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CUSTOMER INTEGRATION IN NEW PRODUCT DEVELOPMENT: A LITERATURE REVIEW CONCERNING THE APPROPRIATENESS OF DIFFERENT CUSTOMER INTEGRATION METHODS TO ATTAIN CUSTOMER KNOWLEDGE

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Abstract

In many instances, customers are seen as one of the key resources for new product development (NPD), as they often have deep product knowledge as well as experience and creativity potential gained by regular product usage. From knowledge management perspective, customers' input to NPD is manifested in different forms of knowledge. Customers' input to NPD typically reflects their needs and desires (need information) but may also represent suggestions describing how ideas can be transferred into marketable products (solution information), in some cases it even leads to radical innovations (leading edge information). In order to internalize customer knowledge, in theory different methods are discussed. However, little is known about these methods' effectiveness and efficiency to transmit customers' knowledge to firms. This research identifies a total of 15 methods with the help of a systematic literature review. By systematically analyzing these methods, we found that there are methods within which customers are involved only "passively" in NPD, as well as methods that enable a more "active" customer integration. This study exhibits that the methods which enable an active customer integration, compared to methods where customers are integrated only passively in NPD, are more suitable for attaining customer knowledge within innovation development.

Keywords: Knowledge Management, Customer Integration, Open Innovation, Co-Creation, New Product Development.

1   Introduction

Considering the increasingly dynamic environment primarily due to advancing competitiveness, new technologies as well as shorter product and innovation cycles, the continuous development of innovations has become indispensable. However, various empirical studies highlight the high failure rates of new products, especially in consumer markets (Urban and Hauser 1993; Crawford 1987; Ernst 2002). It is therefore obvious that management is highly interested in detecting ways that enable the development of successful innovations. A review of old and recent literature reveals that the reduction of innovation failures and the improvement of the return on funds invested in new product development (NPD) are mainly determined by the capability of these innovations to meet customers' wants and needs (Moore 1982; Davidson 1976; Martin and Bush 2003). In the course of time it has been recognized that the creation of successful innovations requires the compounding of knowledge from various perspectives, including especially the knowledge of customers, as these are most suitable for revealing their wants and needs (Bergman et al. 2009; Leonard and Sensiper 1998). Customer knowledge has become indispensable for developing innovative products (Su et al. 2006).

Gassmann et al. (2005), and Lengnick-Hall (1996), amongst others, suggest that absorbing customer knowledge through customer integration into NPD strengthens a company's core competencies. In the context of customer integration, customers creatively contribute and cooperate within the different phases of the innovation process (Zwass 2010). This approach, often referred to as "Open Innovation" (von Hippel and Katz 2002; Chesbrough 2003), becomes more and more important in innovation development (Bretschneider et al. 2008). As a consequence, in the past, various methods that allow engagement of customers in NPD have been developed (Füller and Matzler 2007; Lilien et al. 2002). The application of customer integration methods enables companies to attain extensive information from customers. Customers can provide need information that reflects their desires and wishes, as well as solution information which manifests itself in concrete improvement suggestions or solution ideas. Certain customer integration methods also ensure acquisition of sticky information which refers to customers' latent knowledge, and leading edge information which embodies highly innovative knowledge from lead users (Eisenberg 2011; Reichwald and Piller 2009).

In literature, numerous research articles have investigated different customer integration methods (Leimeister et al. 2009; Jeppesen 2005; Ebner et al. 2009; von Hippel 1986). Nevertheless, hitherto, there has not been a compilation of the various customer integration methods based on a systematic literature review. Thus, the actual number of methods, which are deployed in innovation management, has not been ascertained yet. This aspect becomes crucial, considering particularly the progression of customer integration methods in the light of information technologies. In this connection, especially the Internet as an immersive and multimedia-rich technology with low costs of mass communication allows companies to interact with external sources in a more (cost-) effective as well as interactive manner. Furthermore, despite intensive research on the different customer integration methods, an elicitation of the appropriateness of the existing methods to internalize the different types of customer knowledge is still missing. Existing customer integration methods are all different in their nature; however, the central purpose of all methods is to attain knowledge from customers and internalize that knowledge into innovation development. Hence, the question arises as how appropriate existing methods are to fulfill this purpose.

