EARLY CUSTOMER INTEGRATION INTO THE INNOVATION PROCESS

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ABSTRACT

In this analysis of European high-tech companies, the authors focus on the innovation front-end, since during the early stages of the innovation process, customer consideration can greatly affect innovation success. Focusing on specific manufacturer goals for early customer integration (ECI), the authors derive necessary customer contributions, then develop a conceptual framework for ECI. Based on four in-depth case studies four new customer roles are defined, enhancing the well-known lead user approach: opportunity sensor, complementary specialist, specifier, and selector. Using this foundation, the paper analyses the respective characteristics and managerial challenges of these early customer roles.

INTRODUCTION

For a long time it has been recognized in theory and practice that customers as an external resource can significantly improve innovation processes. This is even more the case in today's diverse and dynamic technology and market environment.. At the same time most innovative ideas fail because of technical weaknesses, competitive disadvantages, non-reflected me-too-strategies, and as most critical factor - lack of market awareness, which results often in over-engineering. Under these conditions the role of customers as source of innovation is becoming more and more important. Companies therefore engage in a lot of different activities to get closer to their customer or involve them in their innovation processes.

Several empirical studies have shown that an active involvement of customers into the innovation process has positive influence on innovation success (Bacon and Beckman 1994; Murphy and Kumar 1996; Murphy and Kumar 1997; Gruner and Homburg 1999; Kristensson, Magnusson et al. 2002). Also surveys among managers show for the creation of new products a similar emphasis on the demand side (Förderer, Krey et al. 1998). Customer integration into the innovation process leads to a more successful product portfolio which is necessary for profitable growth in the marketplace. Consequently firms try to get close to their customers and to listen to their voices. Studying actual discontinuous product development projects lead to the finding that most companies do not employ a formal, highly structured process for these projects. However there are consistent processes followed which differ significantly from that for incremental projects. Generally speaking the former processes are more exploratory and less customer driven. Also the development of prototypes takes place at an earlier stage, preceding opportunity analysis, assessments of the market attractiveness, market research, and

financial analysis (Veryzer Jr. 1998). The following paper aims to contribute to this topic by analyzing real world approaches and theoretical models. A striking deficit in the existing body of literature is the fact that there are hardly any studies looking at the different stages of the FFE and their influences on customer's contributions. We try to contribute to scientific progress by concentrating our analysis on subject relationship.

The following questions are to be discussed in this study:

> What other modes of early customer integration into the FFE besides the classic Lead-User approach can be found and described?
> How do the manufacturers' goals influence the decision for and the management of a specific mode?

To attack this question we will look at roles customers can take (or can be assigned to) and - closely connected - to contributions customers will deliver. Since the generation and selection of the right breakthrough ideas at the very beginning is crucial for the success rate of the whole innovation process we will focus the main part of this paper especially on that stage. The aim of this paper is to derive managerial implications based on suppliers' goals (linked to customers' contributions). We will show that besides the Lead-User approach there are other relevant means of customer integration into the FFE. For this study we use the term customer not only for current customers of a company's products, but also competitor's customers, lead users, untapped customers, and lost customers (Dahan and Hauser 2001).

Furthermore we will focus on the direct link between R&D and the demand side of the market explicitly excluding methods and procedures applied during the FFE as part of marketing processes.

The research procedure behind this study is an iterative learning process considering input from the empirical as well as the theoretical side. The empirical data collection starts with real life problems and develops later on into in-depth case studies explaining certain phenomena or successful practices in a qualitative way. Parallel to this side the theoretical part is based on an literature review leading to more understanding of the identified problems. In addition scientific theories and hypothesis complementing these original findings enable the researcher to address his research questions in a thorough and unique way. A quantitative confirmation of developed models or hypotheses may conclude the whole process.

The empirical data collection took place in 47 interviews that have been conducted at 21 companies. Based on the information collected four in-depth case studies – about companies using typical modes of customer integration into the FFE - have been written and analyzed.

In addition further empirical data came out of a working-group-style research projects conducted by the Institute of Technology Management together with eleven companies from the eastern parts of Switzerland, southern Germany and western Austria.

Analyzed with the current literature in mind the collected material enabled the development of expanded landscape of early customer integration to boost innovation.

