

Open Innovation: Can Modern ICT-Tools Facilitate Customer Integration Into the Fuzzy Front End of the Innovation Process?

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ABSTRACT

This paper addresses the integration of customers into the innovation front-end focusing specifically on the role of potential ICT-support. Applying a two-step approach the initial analysis describes the process steps of early customer integration. Based on these results a conceptual outlook is given pointing at possibilities to facilitate customer integration into the FFE through modern ICT-tools. Our study shows that there are several levels of ICT-support for early customer integration out of which the operational one has been looked at more closely. Some of the already existing approaches to support certain aspects of co-operative innovation activities with customers are described shortly: ICT-based marketing activities, user tool kits for innovation and wikis.

Our findings fit the broader context of an open innovation paradigm that suggests that co-operative innovation processes are imperative for success. Further research areas should be aimed at developing specific tools for co-operative FFE activities together with customers.

INTRODUCTION

Constantly increasing pressure to innovate leads a growing number of companies to open their innovation processes to the ideas of external parties. The ability to bring new product ideas to market represents the success factor par excellence in the modern dynamic environment (e.g. Kim and Mauborgne 1997). However, a great deal of innovative ideas fails due to lack of market orientation. This often results in over-engineered products that misfit customer needs. One recent development addressing that problem is the replacement of the traditional (“closed”) innovation paradigm by an “open” innovation paradigm where there is a push to make the innovation process more open and collaborative (Chesbrough 2003). External entities such as suppliers, customers, business partners, etc., are brought into the innovation process, as they can share existing knowledge and create new relevant knowledge. In tune with this paradigm change customer integration is one key success factor. The positive influence of customer involvement in the innovation process has been demonstrated by several empirical studies (e.g. Bacon and Beckman 1994; Murphy and Kumar 1997; Gruner and Homburg 1999; Kristensson, Magnusson et al. 2002), which show that such integration leads to the more successful product portfolio needed for profitable

growth. One of the very few empirically validated concepts for this field is the Lead User concept by Eric von Hippel (von Hippel 1986; von Hippel 1988).

Integrating customers leads to the challenge of creating knowledge together with externals and supporting the process and the absorption with information and communication technology (ICT)-tools. However there are hardly any studies looking explicitly at the integration process and the role ICT may play in it. The key to look at this gap is to focus on the knowledge perspective, i.e. the integration of tacit external knowledge and its transformation into explicit knowledge for use within the firm's innovation process. Engaging such knowledge calls for a rich interaction between the source and recipients of the knowledge, so the organisational design, the integration process, and the supporting ICT-landscape have to be adjusted accordingly. The purpose of this paper is to develop a conceptual framework for the integration of customers into the front-end of the innovation process focusing specifically on the role of ICT as support tool. We consider inputs from empirical and theoretical data. From existing literature on the innovation process, the management of its front-end, open innovation as well as customer integration we derive theoretically relevant characteristics of successful open innovation processes. Out of the empirical data collection we developed case studies with which we attempt to explain successful customer integration practices qualitatively. Data collection involved semi-structured interviews with senior representatives from R&D, marketing, and product management. The interview data were complemented by desk research, analysis of corporate and annual reports, and company presentations. In follow-up sessions, findings and interpretations for each company were validated.

This study focuses on the question of how actively integrating customers into the early phases of the innovation process can be accomplished efficiently and effectively. Applying a two-step approach the initial analysis describes the process of early customer integration looking in detail at the stages of the integration process. Based on these results a conceptual outlook is given pointing at the possibilities to facilitate customer integration into the front-end of the innovation process through modern ICT-tools by highlighting three related approaches. We conclude with an outlook on future research areas.

PROCESS OF EARLY CUSTOMER INTEGRATION

Various different models are used by researchers and practitioners to describe innovation processes (Koen, Ajamian et al. 2001 Clamen, Davidson, D'Amore, Elkins, Herald, Incorvia, Johnson, Karol, Seibert, Slavejkov, Wagner, 2001). Most approaches incorporate three generic steps: a phase where ideas are collected or generated ("idea generation"), another one to develop and specify those ideas ("idea development") and finally the last one where value creation takes place by transforming ideas into products ("idea commercialisation") (e.g. Cooper and Kleinschmidt 1986). This paper focuses on the first phase of problem recognition and idea formulation often called Fuzzy Front End (FFE). In order to create new knowledge (i.e. start the innovation process) the integration of externals, like customers, into the FFE takes place in form of a process itself. Embedded into that process are the design elements that have to be implemented accordingly (on an operational level) to guarantee success.

