing Artefacts and replaying session histories refers to tools which enable the composition and rearrangement of existing artefacts to new compositions. Functionalities for *Reviewing and replaying session histories* (moving forward and backward in the history of the composition process) thereby ensure the preservation of each state during the composition process.

The activity *Donate* refers to disseminating results to others (e.g., peers and mentors). Thus, elaborated ideas can serve as artefacts others in turn can use as basis for their creations.

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Tools and Functionalities for IT-based Support of the Innovation Process

In order to derive functionalities and tools for software related communities for innovations, we apply a theory-based approach as proposed by Briggs (2006) to develop non-intuitive design choices that produce successes beyond those possible with an intuitive non-systematic approach. In the following we will derive functionalities and tools for communities for innovations following the GENEX framework.

Each of the activities of the GENEX framework can be assigned to one or more stages of the evolution process of a single idea. During the generation and implementation of an idea, tasks out of the activities "Collect" and "Relate" emerge and can be supported by suitable functionalities and tools. After these two stages follows the dissemination of an idea to the community implying tasks out of the activity "Donate".
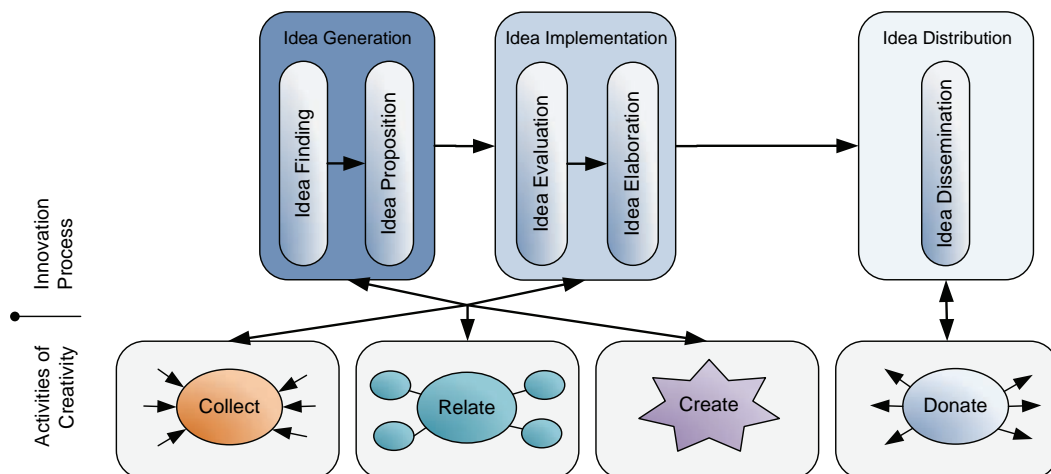

Figure 3: Activities of Creativity assigned to the innovation process

In order to systematically identify and classify tools and functionalities supporting a community for innovation's idea evolution process, in the following we use a classification scheme on the basis of the activities and tasks the GENEX framework implies. Although, we focus on communities for innovations for software companies, the classification itself - to a certain extent - represents a generic scheme for innovation communities in general. The activities and tasks probably emerge in every Community for Innovations.

Activity	Task	Tools / Functionalities
Collect		
	Searching	Filter (e.g. Table Filter), Keyword Search, Logical and Context Operators, Regular Expressions
	Browsing	Continuous Scrolling, Pagination, Tag Cloud, Hyperbolic Browsing, Thumbnails, Carousel View, Sorted Views
	Visualizing	Tag Cloud, Hyperbolic Browsing
Relate		
	Consulting	Email, Instant Messaging, Voice over IP, Chat, Forum, Conference Call, Blog, Wiki, Newsgroups, Comments, Address Directory, "Find an Expert" functionality, "Tell a friend" functionality
Create		
	Thinking by free associations	Mind maps, Copy & Paste, Live Preview, Drag & Drop, Modelling Languages / UML, Interface Mock-up Tools, Collaborative Text Editing, Collaborative Drawing
	Exploring	Device Simulator, Modelling Languages / UML, Interface Mock-up Tools, Integrated Development Environments
	Composing	Wiki, Live Preview, WYSIWYG Editor, Copy & Paste, Interface Mock-up Tools
	Reviewing & replaying session histories	Versioning, Session History, Wiki
Donate		
	Disseminating	Idea Description, Attachments, SVN, Hosting, File Sharing

Table 1: Tasks and corresponding tools / functionalities

Supporting "Collect – Activities"

Activities in the domain of collecting information contain tasks of searching and visualizing. Concerning communities for innovations in terms of an internet based virtual community, we identified functionalities and tools as presented in table 1. The core functionalities in this area enable various ways of browsing, formatting, filtering, browsing and visual processing of information.

