

MANAGING KNOWLEDGE IN FUZZY FRONT END OF OPEN INNOVATION

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ABSTRACT

Following the “open” innovation paradigm leading companies are increasingly integrating customers into their innovation processes as they are the wellsprings of ideas and knowledge about the products. This paper focuses on innovation process and how customers can be integrated in that process with help of knowledge management technologies. Wikis are described as effective conversational technology for ad-hoc problems with decentralized knowledge sources, meaning that they are one fitting information technology answer to the cooperative Fuzzy Front Ends of innovation processes, particularly their realization phases. Our most important contribution is proposal of effective IT tool that enables knowledge creation and execution of – otherwise highly ill structured – initial stage of open innovation process.

Keywords: New Product Development, Fuzzy Front End, Wiki, Knowledge Management, IT

INTRODUCTION

One of the most important organizational capabilities is ability to innovate and create new products for their customers (1, 2). A well managed invention-innovation chain can be seen as one of the most crucial organizational processes. The opening steps of this process are knowledge intensive as problems need to be recognized and ideas for new products generated. As these products will be consumed (or not!) by customers, and as customers know products and their own needs better than the organizations that produce them, they should be one of the central sources of knowledge in innovation process (3). Ideas, thoughts and information about current products and services, customer trends and future needs, such as knowledge *from* customer represent ideas for product innovation. An organization must actively seek out such knowledge and enrich it using capabilities of its employees (3, 4).

Organizations have realized the need to open up the innovation process by involving customers and even business partners in all facets of innovation (5-8). However, they continue to struggle with the lack of effectiveness and efficiency in the innovation cycles. Customers can never properly articulate their knowledge, and organizations are having difficulties introducing customers to product innovation process, querying their knowledge, codifying that knowledge and capitalizing on it. In addition, the knowledge creation process in the front-end is difficult as it is impossible to envision all of the knowledge needs upfront

or a priori. Requirements change over the time span of innovation development. Hence, one needs to be careful not to be too rigid in trying to design something, however, one cannot be too loose and unfocused – hence there is an innate fuzziness of the process, which is not easy to manage, let alone to have information technology (IT) introduced in it to support it.

This paper explores the issue of managing knowledge in open innovation process, particularly in the crucial “fuzzy front end” stage, and introduces potentially effective enabler in a form of information technology support for the process.

AREAS OF CONCERN

In explanation of knowledge management in fuzzy front end of innovation process and corresponding IT support, this paper draws on three important research and practitioner fields:

1. Knowledge based theory of the firm;
2. Process perspective of value of knowledge management and information technology (IT) to business performance;
3. Management of technology: open innovation process.

Add 1) At the background sits the **knowledge based theory of the firm**, which recognizes people and their knowledge capabilities the most important organizational asset. It argues that not merely the volume of knowledge but rather the ability to utilize strategically important knowledge and the ability to dynamically create new knowledge are the hub of company’s sustainable competitive advantage (2, 9-11). **Knowledge management**, hence, is the practice of planning, organizing, actuating and controlling activities that will enable utilization of existing knowledge and new knowledge creation, when it is needed in current and future decision making activities with the purpose of improving the organization’s efficiency and effectiveness.

Add 2) Authors of this paper advocate a **process perspective of value of KM to business performance**. Activities that enable utilization and creation of knowledge have to be injected in everyday business processes, which than, have to be appropriately supported by IT tools. Namely, the process perspective of value of IT to business performance argues, that IT can only impact performance through intermediate contributions through processes (12-14). Reasons for difference in performance of IT applications between different companies stem from within the organization, not from outside environment: effects of IT are best documented at the level of processes within a firm, meaning that just throwing technology in a process does not improve that process .

Add 3) Traditional (“closed”) innovation paradigm has been replaced by “open” innovation paradigm where external parties are brought into the innovation process to improve knowledge creation in that process (5-8, 15).

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In order to innovate successfully, the innovation process must firstly be understood and optimal decisions on how to integrate customers in the process need to be made. In addition, the innovation process needs to be supported effectively both by organizational and technology mechanisms. This is also the order of continuation of the paper.

INNOVATION PROCESS AND THE CUSTOMER INTEGRATION

Traditional (“closed”) innovation paradigm has been replaced by “open” innovation paradigm where there is a push to make the innovation process more open and collaborative (6) (see Figure 1). External entities such as suppliers, customers, business partners, etc., are brought into the innovation process, as they can share knowledge about products and create new relevant knowledge in dialogue. Organizations must co-create products with customers rather than for customers (16, 17).