EARLY CUSTOMER INTEGRATION (ECI)

In the following we will focus on the heart of the FFE and its potential for customer integration. Similar to the early supplier involvement (ESI) on the upstream side of the value chain we will call involvement of customers into the innovation process early customer integration ECI. We will define ECI as

1. Integration of customers, customers' customers, or intermediaries to customers (in short any player on the downstream side of the value chain),
2. into the fuzzy front end FFE of the innovation process,
3. characterized by an active customer role (in contrast to surveys or interviews e.g.).

In contrast to the approaches described before the knowledge from the customer is central for ECI. The underlying rationale is to integrate customers into the FFE by giving them an active role. It covers all phases of the FFE (opportunity, idea, concept) and can be further distinguished into different modes each of them characterized by different customer contributions and roles as well as requiring specific activities from the manufacturer.

The manufacturer integrates customers into the early phases of his innovation process in order to get better results – success in the FFE has to be defined accordingly – out of this process. Therefore the overall goal is to improve the innovation process' output by the help of selected customers. In general this can be done by the development of more ideas or better ideas - in any case of ideas with higher market and business potential.

For the following we will put a special focus on the goals and expectations that motivate manufacturers to run ECI. This is done for two reasons: On the one hand it enables us to structure the following considerations and – most importantly – on the other hand it contributes to fill a research gap. So far there are no specific studies available dealing with the effects of expectations on customer integration. There is literature focusing on the outcome to be expected from the integration however mostly on a generic, unspecific level and without looking on the managerial implications. We will show that goals and results are determining factors to differentiate between specific modes of ECI.

MANUFACTURERS' GOALS AND INTEGRATION RESULTS

Manufacturer's goals stand at the beginning of the chain of influence leading to customer integration results. Based on these goals the customer will play different roles and deliver different contributions. With right customer contributions the overall result of early customer integration ECI should lead to the desired improved innovation results and can be compared with the original manufacturer goals. The results coming out of ECI are strongly influenced by the closely related group of manufacturers' goals, customers' roles and customer's contribution.

We will use manufacturers' goals, their expectations, as well as customer integration results synonymously. Since measurement of the integration's success rates is not part of this study we are not distinguishing between the expected and the achieved results. Keeping the focus on specific results expected from ECI is a challenging task for future research. A possible focus could be the identification of success rates of different result-based modes of ECI and if they are different – as we expect them to be - the explanation of their discrepancy.

The principal goal behind ECI (and customer involvement in general) remains to improve a company's innovation success rate amongst increasing R&D-expenditures and high new product failure rates. The manufacturer expects advantages outweighing the disadvantages coming out of ECI (cf. Kirchmann 1994; Brockhoff 2002).

Existing studies list numerous advantages (in the context of this paper synonymously used with manufacturers' goals) that can be clustered into groups. Eliminating redundancy the following relevant subjects remain and can further be summarized to three paramount

objectives (Kirchmann 1994; Gruner 1997): acquisitive goals, effectivity increasing goals, and efficiency increasing goals.

These three types can also be dubbed market-related results, risk-related results, and resource-related results. Similar to above points they are further distinguished in better understanding of the user market, stronger relationship, improved innovation 'sales' prediction, and competitive intelligence on the market side. Regarding risk, a reduced failure rate during the innovation and R&D-process as well as an overall improved product quality are results found in empirical studies. Synergy effects lead to a reduction both in time and cost and therefore reduce the valuable resources on the way to successful innovations.

Gerpott (1998) studied R&D-cooperation in general and separated the underlying reasons into a macro and micro level. Looking at the macro level the main reasons for R&D-cooperation – and for customer integration as one specific configuration out of them – are the reduction of resources and cost to establish a technological innovation, an increase in quality and acceleration on the way to R&D results, reduction of technological and financial risk, and the preparation to open up new market segments (Rotering 1990 Hauschildt 1997, Sakakibara 1997). Caused by the generic point of view, these reasons are very similar to above mentioned goals for customer integration.

The micro level however leads directly to our focus: Defining the outcome of customer integration as specific contribution for the innovation process leads to the following potential results (Bruce and Biemans 1995):

Generation of new product ideas
Availability of information regarding customer needs
Feedback to concepts and prototypes
Aid during development
Assistance during innovation-marketing

We will use these potential results as a starting point for our framework and discuss them in the following. The assistance during development as well as innovation-marketing are part of the customer orientation and therefore outside the frame of ECI.

RESULT-ORIENTED CUSTOMER ROLES DURING ECI

The goals for and results of customer integration have been employed as determinants to come up with the basic framework and specific drivers for ECI. Based on these results distinctive customer roles have been identified – Opportunity sensor, Complementary specialist, Lead-User, Specifier, and Selector (see Figure 1 for an overview). In this chapter these roles are analyzed to understand their implications on ECI management.

