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# Technologie- und Innovationsmanagement

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**Working Paper / Arbeitspapier**

## **Integration of innovative users as source of service innovations**

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April 2008  
Arbeitspapier Nr. 54



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# Integration of innovative users as source of service innovations

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## ABSTRACT

In this study we research user integration in the German service industry. Goal is to explore the industrial practice with regard to four dimensions of user integration, i.e., why, whom, how, and how successful the service industry integrates to find novel service ideas. Data is collected from a large-scale survey sent out to 2,905 service companies and posted in various user groups related to service innovations.

Drawing from data gathered from 301 respondents in our study, we present explorative findings for each distinct dimension of user integration. To better understand the interrelation of these dimensions, we also create a structural equation model using partial least square for estimation of direction and strength of relationships between those.

Results show that service companies like companies from other industries actively pursue the development of radical innovations. We find that service companies do not integrate users by random. Instead a service company's level of importance for radical innovation significantly determines both, choice of users integrated as well as choice of integration instruments deployed.

In our study we can also show, that many of the beliefs brought forward by service companies for not integrating users cannot be sustained in the light of our findings. We can demonstrate that user contributions provide true value to those companies integrating the latter, and also that using tools which are considered easy and versatile to apply can still have a significant impact on the attractiveness of user ideas.

## INTRODUCTION AND OVERVIEW

### Innovations in the service industry

Most growth in modern economies is in services. In the US, the service sectors grew from 50% to 80% of the total employment over the last 50 years (Fitzsimmons and Fitzsimmons, 2005); same picture showing for OECD countries, where about two-thirds of business sector growth between 1985 and 1997 was in services (Howells and Tether, 2004). In Germany, a country with a strong industrial heritage, service is now reaching levels of 70% and more of total economic value added (Destatis, 2007).

As the service sector continues to grow, over time new entrants are attracted, technologies change, and user needs are shifting. Continuous innovation efforts therefore become an imperative for incumbent service providers to reduce costs, enhance existing service quality, and to expand current service offerings to increase market share in existing markets or to enter new ones (Ginzburg et al., 2007; Tether, 2003).

Research data however also show that new services may be as prone to failure as any new product. A new service failure rate of 80% has been reported for instance in the financial service industry (Clancy and Shulman, 1991).

To fully understand the reasons behind the challenges in developing successful service innovations, one has to appreciate the constitutive characteristics of services. The intangible nature of services and the integration of the user as an external factor thereby impose the biggest challenges for a successful development of radical service innovations on various

items (Hipp and Grupp, 2005). Compared to manufactured products, the intangibility of the output dimension requires a much higher level of abstraction from the user, not only to evaluate existing services (Zeithaml, 1991) but even more so for the ideation and conceptualization of novel services – the same problems exist for sources within the firm. Prototypes, which help discussing conceptual changes and communicate the concept to all stakeholders in the development process, can neither be provided in the same remote format as for manufactured products, i.e., without involving test users and having all capabilities in place to test-run the service concept, nor in the early phases of the product development process – for the same reasons. Besides, in some instance, new services can also require the user to learn new protocols, e.g., people at the airport having to use a terminal for self-check in, compared to the traditional way of having an assistant at the desk helping with the check-in procedure.

### **Importance of user integration for service innovations**

To decrease the risk of market failure for innovations, future user needs must thus be anticipated and translated into innovative services early in the process of designing such market offerings. Various empirical studies show that the involvement of users as spokesmen of the market positively impacts multiple areas of the companies' innovation efforts and is an important success factor for the development of products (Baker et al., 1986; de Brentani, 1995) and services (AberdeenGroup, 2005; Edgett and Parkinson, 1994; Martin and Horne, 1995). By circumventing existing gaps between the internal believes of market needs and the actual existing market needs as one of the most frequent causes of failure of innovations projects (Zollner, 1995), a user-centric development of products and services saves time and money. The involvement of users will provide a deeper understanding of their needs and increase the likelihood that ideas for new services will meet those needs (Alam and Perry, 2002; Flint, 2002). Findings from recent empirical research about companies' intensified interaction with users show that involving these will improve the effectiveness of new service development (Alam and Perry, 2002; Magnusson, 2003; Olson and Bakke, 2001; Thomke, 2003).

Research, however, shows that user involvement not only offers companies the prospect of probing, testing, and filtering their internally generated ideas and concepts, but also the possibility of leveraging the user as a source of innovations (Kristensson et al., 2004; Kristensson and Magnusson, 2005; Magnusson, 2003; Magnusson et al., 2003; Matthing et al., 2006). For leveraging this creative potential offered by users, firms have various degrees of freedom with regard to 'why', 'when', 'whom', 'how' and 'how much' to integrate users (Alam, 2002; Gruner, 1997). In the following we will review existing literature on the subject of user involvement in the ideation phase of service innovation ('when'). Along these dimensions we present state-of-the-art findings for service and manufacturing industry and identify blind spots of research as motivation for our study.

### Objective of innovation as driver for user integration

While the overall goal of user integration is stated to be "*an ever-growing need for the development of new services*" (Alam, 2002: p.245), on a more granular level, innovations can be differentiated into two main categories, incremental and radical innovations (All, 1994; Baker et al., 1986; Booz, 1982; Herstatt, 2003; Lynn et al., 1996; Nord and Tucker, 1987; Shaw, 1985; Sundbo, 2007). Besides continuous incremental innovations for optimization of existing service offerings, or closure of gaps in the existing service portfolio, companies from time to time do require a radical innovative leap to expand into new markets or cement their competitive situation in existing markets.

In general – with a comprehensive and commonly agreed on single definition of the term 'radical innovation' still not having evolved (Green et al., 1995) – breakthrough, disruptive,

or radical innovation are referred to as new rather than improved products with a high long-term sales-potential. They are based on new discontinuous technologies (Kessler and Chakrabarti, 1999; Lynn et al., 1996; McDermott and O'Connor, 2002; Rice et al., 1998), have a high inherent level of market uncertainty (Abernathy and Utterback, 1978; Rice et al., 1998; Vreyzer, 1998), and impose a significant level of risk to the innovating companies for the usually high costs involved in developing such products might not pay off. Radical innovations therefore are usually considered to mark one extreme in the innovation continuum. Incremental innovations, which rather engage improvements of existing products or technologies, involving a walk along a known technology trajectory with little uncertainty regarding success and failure potential, are the other. From a pure market perspective, i.e., blinding out the experienced characteristics of radical innovations and their implications on the management of innovations from a standpoint within a firm (Green et al., 1995), the common denominator of all attempts to define radical innovations would be the constitutive characteristics of all innovations, i.e., the degree of novelty as perceived by the market (Gadrey et al., 1995).

#### Characteristics of involved users

*"[...] an important challenge facing companies is the identification of innovative users who are likely to be most helpful during new service development"* (Matthing et al., 2006: p.289), see also (Parasuraman and Colby, 2001; Rogers, 1995; von Hippel, 1988). By differentiating radical and incremental innovations, it already shows that these two innovation types are so diverse it seems logical to also involve distinct users as sources of the latter. Average users for instance often do not qualify as a source of radically novel ideas for reasons of functional fixedness. An involvement of the latter still results in market-conforming innovations, though incremental ones (Lettl et al., 2006). The concept of functional fixedness stems from 'Gestalt Psychology' and is defined as "... *a mental block against using an object in a new way that is required to solve a problem*" (Duncker, 1945). Average users' insights into new product (and process and service) needs and potential solutions are constrained by their individual real-world experience. This 'block' then limits the ability of an individual to use the components given to them to make a specific item, as they cannot move past the original intention of the object (Duncker, 1945). Users infused by the present are thus unlikely to generate novel product concepts which conflict with the familiar ones (Adamson, 1952; Luchins, 1941). On the other hand, numerous studies show that certain users are very well able to generate radical innovations. These users not only initiate innovations by request and concrete needs (Biemans, 1991; Mansfield, 1988; Utterback et al., 1976), they also generate ideas and concepts (Baker et al., 1986; Voss, 1985) and even develop and use prototypes (Lettl et al., 2006; Lüthje, 2004; Shah, 2000; von Hippel, 1982; von Hippel, 1986; 1988). Erich von Hippel, one of the pioneers on the field of innovative users, terms the latter as lead users. According to von Hippel "*lead users face needs that will be general in a marketplace – but face them months or years before the bulk of that marketplace encounters them.*" and "*lead users are positioned to benefit significantly by obtaining a solution to those needs.*" (von Hippel, 1986: p.796). Although their insights are as constrained to the familiar as those of average users, lead users are familiar with conditions, which are *ahead of trend* for the majority of the remaining market. Consequently they are in a position to provide valid information on needs and ideas related to such future conditions. From the perspective of innovation as an economically motivated activity (Mansfield, 1968), *expected economic or personal benefits* associated with an innovation can become so strong that lead users become the innovators themselves. Echoing von Hippel's underlying idea of users being able to act as source of novel ideas multiple other studies have been conducted to validate von Hippel's lead user characteristics and to identify additional innovation enabling personality traits. While benefit expectation and being ahead of trend showed to have a positive influence on the

propensity of users to generate attractive ideas for new products (Lilien et al., 2002) and to build prototypes for own use (Franke and Shah, 2003; Franke et al., 2005), other traits have been tested to be of equal importance with regard to user innovativeness.

From existing literature it is well known that a detailed *knowledge* in a particular area is imperative for finding novel and useful solutions to existing problems (Gavetti et al., 2005; Magee, 2005; von Hippel, 1998; Widemann and Owston, 1991). General notion is: the more experience and competency a person owns, the higher the expected quality of that person's solution (Antonetti and Gioletta, 1995; Larkin et al., 1980; Walberg, 1988). Literature differentiates two facets of relevant knowledge (Lüthje, 2003; Lüthje et al., 2005). Profound knowledge about product architectures, used materials and built-in technologies is likely to promote product development. Also, the availability of information about all market offers through sources such as publications, conferences, fares, and the World Wide Web is supposed to enhance the knowledge and awareness about need-related issues that are not addressed by existing products. The postulated positive effect of technology and market know-how on a user's ability to innovate has been proven in multiple studies for manufactured goods (Franke et al., 2005; Hienerth et al., 2007; Lüthje, 2003; Lüthje et al., 2005; Tietz et al., 2004). Though, as stated, knowledge is a necessary enabler for innovation, too much can act as inhibitor of creativity. It shows for the service domain that ordinary users with regard to perceived user value and originality of generated new service ideas outperform professional experts with a rich understanding of deployed technology (Kristensson et al., 2004; Kristensson and Magnusson, 2005; Magnusson, 2003 226; Magnusson et al., 2003).

A related user characteristic documented in multiple studies to have an effect on idea generation and prototyping activities of users is *experience*. While user knowledge encompasses know-how stemming from various sources outside a person's use experience (e.g., knowledge gained from external sources such as other users), use experience refers to knowledge generated by direct acquaintance (Russell, 1948; Schreier and Prügl, 2006). *"Use experience therefore refers to learning from experience and to performance-related knowledge from primary product usage"* (Schreier and Prügl, 2006: p.12), see also (Alba and Hutchinson, 1987; Hoch and Deighton, 1989). Numerous empirical studies in the domain of manufactured goods demonstrate that innovative users are often very experienced practitioners. They exhibit a high frequency and history of using a product (Lüthje, 2004; Shah, 2000) and consequently have better insights into the activity than the majority of those users who do not innovate. Same as the above types of knowledge experience appears to be one elementary base for the innovation process. Similar to knowledge it also is argued that too much experience constrains a user's ability to generate novel product concepts which are outside the boundaries of conventional product use (Adamson, 1952; Luchins, 1941; von Hippel, 1986).