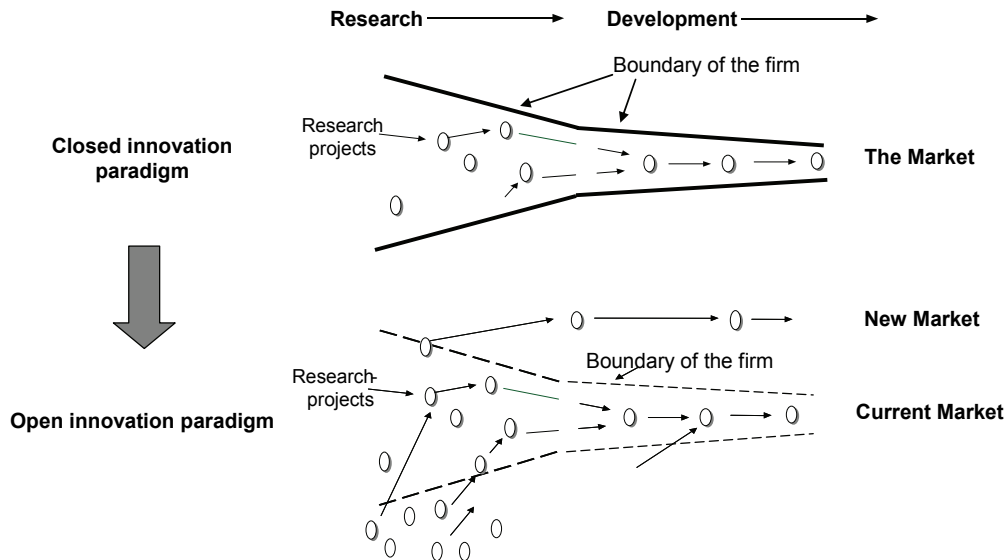


Figure 1: Traditional vs. Open-innovation paradigm (Chesbrough, 2003)

This paper focuses on the first phase of problem recognition and idea generation often called “**Fuzzy Front End**” (FFE). In order to successfully and fruitfully create new knowledge (i.e. start the innovation process) the integration of customers into the Fuzzy Front End process needs to be well-planned and implemented. The necessary process steps are derived from both theory – drawing from the field of cooperations in general and R&D cooperations in particular – and practice – numerous interviews and case studies in Europe and the US (18).

First, the decision to open the innovation process for external partners has to be made in accordance with the overall company and technology strategy. The expected customer contribution and the resulting specific customer roles are crucial for the execution/design of the whole process (15). **Open innovation is initialized.**

Second, **customers to be integrated need to be selected.** The selection and engagement of fitting customers are important success factors (19). The search for potential partners has to be systematic considering contextual factors like competition, market situation, and existing experiences. The probability of success regarding the above mentioned integration goals as well as a pre evaluation of strategic and cultural fit have to be taken into account. Especially relevant is consulting “lead user” segment of customers. Research has shown that the pressing needs of lead users will eventually become requirements for other users in the marketplace (20).

Finally, in the **realization phase**, the actual value creation takes place (18). The necessary steps are to shape the cooperation considering the respective customer role and to realize the integration on an operational level. In the remainder of the paper we focus on realization

phase, as it is the most important of the three to gain *knowledge from customers*. Managers are faced with the challenge of identifying and selecting those activities that enable the organization to tap into customers' knowledge and therewith create new organizational knowledge. Geographical dispersion of customers additionally adds to complexity and fuzziness of the FFE process.

In next two sections, based on characteristics of each phase, necessary activities for knowledge creation in mixed teams will be identified. Special attention will be paid to **1) looking at contributions from integrated customers** and **2) IT-support for the process**.

KNOWLEDGE CREATION WITH INTEGRATED CUSTOMERS

According to Nonaka and Takeuchi (2, 9), knowledge creation is a dynamic process. Knowledge is constantly constructed with help of information that elicits new beliefs (based on existing ones), upon which expertise is applied in follow-up action. Mutual generation of knowledge is based on social relations, which result from the personal interaction between the individual persons involved - here between representatives of the manufacturer and the customer (21, 22).

Nonaka & Takeuchi (2) identified four fundamental kinds of knowledge conversion in their knowledge creation »SECI« cycle: the socialization (tacit to tacit), the externalization (tacit to explicit), the combination (explicit to explicit) and the internalization (explicit to tacit). Regarding the focus of this work - to facilitate the exchange and the creation of product and application-oriented knowledge for a manufacturer and its customer - the **combination**, **externalization** and **socialization** are of particular importance. Customers can synthesize new knowledge (e.g. new product properties) from the combination of various (explicitly) externalized knowledge elements. Externalization is the key to knowledge creation as it creates new concepts from tacit knowledge. However, when tacit knowledge is difficult to express, **socialization** process should be pursued as well. Engaging in joint activities such as brainstorming camps, working together, and observing customers at using products, facilitates common understanding between people with different knowledge bases (2), which customers vs. company employees often have. Knowledge is sensed and understood through social interaction in group setting, resulting in new tacit knowledge creation.