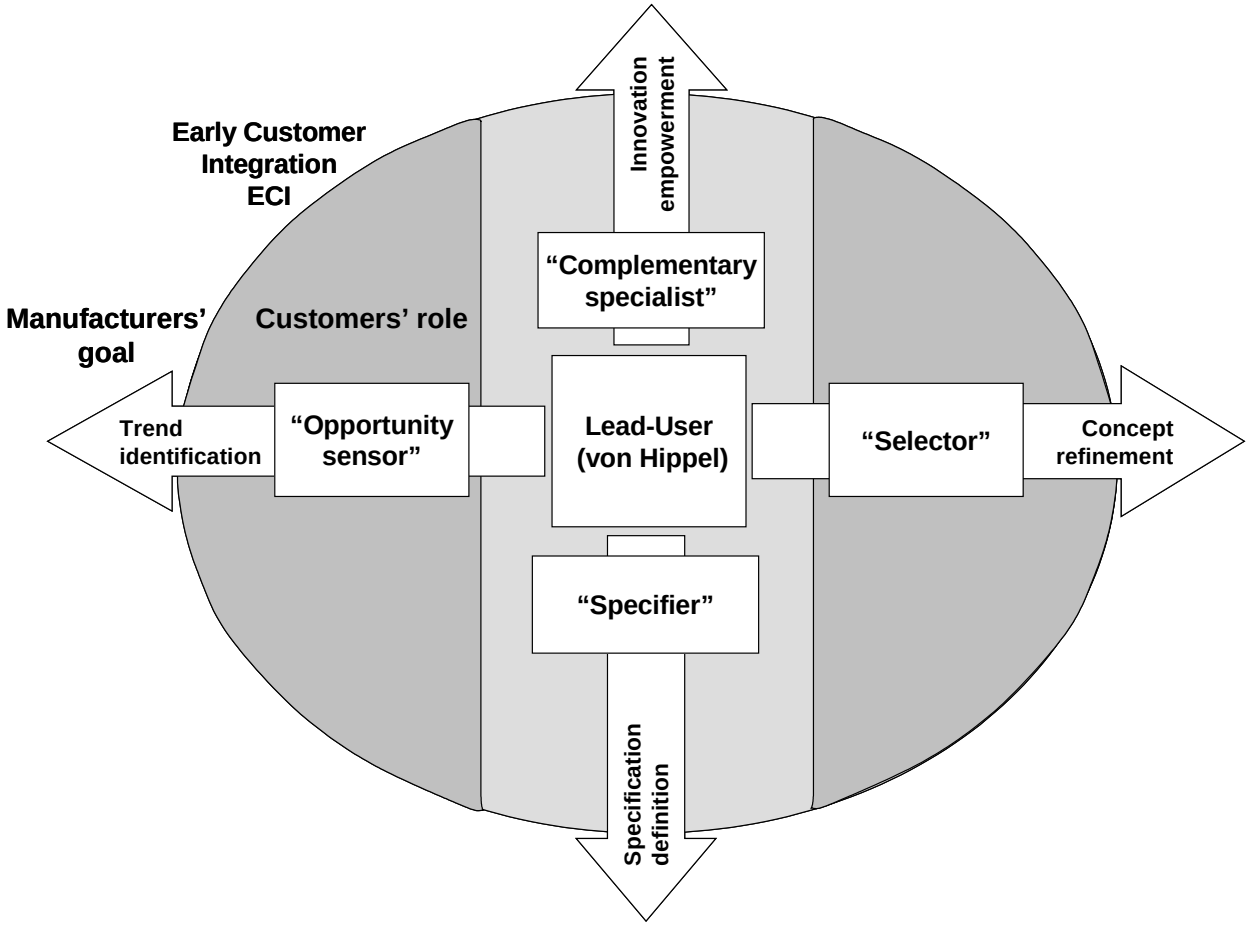

Figure 1: Customer roles during ECI

To get deeper into customer roles it is further helpful to look at the knowledge perspective of innovation. Basically the creation of new knowledge is the central theme of the NPD process (Leonard-Barton 1995; Madhavan and Grover 1998). Depending on the customer role different types of knowledge are generated. One differentiation level builds on the classic differentiation between tacit and explicit knowledge (Nonaka and Takeuchi 1995; von Krogh, Ichijo et al. 2000) the other one on the distinction between market-related or technology-related content (Gassmann and Gaso 2004). Furthermore regarding knowledge creation in general the two broad types of knowledge acquisition and knowledge conversion can be identified (Huber 1991; Nonaka and Takeuchi 1995).