To escape the imposed boundaries of functional fixedness, in which even lead user can be captured (von Hippel, 1986), cognitive science recommends the use of analogies as enhancing mean of innovative problem solving (Gick and Holyoak, 1983). Analogy is a well researched area in cognitive science (Blanchette and Dunbar, 2001; Genter, 1983; Genter et al., 1997; Gick and Holyoak, 1980; Holyoak and Thagard, 1995). It is understood as the cognitive process of transferring information from a particular subject (the analogue, source or base domain) to another particular subject (the target) (Gick and Holyoak, 1983; Keane, 1988). As creative solutions commonly result from the amalgamation of pieces of knowledge that have not been connected before (Geschka, 1992; Geschka, Moger et al., 1994; Hargadon, 2002) analogies offer new paths for the combinations of knowledge. *"[...] [I]n the context of idea generation for new products [analogy however] has not been subject to extensive research"* (Kalogerakis et al., 2008), see also (Bonnardel, 2000; Dahl and Moreau, 2002; Hargadon, 2002). This holds especially for the realm of user innovations. In our literature review we only identified some initial conference papers of Marion Pötz and Christoph Hienerth researching the impact of a

user's *analog use experience* on the attractiveness of generated ideas (Hiernerth et al., 2007). Presented data evidences that while the market distance positively correlates with the attractiveness of ideas, the technical distance of the users' originating market showed negative effects on the latter (Hiernerth et al., 2007).

The *technology readiness* [TR] construct refers to "*people's propensity to embrace and use new technologies for accomplishing goals in home and life*" (Parasuraman, 2000: p.308). It can be understood as a general state of mind caused by a gestalt of mental enablers and inhibitors that jointly determine a person's overall predisposition towards new technology (Matthing et al., 2006). Work of Matthing et al. (2006) shows that the construct of TR – respectively its operationalisation as technology readiness index [TRI] – is "[...] *an especially appropriate tool for trying to identify lead users in the context of new technology based services*" (Matthing et al., 2006: p.290). This is because "*the highly techno-ready consumer will instinctively try to solve the problem alone*" (Parasuraman and Colby, 2001: p.158), reflecting a common characteristic of lead users, e.g., (Shah, 2004; von Hippel, 1976; 1986). In their work the authors demonstrate that TR not only is a good indicator of users' propensity to adopt and actively search for new technologies and to overcome problems related to these, but also of users' capability for generating original new service ideas (Matthing et al., 2006).

#### Integration instruments: determining intensity and means of user integration

Previous research with regard to user innovation often took a rather dichotomous standpoint, i.e., it only analyzed whether users were or were not integrated (Gemünden et al., 1992). Cooper and Kleinschmidt (1986) however found that with regard to innovation success it is not so much the question of what activity is performed in innovation management, but a question about the level of its 'proficiency'. For user involvement this means that both intensity and mean are critical success factors.

Alam understands the intensity of user involvement as "*continuum, where passive user participation is at the least end of the continuum and representation (i.e., participative decision making) is at the extremely intensive end of the continuum*" (Alam, 2002: p.255). As we will show for the most prominent integration instruments (Alam, 2002; Busse and Reckenfelderbäumer, 2001; Herstatt, 1996; Kunz and Mangold, 2004), intensity and mean however often cannot be clearly segregated. *User observation*, i.e., the identification of optimization potentials by analyzing user behavior within the direct surrounding of service production, assigns the user a very passive role only. He does not participate directly in service development but acts as remote source of information only. In case of *interviews/questionnaires* the impetus of involvement still is with the service provider. The user however takes a much more active role. He is able to provide in depth information about perceived service quality and improvement potentials. *Complaint management* already is a process actively triggered by the user. Information gathered by systematically analyzing user complaints can provide valuable insights into existing shortcomings of service offering (both quality and portfolio) and thus act as important source of innovation. *User groups*, i.e., a community of users exchanging on a certain topic, can also be utilized for leveraging user information as source of innovation. As user groups usually attract highly involved individuals, the posted information provide a rich source to identify unaddressed needs but also to evaluate the opinion about any changes made to existing service offerings. *Idea competitions* provide an even higher degree of user integration. Compared to the previous instruments, here the user is actively questioned to bring forward ideas for new services outside the realms of problems and needs directly related to existing service delivery. The chance of winning a price increases the motivation of the user to participate and also to bring forward ideas, which require some effort to codify. Dependent on the set-up of the competition, service providers can retrieve levels of details far beyond first ideas. In *focus groups*, the service producer conducts discussion with actively selected groups of prequalified

users. In this format an active exchange on new ideas between the invited users, but also between user and employees of the service company is possible, allowing guidance in the ideation process to improve the quality of the generated ideas (Magnusson et al., 2003). The *lead user method* [LUM] goes back to the work of von Hippel (1986). It is a multistage method designed around the identification of lead users in the target but also analog markets after having identified the underlying trend on which these users have a leading position (Herstatt and von Hippel, 1991; Urban and von Hippel, 1988; von Hippel, 1986; von Hippel and Riggs, 1996).

Innovation management literature from the realm of manufactured goods however sees using the same instruments for radical and incremental innovation projects very critical (Herstatt, 2002; Rust and Lemon, 2001; Trott, 2001; von Hippel, 1986). Methods too much leaning towards present situation of service delivery impose the threat of 'functional fixing' the user to status quo. On the other hand, methods such as interviews offer the possibility to gain information of high quality as leveraging user information immediately before, after, or within its involvement in the service process (Busse and Reckenfelderbäumer, 2001).

### **Problem formulation**

As we have seen from the above, most findings on user involvement stem from the manufactured goods sector. "*User involvement in new service development is an area that is almost unexplored*" (Magnusson et al., 2003: p.113). Though we have named multiple studies providing insights to rationales for and processes of user involvement in the service industry, so far these rely mainly on anecdotal proof, case studies, or interviews. Quantitative findings are limited to few aspects of user involvement only. To date only large-scale governmental studies such as the OECD funded pan-European Community Innovation Survey (CIS) provide data that companies do value users as important sources of innovation on large-scale. Additionally, for service innovations, so far in total 7 experiments and quasi experiments have studied the effect of the characteristics of involved users on the attractiveness of the user-generated ideas.

The set-up of existing studies so far, however, spares appraising the as-is situation of service user integration on basis of a representative quantitative research. Except for the works of Gruner (1997) and Fähnrich et al. (1999) – to our best knowledge neither for service nor manufactured goods – no other studies relate to this aspect at all. Gruner quantitatively researches the effects of whom and how the German (engineering) industry is actually integrating on overall innovation success. The study of Fähnrich et al., though extensively studying the situation of service innovation in Germany, does not cover the aspect of user characteristics. A comprehensive analysis of interdependencies for the dimension of user integration also lacks his paper in the above aspect. Especially the frequently discussed implications of radical innovations on obstacles and prerequisites for innovation management (Herstatt, 2003) make it worthwhile understanding whether in the service industry significant differences can be found in strategic dimensions of user integration for incremental and radical innovations.

Compared to the rich spectrum of personality traits researched for effects on users' innovativeness, only a small number of these have been tested for in a service setting. Empirical studies on traits such as 'user experience', 'service know-how', and the aspect of 'analog use experience' for instance are lacking in service innovation research.

As with all surveys and polls, to make a generalization of the findings it is important that the sample is representative of the group that a conclusion will be drawn about, both by choice and size of sample (Tindale, 2007). The first aspect however is limited by the experimental set-up of the existing studies on service users (Kristensson and Magnusson, 2005; Magnusson, 2003; Magnusson et al., 2003) "*which strengthens the internal validity at the expense of the external validity*" (Kristensson and Magnusson, 2005: p.12). Also the total

number of 187 sampled<sup>1</sup> users seems low in the light of making representative statements for such a diverse and large population as service users are. Or as Matthing et al. very appositely summarize (2006: p.294): "[...] *making empirical generalization with confidence [...] should await results from studies involving larger and more diverse samples of respondents*".

Summarizing the above, in the present paper we will provide a comprehensive picture of the as-is situation of user involvement in the early phase of the innovation process in the service industry. In addition to the explorative part, we also will analyze the relationship of the described dimensions of user involvement on the attractiveness of user-generated ideas. Four research questions provide the structure of the casual analysis: 1) What characteristics do users integrated as source of innovation by service companies have?, 2) What means do service companies use to leverage ideas of users?, 3) What moderating effect does the innovation scope of a service company have on the choice of user characteristics and involvement instruments?, and 4) What effects do the different means of user involvement and user characteristics have on the attractiveness of the user derived ideas for new services?

### **Objective and structure of work**

For addressing stated research needs we will collect data from a large-scale survey in the service industry to provide explorative evidence of as-is practice with regard to the distinct dimensions of user involvement. In a second step relationships among the various dimensions are analyzed according to the formulated research questions. Based on this analysis, central determinants for each of the research questions' underlying causalities are identified and answers to the latter are derived from our synthesized findings.

Accordingly we organize the paper as follows. After having derived the motivation and scope of our research, the next section provides detailed information on the approach for studying the formulated research questions. This includes the set-up of the research model, a description of the data sample used, the conceptualization and empirical testing of latent variables and the definition of manifest variables, as well as a brief theory on structural equation modeling [SEM]. In the section on the results we will start drawing an explorative picture of the current as-is situation of user involvement in the service industry by providing frequency analysis of our results. Next we will analysis the SEM to test and understand the relationships of the innovation objective, integration instruments, characteristics of integrated users, and the attractiveness of the user-generated ideas. The paper ends with a discussion of implications of findings for industry and further research.

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<sup>1</sup> Though the number of users in the listed service innovation studies sums up to 249, it needs to be noted that the studies of Magnusson (Magnusson, 2003), Magnusson et al. (Magnusson, et al., 2003), and Kristensson et al. (Kristensson, et al., 2004) all share 31 users as subset of their sample.

## RESEARCH DESIGN

### Research model

Based on the previously described dimensions of user involvement, its underlying constructs, and the formulated research questions we develop a casual model. The latter is used as backbone of our research to explore all relevant aspects of the as-is situation of user integration in the service industry and to test magnitude and direction of possible relationships between the different dimensions. As summarized in table A1 (in the appendix), the definition of the constructs is based on an extensive study of previously conducted studies in either service or product innovation cases.

Marking the starting point of casual chains is the service company's 'objective' of user involvement. As discussed in the previous section, the 'objective' is said to be the driver for all other dimensions of user involvement. Dependent on whether 'radical innovations' or 'incremental innovations' are goal of the development project, findings from previous research suggest integrating different users. Same holds true for the mean of integration. To capture the 'objective' of user integration, i.e., to conceptualize the types of innovation of greatest importance to a service company, we set-up the two constructs 'radical innovations' and 'incremental innovations'. As we have learnt, these are believed to mark the extremes in the continuum of innovation. To translate the construct of 'radical innovation' into easy to grasp items, we use Ansoff's product market/growth matrix (Ansoff, 1957). In the latter Ansoff proposes to differentiate innovations by two dimensions, namely product (new and existing) and market (new and existing). For 'radical innovations', which are referred to as new rather than improved products (Kessler and Chakrabarti, 1999; Lynn et al., 1996; McDermott and O'Connor, 2002; Rice et al., 1998), we thus use items referring to 'new services for existing markets' and 'new service for new markets' (Booz, 1982). To capture the opposite pole of innovation, we draw to Ansoff's dimension of existing products and in line with additional literature<sup>2</sup> use the items 'improvement of existing services' and 'advancement of existing services' to measure the construct of incremental innovations.

To explore the effect which the objective of user involvement imposes on the characteristics of the integrated users as well as the effect of these on the attractiveness of the generated ideas, the model contains a selection of the most prominent personality traits of users tested so far in the described studies from the manufactured goods sector. As an additional characteristic we introduce 'averageness' in this paper. From our perspective, all of the so far used characteristics in literature fall short to directly draw conclusions on how far away the particular users are from the typical, representative, average user. To allow industry explicitly expressing whether or not they involve this user type, we added this particular personality trait into our model (which, as statistics shows, for our sample matches all quality to be considered sufficiently independent from the other traits).