So that such innovation can occur, customers must be able to make various interpretations of a given product or a given technology as well as to exchange those with other members of the "mixed innovation team" (also other customers). A substantial focus is thus on the integration of tacit customers' knowledge (about a product and its application context) and its conversion into explicit knowledge for use within the innovation process of the manufacturer. A distributed perception system supports such interpretations and dialogues within the innovation team by the supply of richer forms of self reflection and communication. In this connection (23) speak of "interacting ba" in that individuals exchange their mental models but at the same time also reflect and analyze their own. Such processes can lead to innovative results, which rise above the common knowledge stock of the "mixed innovation team".

Organizations have begun to host user workshops and conferences for the specific purpose of getting to know how their customers utilize their products and how they have customized or modified them to meet their needs. To address these issues, many organizations have deployed user toolkits that enable customers to innovate with products and services (24).

They can directly modify and customize products to meet their peculiar needs and preferences.

The nature of knowledge acquisition and conversion varies, as marked before, with the customer roles during integration. Therefore the instruments to support the generation of knowledge must be selected and adapted by the manufacturer accordingly. Next section presents possible IT support for discussed FFE activities.

IT SUPPORT FOR FFE PHASES

Role of IT in FFE phases

In the **initialization stage** IT will have a low role, except for the fact that helps us manage knowledge *about* our customers. Here, we can use IT get a sense of how our customer use our products and services by examining demographic, usage, and other forms of collected information. The primary technology used here might be a data mining application to swift through databases that capture how customers interact with products and services, and to identify the right segments to target for invitations to the innovation process.

At the **preparation stage**, once again, IT will play a support role, expect for the fact that we can use information and communication technologies to setup initial meeting with customers, post request for particiaption, host web seminars about the innovation projects, etc. All of these do not directly touch on the acts of innovation, but are used to set the stage for the innvoation process to begin.

In the **realization stage** the role of the FFE, role of IT could be paramount. Among other ways, the following types of support are plausible to enable knowledge creation and utilization in the process:

1. We can think of the need of IT to help connect the customer with the organization, for example the creation of shared electronic workspaces, team meetings.
2. IT can help in the distribution and integration of codified knowledge through the sharing of corporate repositories.
3. IT, in the form of yellow pages or more advanced knowledge maps, can help organizations map out who are the experts on different topics. Hence, i.e. when difficulties arise during the innovation process, appropriate person can be located.
4. IT in the form of listservs, discussion groups, can help in brainstorming for ideas, sharing solutions to problems.
5. IT can help in the product design and product development through the use of virtual studios, CAD diagram tools.

Figure 2 summarizes the role of IT in each of the FFE phases.

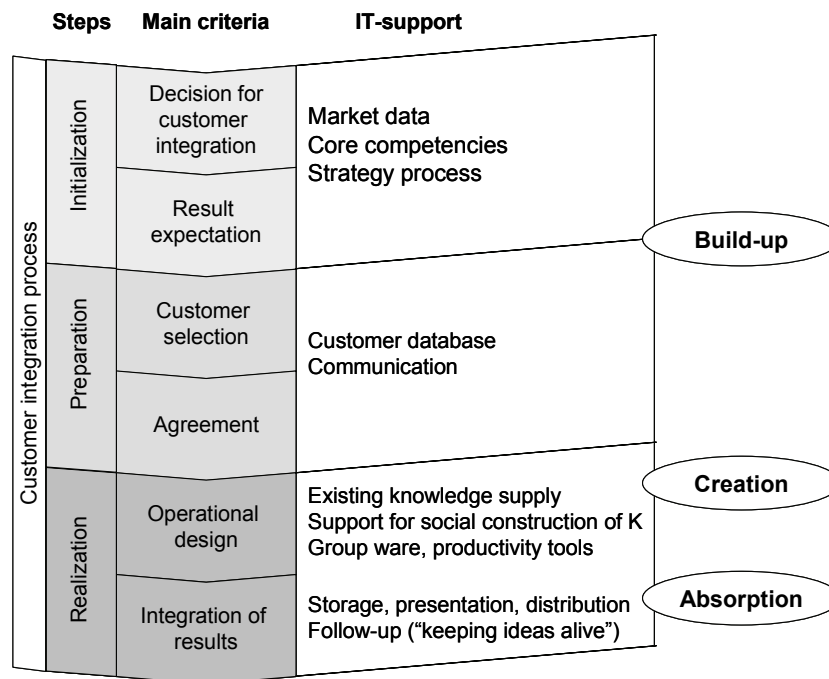


Figure 2: Application of IT in FFE

Possible operationalization of joint knowledge creation, distribution and storage in the operationalization phase is the use of Wikis, which functionalities cover many of the above mentioned types of support-functionalities.