The identified customer roles in ECI fit to the underlying innovation process steps and show different characteristics according the nature and creation of new knowledge. The following paragraphs elaborate on these findings and lead to an summarizing line-up depicted in Table 1.

Opportunity Sensor

This role focuses mainly on the problem identification or idea generation part of the innovation process. Focussing on trends and scenarios possibly leading to new opportunities

and chances. The type of knowledge involved is market-related and tacit. Depending on the concrete ECI set-up the knowledge creation mode can be both acquisitive (e.g. specifically collecting customer knowledge about new competitor offerings) or transforming (e.g. jointly developing new scenarios with customers). In this ECI mode the specific contributions the customer delivers - in addition to his needs which are defining his basic role as customer - are information about latest trends, new technologies, or new market developments.

An example for this very early customer integration aimed at new business opportunity identification is the approach taken by the Creative Center of Bayer Material Science. Already at the very beginning of its innovation process, at the development of scenarios, selected customers are involved to adjust scenarios developed at Bayer with such coming from the customers. This approach applied with large customers, such as German car manufacturers who deploy sophisticated methods for long-term product planing. Also the next process steps feature intense customer integration. After the scenario development roadmaps, firstly generic then secondly focused on technology, are built up in joint meetings with customers facilitated by an external expert. For the management of the Creative Center the key for success in ECI is the establishment of a win-win situation by purposely offering valuable information to the invited customer in exchange for their input. The goals are to identify new developments in the market environment as well as market potentials (at this point of time in a wide and generic sense) during the scenario development and possible future technology platforms and technology overviews during the roadmap evolution. At the end of this early innovation stage at Bayer Material Science stands the hand over of a standardized feasibility study for a specific new project to the respective development group.

That means that even before the real development of a polymer product starts an intense contact and exchange with customers – in this case end of the line customers - takes place. This ensures a market focused set-up of the innovation process from its very beginning.

For the next three roles the main focus lies on the further development of ideas and the drafting of problem solutions. Innovative leading edge customers are integrated to deliver highly specified technological knowledge besides their inherent proficiency regarding their needs and requirements. Here joint creation of new knowledge is key and requires customers that are sensitive for this co-creation approach.

Complementary Specialist

Explicit knowledge in a field complementing the core competence of the manufacturer is the main asset of these complementary specialists. They can be found both for specific market knowledge and product related expertise in fields such as styling or production. The focus lies mostly on the combination and thereby conversion of existing tacit knowledge to create innovative solutions pushing the envelope of the manufacturers own innovation capabilities.

On the product-related level Zumtobel Staff gives an excellent example. This internationally renown specialist offers innovative lighting solutions in all areas of application of professional interior lighting such as offices, industry, and retailing. Zumtobel Staff's innovation strategy is marked by the rapid implementation of state-of-the-art lighting technology into mature systems, and the transfer of the latest scientific findings to sophisticated lighting solution concepts. Thanks to this strategy, the organization has become an expert partner to architects, lighting designers, electrical consultants, building owners, real estate developers, key account customers and facility managers. In collaboration with internationally leading architects and designers, a number of new systems for a wide range of

application areas has been created, which are set to account for substantial proportions of turnover in the next few years, such as „Lighttools“ – a miniaturized modular lighting channel. The close cooperation with architects and lighting designers means an integration of complementary experts. Both groups represent no direct customers for Zumtobel Staff however they are significantly influencing the buying decision (directly or indirectly). So they are part of the downstream value chain and hold special complementary knowledge, namely styling and integration capabilities. Organizationally the management of the integration process is located in a special group called strategic partner development. One level above sits the international projects department reporting directly to the executive vice president for marketing and sales. Strategic partner development is stuffed with specialists that are on the one side mobile and international to work locally at customer' office locations and on the other side closely involved in the concrete Zumtobel Staff innovation process. Zumtobel's main goal for integrating selected architects and designers is the joint generation of highly innovative lighting products. Only the combination of Zumtobel's technological expertise with the partner's design, styling, and project realization competence enables the innovative solutions. A very important criteria for the partner selection is therefore his proven ability to accomplish the common project plans. Many innovative impulses were triggered by these international project partnerships with architects and lighting designers. The development of customized special solutions is one aspect of the ongoing trend towards more individualized customer relations. Even more important however is the potential to turn these customized innovations into standard products and reap profits on a larger scale. So architects and designers are complementary specialist leveraging Zumtobel's own innovation power.