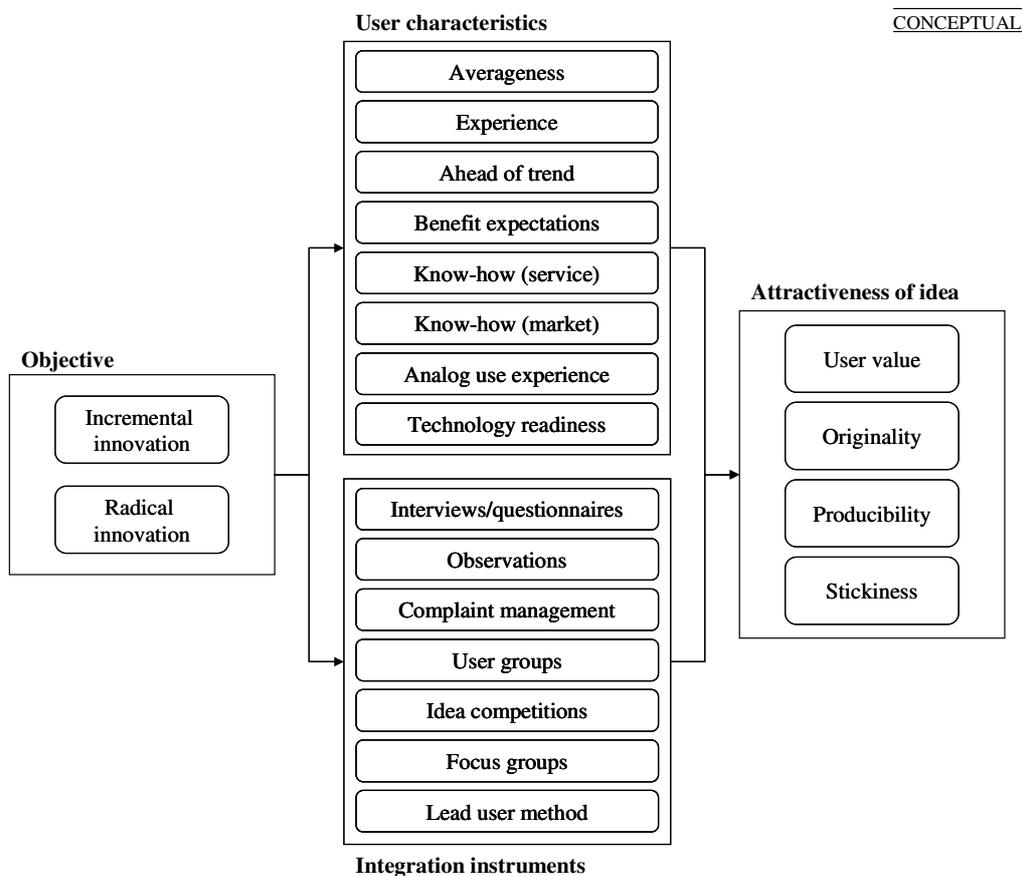
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<sup>2</sup> e.g., revolutionary vs. evolutionary (Baker and Sweeney, 1978), radical vs. routine (Nord and Tucker, 1987), pioneering vs. incremental in (All, 1994), major improvements vs. basic (Shaw, 1985), new-to-the-world vs. extensions (Booz, 1982), discontinuous vs. continuous improvements (Lynn, et al., 1996), radical vs. instances of learning (Sundbo, 2007), or breakthrough vs. incremental (Herstatt, 2003).

**Figure 1: Research model**

What users do service companies integrate dependent on the objective of innovation?

What is the impact of the integrated users' characteristics on the attractiveness of the generated idea?



What instruments do service companies utilize to integrate users dependent on the scope of innovation?

What is the impact of the utilized instruments for user integration on the attractiveness of the generated idea?

Same as for user characteristics we tap existing literature to come up with a list of most prominent instruments for user integration applied in the realm of service innovations. In our study we explore frequency of utilization and interdependencies with objectives and attractiveness of ideas for the previously described instruments: 'interviews/questionnaires', 'observations', 'complaint management', 'user groups', 'idea competitions', 'focus groups', and 'lead user method'.

For studying the perceived effects of the different user types involved and the applied integration instruments under the fore signs of the distinct objectives of user involvement, the attractiveness of user-generated ideas serves as the model's dependent variable. *"Evaluating a service as the best is not a trivial task"* and *"'best' can be determined from many different aspects"* (Magnusson et al., 2003: p.114). As we are only interested in the development contribution of users in the ideation phase of the service development process, we cannot draw on measures focusing on innovation (market) success in general. The design of the subsequent stages, the organization culture, and the actual implementation of the novel service idea in the field organization impose too many uncontrollable factors. Instead, we adopt the dimensions developed by Magnusson et al. (2003) in the context of distinguishing between successful and less successful ideas for new mobile telecom services. Based on focus group session with experts in mobile telephony development, Magnusson et al. identified the following three dimensions: 'User value', i.e., *"the estimated value for the user when using the service"*, 'originality', i.e., *"a concept that enfolds the innovative dimension of a service"*, and

'producibility', i.e., "*the estimated effort required to implement the service*" (Magnusson et al., 2003: p.114). As all three dimensions only in direct comparison to ideas generated by professionals allow evaluating whether the idea generated by the user adds additional valuable insights to the ideas phase, we also measure the 'stickiness' of an idea. The works of von Hippel (1994; 1998) and Lüthje et al. (2005) define 'stickiness' as the incremental expenditure of transferring a unit of information from a source of information to an information seeker in a usable way. The more 'sticky' information is, the more expensive it is for a company to access it. For information on user needs, we therefore understand the attribute 'stickiness', as the extent to which an idea is so local to a user that service companies are not able to come across the latter themselves.

### **Data collections**

With the goal to provide both a general perspective of the as-is situation with regards to user integration in the service industry as well as understanding the interplay of the different dimension of user involvement in practice, a large sample is required. We therefore have conducted a large-scale survey in the German service industry. Using address data acquired from Hoppenstedt™ (a commercial German database for company data), 2,905 standardized questionnaires have been sent out. Targeted companies included all those stating to offer services as primary or secondary business branch. As filtering criteria for mail postings we imposed an employee size of > 250, for reasons of convenience.

In parallel, a link to the survey has also been posted in various user groups dedicated to services, service marketing, and service innovations at XING (a German based business Web community). A filter with regard to firm size has not been imposed here.

As stated in table 1, the majority (88%) of answers stems from companies with more than 250 employees. T-test ( $\alpha < 0.05$ ) however showed no significant differences with regard to objectives, instruments and user characteristics between small to medium sized companies with less than 250 employees and larger companies.

The overall response rate with regard to fully completed surveys is 9%. This shows to be a good level for large-scale service surveys compared to previous work in this industry conducted in Germany. Fähnrich et al. for a governmental funded study on service innovations for example consider a response rate of only 7% to be "*positive*" (Fähnrich et al., 1999: p.21).

**Table 1:** Population and response rate of study

Branch (NACE - Code)	Send-out	Posted <sup>*</sup>	Completed	# of employess					No info.
				10-49	50-249	250-499	500-1999	>2000	
Wholesale trade (G51)	694		21	0	0	17	0	1	3
Hotels and restaurants (H)	77		1	0	0	0	0	0	1
Transport, storage and communication (I)	358		41	1	0	29	1	3	7
Financial intermediation (J)	664		62	4	0	45	6	3	4
Computer and related activities (K72)	209		48	5	3	20	3	3	14
Other business services (K70, 71, 73, 74)	680		101	15	5	53	3	7	18
Health care (N85)	192		13	0	2	10	1	0	0
Sewage and refuse disposal, sanitation and similar activities (O90)	31		0	0		0	0	0	0
No information	0	↓	14	1	0	12	0	0	1
<b>Total</b>	<b>2,905</b>		<b>301</b>	<b>26</b>	<b>10</b>	<b>186</b>	<b>14</b>	<b>17</b>	<b>48</b>
<b>Response rate</b>			<b>9%</b>						

\* as number of total persons having followed link to online survey

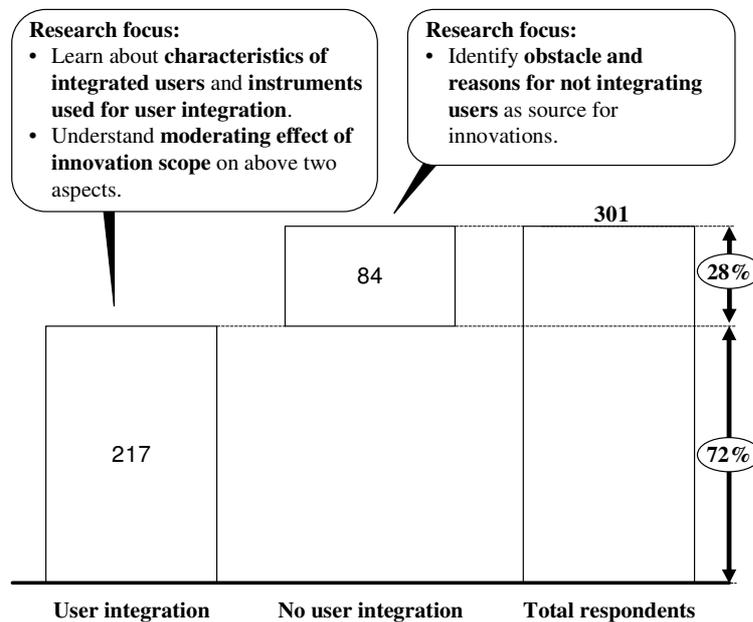
## EXPLORATIVE FINDINGS OF USER INTEGRATION IN SERVICE INNOVATIONS

Before commenting on quality and results of the SEM we would like to present explorative data first to draw a statistic picture of current state user integration in the service industry. The coming discussion of explorative findings from our research thereby is twofold. Those companies integrating users as source of innovation help us to better understand specifications of user involvement in the service industry. The responding companies not integrating user still help drawing the other half of the picture by providing us with information on reasons for not involving users.

As illustrated in figure 2, for our sample it shows that 72% of companies actually are integrating users as sources for innovation. This picture is in line with the findings of Tether (2003). In his analysis of CIS data he demonstrates that of all responding firms, 84% considered 'customers/clients' to be a relevant source of innovation and still 43% considered the latter to be an important source.

**Figure 2:** Overview user integrating vs. user non-integrating respondents in sample

Responses to question: "Do you integrate users as source for innovative ideas for new services?"



To better understand the reasons of not integrating users, we asked the 28% of respondents to state how much they agree to possible reasons for not integrating users. Figure 3 presents an overview of the average level of agreement to the various answer choices given in the survey. Most surprisingly 12% of the respondents not integrating users 'very' or 'extremely' agree to the statement that 'users do not have innovative ideas'. The overall level however shows that this is not representative for the others. In average very few believe that users do not have innovative ideas. Same holds true for bad prior experience. Another unexpected fact is that many of these service companies not yet have considered integrating users – which is very surprising in the light of what we learnt about the benefits of user integration from theory before. With regard to actual reasons showing high levels of common agreement a 'lack of resources' and ideas that are 'too far away from practice' have been named.

After having dealt with hampers for user integration, in the following we turn towards those respondents integrating users and present explorative data with regard to the four dimensions encompassed in our research model.

Concerning the 'objective' of user integration, we asked the companies how important they consider the four items we named to be our indicators for 'radical innovations' and 'incremental innovations' as goals of their innovation activities.