In view of this, this paper seeks to fill the outlined research gaps by addressing the following research questions:

1. What kind of customer integration methods can be identified within the NPD literature?

2. How suitable are the particular methods for internalizing customer knowledge?

The rest of the paper is structured as follows. In section two, we present the methodology for the literature search and analysis before we outline the identified customer integration methods. Section

three first describes the framework for the derivation and explanation of information that is crucial in the context of co-creation within NPD. Here, we then present the results of the literature analysis by assessing the appropriateness of the existing methods for internalizing customer knowledge. Finally, conclusions as well as an outlook for future research conclude the paper.

2 Literature Review

2.1 Methodology

Due to its importance regarding the progression and the eventual success of enterprises, innovation is an intensively researched area (Gianiodis et al. 2010). Since the involvement of customers in innovation processes has gained greater importance over the years, much research has been conducted concerning various customer involvement methods. In this context, especially within the research field of open innovation, customer integration methods have been thoroughly analysed. Given these facts, a systematic and exhaustive literature analysis becomes more and more important (Webster and Watson 2002). According to Torraco (2005), the design of the procedure of a literature review is to be intersubjectively verifiable in order to maintain the scientific value of the literature analysis (Berkovich et al. 2011). Hence, in the following, we explicitly show our procedure in identifying the relevant literature regarding customer integration methods following the approach of Webster and Watson (2002).

We deployed a three-stage approach to identify an extensive set of academic studies upon which our review is based. First, we conducted a search of key strings in the EBSCO, Business Source Premier, EconLit, JStor and Science Direct database, as well as in the Google Scholar search engine. We chose these databases because they allow access to a comprehensive set of scholarly publications, especially within the research fields of marketing and (IT-) management, where innovation management is allocated. In the literature, the term "customer integration" is often used synonymously to the term "customer involvement." Due to the fact that customer involvement – in contrast to customer integration – is a highly comprehensive term, which therefore is seldom explicitly used as a keyword in abstracts, we used two different search strings: First, we used the search string "customer involvement OR user involvement AND innovation." Thus, we narrowed the range by adding the keyword "innovation" as we searched for studies within innovation research. Further on, we performed another search using the string "customer integration OR user integration OR open innovation OR user innovation." Drawing from the sample of articles from the first stage, subsequently, in the second stage, we enlarged our search by using forward and backward citation indices. We continued this procedure until we identified an exhaustive set of studies (Gianiodis et al. 2010). Concerning the timeframe, we searched the literature from 1980 up to 2011, since the involvement of customers in the innovation process started to attract interest in the academic business literature from about the 1980s (see e.g., Rosenblad-Wallin 1985). Apart from these areas, research articles and books also depict a relevant object of analysis, as they condense substantial research findings. Hence, using the mentioned key strings, in the third stage we also searched on Google Books.

Subsequently, we applied two boundary criteria to identify the relevant literature. First, concerning the identified research articles, we solely included papers published in peer-reviewed scholarly journals, since the terms customer involvement, customer integration, and especially open innovation, have gained major attraction in the popular press and other nonacademic print media (Gianiodis et al., 2010). We then analysed each paper and book, including only those which explicitly addressed methods involving customers in the innovation process.

2.2   Results

In total, we identified 105 literature sources[1] upon which our analysis is based. Within these papers and book sections, a total of 15 customer integration methods were identified. Five of these methods (namely, Toolkits, Idea Communities, Idea Competitions, Lead User Workshops and Focus Groups) directly relate to the context of open innovation, whereas the other ten methods (namely, Surveys, Interviews, Reclamation Management, Boundary Spanner, Empathic Design, Concept Test, Product Clinic, Security Trading of Concepts, Quality Function Deployment, Listening In and Information Pump) are covered more extensively in the marketing literature. To obtain a better understanding of the subsequent analysis of the identified customer integration methods regarding their appropriateness to internalize customer knowledge, they are at first briefly described.

The *Survey* is the most disseminated method used in practice as well as in research to gather customers' opinion, respectively customer knowledge (Reichwald et al. 2004). Here, interviews can be carried out personally, telephonically or by mail (Hemetsberger and Füller 2009). Ordinarily, surveys are standardized due to the fact that managers try to capture an overall or average view of customer knowledge by interviewing numerous customers. A less standardized method is the *Complaint Analysis* within which customers submit information according to their dissatisfaction with offered products. Contrary to surveys, here customers initiate the information transfer process (Stauss and Seidel 2005). Besides complaints, they can also provide wishes, suggestions or improvement ideas regarding existing products (Berry and Parasuraman 1991; Brockhoff 2003). Relevant customer information can also be gathered by direct customer contact as it is done within the *Boundary Spanner* approach. Here, field workers record relevant customer information in the course of their direct contact to clients. Afterwards, the acquired information is analyzed systematically. Reid and De Brentani (2004), as well as Johlke et al. (2002) found that in this way, information that is essential for innovation development can also be acquired.