Lead-User

This customer role is located right in the middle of ECI being the prototype of early and active customer integration. Customers are selected for the generation of new solutions based on their 'innovative need profile', i.e. being ahead of the main market. In addition a certain technological expertise is needed expressed by the fact that some Lead-users even develop their own prototypes to solve their problems. Once again tacit knowledge is dominating and the joint innovation process stresses the importance of knowledge conversion.

Within the body of knowledge customers may provide application knowledge within the main technological competence field of the manufacturer characterizes the first possible customer role - the 'Lead User". The classic Lead User concept as introduced by von Hippel already during the 1980s is the prototypical creation-driven ECI. Von Hippel (1986) stated that a customer (user of a certain product) can be crucial for the fast and successful development of innovative products. In this context lead users are described as customers that face needs that will be general in a marketplace – but face them months or years before the bulk of that marketplace encounters them – and are positioned to benefit significantly by obtaining a solution to those needs. Von Hippel describes how to identify lead users, and then how to incorporate their insights into the product design process in a five-step process.

An example for a current Lead User success is the medical technology division of 3M, an US-based technology firm. For innovative solutions providing cut disinfection during surgeries a focused search for users as well as potential users that had found or developed alternative solutions for this problem were started. Being successful in a parallel market 3M conducted workshops with veterinary surgeons and came up with a radically new solution (namely a foil).

Specifier

Besides the complementary knowledge roles described above there is one more specific role grounded on the integration of customers with deep expert knowledge right in the manufacturers competence field. This enables the customer not only to push and steer innovation via the product specification but also to take the leading role in the integration process (from the customer's perspective the same process can be seen as supplier integration). The required level of knowledge exceeds the one typical for the Lead-User approach and limits the number of cases where this approach may be chosen.

A typical example for this ECI mode is given by the European satellite manufacturer EADS Astrium and its main customer the European space agency ESA. EADS Astrium is a world leader in the design and manufacture of satellite systems, with business activities covering civil and military telecommunications and Earth observation, science and navigation, space equipment and associated ground infrastructure. EADS Astrium offers a total communications system capability, from system design and integration, satellite and payload manufacture, launch and in-orbit operations to the ground control and communications networks. A key prime partner for ESA's major scientific programs, EADS Astrium has established a world-renowned expertise in the highly specialized field of space science. EADS Astrium designed and built ESA's latest ambitious space exploration craft, Mars Express, the first European mission to another planet. The ESA employs highly qualified specialists in the field of satellite systems very similar to the experts working at EADS. This leads to very close cooperation during the early phases of new missions. Based on first mission sketches and official application documents filed by EADS (as answer to an official ESA tender) the innovation is driven in mixed teams during the specification definition phase. In theory ESA specifies and selects fitting solutions out of those presented by EADS – in reality however, enabled by the high level of specialist knowledge on the customer side, a co-creation process takes place. EADS even hosts EAS engineers in its R&D facilities to support this process. Once the specification is finished fixing the specific module technologies and parameters EADS takes the leading role in realizing the spacecraft or instrument together with its network of partners and suppliers.

Selector

Ending the front-end of the innovation process are procedures necessary to feed new concepts into the new product development process. At this stage an integrated customer can build on his user experience with existing products and help in selecting and refining promising product concepts. Tacit customer knowledge is converted into feedback and increases the manufacturer's chance to develop a successful new product.

Hilti based in Schaan, Principality of Liechtenstein, demonstrates this type of close solution-driven customer interaction. The Hilti Group, still controlled by the Hilti family, is a world leader in developing, manufacturing and marketing added-value, top-quality products for professional customers in the construction industry and in building maintenance. The product range covers drilling and demolition, direct fastening, diamond and anchoring systems, firestop and foam systems, installation, measuring and screw fastening systems as well as cutting and sanding systems. The basic company principles are commitment to excellence in innovation, total quality, direct customer relationships and effective marketing. Out of the more than 14,500 employees, two-thirds work directly for the customers, in sales organizations, engineering and customer service. The business unit Diamond systems successfully executes