**Figure 3: Reasons for not integrating users in service innovations**

Responses to question: "How much do you agree to the statements for not integrating users"  
 Items measured on a 5-point Likert scale with 1 = Not at all agree and 5 = Extremely agree

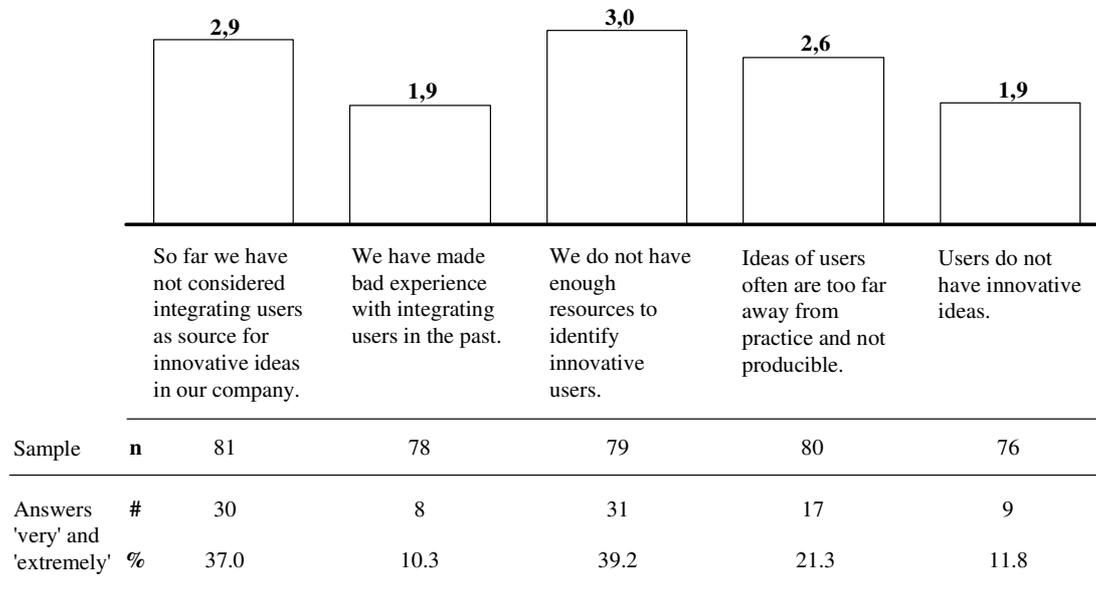
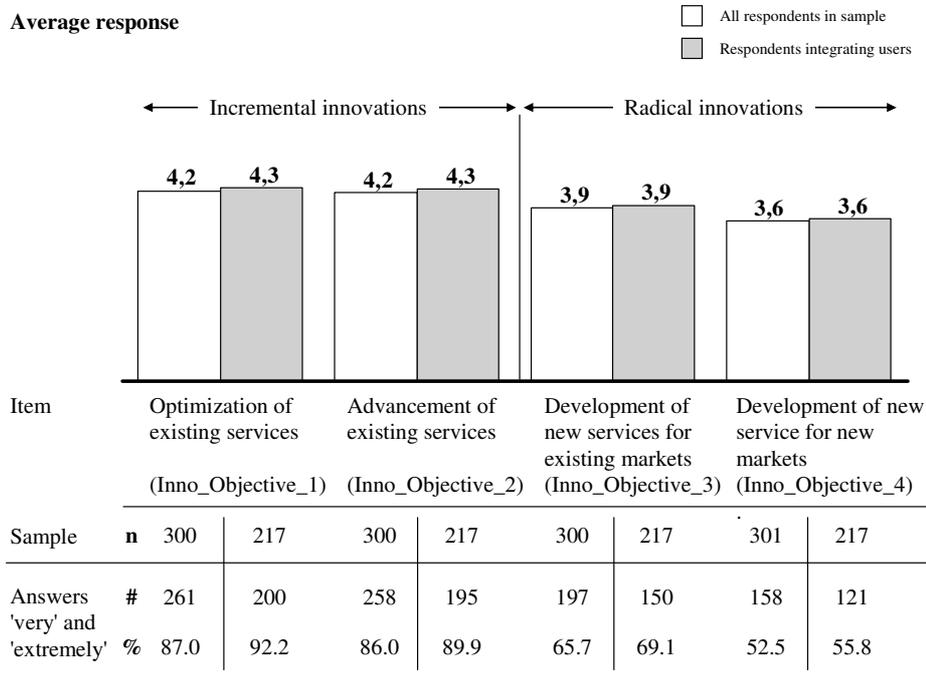
**Average response**

Figure 4 illustrates the average response pattern of all respondents respectively the respondent integrating users, i.e., our target group in this section. Data illustrate that service companies not only value improvements of existing services as innovation, but also pursuit innovative activities to develop services completely new to the market or even to shape new markets. The items for incremental innovations, i.e., optimization and advancement, are considered to be very and extremely important goals for innovation by approx. 90% of respondents. Still however, approx 69% and 56% of the respondents define the items for "radical innovations as 'very' or 'extremely' important goal of innovation (data refers to user integrating respondents only – slightly lower value show for the overall sample). This finding supports researchers stating the importance of the development of new services for service companies to maintain competitiveness in rapidly changing markets (Kelly and Storey, 2000; Matthing et al., 2006; Storey and Easingwood, 1996). It also supplements existing literature stating that service companies for reasons of low protection from intellectual property rights prefer investing in improvements rather than new services (Sundbo, 1997; 2007). Data in figure 4 – and t-test statistics – display no significant differences with regard to the formulated innovation objectives between those companies integrating users as source of innovation and those not doing so.

**Figure 4:** Importance of innovation objectives to the service industry

Responses to question: "How important are the below innovation goals in your company"  
 Items measured on a 5-point Likert scale with 1 = Not at all and 5 = Extremely



Next we analyze the response data concerning the question of how often service companies use one of the different integration instruments we have outlined before. Summarized in figure 5, data at first glance shows that service companies much more frequently use integration instruments which relate to existing service offerings, i.e., 'interview/questionnaires', 'observations', and 'complaint management'. The groups of instruments stated allowing the user to break free from the existing and thus to come forward with more attractive ideas (Trott, 2001) show to be much less commonly used. One rationale declared by interviews of Alam (2002) with service providers is that the effort required for using the latter instruments compared to others is much higher. This would also explain why complaint management is stated to be the most frequently used instrument, as the latter can be used as continuous channel for user involvement outside specific innovation activities.

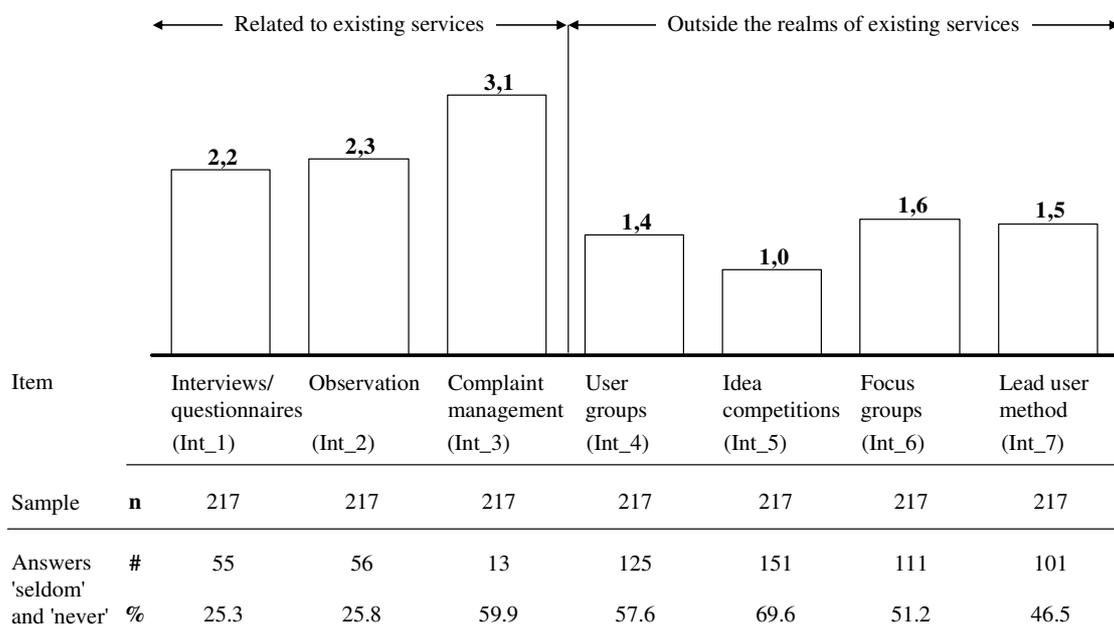
Still data on the use of the rightmost four instruments in figure 5 provide some interesting insights. First it shows that service companies actually do apply instruments such as the lead user method, which require a careful selection and filtering process of users to be integrated. Literature so far for instance bewailed lacking proof of service companies actually using the lead user method (Kunz and Mangold, 2004). With regard to current understanding of literature that these tools provide more creative ideas, we would expect to find these especially with service firms valuing radical innovations more than others. Second it shows that over half of the respondents use the latter instruments 'never' or only 'seldom'. Our data therefore again provides quantitative support for the findings of Alam (2002). By means of conducting several interviews in service sector, Alam learns about the two by his interviewees most dominantly used instruments for user integration: These are 'extensive consultation' and 'information and feedback on specific issues'. 'Extensive consultation' refers to instruments integrating users "[...] by means of a planned process governed by a predetermined objective" (Alam, 2002: p.255), i.e., user groups, focus groups and detailed interviews. 'Information and feedback' relates to directly approaching the users in the development process to obtain information and feedback on specific issues. Main reason for using those more frequently was

that these instruments were stated to be "*easier and inexpensive modes of obtaining user input*" (Alam, 2002: p.256). Opposing it showed that especially tools demanding an identification of suitable users were used much less frequently. "*Where possible we avoided to focus groups because it was difficult for us to bring users together at a given time and conduct the group discussions, instead one-to-one interviews were more useful and versatile*" (Quote of interviewed service manager in (Alam, 2002: p.256). The same situation is depicted by our data on a general basis for service companies.

**Figure 5:** Frequency of using instruments for user integration in the service industry

Responses to question: "How often does your company use one of the following instruments for user integration?"  
Items measured on a 5-point Likert scale with 0 = Never and 4 = Always

**Average response**



After having learnt about the as-is situation with regards to applied instruments for user integration, we now study the explorative data with regard to which attributes integrated users in services usually exhibit. Figure 6 brings forward summarized findings with regard to that particular question.

In general it shows that service companies acknowledge the fact that users have to exhibit certain personality traits to make a valuable contribution to the development of new services. Being asked which user types industry 'specifically' integrates, data quite clearly states that users are not integrated by random. Only 12% of the companies in our sample agree 'very' and 'extremely' on doing so (AV\_2).

**Figure 6:** Characteristics of users integrated by service firms as source of innovation

Responses to question: "As source for innovative ideas, your company usually specifically integrates users, which ..."  
 Items measured on a 5-point Likert scale with 1 = Not at all agree and 5 = Extremely agree

Construct	Item	Average response	Ø 2.86	Answers 'very' and 'extremely'	
				#	% of n=217
<b>Averageness</b>	AVG_1	3.02		64	29
	AVG_2	2.01		27	12
<b>Experience</b>	EXP_1	3.08		88	41
	EXP_1	3.34		100	46
<b>Ahead of trend</b>	AOT_1	2.94		62	29
	AOT_2	3.26		95	44
	AOT_3	2.56		44	20
	AOT_4	2.93		62	29
<b>Benefit expectation</b>	BE_1	3.36		107	49
	BE_2	3.13		86	40
	BE_3	2.69		61	28
	BE_4	3.18		80	37
<b>Know-how (service)</b>	KHS_1	3.18		90	41
	KHS_2	2.98		73	37
	KHS_3	3.09		80	37
	KHS_4	3.38		110	51
	KHS_5	2.92		61	28
	KHS_6	3.02		75	35
<b>Know-how (market)</b>	KHM_1	2.71		56	26
	KHM_2	3.55		118	54
	KHM_3	2.99		61	28
	KHM_4	2.42		34	16
<b>Analog use experience</b>	AU_1	2.64		43	20
	AU_2	2.51		32	15
	AU_3	2.62		47	22
	AU_4	2.17		19	9
	AU_5	2.65		47	22
	AU_6	1.77		10	5
<b>Technology readiness</b>	TR_1	2.99		72	33
	TR_2	2.76		58	27
	TR_3	2.82		64	29
	TR_4	2.74		59	27