In the area of strategic management many studies are dealing with R&D co-operation or co-operation for innovation (e.g. Staudt, Toberg et al. 1992; Kirchmann 1994; e.g. Fuchs 1999; Marxt 2000). Since the integration of externals into the innovation process is a special form of co-operation, the same basic steps to structure the process can be applied. Out of existing

approaches, the following three general segments to co-operate or integrate externals are condensed: *initialisation*, *preparation*, and *realisation*. For each step main criteria - representing the most relevant objectives that have to be reached in order to complete respective segment successfully - as well as relevant characteristics are described next.

Initialisation of Customer Integration

At the beginning of customer integration stands, like for any type of co-operation, the determination, i.e. the realisation of the necessity and the strategic decision for external co-operation. As part of the strategy process value creation projects that may be realised together with externals have to be identified and evaluated (e.g. Fuchs 1999). The decision to open the innovation process for external partners has to be made in accordance with the (overall) company strategy and technology strategy or has to be derived directly out of those strategies. The expected customer contribution and the resulting specific customer roles are crucial for the execution/design of the whole process (cf. Wecht 2006). The first task of technology- and innovation management is therefore to prepare the decision for integration. The next important step is then to specify the co-operation goals to clarify expected results. Those goals can be further clustered into result, cost, and time related objectives and will be used to assess and select customers. They also play an important role to monitor the integration process and evaluate its success. Together with the goal definition the integrating company has to carve out certain areas where the integration will take place. To secure the company's competitive position, technological areas of core competencies need to be defined, as for them an in-house development approach should be preferred. Complementing those areas are the external competencies to be integrated during potential co-operation activities. After this statement for co-operation/integration and the definition of expected results the following step deals with customer selection and finding of common agreements.

Preparation of Customer Integration

The selection and engagement of fitting customers are important success factors (cf. Yoshingo and Rangan 1995). 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. The establishment of a precise search profile, the search process, and the final selection are the necessary steps. The whole search process may be quick (i.e. for small, easy to grasp market segments) or slow (if several departments are involved). The search is very often directly linked to the partner selection. Besides role specific selection criteria basic considerations regarding strategic and cultural aspects have to be considered. Strategic fit (e.g. Rotering 1990; Teichert 1994) is related to the danger of opportunistic behaviour from on partner and therefore inversely depending on the advantages both parties could gain out of the integration (Dutta and Weiss 1997). The cultural fit increases when decision-process and –speed, tolerated risks, and work related values are similar. Also the willingness to adapt to cultural differences improves cultural fit. Overall it can be stated that the importance of cultural factors is often underestimated (Marakas 1999).

Also part of this step is the development of common goals together with the selected customer and the establishment of contracts regulating the co-operation (if necessary). Common goals and motives have to be discussed openly and fixed as soon as possible (Kanter 1999). Mutual goals may differ significantly from the respective goal of each

individual partner and should therefore together with aspects of potential intellectual property rights out of the co-operation be captured in contracts. Those activities conclude the composition of the part of the whole co-operation process where most mistakes are happening which lead to overall failure (e.g. Doz and Hamel 1998).

Realisation of Customer Integration

This segment, where the actual value creation takes place, starts after fitting customers have been found and the general set-up has been clarified. The necessary steps are to shape the co-operation considering the respective customer role, to realise the integration on an operational level, and to utilise the results at the integrating company. While the ever-popular efforts involving capture, access, and transfer of knowledge can lead to increased efficiency, knowledge generation is the key to growth (Nonaka and Takeuchi 1995; Ruggles 1998). Even if there is no consistent model to link innovation and knowledge (e.g. Barker 2002) the creation of new knowledge is the main aim of any innovation and new product development process (Leonard-Barton 1995; Madhavan and Grover 1998; Aslanidis and Korell 2003). Managers are faced with the challenge of identifying and selecting those knowledge management methods that enable the organisation to reach and to excellently perform the third stage of the evolution of knowledge management initiatives, i.e., creating and enabling. However, already complex task of successful knowledge management strategy implementation is enhanced in complexity and fuzziness as collaborating parties are geographically distributed and some are even external to the company. More specifically, aspects of organisational design, human resources and financial management regarding the co-operation with the integrated customer have to be considered. At the centre of this task stands, besides the selection of the right personnel, the formulation of rules of conduct as well as the distribution of work load between company and customer. The two main areas to adjust the organisational design are integration structure and interaction process. Also a potential termination of the co-operation (both premature and planned) is part of this process step. Finally the diffusion of the newly created knowledge within integrating company has to be ensured.