Search tasks imply functionalities to define search keys for example in terms of single keywords, combinations of keywords by logical and context operators or regular expressions. Furthermore, search tasks can be supported by filtered views of data for example using table filters.

Supporting the *browsing* of data, functionalities are required which enable a clearly arranged, intuitive and easy to use interface for browsing few as well as a lot of data sets. Suitable functionalities here are various forms of presentation

such as thumbnail previews, hyperbolic browsing, tag clouds, pagination or sorted views (cp. figure 4).

Support for *visualization* tasks overlaps with support for browsing tasks. They can also be supported by functionalities such as tag clouds or hyperbolic browsing mentioned above. These tools and functionalities help users in gathering relevant information out of large amounts of data (cp. figure 4).
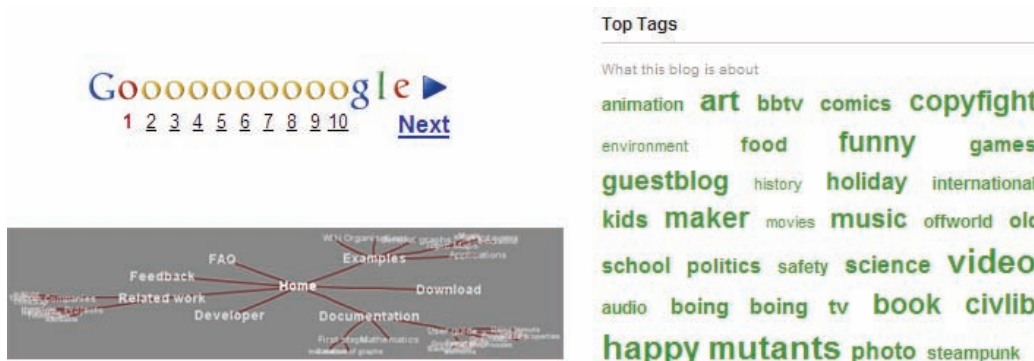
Figure 4: Pagination, tag cloud, and hyperbolic browsing (clockwise from top left; sources: google.com, technorati.com, mfirst.de)

Supporting "Relate – Activities"

Tasks in *relating* activities are all about communicating with other people such as peers and mentors within or also outside of the Community for Innovations. Besides common and well-established functionalities fostering communication such as email, instant messaging and conference calls, we also focused on how to find peers to communicate with for example in order to get assistance on specific topics. Therefore, we consider tools such as "Find an Expert" tools, which propose community members with expertise in a special topic (cp. Maybury, D'Amore, & House, 2001), address directories or at least searchable user profiles providing personal information. In this domain, the parameters place and time have to be considered in order to support the different requirements of a Community for Innovations. Wikis, Blogs and the use of comments for example cover asynchronous communication whereas instant messaging and chats cover synchronous communication.

Supporting "Create – Activities"

Supporting creating activities includes the majority of functionalities and tools we identified as suitable. In this area, a vast amount of functionalities and tools exists fostering thinking by free associations, exploring, composing and reviewing & replaying of session histories. We focused on general approaches such as Mind

maps, Wikis, WYSIWIG Editors, collaborative text editing or drawing (cp. Baecker, Nastos, Posner, & Mawby, 1993; T. Buzan & B. Buzan, 1996; Leuf & Cunningham, 2001) as well as on tools and functionalities dedicated to software development. The latter for example covers the use of interface mock-up tools and device simulators (cp. Shneiderman, Plaisant, Cohen, & Jacobs, 2009), modelling languages such as UML or even the integration of integrated development environments (IDE) such as eclipse.

Supporting "Donate – Activities"

Donating activities refer to the dissemination of a participant's results to the Community for Innovations. The dissemination can be realised by basic functionalities of an internet based platform such as the possibility to post the description of an idea and maybe several attachments which is included into an idea-pool. This pool in turn combined with functionalities and tools supporting collecting activities can serve as a basis for other community members executing tasks such as search and browse. Regarding communities for innovations for software companies, in our opinion, domain specific tools fostering the management of source code (e.g. Subversion) or the hosting of digital resources are suitable (e.g. by FTP servers or file-sharing solutions).

Conclusion

In this paper, we derived classes of functionalities and tools for IT-support in software related Communities for Innovations based on a classification scheme we deduced from theory. The requirements we identified are not exhaustive but a first starting point. Moreover, the collection we presented still has to be evaluated in terms of adequateness, usefulness and user acceptance. As we currently are engaged in specifying and establishing a Community for Innovations for software companies, we will implement the mentioned functionalities and tools as a firs application of the classification scheme. Thus, we will also be able to evaluate the proposed classification scheme in future work.

Even though we deduced the classification scheme focussing on its use for software related communities for innovations, to a certain extent it can be used for any Community for Innovations. In future work, we will enhance and generalize the classification scheme in order to cover Communities for Innovations in general.

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