**Note:** For a detailed explanation of items please see table A1 in the appendix

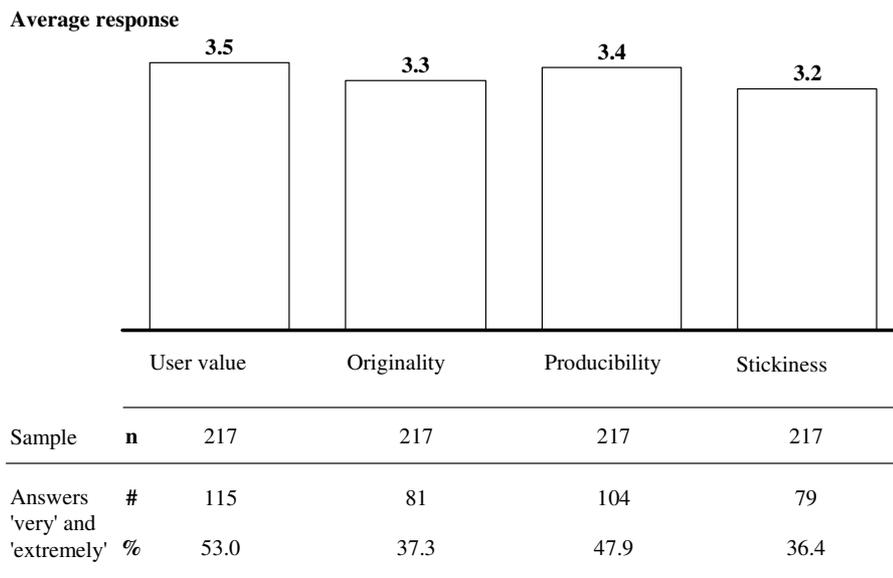
Data however also reveals that service companies agree on targeting users being average in every regard (AV\_1) higher than the average. This means that 'averageness' still is considered to be a user attribute valuable for service innovation. Nonetheless data also shows that many companies however do acknowledge the creative potential outside the realms of 'averageness'. Most items of the constructs 'ahead of trend', 'benefit expectation', 'know-how service', 'know-how market' and 'technology readiness' seemingly are important attributes for selecting particular users for integration from the broad user base. Only the construct 'analog use experience' a construct that is highly valued in cognitive science and already has proven its positive impact in the realm of manufactured innovation receives agreement levels far below average.

Last we turn our attention to the attractiveness of user-generated ideas in the service industry. Opposing to those companies not considering users as sources for innovation, sparing on resources for doing so, or thinking that users produce ideas that cannot be implemented, the findings show general agreement on the value of user contribution in the ideation phase of service innovations. Figure 7 illustrates 53% and 48% of responding service companies considering the 'user value' respectively 'producibility' of user-generated ideas 'very high' to 'extremely high'. Approx 37% of service companies in our sample state the same for the dimension of 'originality' and 'stickiness' of user ideas. As always with stand alone figures, it is difficult to reason why in average the levels of satisfaction are lower, respectively why

obviously some service providers are far less content than those we named to state high levels of satisfaction. We therefore now lead over to the analysis of relationships between the different so far isolated dimensions.

**Figure 7:** Attractiveness of user-generated ideas for service innovations

Responses to question: "How do you evaluate the ideas generated by users in your company so far"  
Items measured on a 5-point Likert scale with 1 = Not at all high and 5 = Extremely high



## RESEARCH METHOD FOR STRUCTURAL MODEL ANALYSIS

With the underlying goal of this work to test and validate the relationships between the specified constructs an adequate analytical method needs to be selected first.

Of all available methods, structural equation modeling (SEM) is recommended in literature as method of choice for a holistic analysis of indicators, constructs, and their structural relationships (Gefen et al., 2000; Homburg, 1992; MacKenzie, 2001; Ringle et al., 2006). SEM is a statistical technique for testing and estimating causal relationships using a combination of statistical data and qualitative causal assumptions. Primary advantage over regression analysis is the ability to simultaneously calculate multiple causal relationships (Bollen and Long, 1998). Its capability to model constructs as latent variables additionally further enables the modeler to explicitly capture the unreliability of measurement in the model via residual variables, which in theory allows the structural relations between latent variables to be accurately estimated (Chin, 1998; Homburg, 1992). In comparison to other methods, SEM also allows analyzing complex causal interdependencies (Homburg, 1992). These include causal chains, such as the relationship between objective characteristic and attractiveness of generated ideas we present in our model.

For constructs with latent variables, as present in the existing model, literature holds two distinctive methods for modeling and analyzing the latter. The first is based on analysis of covariance (LISREL/AMOS) and estimates the model parameters by trying to remodel the covariance matrix of the model's indicators. The second approach uses the variance based partial least square (PLS) method, which estimates the model parameters by resembling the structure of actual empirical data (Hermann et al., 2004).

So far, in research covariance-based models dominate, or as Chin phrases it: "*[...] to many social science researchers, the covariance-based procedure is tautological synonymous with the term SEM*" (Chin, 1998). Most recently variance based PLS models however have gained increasing momentum in social science research<sup>3</sup>. It is especially the ability of PLS to estimate formative constructs without any problems (Bliemel et al., 2005; Chin and Newsted, 1999) that – in the light of Jarvis' and his co-authors' (Jarvis et al., 2003) clearly formulated criticism of too often using (miss specified) reflective measurement models and the consequent discussion in literature – has fostered the latter development. In comparison with covariance based models, the broad acceptance of using PLS is further promoted by its less strict data requirements (Götz and Liehr-Gobbers, 2004; Ringle et al., 2006) and its approach to maximizing the models explained variance (Hermann et al., 2004). Under consideration of the above points and especially the fact that the present model consist of both formative and reflective constructs We regard PLS as method of choice for the estimation of the SEM.

### Operationalization of constructs and variables

The foregoing sections have assisted the development of theory based constructs, i.e., the distinct dimensions of user involvement. In this section we now bridge theory with the empirics by translating each construct into a set of concrete indicators, which can be used to measure the latter in reality. Latent variables represent theoretical respectively hypothetic constructs, which cannot be observed directly, i.e., via a single quantitative indicator. For our research model these are the different constructs accounting for the characteristics of the integrated users as well as the objective of user integration. All of these – as the literature review has revealed – are multidimensional traits. In the run-up to an empirical analysis using these constructs, the latter first have to be operationalized by suitable indicators. As shown in the course of developing the research model, most of its constructs have been deployed in previous empirical studies in the field of manufactured goods already. For this situation,

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<sup>3</sup> Examples of studies using PLS include: Birkinshaw et al. (Birkinshaw, et al., 1995), Cox/Gudergan (Cox and Gudergan, 2005), Huber et al. (Huber, et al., 2003), Johanson/Yip (Johanson and Yip, 1994), Reinartz et al. (Reinartz, et al., 2004)

theory suggests a review of the foregoing models for defining the construct's indicators. Where possible, the conceptualization and measurement of the constructs should be based on previously used indicators (Stump et al., 2002). According to Edwards and Bagozzi (2000) the search thereby always needs ensuring that the selected items are inherent attributes of the contoured phenomena of the latent variables. Thoughts regarding the definitory delimitation of the construct therefore always mark the starting point of identifying suitable indicators (Edwards and Bagozzi, 2000).

#### Operationalization of reflective constructs

When it comes to choosing the indicator measuring the construct the causal direction between indicator and construct is of outmost importance (Diamantopoulos and Winkelhofer, 2001; Edwards, 2001; Wagner et al., 2005), as models can be either formative or reflective ones (Bagozzi and Fornell, 1982; Bollen and Lennox, 1991; Eggert and Fassott, 2005; Fornell and Bookstein, 1982; Jarvis et al., 2003; MacCallum and Browne, 1993). Indicators of reflective constructs are affected by an underlying latent, unobservable construct (MacCallum and Browne, 1993). Changes in the underlying construct are hypothesized to cause changes in the indicators (Jarvis et al., 2003). Reflective indicators thus represent a 'reflection' of the constructs in reality. A change in the construct always causes a change in all indicators, as they exactly measure the respective construct – thus all variation of the latter. For this reason, indicators of a reflective model need to be highly correlated, as they represent interchangeable measurements of the latent variable<sup>4</sup> (Bollen and Lennox, 1991).

In the present model this holds true for the constructs of 'ahead of trend', 'benefit expectation', and 'technology readiness'. All items of these constructs are based on item batteries previously used in the context of researching user innovations in the manufactured goods sector. As shown in table A1, the respective items are either directly adopted (technology readiness) or slightly modified to fit the nature of service innovations ('ahead of trend' and 'benefit expectation'). In accordance with prominent literature on statistics and SEM, e.g., Hair et al. (1998) various quality measures for construct validity, i.e., how well the set of defined items actually measures the latent construct they are intended to measure, are calculated.

As a matter of too low convergent validity, i.e., factor loadings below 0.7 we have to eliminate item BE\_3. As depicted in table 2, quality measures for all remaining reflective items indicate sufficient convergence with regard to their respective constructs. All factor loadings exceed 0.7 (meaning that more than 50% of the items' variance is explained by its factors) and are significant at a level of  $\alpha < 0.05$ . Average variance extracted (AVE) and construct reliability (CR) as summary indicators of item convergence (Bagozzi and Yi, 1988) also are above the critical values of 0.5 (Bagozzi and Yi, 1988) respectively 0.7 (Hair et al., 1998). To test the extent to which a construct truly is distinct from other, i.e., its discriminant validity, literature suggests to compare AVE for any two constructs with the square of correlation estimates between those constructs (Hair et al., 1998). With AVE for all reflective constructs being greater than the largest squared correlation estimate ( $R^2_{\max}$ ) with any other, the latent reflective constructs also explain their items better than they explains another construct (Hair et al., 1998). Predictive validity states how good a latent variable can be reconstructed by its items. After part of the data is systematically assumed missing, PLS recalculates the missing values on basis of estimates for the parameter values from the structural model. The test criteria Q-square shows how well the missing data could be restored by PLS-parameter and the structural model (Fornell and Cha, 1994). Values of Stone-Geissers Q-square  $> 0$  thereby indicate sufficient predictive validity for all constructs.

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<sup>4</sup> Indicators showing a low item-to-total-correlation need to be removed from the model for reasons of increasing the reliability of reflective measurement models (Cronbach Alpha). (Churchill, 1979), (Nunally, 1978)

**Table 2:** Quality measures for reflective constructs used in research model

Construct	Item	Loading	Internal consistency	Variance extracted	Reliability	Discriminant validity	Predictive validity	Uni-dimensionality
		> 0.7	t-value > 1.66	AVE > 0.6	CR > 0.7	AVE > R <sup>2</sup> <sub>max</sub>	Q <sup>2</sup> > 0	RCV <sub>max</sub> < 0.25
<b>Ahead of trend</b>	AOT_1	0.78	18.02	0.56	0.83	0,56 > 0.722	0.04	0.15 < 0.25
	AOT_2	0.74	20.10					
	AOT_3	0.70	11.70					
	AOT_4	0.77	19.75					
<b>Benefit expectation</b>	BE_1	0.84	26.45	0.62	0.83	0,62 > 0.682	0.01	0.10 < 0.25
	BE_2	0.81	23.19					
	BE_3	Eliminated - too low loading						
	BE_4	0.71	10.15					
<b>Technology readiness</b>	TR_1	0.87	46.22	0.75	0.92	0.75 > 0.722	0.03	0.10 < 0.25
	TR_2	0.88	45.66					
	TR_3	0.86	31.06					
	TR_4	0.86	40.85					

By testing for unidimensionality we ensure that each set of measured indicators has only one underlying construct. In accordance with multiple studies focusing on the issue of unidimensionality (Embretson and Reise, 2000; Hambleton and Slater, 1997; Nandakumar, 1994; Stout, 1987; Waller et al., 1996) we use analysis of residual covariance (RCV) as reliable mean to test for unidimensionality of the item batteries. This for all items shows values below the critical threshold of 0.25. All items can thus be assumed to reflect their respective construct only.

#### Operationalization of formative constructs

By way of contrast, formative construct consists of the composite of its indicators. Formative scales are used when a construct is viewed as an explanatory combination of its indicators (Fornell, 1987; Fornell and Bookstein, 1982). The latent variable alters, if a single indicators changes. The other indicators however do not have to change accordingly. It therefore is possible that changes in the latent variable are caused singularly by the alteration of a single indicator (Eggert and Fassott, 2005). For this particular reason in formative models, single indicators cannot be dismissed without altering the definitory delimitation of the construct (Diamantopoulos and Winkelhofer, 2001; Edwards and Bagozzi, 2000). In case of formative models, the value of the formative measurement model differs from the true construct value. This is because of the limited ability of the construct's indicator-battery to measure all of its dimensions.