In addition to these methods, in customer research the observation of customers is also a common approach. In this context, two methods are applied within innovation management: *Empathic Design* and *Product Clinic*. The aim of these methods is to observe noticeable issues, behaviors and characteristics of customers. From these findings, specific customer needs and requirements are derived for product development. In the scope of the *Empathic Design* method customers are observed while using products in a natural environment (Leonard and Rayport 1997; Evans et al. 2002). As opposed to this, within the method of *Product Clinic,* customers deal with specific products in a laboratory setting while they are observed (Wildemann 1999). Subsequently, the participating customers are asked about their experience with the provided product. This monitoring method is applied particularly in the automotive industry (Schuh 1991). Another method, which is widely used in practice, is the *Concept Testing*. Here, prototypes, design drafts and concepts are presented to selected customers, who in turn evaluate the presented objects (Moore 1982). *Security Trading of Concepts*, *Information Pump* and *Listening In* represent similar methods which, however, are conducted virtually. Within the first method, prototypes or concepts are traded as 'securities' in an exchange-like business situation. The higher the price of a product concept, the better is its chances to succeed in the market. In this way, customers' preferences can indirectly be ascertained (Hemetsberger and Füller 2009). *Information Pump* is a method within which customers are encouraged by playful means to state their opinions and preferences regarding a product concept which is shown virtually (Prelec 2001). In this context, the interactive gaming can be implemented in various ways. However, the main goal of this method is to gather many unconventional ideas regarding a specific concept. These ideas can in turn be used within innovation development. Within the scope of the *Listening In* method, a virtual configurator proposes customers several concepts which are graphically illustrated and simultaneously valuated by the customers (Dahan and Hauser 2001). Based on the valuation, the configurator develops new concepts, which

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[1] Due to limitations regarding the number of pages, the identified studies cannot be listed and outlined here.

are valuated again in a second round. This procedure continues for several steps. In this way, concept specifications that best reflect customer desires are captured. In contrast to these currently developed methods, the *Quality Function Deployment* is a rather classical, though wide-spread method for product development which was originally conceptualized in 1966 by Yoji Akao. Within this concept, it is assumed that the company already has an innovative idea and that the evolutionary development of that idea will be oriented on customer needs (Daetz et al. 1995; Huovila and Serean 1998; Kaulio 1998). In other words, customer needs are the basis for the further development. In the first step, customers are interviewed about their needs and requirements regarding the underlying innovation idea. Here, they must provide appropriate judgments regarding any possible peculiarity of the idea, respectively regarding the product which will result out of that innovation idea. The contribution of the different characteristics to the overall rating is determined by means of a conjoint analysis. Subsequently, the determined customer requirements are transferred in technical specifications. As a result, the use of QFD, which is based on very detailed customer requirements, provides qualified insights on the customer-oriented design of a product (Urban and Hauser 1993).

The *Lead User* approach is a well-established method that, in its modern form, aims to systematically identify innovative, highly advanced customers or users – so-called lead users – and to integrate them in NPD by organizing workshops within the company (von Hippel 1986; Eisenberg 2011). In the scope of these workshops, lead users together with company staff generate ideas and elaborate these into final concepts (Urban and von Hippel 1988). The *Focus Group* method is very similar to the lead user approach. However, the difference lies in the target group which is integrated in the innovation development: Within the focus group approach, 'ordinary' customers – instead of lead users – are assembled in innovation workshops (Dahan and Hauser 2002; Bristol and Fern 1996). *Ideas Competitions* and *Innovation Communities* are two customer integration methods that are primary used to generate innovative ideas in the first stages of the innovation process. According to Leimeister et al. (2009), an ideas competition can be described as an invitation of a company to its customers to submit contributions to a certain topic within a predefined period of time. The submitted ideas are evaluated by a review committee, which also selects the winners of the campaign. The competitive character of an ideas competition motivates customers to produce a winning idea that is innovative and possibly even unique (Ebner et al. 2009). Ideas competitions are predominantly used to expand the source of potential new ideas. The same applies to *Innovation Communities*, which occasionally are referred to as 'idea communities'. Here, customers generate ideas and collaborate with other customers within an internet-platform. Customers have the opportunity to submit ideas, to connect with idea contributors that submitted similar or complementary ideas and to elaborate ideas in collaboration with other members (Bretschneider et al. 2008). Consequently, within innovation communities various networks are formed that collaboratively elaborate matured innovation ideas, which are more qualitative compared to those initially submitted. As a result of the usage of this method, companies will generate a rich content of viable innovation ideas (West and Lakhani 2008).