ICT-SUPPORT FOR CUSTOMER INTEGRATION

Looking at the role ICT-tools can play during early customer integration three generic fields of support can be distinguished (see Figure 1):

- Ø *Communicational support*: communication tools (e.g. productivity tools, group ware, mail service) have to be used to facilitate the information exchange with integrated customers.
- Ø *Functional support*: existing systems like engineering/product data management (EDM/PDM) have to be adjusted to ensure their openness to customers, while at the same time considering access-restrictions that have to be applied based on the particularities of co-operation project
- Ø *Operational support*: innovation-specific tools developed for certain tasks customers will fulfil during the FFE

The first two functions are not focus of this paper. The operational innovation-specific function is the most relevant one regarding focused co-innovation efforts. So far there have been no coherent research efforts to cover this particular field. However several approaches are discussed already. To structure this area we look at three areas. Firstly, ICT-based

marketing tools – automating what has been done in person or with other means before. Secondly, use of user tool-kits for innovation – handing over configuration tasks to customers. Thirdly, “open source”-based approaches -such as wikis- letting group dynamics and intelligence to take place.

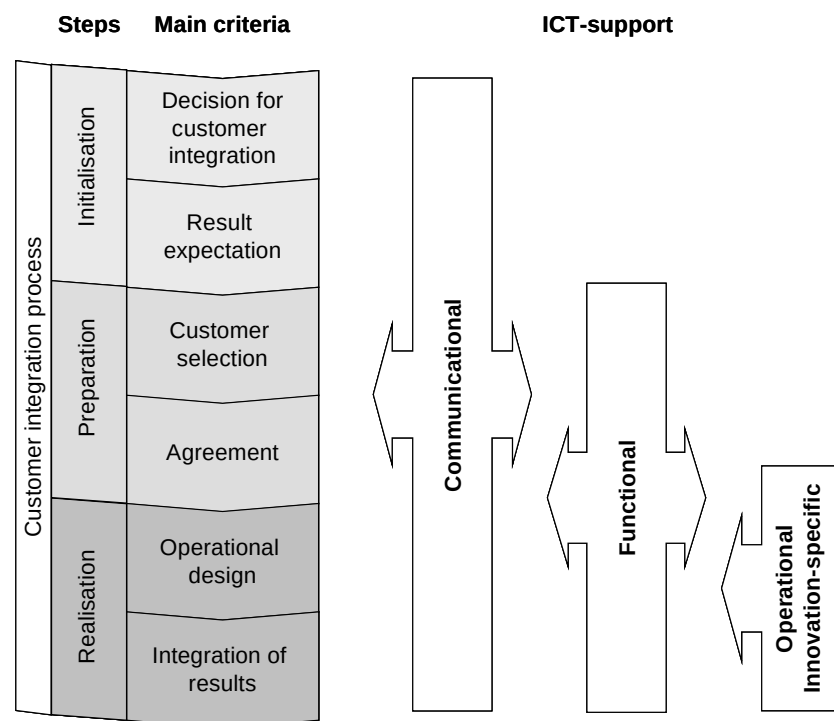


Figure 1: Generic view on ICT-support for customer integration processes

The main characteristics of the existing approaches are shown in the following examples.

ICT-support example 1: “The virtual customer”

One way to take advantage of new computational algorithms, multimedia visualisation tools and the interactivity of the web is to transfer traditional methods of getting customer input to the web. Dahan and Hauser (2002) have shown that there are methods (as a set called “the virtual customer”) available for the various stages of product development. Resting on the dimension of communication, conceptualisation and computation these methods enable much more rapid interaction, depiction of virtual products and product features as well as adaptive survey design. Overall they have huge potential to save time and cost for companies which aim at improving their ability to listen to the voice of the customer. However there are still relevant costs associated with recruiting and maintaining panels of customers who agree to complete Web-based surveys quickly (Paustian 2001).

Looking specifically to the front end of the product development process there are three methods relevant (Dahan and Hauser 2002). The fast polyhedral adaptive conjoint estimation can be used to screen product features in a fast and inexpensive way. Based on the results the most promising features are identified and focused on for further R&D-activities. The information pump enables customers to interact with each other. A web-based game setting is aimed at identifying product features customers like most. Utilising incentives for truth-

telling customers are encouraged to think hard and verbalise their needs. The Web-based conjoint analysis finally transfers existing and proven methods to the web adding new capabilities to present relevant elements such as product features.

ICT-support example 2: “User tool kits for innovation”

Since it is difficult and often misleading to get at the needs of their customers (make customers’ needs explicit), companies start to deploy user toolkits that enable customers to be innovative with products and services themselves (e.g. von Hippel 2001; von Hippel and Katz 2002). They can directly modify and customise products to meet their peculiar needs and preferences (cf. e.g. Franke and Shah 2003). With user toolkits for innovation manufacturers no longer have to try to understand their customers’ wishes in detail. Instead, they will transfer solution-related information that is unstuck (von Hippel and Katz 2002). All need-related aspects of product and service development may be shifted to users along with an appropriate toolkit.