For the present research model, all remaining constructs of user characteristics, i.e., 'averageness', 'experience', 'know-how' (market and service), and 'analog use experience', as well as the two latent variables resembling the service companies 'objectives' are operationalized formative. As summarized in table A1 the constructs 'experience' and 'know-how service' respectively 'know-how market' are based on item batteries previously used in studies from the manufactured goods sector. Again these have been adapted to suit the context of service innovations. The items for the constructs 'averageness' and 'analog use experience' are self developed based on existing literature.

As argued before, we understand the construct of 'averageness' as measure how close a user is to the rest of the market, i.e., how representative or typical the latter is. As indicators to measure this construct we therefore directly ask the service companies how much they agree that integrated user 'are average in every sense compared to other users in the target market' or 'selected by random'. The second question thereby targets the aspect of whether or not companies actively search for specific attributes or just pick any user from the grey mass of the user base.

The construct of *'analog use experience'* is set-up to capture the different aspects and sources users can draw from when rearranging bits and pieces of previous know-how. According to work of Hienerth et al. (2007), we understand market and technology as elements influencing a persons ability for analog reasoning. We thus use items referring to a user's technology know-how regarding technologies used in markets other than the target market, same as asking for a user's experience in and market- as well as service-know from markets other than the target market.

Compared to reflective constructs, formative constructs reverse the causal direction. The construct is not cause of the indicators, but the indicators form the construct. *"As a result of these characteristics, conventional procedures used to assess the validity and reliability of scales composed of reflective indicators (e.g., factor analysis and assessment of internal consistency) are not appropriate for composite variables (i.e., indexes) with formative indicators"* (Diamantopoulos and Winkelhofer, 2001: p.271).

The test of indicator reliability based on the squared correlation between the constructs and the individual indicators, i.e., the factor loading, as conducted for reflective indicators (Carmines and Zeller, 1979), is of little use for formative constructs, as no assumptions on the covariance of formative indicators exist (Chin, 1998). Reliable indicators of formative constructs can show positive, negative, or no correlation at all. Consequently the indicator weight cannot be interpreted as factor weights. As the PLS approach optimizes the indicators' weights to maximize the dependent variable's level of explained variance, low individual indicator weights should not be misinterpreted as bad fit (Chin, 1998). Factors are not allowed for elimination by reason of low weights, as this would falsify the substantial content of the construct (Bollen and Lennox, 1991; Jarvis et al., 2003). T-values, stating the significance of the formative indicators, can be obtained by re-sampling. For a two-sided test these should show t-values  $> 1.98$  for  $\alpha < 0.05$ . Smaller values show that the respective indicator is insignificant with respect to the specified construct. If this is the case, Bollen and Lennox (1991) and Diamantopoulos and Winkelhofer (2001) suggest considering the respective items for elimination as these cannot be valid indicators of the construct. Elimination in any case requires a review of the definitory delimitation of the construct, as not all of the initially defined facets empirically compose the construct anymore.

- For our construct 'averageness' we find the item AV\_2 referring to the random user selection eliminated. With the question whether integrated user *'are average in every sense compared to other users in the target market'* remaining in the construct, we continue with understanding this construct as measure of a user's 'averageness'.
- Validity testing also leads to the elimination of the item EXP\_2, referring to the history of service usage. Though we will continue referring to this construct as 'experience', we need to keep in mind that for the following it only measures 'frequency of use' (EXP\_1).
- In the construct 'know-how service' we find the items KHS\_1, KHS\_2, and KHS\_6 eliminated. These refer to the user's professional work background, the know-how about processes, and the respective know-how on capabilities required for service delivery. The remaining three items cover the know-how of deployed technologies, as well as quality aspects of service delivery. The meaning of the construct therefore is biased towards some sort of measure for 'technology and quality know-how'.
- For the construct 'know-how market' we find only one item eliminated. The underlying question of the latter item has been included to measure the facet of a user's thorough market understanding. Without this, the construct mainly composes of the exchange with other users as well as know-how about market trends we find the meaning of the construct biased towards know-how about trends.

- Though for the construct 'analog use experience' the majority of items shows insignificant, the items AU\_3 and AU\_5 capture the previously highlighted aspects of technology and market distance. A content wise redefinition of the constructs thus is not indicated.
- For the exogenous construct 'incremental innovations' one of its two indicators has been eliminated also. As the remaining item 'advancement of service' (Inno\_objective\_2) is fully in line with Sundbo's (2007, 2002) understanding of service companies gradually advancing service by incremental innovations steps, the construct's definitory nature remains unchanged.

A commonly agreed reason for item elimination also is the presence of high multicollinearity (Götz and Liehr-Gobbers, 2004; Jarvis et al., 2003). As formative models are based on the principles of multiple regression analysis, multicollinearity increases the standard-error of the beta-coefficients and consequently makes the model less reliable (Backhaus et al., 2006; Diamantopoulos and Winkelhofer, 2001). From a content standpoint the elimination is justifiable also, as multicollinear indicators tend to measure the same facet of a construct. An elimination of the latter thus does not conflict with a construct's content validity.

**Table 3:** Quality measures for formative constructs used in research model

Construct	Item	Weights	Reliability	Multi collinearity	Discriminant validity
		> 0.70	t-value > 1.98	VIF < 10	CCR <sub>max</sub> < 0.90
Averageness	AV_1	1.00	----	----	----
	AV_2	Eliminated - not significant			
Experience	EXP_1	1.00	----	----	----
	EXP_2	Eliminated - not significant			
Know-how service	KHS_1	Eliminated - not significant			0.66 < 0.70
	KHS_2	Eliminated - not significant			
	KHS_3	0.55	4.44	1.35	
	KHS_4	0.39	4.19	1.35	
	KHS_5	Eliminated - not significant			
	KHS_6	Eliminated - not significant			
Know-how market	KHM_1	0.36	2.50	1.33	0.66 < 0.70
	KHM_2	Eliminated - not significant			
	KHM_3	0.60	4.73	1.30	
	KHM_4	0.31	2.19	1.28	
Analog use experience	AU_1	Eliminated - not significant			0.66 < 0.70
	AU_2	Eliminated - not significant			
	AU_3	0.67	6.13	1.31	
	AU_4	Eliminated - not significant			
	AU_5	0.49	4.04	1.31	
	AU_6	Eliminated - not significant			
Incremental innovations	Inno_objective_1	Eliminated - not significant			----
	Inno_objective_2	1.00			
Radical innovations	Inno_objective_3	0.66			1.18
	Inno_objective_4	0.56			0.36 < 0.70

After testing the indicators for their content validity the next step thus encompasses testing for multicollinearity among the constructs respective indicators. For this theory suggest calculating the Variance Inflation Factor (VIF). The VIF is a mean for detecting the severity of multicollinearity. More precisely, the VIF is an index, which measures how much the variance of a coefficient is amplified due to collinearity (Eckey et al., 2004; Hair et al., 1998). Though an exact threshold cannot be given (Götz and Liehr-Gobbers, 2004), a normally accepted cut-off value in literature is a VIF >10 (Gujarati, 2003; Hair et al., 1998; Kennedy, 2003).

While convergence is not a criterion of validity of formative constructs, the previously tests commonly applied for reflective constructs (AVE, CR) are of little value for formative constructs. Instead literature proposes unique testing procedures for discriminant validity of formative constructs (Jarvis et al., 2003; Petter et al., 2007). Discriminant validity asks whether an indicator correlates more with items it should diverges from than it correlates with items is should be similar to (Campbell and Fiske, 1959). Irrespective of the level to which the indicators of a construct correlate with each other, they should in any case correlate less with indicators of other constructs (Petter et al., 2007). To examine construct validity literature suggests to analyze whether each constructs shares less than half of its variance with others (Diamantopoulos et al., 2008), i.e., construct correlation is below a critical value of 0.71 (Fornell and Larcker, 1981).

With regard to all of the above, data after elimination of selected items in table 3 shows no critical values for all quality measures proposed in statistics.

Manifest variables are also used in the model. These are deployed to measure the use of the distinct integration instruments as well as for evaluation of the specific dimensions developed to have user-generated ideas evaluated by industry. All of these variables are included into the model without empirical operationalization, as this only is necessary for latent variables.

### **Quality criteria for inner PLS model**

Compared to covariance based methods, interference tests cannot be used for validity and reliability testing of the outer PLS model for reasons of less restrictive assumptions in PLS modeling. Literature instead suggests evaluating "*the structural model [...] by looking at the percentage variance explained that is, the R-square for the dependent variables [...]*" (Venaik et al., 2001), also see (Chin, 1998; Gefen et al., 2000).

The coefficient of determination R-square is a measure for the explained proportion of variability of the latent endogenous construct. It reflects the goodness of fit of the regression function with the empirical manifested items from the data set (Backhaus et al., 2006). R-square is a normalized measure, which can take value between 0 and 1. The higher R-square is, the higher the proportion of explained variance for the independent variable. According to Backhaus et al. (2006) a universally valid statement about critical values for R-square cannot be made. The evaluation of values for R-square is rather dependent on the particular formulated problem. Herrmann et al. (2004) however propose a critical value of 0.3 for R-square, in case a model intends to exhaustively explain the dependent variables. In accordance with above also Chin (1998) considers values around 0.3 to be satisfactory.

**Table 4:** Quality measures for inner PLS model

Construct	R <sup>2</sup>	Predictive	Multi
		validity	collinearity
		Q <sup>2</sup> > 0	VIF < 10
Averageness	0.09	----	1.20
Experience	0.06	----	1.21
Ahead of trend	0.08	0.04	1.21
Benefit expectation	0.03	0.01	1.15
Know-how (service)	0.06	----	1.18
Know-how (market)	0.10	----	1.24
Analog use experience	0.11	----	1.19
Technology readiness	0.06	0.03	1.20
Survey	0.08	----	1.19
Obeservation	0.06	----	1.16
Complaint management	0.08	----	1.21
User groups	0.09	----	1.20
Idea competition	0.07	----	1.20
Focus groups	0.09	----	1.20
Lead User Methode	0.10	----	1.20
User value	0.31	0.22	3.45
Originality	0.30	0.20	3.45
Producibility	0.26	0.16	3.46
Stickiness	0.12	-0.02	3.47

The Stone-Geisser test of predictive relevance we already know from testing quality of reflective constructs can also be used as an additional assessment of model fit for the inner model PLS analysis (Chin, 1998; Fornell and Cha, 1994; Geisser, 1975; Stone, 1975) – however only for its reflective endogenous constructs though (Huber et al., 2007). Here we remember that if Q-square is bigger than 0, the predictive relevance of the model can be assumed (Chin, 1998; Fornell and Cha, 1994).

For our model we find all constructs except for 'stickiness' to exhibit satisfying levels with regards to above defined quality measures in table 4. R-square is above 0.3 thresholds for 'user value' and 'originality' and close to the latter for 'producibility'. The three variables thus can be regarded to be sufficiently explained by our model. R-square values for user characteristics and integration tools are below 0.3. This however is acceptable, as we rather want to analyze whether the 'objective' has a significant influence on the latter rather than fully explaining their overall level. VIF also indicates no sign of multicollinearity for the constructs of the inner model. Expect for the variable 'stickiness' Stone-Geisser-test criteria is also fulfilled. Coming back to the construct of 'stickiness', it shows that as it cannot be sufficiently explained by its independents variables. Also Stone-Geisser criterion is not met. For the subsequent path analysis this means that all of the latter leading to the variable 'stickiness' have a low predictability.