Different from the hitherto described customer integration methods, *Toolkits for User Innovation* are mainly used for conceptualizing new products. This method proposes that customers autonomously innovate by using a special instrument – the 'toolkit' (von Hippel and Katz 2002). These tools enable customers to create designs of new product innovations or product variations according to their individual needs and preferences. The toolkit is usually an internet platform or a software application that is provided by the manufacturer (Jeppesen 2005). However, the provided toolkit can also inherit various raw materials or ingredients that are needed to construct a corresponding product (von Hippel and Katz 2002; Franke and Piller 2004). Eventually, the resulting concepts are used by the company as a basis for further product development.

3 Evaluation of Identified Methods

As the previous literature review has shown, various methods have been developed whose purpose is to acquire customer information regarding innovation ideas, initial and finished product concepts. In

the following section, we present a framework upon which the literature analysis and evaluation is based. The goal is to present different information types through which customer knowledge can be transferred into the innovation process. In Section 3.1, these various information types are described, whereas in section 3.2, the identified customer integration methods are analysed regarding their appropriateness to attain customer knowledge.

3.1   Framework

The results of the literature review show that by applying customer integration methods, customers can be involved in different activities within NPD. For instance, customers can assess and generate innovative product ideas, or they can be involved in the creation and evaluation of first concepts or prototypes. This approach is often referred to as 'interactive value creation' (Reichwald and Piller 2009) or 'value co-creation' (Zwass 2010). Thus, within customer integration, not only information regarding customer wants and needs is generated, but customers also provide various solutions concerning different activities within the innovation process. Customer integration methods are used to internalize customer knowledge in order to identify customer wants and needs, as well as to use the innovative potential of customers. Generally, knowledge is transferred by information (Wallace, 2007). In this paper, following the insights provided by Reichwald and Piller (2009), we deploy a framework which encompasses different information types and their effect on efficiency and effectiveness on value co-creation. According to Von Hippel (1994) and Reichwald and Piller (2009), amongst others, mainly two different information types are required from external contributors within value creation processes: need information and solution information. *Need information* refers to customer needs and preferences, as well as to specific requirements of customers regarding specific products (von Hippel 1994). Customer need information is based on the experiences of customers with existing products and may lead to incremental innovations. However, this kind of information may also reflect the desires and needs that have not been met by products offered on the market. Given this, need information can also lead to radical innovations. The more need information is extracted from customers, the more suitable the innovations are to meet customers' wants and needs. However, within some customer integration methods (e.g., surveys), customers inherit a passive role because they are able to only state their need information. Here, concrete improvement suggestions or solution ideas are not considered. *Solution information*, in contrast, embodies knowledge on how a problem can be solved by a certain product specification. This knowledge manifests itself in concrete suggestions or statements on how need information can be translated into definite product concepts. Thus, by varying existing or raise own solutions, customers can also actively participate in value creation.

Füller and Matzler (2007) and Jeppesen (2005), amongst others, argue that customers are often not able to express their needs and desires because these are sometimes implicit and unconscious. They can be – as is known from the domain of knowledge management – difficult to express (Krcmar 2005). This kind of information is referred to as *"sticky" information* (von Hippel 1994). "Stickiness" is defined by von Hippel (1994) as "the incremental expenditure required to transfer a unit [of information] from one place to another, in a form that can be accessed by the recipient. When this expenditure is low, information stickiness is low; when it is high, stickiness is high." The higher the stickiness, the more iterations and "trial-and-error"-cycles between a company and its customers are needed to transfer implicit knowledge within innovation NPD (Franke and Piller 2004). However, in order for new products to be successful, in addition to the conscious needs and wants, innovations must also address the unconscious desires of customers. Access to sticky information builds the basis for the development of radical innovations.