In general user toolkits for innovation have the following four characteristics. First, they enable users to carry out complete cycles of experimentation and learning during the process of designing their custom product or service. This capability is essential since problem-solving in product design, is fundamentally based upon trial-and-error learning (Baron 1988). Second, toolkits have to be “user-friendly.” Users must be able to operate them using their existing skills. Additional training may be necessary however it should be as less extra effort as possible. Third, based on the existing experiences they have to include libraries of useful components and modules – already tested and debugged. Fourth and finally, toolkits must contain information about the framework within, for creativity to be possible. In most cases the production process that will be used to manufacture the product will determine the limits. This ensures that a user’s design will in fact be producible and not an imaginary “super-product”. That means that user toolkits for innovation are specific to given product or service type and to a specified production system. Within those general constraints they allow users to develop their custom product via iterative trial-and-error processes. There are applications available in areas ranging from the development of custom integrated circuits to the development of custom foods.

Consider the example of Bush Boake Allen (now under International Flavors & Fragrances Inc.), who allowed its clients - like Nestle - to develop their own specialty flavors using an Internet-based tool. The customer could create a customized flavor by using a database of flavors, and then send the new flavor design to an automated machine that manufactured a sample within minutes. After tasting the flavor, the customer could immediately make modifications, request and try the new sample (Baloh and Desouza 2006).

ICT-support example 3: “Wikis”

The knowledge needs in the realisation phase of FFE are both about new knowledge creation and existing knowledge utilization. Wiki (from “wikiwiki” meaning “fast” in Hawaiian (Cunningham 2004)) is a promising new technology with functionalities that fit to particular knowledge needs of the discussed process.

Knowledge creation in FFE should have a strong social-construction focus, being generated through dialogue and interactions. However collaborating parties often do not have the possibility of same-time/same-place conversations. With live chats/video conferences, there

is a problem of limited scope of conversation participants and lack of storage and organising functionality.

Wiki emerged as an answer to many-to-many broadcasting need with functionality such as storage, organisation, cross-linking, done in effortless manner. It supports “conversational” knowledge creation and sharing and as opposite to weblogs, it enables many-to-many broadcast (Wagner 2004). It offers fast knowledge creation (without need of editing, publishing, authorisation by experts as is the case with FAQ's, knowledge bases or content management systems), making it useful for environments such as early innovation process stages where ad-hoc knowledge creation is required. Wiki acts as supportive and enabling knowledge creation tool, bringing together people from different locations to a centralised location, where knowledge can be edited (created) by everyone, as in dialogue. Moreover, wiki overcomes the "same-time" issue (vs. scheduled chat) as knowledge is stored around concepts and doesn't need to be created in one particular point in time.

As a conversational technology wikis are most effective for ad-hoc problems with decentralised knowledge sources, meaning that they could be one of the most appropriate ICT tools for the FFE process.

SUMMARY, FUTURE RESEARCH AND CONCLUSION

Our findings fit the broader context of an open innovation paradigm (Chesbrough 2003) that suggests co-operative innovation processes are imperative for success in today's challenging business environment. That is, the careful integration of externals becomes necessary for firms to capitalize on knowledge of people outside their borders.

We developed a process model for early customer integration. Our study has shown that there are several levels of ICT-support for early customer integration out of which the crucial - operational - one has been looked at more closely. Some of the already existing approaches to support certain aspects of co-operative innovation activities have been considered shortly: ICT-based marketing activities, user tool kits for innovation and wikis.

This preliminary analysis does not address contingency issues. The relevant situative factors which could be considered in further research include the market environment, the competitive situation, the product specificity, the level of technologies, customer characteristics, and the company's in-house innovation culture. Additional empirical research will help to reveal deeper insights into the organisational design of the integration process and its ICT-support on the basis of key layout elements and parameters. Further research areas could also be aimed at developing specific tools for co-operative FFE activities. As a starting point it may be worthwhile to adjust and maybe merge existing approaches.

This paper contributes to the discourse on early customer integration in two ways. First, it affirms evidence that thoroughly executed customer integration into NPD can be beneficial for a company's innovation performance. Second, it addresses a deficit in the existing body of literature, namely the almost complete lack of studies that focus on the role of ICT-technology to support specific customer contributions during the innovation front-end. By focusing on customer integration, the FFE and the role of ICT-support we look at a highly relevant area of open innovation. Suggesting ICT-approaches to facilitate this integration ensures the relevance for practitioners. With our study we wish to lay the foundation for future enquiry and therefore to contribute to the highly relevant research stream of opening up the innovation process to external partners.

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