## RESULTS OF STRUCTURAL MODELING

After having derived the model, presented isolated explorative data, and validated the models constructs, in the final section we now focus on the structural relationships between the different variables in our model. The individual path coefficients of the structural PLS model indicate the direction and strength of relationships between the model's constructs and thus can be interpreted same as standardized beta-coefficients in normal regression models. The reliability of the structural parameters is assessed via t-statistics, which are generated from bootstrapping re-sampling. Paths, which are not significant, are disregarded from having an effect on the dependent variable. Relationships, i.e., path coefficients, are generally considered significant for levels of  $\alpha < 0.05$ . In some cases  $\alpha < 0.10$  is also believed to provide sufficiently significant results for discussion (Hienerth et al., 2007; Lüthje et al., 2005).

### The effect of innovation objective on user characteristics

To learn about the statistical effects of a service company's 'objective' for innovation on the characteristics of integrated users we study the relevant path coefficients and their significance levels.

For our model none of the personality traits in focus shows to be significantly related to the importance of 'incremental innovations' to a service company. The data provided in table 5 proves none of the respective path coefficients significant. Synthesized this means: The importance of incremental innovations does not influence the selection of user as source of service innovations. The differences in patterns of integrated users by service companies therefore have to be driven by another factor.

We therefore now analyze the effect the importance 'radical innovations' impose on the selection of user types for integration. For the paths between the objective 'radical innovations' and the personality traits we in contrast find multiple positive and highly significant ( $\alpha < 0.05$ ) path coefficients for all types of user characteristics except for 'benefit expectation'. The more important service companies consider 'radical innovations' to be as goal for their innovation activities, the more likely they specifically integrate users exhibiting the listed traits. We compare magnitudes of significant path coefficients next to analyze the effect strength of independent on dependent variable. All coefficients are similar in size. The coefficient for 'market know-how' shows the highest value (0.30) and the one of 'service know-how' the lowest value (0.22). In this context it is interesting to note that those coefficients closely related to know-how/experience derived from situations inflicted by the presence of service delivery, i.e., 'service know-how', 'averageness', and 'experience', have all lower values than most of those beyond the as-is situation, i.e., 'analog use experience', 'market know-how', and 'ahead of the trend'. A pattern that mirrors science's understanding of breaking free from the boundaries inflicted by functional fixedness when striving for truly novel ideas.

**Table 5:** Effects of innovation objective on characteristics of integrated users

	Path coefficient	Significance
<b>Paths from 'Incremental innovations'</b>		* t-value > 1.65 for $\alpha < 0.10$ ** t-value > 1.98 for $\alpha < 0.05$
Incremental innovations -> Averageness	0.07	1.04
Incremental innovations -> Experience	-0.04	0.59
Incremental innovations -> Ahead of trend	0.01	0.18
Incremental innovations -> Benefit expectation	0.10	1.47
Incremental innovations -> Service know-how	0.05	0.65
Incremental innovations -> Market know-how	0.03	0.48
Incremental innovations -> Analog use experience	0.09	1.41
Incremental innovations -> Technology readiness	-0.02	0.35
<b>Paths from 'Radical innovations'</b>		* t-value > 1.65 for $\alpha < 0.10$ ** t-value > 1.98 for $\alpha < 0.05$
<b>Radical innovations -&gt; Averageness</b>	<b>0.26</b>	<b>4.12**</b>
<b>Radical innovations -&gt; Experience</b>	<b>0.26</b>	<b>3.88**</b>
<b>Radical innovations -&gt; Ahead of trend</b>	<b>0.28</b>	<b>3.68**</b>
Radical innovations -> Benefit expectation	0.09	1.27
<b>Radical innovations -&gt; Service know-how</b>	<b>0.22</b>	<b>3.23**</b>
<b>Radical innovations -&gt; Market know-how</b>	<b>0.30</b>	<b>4.43**</b>
<b>Radical innovations -&gt; Analog use experience</b>	<b>0.28</b>	<b>3.67**</b>
<b>Radical innovations -&gt; Technology readiness</b>	<b>0.25</b>	<b>3.47**</b>

### The effect of innovation objective on use frequency of integration instruments

A summary of results for the relationships between the 'objective' and utilized 'integration instruments' is provided in table 6. For incremental innovations, we find positive, significant path coefficients for 'complaint management' and 'observations' (for  $\alpha < 0.05$  and  $\alpha < 0.10$

respectively). It shows that the value of 'incremental innovations' to service companies has a significant effect on the frequency of utilizing these two integration tools. Opposing to the previous discussion of personality traits 'outside the present' being somewhat stronger influenced by radical innovations, here it can be seen that integration tools closely related to the present situation of service delivery show to be applied more frequently in case of 'incremental innovations'. This very much is in line with what we would have expected from theory. We remember that these tools were reasoned to provide particularly rich information for optimization opportunities. Hereby the importance of 'incremental innovations' shows to have the strongest effect on the frequency of applying 'complaint management' with a coefficient of 0.27 – more than double the magnitude of the other significant coefficient. From our literature review we memorize: 'complaint management' still is strongly linked to the present situation, thus close to 'fresh information'. Yet it demands much higher levels of activity from the user compared to user 'observations'. The involved effort could therefore be seen as some sort of filter between ideas for service improvement mattering to users.

**Table 6:** Effects of innovation objective on use frequency of integration instruments

	Path coefficient	Significance
<b>Paths from 'Incremental innovations'</b>		
		* t-value > 1.65 for $\alpha < 0.10$
		** t-value > 1.98 for $\alpha < 0.05$
Incremental innovations -> Interviews/questionnaires	0.08	1.20
<b>Incremental innovations -&gt; Observations</b>	<b>0.12</b>	<b>1.71*</b>
<b>Incremental innovations -&gt; Complaint management</b>	<b>0.27</b>	<b>3.91**</b>
Incremental innovations -> User groups	0.10	1.51
Incremental innovations -> Idea competitions	0.04	0.65
Incremental innovations -> Focus groups	0.06	0.91
Incremental innovations -> Lead user method	0.11	1.59
<b>Paths from 'Radical innovations'</b>		
		* t-value > 1.65 for $\alpha < 0.10$
		** t-value > 1.98 for $\alpha < 0.05$
<b>Radical innovations -&gt; Interviews/questionnaires</b>	<b>0.25</b>	<b>3.54**</b>
<b>Radical innovations -&gt; Observations</b>	<b>0.17</b>	<b>2.23**</b>
Radical innovations -> Complaint management	0.03	0.47
<b>Radical innovations -&gt; User groups</b>	<b>0.25</b>	<b>3.45**</b>
<b>Radical innovations -&gt; Idea competitions</b>	<b>0.25</b>	<b>3.49**</b>
<b>Radical innovations -&gt; Focus groups</b>	<b>0.27</b>	<b>3.86**</b>
<b>Radical innovations -&gt; Lead user method</b>	<b>0.26</b>	<b>3.63**</b>

When it comes to the influence of 'radical innovations' on the frequency of using the various integration instruments a different picture appears. The values from table 6 evidence that the importance of 'radical innovations' positively impacts the frequency of all instruments except for 'complaint management' (all significant at  $\alpha < 0.05$ ). To understand the absolute impact we analyze the magnitude of their path coefficients. For all paths, except the one leading to 'observations', these show similar levels (all between 0.25 and 0.27). The coefficient for the path leading to 'observations' has a level of 0.17 only. From studying the previous section on instruments for user integration, we would have hypothesized such a relationship between the importance of 'radical innovations' and those instruments focusing on the integration of users outside the 'realm of the existing'. In line with what we have learnt from the interviews of Alam (2002) so far (see section on explorative findings on instruments for user integration), the use of instruments targeting the selection of prequalified users groups is considered cost- and time-expensive. From a cost/benefit perspective for service companies to increase utilization of these instruments thus makes sense only for radical innovations, which in return also offer higher benefits. It also shows that the industry preference for tools that are easy and versatile to use also relates to the situation of 'radical innovations' as indicated by our research data.

**The effect of user characteristics on the attractiveness of user-generated ideas**

Knowing what user types the service industry values in the light of various innovations objectives is one thing, understanding what impact these characteristics have on the attractiveness of generated ideas is another. To provide such insights we therefore analyze the relationships of the individual user traits on the distinct dimensions of the attractiveness of user-generated ideas next.

As illustrated in table 7, astonishingly just one of the analyzed personality traits has a significant influence on the attractiveness of user-generated ideas. Only for 'service know-how' we find a significant path to 'originality'. From what we have learnt from theory about the positive effects promised from integrating most of the researched user types, these results demand some thoughts. Reviewing our study set-up, we identify using the industry as indirect source of evaluation of user characteristics as possible reason for this significant delta to literature. Compared to all other studies in which the personality traits were self-assessed directly by the users (e.g., Franke and Shah, 2003; Franke et al., 2005), we instead had to rely on industry's assessment of integrated users. This information, however, may be skewed for industry might have fewer insights into the motivation, cognition, and experience of its users than it believes – and definitely less insights than the user itself. While this fact may contort our data with regard to using the industry assessment for further analysis, we can accept the latter 'intention of industry' still as valid enough data to answer the previous question of what kind of users the industry seeks to integrate.

**Table 7:** Effects of characteristics of integrated users on attractiveness of generated ideas

	Path coefficient	Significance
<b>Paths on 'User value'</b>		
		* t-value > 1.65 for $\alpha < 0.10$
		** t-value > 1.98 for $\alpha < 0.05$
Ahead of trend -> User value	0.04	0.16
Analog use experience -> User value	-0.09	1.09
Averageness -> User value	0.01	0.38
Benefit expectation -> User value	0.05	0.46
Experience -> User value	0.09	0.79
Market know-how -> User value	0.08	0.93
Service know-how -> User value	0.08	0.84
Technology readiness -> User value	0.06	0.57
<b>Paths on 'Originality'</b>		
		* t-value > 1.65 for $\alpha < 0.10$
		** t-value > 1.98 for $\alpha < 0.05$
Averageness -> Originality	0.05	0.62
Experience -> Originality	-0.04	0.56
Ahead of trend -> Originality	0.12	1.03
Benefit expectation -> Originality	-0.02	0.15
<b>Service know-how -&gt; Originality</b>	<b>0.18</b>	<b>1.70*</b>
Market know-how -> Originality	0.00	0.00
Analog use experience -> Originality	0.13	1.17
Technology readiness -> Originality	0.03	0.28
<b>Paths on 'Producibility'</b>		
		* t-value > 1.65 for $\alpha < 0.10$
		** t-value > 1.98 for $\alpha < 0.05$
Averageness -> Producibility	0.03	0.30
Experience -> Producibility	0.04	0.45
Ahead of trend -> Producibility	-0.05	0.42
Benefit expectation -> Producibility	0.10	0.83
Service know-how -> Producibility	0.08	0.70
Market know-how -> Producibility	-0.03	0.40
Analog use experience -> Producibility	0.16	1.56
Technology readiness -> Producibility	0.05	0.41
<b>Paths on 'Stickiness'</b>		
		* t-value > 1.65 for $\alpha < 0.10$
		** t-value > 1.98 for $\alpha < 0.05$
Averageness -> Stickiness	0.10	1.15
Experience -> Stickiness	0.04	0.45
Ahead of trend -> Stickiness	-0.09	0.66
Benefit expectation -> Stickiness	0.03	0.24
Service know-how -> Stickiness	0.07	0.58
Market know-how -> Stickiness	0.10	0.82
Analog use experience -> Stickiness	0.08	0.74
Technology readiness -> Stickiness	-0.15	1.26

### The effects of user characteristics on the attractiveness of user-generated ideas

As companies can make valid assessments about the use frequency of various integration instruments, we can assume the latter data to be valid enough as a basis for analyzing its effects on attractiveness of user generated ideas. In table 8 multiple significant paths show with regard to the frequency of applying the various integration instruments and the effect this has on the dimensions of the attractiveness of user ideas. The frequency of using 'interviews/questionnaires' has a significant positive influence on the dimensions of 'user value', 'originality' and 'producibility' (for all  $\alpha < 0.05$ ). With regard to the previous bias of industry towards this instrument, the latter not only seems easy to apply but truly "*versatile and useful*" (Alam, 2002: p.256) for generating valuable ideas for service innovations.