Within innovation management, it is widely known that especially lead users may generate radical innovation ideas (Eisenberg 2011; Lilien et al. 2002). Lead users are characterized by high involvement in a specific area; they inherit utterly innovative needs. Their preferences and desires regarding a specific product field are vastly advanced compared to those of average users. They inherit valuable knowledge and can therefore provide worthwhile need, as well as solution, information. The informa-

tion stemming from lead users we denote as *leading edge information*. However, a major issue is that lead users are difficult to identify, as they are exceptional customers due to their characteristics (von Hippel et al. 2006). Especially in the scope of certain customer integration methods, such as surveys, complaint analysis, or the quality function deployment, lead users are only considered as a representative, respectively, statistical factor.

In conclusion, there are two relevant information types that are essential within NPD, namely, need information and solution information. In this context, need information stands for effectiveness (Reichwald and Piller 2009). This is due to the fact that new products ought to fulfill customer requirements – and therefore meet their wants and needs – 'better' than existing products. Considering an ideal-typical NPD process – from the identification of customer needs over ideation and concept development to the final market launch – need information are primary necessary in the phases of customer need identification and ideation. The more need information is attained within these two phases, the more effective is the innovation development, thus ensuring that the new products meet customers' needs. Compared to need information, solution information stands for efficiency in value creation and refers to the issue of how to actually develop the 'right' products, respectively the products that meet the identified needs (Reichwald and Piller 2009). By generating plentiful, as well as adequate solution information, the efficiency of value creation can be enhanced due to the fact that solutions regarding different issues within NPD are available. Thus, solution information is indispensable for the development of first concepts or final products as well as for market launch as within these two phases solutions are required. However, in this context, sticky information and leading edge information are also valuable. These two information types are subspecies, as they can embody need, as well as solution information. Customers inherit unconscious needs that are valuable for the first two phases of NPD, as well as tacit solution knowledge which is relevant for the phases of concept development and market launch. Meanwhile, leading edge information is a valuable input for all phases of innovation development and positively affects the effectiveness as well as the efficiency of NPD. The subsequent illustration encompasses the issues outlined in this section and depicts the framework of this study.
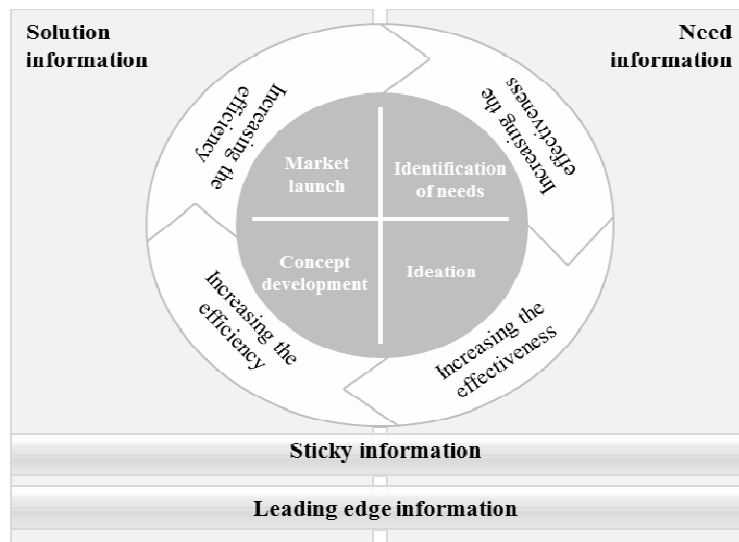

Figure 1.   Information types within value co-creation (Adapted from Reichwald and Piller 2009).

3.2   Evaluation

A major goal of this study is to determine the appropriateness of the previously identified customer integration methods for internalizing customer knowledge. Meanwhile, within co-creation, customer knowledge is transferred through different types of information (need information, solution information, sticky information and leading edge information). Hence, based on a thorough examination of the

findings obtained from the systematic literature search, the identified customer integration methods are analyzed regarding their appropriateness for internalizing these information types in NPD. However, first of all we found that there are methods within which customers are involved only "passively" in the innovation process, as well as methods that enable a more "active" customer integration. Within "passive" customer integration, customers are assigned to solely provide information about their needs and desires. Von Hippel (1988) describes this as the *manufacturer-active paradigm*, where the manufacturer discovers customer needs and then develops and implements innovative ideas, whereas customers "speak only when spoken to." This concept is in contrast to the *customer-active paradigm*, which becomes apparent within the scope of "active" customer integration. Here, customers actively take part in various tasks within NPD by performing activities which used to be executed by the internal R&D, such as idea generation regarding new products, or development of concepts and prototypes.