ECI with “selector” customers with two sequential methods. Relatively late in the FFE when different concepts have already been developed by the internal R&D (however based on Hilti’s exceptional market closeness) so called “focus groups” are utilized. Based on statistical information provided by market research customers are invited to join a interdisciplinary group of Hilti specialists to discuss and rate different concepts. Based on their application knowledge and experience the customers take an active role and – in contrast to traditional focus groups – are part of the team discussing and selecting the best concept. Also in the following step the Hilti internal term does not explain the actual procedure. The so called “Lead-User” workshops differ significantly from the classical Lead-User definition and instead clearly exemplify subject “selector” role. Outstanding top-partners (defined as valuable customers treated with special service offerings) are invited to comment on and try out the specific solution that has been developed based on the previously selected concept. The goal here is to receive specific feedback in order to apply changes before the solution is finalized. In Hilti’s terms the focus groups are aimed at defining the right value proposition and the Lead-User integration at confirming that propositions.

	Opportunity sensor	**Selector**	**Complimentary specialist**	**Specifier**	**Lead-User**
Customer contribution	**Future market knowledge**	**Application knowledge**	**Complementary competence and leveraging capability**	**Deep R&D knowledge**	**Coming need and concept ideas**
Rationale	**Integrate customer to identify market and technology opportunities**	**Integrate customer to select and improve concepts**	**Integrate customer to conduct leading innovation project**	**Integrate customer to jointly develop specification**	**Integrate customer to jointly develop specification**
Key issues/ Managerial challenges	**Early in the FFE** **Select customer based on his ability to predict future markets requirements** **Focused on market knowledge and generic technology trends** **Consider also customers’ customers**	**At the end of the FFE** **Select customers based on their experience level and usage intensity** **Focused on specific application knowledge**	**Covering most of the FFE** **Select customers or intermediaries based on their specific knowledge necessary to leverage the suppliers core competence** **Focused on complementary knowledge**	**Focus the later parts of the FFE** **Select customers that are technology experts and co-create with them** **Focused on core competence**	**In the middle of the FFE** **Select customers based on their leading edge needs and high motivation** **Focused on customer needs**
Examples	**Bayer Material Science Creative Center**	**Hilti Diamond Systems focus groups**	**Zumtobel Staff strategic partner development**	**EADS Astrium ESA mission projects**	**3M Lead-User projects**

Table 1: Overview early customer integration ECI

This first analysis does not address issue of concrete design elements of the ECI process to realize distinctive roles. The manufacturer first of all has to take the basic decision towards ECI. Based on the occurring circumstances he then can select the respective mode and according customer role. Then the design of the ECI process is to be worked out based on key layout elements and parameters. These relevant layout elements are to be developed in future research. Among the relevant contingency factors to be considered will be the respective

market environment, the competitive situation, specificity of products, level of used technologies, customer characteristics, as well as the in-house company innovation culture.

CONCLUSION AND FUTURE DIRECTIONS

Main message of this research is that different ways to involve customers into the innovation process can be identified. Looking at the heart of the front-end we introduced early customer integration (ECI) as an area of active customer integration that centers and includes the classic Lead-User approach. Fitting to the specific customer contribution the ECI takes place at different stages within the front-end and with different objectives, intensity and layout. Depending on the respective manufacturers' goals (i.e. expected output) three main drivers can be distinguished namely a chance-orientation, creation-orientation and solution-orientation. These drivers contain four additional modes manifested in specific customer roles. The framework of drivers and roles has been used to take a closer look at respective characteristics and managerial challenges of customer roles during ECI. Taken together, this analysis indicates that while early customer integration can help the innovation process by enabling powerful new knowledge creation, its effective deployment calls for careful consideration of the whole process set-up and execution.

Our findings fit to the broader context of an open innovation paradigm (Chesbrough 2003) making cooperative innovation processes the mantra for success in today's challenging business environment. A company has to realize the fact that it does not employ all smart people there are and the necessity to work with clever people outside its company borders. This trend will further increase not only with customers but all types of external entities. A role model market is the software development, where concerted innovation efforts are becoming the new standard, either initiated by the manufacturer like in agile computing situations (e.g. Xtreme Programming XP) or even completely dominated by an autarky community in the very successful open source scene (e.g. like the current Mozilla Firefox Browser). Prahalad and Ramaswamy (2004) take it one step further by proclaiming the future of competition as a completely new approach to value creation where personalized co-creation experiences – enabled by technical and social infrastructure – allow each customer to co-create unique value with a network of companies and consumer communities.

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