**Table 8:** Effects of use frequency of integration instruments on attractiveness of generated ideas

	Path coefficient	Significance
<b>Paths to 'User value'</b>		
		* t-value > 1.65 for $\alpha < 0.10$
		** t-value > 1.98 for $\alpha < 0.05$
<b>Interviews/questionnaires -&gt; User value</b>	<b>0,30</b>	<b>3,78**</b>
Observations -> User value	-0,01	0,10
<b>Complaint management -&gt; User value</b>	<b>0,13</b>	<b>1,68*</b>
User groups -> User value	-0,04	0,52
Idea competitions -> User value	-0,04	0,51
Focus groups -> User value	0,04	0,43
Lead user method -> User value	0,14	1,59
<b>Paths on 'Originality'</b>		
		* t-value > 1.65 for $\alpha < 0.10$
		** t-value > 1.98 for $\alpha < 0.05$
<b>Interviews/questionnaires -&gt; Originality</b>	<b>0,24</b>	<b>3,09**</b>
Observations -> Originality	0,04	0,44
Complaint management -> Originality	-0,03	0,43
User groups -> Originality	-0,10	1,26
Idea competitions -> Originality	0,04	0,53
Focus groups -> Originality	0,06	0,68
Lead user method -> Originality	0,03	0,37
<b>Paths on 'Producibility'</b>		
		* t-value > 1.65 for $\alpha < 0.10$
		** t-value > 1.98 for $\alpha < 0.05$
<b>Interviews/questionnaires -&gt; Producibility</b>	<b>0,16</b>	<b>2,10**</b>
Observations -> Producibility	0,08	0,85
Complaint management -> Producibility	0,01	0,20
User groups -> Producibility	0,00	0,02
Idea competitions -> Producibility	0,00	0,05
Focus groups -> Producibility	0,07	0,78
Lead user method -> Producibility	0,09	1,16
<b>Paths on 'Stickiness'</b>		
		* t-value > 1.65 for $\alpha < 0.10$
		** t-value > 1.98 for $\alpha < 0.05$
Interviews/questionnaires -> Stickiness	-0,03	0,38
Observations -> Stickiness	-0,08	0,90
Complaint management -> Stickiness	-0,09	1,07
User groups -> Stickiness	-0,02	0,20
<b>Idea competitions -&gt; Stickiness</b>	<b>0,31</b>	<b>3,89**</b>
Focus groups -> Stickiness	-0,02	0,27
Lead user method -> Stickiness	-0,06	0,60

Also the frequency of applying 'complaint management' shows to have a positive significant influence ( $\alpha < 0.1$ ) on 'user value'. We already proposed that the effort users face to forward their complaint to a service provider might act as filter. Only ideas the user considers truly useful if implemented, i.e., the expected benefit overcompensates the effort of filing the complaint, are passed to the service provider.

The frequency of using 'idea competitions' also positively impacts the 'stickiness' of generated ideas. Of the tools trying to skim user ideas dislocated from the existing service situations, the latter however is the only one having a significant impact on the attractiveness of generated idea. It amazes though not to find significant results for instance for the lead user method, which has been proven to be highly successful in bringing out novel ideas in the innovation projects for the manufacturing industry (Lilien et al., 2002).

In line with previous findings from Magnusson et al. (2003) data still again highlights the value of users to companies in search for new service idea. Though under the fore sign of limited predictive validity, it shows that users under certain conditions are able to generate ideas service providers lack the cognitive abilities to think of themselves.

## DISCUSSION AND IMPLICATION OF RESULTS

Research on service innovations to date has neither provided a representative and comprehensive picture of the current state of user involvement in the service industry, nor has it analyzed the interrelationships between the dimensions of user integration. Our study therefore is believed to provide valuable new insights into industrial practice of user integration in the service industry. As a premier paper of analyzing structural relations between the various dimensions of user integration, we both provide guiding principles for the service industry as well as uncovering relationships so far not tested for service innovations. In the light of a significant share of respondents not integrating users yet, we also strongly believe and hope that data and results brought forward in this paper counsel those companies to reconsider their beliefs.

As reasons for not integrating users, respondents most often stated: 'lacking resources', 'not having considered doing so', and considering 'user ideas as not producible'. Of those, 12% even 'highly' and 'extremely agreed' with the statement that 'users do not have innovative ideas'. In our study, however, we discover that companies integrating users very much value their idea contributions with regard to 'originality', 'producibility' and also 'stickiness', meaning that they would not have come across those ideas themselves. In addition our findings demonstrate that for service companies any increase in especially using integration instruments which are considered easy to apply (Alam, 2002), e.g., 'interviews/questionnaires' and 'complaint management', results in the most significant quality improvements in quality of generated.

With regard to contribution to service innovation research we were able to answer most of our research questions derived from gaps in existing literature. We find that service companies do not integrate users by random. Characteristics of integrated users in general instead mirror many of the personality traits argued in literature to be most promising when searching for new ideas. With regard to how service companies integrate users in the ideation phase of service development data indicates that the service industry is drawing from a wide variety of tools. Here tools such as 'interviews/questionnaires', 'observations' and 'complaint management' are the most frequently applied instruments. The service industry however also utilizes instruments requiring an active selection/filtering out of qualified users. Even the lead user method, so far mainly associated with user innovation in consumer goods, is well known to the service industry and applied in innovation management. With regard to whether service companies do integrate different users dependent on pursuing 'radical innovations' or 'incremental innovations', data draws a very clear picture. We find that the wish of service companies to develop 'radical innovations' significantly determines the choice of integrated users – this in contrast is not the case for incremental innovations. Users integrated for 'radical innovations' thereby strongly mirror those traits said to be most effective in literature for generating novel ideas. However, service companies striving for 'radical innovations' also consider average users for integration. This result echoes Kristensson et al.'s (2004) and Magnusson et al.'s (2003) findings that average users in service can generate ideas more original and of higher user value than those of professional developers.

Concerning the question whether service companies leverage different instruments for user integration dependent on their 'objective' of innovations, data also points out a clear 'yes' as an answer. We find that a company's level of importance for 'incremental innovations', in accordance with literature, significantly impacts the use frequency of tools strongly related to the as-is situation of service delivery. Vice versa, the importance of 'radical innovations' increases the frequency of using tools requiring the selection of qualified groups of users for integration, e.g., 'focus groups', 'lead user method'.

Other than expected, we find the frequency of applying the first set of tools to have a significant positive impact on dimensions such as 'originality', 'producibility' and 'user value'. The other tools, such as 'lead user method', show no such significant paths.

With regard to analyzing what effect the characteristics of integrated users have on the attractiveness of generated ideas, we only found a significant positive effect for the trait 'service know-how'. This is in stark contrast to all previous work. As already outlined, using industry to assess user characteristics might have introduced a bias to data as the presence of some user traits might have either been over or understated by responding industry. Our findings might therefore not be comparable to studies using self-assessed personality traits as independent variables.

Consequently the question which users contribute the best ideas to radical innovations still requires additional research. Especially as we have found that service companies in search for 'radical innovations' also acknowledge many of the traits showing positive effects on user innovativeness in other industries.

Our study also shows that many of the integration instruments promoted in innovation management literature do not to have the expected significant impact on the attractiveness measures of user ideas. Though model quality is good and data sufficient to estimate the relationships we propose a more experimental setting to find additional evidence for whether our findings can be generalized or not. As possible benchmark for such a study we suggest the work of Lilien et al. (2002). These researchers researched the effect of the 'lead user method' by retrospectively comparing quality of innovations generated by different methods.

In the light of previous work from Hipp and Grupp (2005) showing that innovation management in the service industry is all but homogenous we also propose a sector specific analysis of the dimensions of user integration. Considering the rich data at hand such analysis also is on our agenda – so stay tuned.

## APPENDIX

Table A1: Operationalization of constructs

Construct (Form of construct)	Item	Survey item: Searching for novel ideas we specifically integrate ...	Codified item	Adapted from
<b>Averageness</b> [Users, which ...]				
(Formative)	AVG_1	are average in every sense compared to other users in the target market		self developed
	AVG_2	got picked by random		self developed
<b>Experience</b> [Users, which ...]				
(Formative)	EXP_1	use the service more frequently than others	Frequency of use	Lüthje (2004: p.690), Lüthje et al. (2005: p.960), Shah (2000: p.11), Shah (2000: p.13).
	EXP_2	have a long history of using the service	Long history of use	Lüthje (2004: p.690), Lüthje et al. (2005: p.960), Shah (2000: p.12)
<b>Ahead of trend</b> [Users, which ...]				
(Reflective)	AOT_1	try out new services as soon as they are offered	Early adoption of market novelties	Lüthje (2000: p.17),
	AOT_2	have approached your company with ideas for improving existing services	Actively innovating customers	Herstatt and von Hippel (1991), Franke and Shah (2003: p.163), von Hippel (1986: p.799).
	AOT_3	have demands that strongly differ from the majority of customers	Needs differing from rest of market	von Hippel (1989: p. 796).
	AOT_4	have needs that reflect the very latest market trends	At leading edge of market trend	von Hippel (1986: p.798).
<b>Benefit expectation</b> [Users, which ...]				
(Reflective)	BE_1	ask for solutions to specific unsolved needs	New/unsolved needs	Lüthje (2000: p.13), Lettl et al. (2006: p.259), Franke et al. (2005: p.13), Franke and Shah (2003: p.163), Shah (2000: p.11).
	BE_2	benefit more than others from any improvement in service costs or quality	Direct benefit	von Hippel (1986: p.797).
	BE_3	are personally (e.g. nursing case from quality of health care) or financially (e.g. airline from speed/cost of ground service at airports) highly dependent on service outcome		
	BE_4	have indicated dissatisfaction with the existing service or aspects of it	Dissatisfaction with existing market offerings	Franke et al. (2005: p.13), Franke and Shah (2003: p.163), Lüthje (2000: p.13).
<b>Know-how (service)</b> [Users, which ...]				
(Formative)	KHS_1	are working as employees of your or other companies in the target market	Professional background (work)	Hienert (2006), Lettl et al. (2006: p.259), Lüthje et al. (2005, p.962).
	KHS_2	know how user request in service companies in the target market are processed (i.e., know about internal processes)	Process know-how	Self developed
	KHS_3	have profound knowledge of the deployed key-technology in the target market	Technology know-how	Lüthje (2000: p.13).
	KHS_4	know about all details/facets/aspects of the service offering in the target market	Outcome know-how	Lüthje et al. (2005: p.961), Lüthje (2000: p.13).
	KHS_5	know about critical aspects of service quality in the target market		Self developed
	KHS_6	know about required capabilities to deliver a service in the target market	Capability know-how	Self developed
<b>Know-how (market)</b> [Users, which ...]				
(Formative)	KHM_1	frequently exchange ideas & experience with other users (e.g. communities) from the target market	Knowledge about all market offers	Lüthje (2003: p.2).
	KHM_2	have a thorough understanding for the target market		
	KHM_3	are well informed on latest market trends in the target market		
	KHM_4	regularly are visiting service fairs and exhibitions on service offerings from the target market		
<b>Analog use experience</b> [Users, which ...]				
(Formative)	AU_1	have profound experience in other service industries	Market distance	Self developed
	AU_2	know how user request in service companies outside the target market are processed (i.e., know about internal processes)		Self developed
	AU_3	have a thorough market know-how of other service sectors	Market distance	Hienert et al. (2007)
	AU_4	work as professionals in other service industries		Self developed
	AU_5	have a thorough knowledge of technologies used in other service industries	Technology distance	Hienert et al. (2007)
	AU_6	are no users in the target market		Self developed
<b>Technology readiness</b> [Users, which ...]				
(Reflective)	TR_1	You enjoy thinking about novel technology-based services and solutions		All directly adapted from Matthing et al. (2006: p.292)
	TR_2	You often come up with new solutions to problems you experience with new technology		
	TR_3	You enjoy finding solutions to problems that accompany new technology		
	TR_4	You actively search for updates and launches of new technology-based services		

All items are measured on 5-point Likert scale with 1 = Not at all agree and 5 = Extremely agree

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