Table 1 summarizes the analysis results for the various customer integration methods. Subsequently, the acquisition of the previously described information types via the several methods is explained in detail.

	Method	Information type			
		Need information	Solution information	Sticky information	Leading edge information
"Passive" Customer Integration	Survey	●	○	○	○
	Complaint Analysis	●	◐	○	○
	Boundary Spanner	◐	◐	○	○
	Empathic Design	○	◐	◐	○
	Product Clinic	●	◐	◐	○
	Concept Testing	●	◐	◐	○
	Security Trading of Concepts	◐	○	○	○
	Information Pump	●	○	○	○
	Listening In	●	○	○	○
	Quality Function Deployment	●	○	○	○
"Active" Customer Integration	Lead User Method	●	●	◐	●
	Focus Group Method	●	●	◐	◐
	Ideas Competitions	●	●	◐	◐
	Innovation Communities	●	●	◐	◐
	Toolkits for Innovation	●	●	●	◐

● Full access   ◐ Partly access   ○ No access to information type

Table 1.   Analysis of customer integration methods for their appropriateness of internalizing the various information types

Need information can be acquired by providing customers the possibility to valuate existing solution ideas and to state their preferences regarding those ideas. Except for the method of empathic design, *need information* is covered by all customer integration methods. By valuating solutions within surveys and concept testing, or by posting contributions in idea communities, customers are able to provide information regarding their needs, desires and preferences (West and Lakhani 2008; Bretschneider et al. 2008). In comparison to this, by using toolkits for user innovation, customers are only able to partially express their needs as they develop concepts that correspond to personal desires. However, here customers do not have a chance to compare different solutions or ideas with each other

and therefore they cannot state personal preferences. The same applies to the two approaches of boundary spanning and security trading of concepts. Meanwhile, within empathic design users are solely observed while using a product. Thus, customer needs cannot be gathered since customers have no possibility to state their desires and preferences.

The literature analysis has shown that methods within which customers are integrated actively in NPD ensure full access to *solution information* as within all of these methods, customers have the opportunity to contribute own solutions and suggestions, which describe how these ideas can be transferred into marketable products (Blohm et al. 2010; von Hippel 1994). The lead user method, the focus group approach, as well as innovation communities facilitate innovation managers to benefit from the compounded knowledge of various customers due to the fact that in the frame of these methods, customers have the chance to jointly elaborate specific solutions or ideas. Passive integration methods, where observation is used – namely, empathic design, product clinic and concept testing – partially allow access to solution information. This can be explained by the fact that while testing a certain product, customers may generate new ideas or methods regarding its usage and application. However, all the remaining methods are not suitable for obtaining solution information, since in this connection customers are involved just passively in innovation activities. Active involvement of customers, in terms of enabling customers to alter existing ideas or actually contribute own solutions, is not supported by these methods.

One way of detecting *sticky information* is offering the opportunity to 'experience' a solution (Füller and Matzler 2007). This can be realized by providing tools with which customers can 'try' a product concept, or even create concepts or prototypes by themselves. These tools can be IT-based, e.g., programs for product configurations, or they might consist of real modules with which various product or service concepts can be designed (Franke and Piller 2004). However, *sticky information* is hard to acquire, since from the outset it is difficult for customers to articulate this kind of information. This is particularly evident considering our findings, which show that within passive customer integration only three methods are partly suitable for recalling sticky information; namely empathic design, product clinic and concept testing. Here, by enabling customers to experience concepts or prototypes while testing them, customers' latent needs can be partly discovered. Experiencing a solution is not possible within innovation communities, ideas competitions, lead user or focus group workshops. However, in the scope of these methods, customers are able to run trial-and-error cycles since they have the opportunity to contribute suggestions as well as to alter their solutions or prototypes after having had a critical look at them. Nevertheless, toolkits for user innovations are the only method with which sticky information can be fully accessed. By self-designing and simultaneously experiencing concepts and its features, customers are able to realistically assess whether the new product idea fulfills their latent needs (Jeppesen 2005; Franke and Piller 2004). While designing, customers usually run several iterations until they finalize their individual concept which reflects their wants and needs.