Wikis in Fuzzy Front End phase of product development

Knowledge creation in FFE should have a strong social-construction focus, being generated through dialogue and interactions. Traditional KMS applications (intranet repositories, expert reports, data minings, search engines) offer less ad-hoc knowledge creation capabilities as a dialogue. Conversational technologies exist (i.e. instant messaging, email, weblogs), however they have their limitations.

Wikis (from *wikiwiki*, meaning “fast” in Hawaiian (25)) are a promising technology that supports “conversational” knowledge creation and sharing.

- They enable many-to-many broadcast. More importantly, they come close to enabling social interaction as knowledge artefacts are edited rapidly (as in dialogue), and knowledge stored is changing until it reaches common understanding, belief, mental model. Then, it is also transferred in a central location, acting as a knowledge repository.
- At the same time, it stores meta knowledge (indexed content), which is currently not implemented in video/audio conferencing applications (such as Instant Messaging, where person to person dialogue is delivered “live”) or email applications (where only local knowledge is stored).
- Wikis enable collection / combination of knowledge of multiple experts seamlessly.
- Wikis offer fast knowledge creation (without need of editing, publishing, authorization by experts as is the case i.e. with FAQ's or content management

systems), making it useful for environments where ad-hoc knowledge is required. It also offers knowledge creation tool to bring together knowledge of people from different locations to a centralized location, where it can be created by everyone. Wikis overcome the "same-time" issue (vs. scheduled chat, i.e.) as knowledge is stored around concepts.

Table 1 on the next page shows how Wikis' functionalities support particular knowledge needs of the Fuzzy Front End of the open innovation process.

In the open innovation paradigm, external entities such as suppliers, customers, business partners, etc., are brought into the innovation process, as they can share knowledge about products and create new relevant knowledge in dialogue. Engaging such knowledge calls for a rich interaction between the source and recipients of the knowledge, so most organizations try to promote rich human-to-human interactions to get at such knowledge.

Table 1: Knowledge management needs in FFE, corresponding Wiki design principles, characteristics and features (25, 26)

User needs	Principles	Wiki Characteristics and Features
Ad-hoc knowledge	Incremental, Organic, Universal	Incremental knowledge creation as question answering; Power of N; Wiki editing features (speed of publication)
Finding knowledge	Unified, Precise, Incremental	Knowledge indexing and hyperlinking; Backlinking; Centralized, web-based resource
Filtering knowledge from noise	Unified, Precise, Convergent	Hyperlinking, Power of N; Removal of duplication
Quality of source	Open, Organic, Observable	Power of N; Record of history of changes with author information; Ability to comment on changes
Dynamically changing knowledge	Organic, Observable	Power of N, Wiki editing features (history and version management)
Distributed knowledge	Organic	Power of N
Errors and recovery	Open, Tolerant, Observable	Power if N; Wiki editing features (history and version management)
Publication overhead	Mundane, Universal, Overt	Wiki editing features; Wiki publication features

Source: Adapted from Cunningham, 2004 and Wagner, 2004.

CONCLUSION

This paper focuses on the early phases of innovation process as they are important to start the innovation. Not that others are not important, on the contrary. Once those ideas are generated and developed, they need to be synthesized, crystallized, and implemented into a knowledge artefact which then has to be commercialized.

Conventional wisdom would propose that there is no place for a "well defined" IT tools in such an undefined ("fuzzy") process. Wiki, however, comes close to "real" conversational technology. It is the most effective for ad-hoc problems with decentralized knowledge

sources, meaning that wiki is appropriate answer for the crucial, *realization* phase of the Fuzzy Front End innovation process.

This is also the most important contribution of the paper, as it first explains a contemporary design of innovation process and – through analysis of information and knowledge needs in that particular process – selects appropriate IT tool that can support a crucial part of – usually not very well structured and defined – process. This makes effective introduction of IT into a fuzzy front end of innovation process possible.

ACKNOWLEDGEMENTS

The authors wish to thank the two anonymous reviewers for their comments and suggestions that improved this paper. The previous version of this research has been published in “Dnevi Slovenske Informatike 2006” conference proceedings (15). The authors would also like to thank participants of the conference who shared ideas for research improvement.

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