Finally, in the scope of our literature analysis, we also examined the appropriateness of the various customer integration methods to capture *leading edge information*. The findings show that methods within which customers are integrated passively in NPD are not suitable for recalling leading edge information. This is due to the fact that here all involved customers are regarded as a representative, respectively statistical factor. Thus, only average values (e.g., the valuation of specific ideas) are considered, so that leading edge information falls by the wayside. In the frame of ideas competitions, innovation communities, and toolkits for user innovations, leading edge information may partially be identified; however, here advanced ideas and concepts are not systematically selected and subsequently elaborated. The lead user method is the sole method which is appropriate to fully access leading edge information. However, this result is less surprising since the lead user method was developed for the purpose of identifying lead users and fully using their innovation potential (von Hippel 1996).

In conclusion, most of customer integration methods are generally suitable for recalling need information. However, customer integration methods, where customers are only integrated *passively* in NPD, are just slightly suitable for recalling solution information and sticky information, whereas the knowledge of lead users cannot be accessed by this means. These results are less surprising since these

methods (e.g., survey, quality function deployment) were pre-eminently developed to attain customers' needs and desires. Nevertheless, based on our findings, product clinics and concept tests are the most suitable methods for partly recalling the different information types at once. This rating is justified by the fact that within these two methods, customers have the opportunity to test, respectively experience a concept, to valuate it and also to contribute suggestions regarding the underling concept. Furthermore, we established that by means of *active* customer integration, need and solution information can most widely be attained, whereby a broad identification of sticky information and leading edge information is ensured as well. In this connection, lead user methods are best suitable for attaining customer knowledge. This result corresponds with the fact that lead user workshops are quite popular in practice – particularly in industrial markets (Lüthje and Herstatt 2004) – and innovation research (Eisenberg 2011; Lilien et al. 2002).We thus conclude that customer knowledge can be attained more effectively if customers have the chance to actively participate in innovation processes.

4 Conclusion and Outlook

Customer knowledge has become a valuable input in innovation processes (Gassmann et al. 2005). Starting from research gaps regarding a systematic compilation and assessment of existing methods for internalizing customer knowledge in NPD, we systematically analysed literature to address these issues. We identified and outlined a total of 15 methods with which customer knowledge can be attained within innovation development. In conclusion, the underlying study, which is based on a systematic and in-depth literature analysis, shows that methods which enable an active customer integration, in comparison to methods where customers are integrated only passively in NPD, are more suitable for attaining customer knowledge within innovation development.

For innovation managers in practice, the underlying literature review serves as an overview of methods used to involve customers within innovation development. More to the point, the results of this study provide an assistance regarding the use of the various methods in specific contexts. Depending on the information type that managers tend to gather from their customers within NPD, our study depicts the appropriateness of different customer integration methods to address the corresponding information type. As for theoretical implications, this paper contributes to open innovation research by collating insights from different research disciplines (e.g., marketing, software engineering, engineering design, innovation management) and harnessing that knowledge for open innovation. The various methods identified within the literature review have been used for various purposes and in different settings, whereas within open innovation usually only four customer integration methods have been discussed – i.e., Toolkits for Innovation, Lead User Workshops, Idea Competitions, and Innovation Communities. Thus, this study enriches the field of open innovation by revealing customer interaction methods which allow customers to be involved in innovation development. Based on the findings acquired within this paper, implications for further research may be derived as regarding the presented results, a major question arises: Is there a chance to modify and consequently improve the existing methods, in order to enable a more effective access to customer knowledge? This issue seems to become crucial considering the fact that none of the existing method is suitable for fully attaining the various information types presented in this study. Consequently, this depicts an interesting research issue especially in the field of IS research. Developing IT applications that support the existing methods might be a possible approach to address this research problem. For instance, modern virtual toolkits (e.g., 3D simulation tools) empower customers to experience innovations long before their design has been finalised, thus enabling a more effective acquisition of sticky information (Füller and Matzler 2007). Furthermore, combining the use of different methods or only specific aspects of various methods might be another possible approach for addressing the stated research problem. For instance, Piller and Walcher (2006) introduced so called internet-based toolkits for idea competitions, where the toolkit approach is combined with the idea of competition. Further on, Hutter et al. (2011) and Ebner et al. (2009) conflate innovation communities with ideas competition. These are some promising approaches towards a more effective acquisition of customers' innovation potential. Nevertheless, more intense research needs to be done in this direction.

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