Please quote as: Menschner, P.; Peters, C. & Leimeister, J. M. (2011): Engineering Knowledge-Intense, Person-Oriented Services – A State of the Art Analysis. In: 19. European Conference on Information Systems (ECIS 2011), Helsinki, Finland.

10-6-2011

ENGINEERING KNOWLEDGE-INTENSE, PERSONORIENTED SERVICES – A STATE OF THE ART ANALYSIS

Philipp Menschner

Christoph Peters

Jan Marco Leimeister

ENGINEERING KNOWLEDGE-INTENSE, PERSON-ORIENTED SERVICES – A STATE OF THE ART ANALYSIS

Menschner, Philipp, Kassel University, Nora-Platiel-Str. 4, 34127 Kassel, Germany, menschner@uni-kassel.de

Peters, Christoph, Kassel University, Nora-Platiel-Str. 4, 34127 Kassel, Germany, peters@uni-kassel.de

Leimeister, Jan Marco, Kassel University, Nora-Platiel-Str. 4, 34127 Kassel, Germany, leimeister@uni-kassel.de

Abstract

This paper provides a state-of-the-art analysis of service engineering (SE) approaches for knowledge-intense person-oriented (KIPO) services, focussing on IT-enabled provision of such services. Key attributes are derived that distinguish KIPOs from other services. These attributes are integrated in a framework with regard to their applicability on KIPOs development and used for a systematic literature review. KIPOs are of high economic relevance, yet they are laggards in terms of realization of IT potentials. As the most value-creating activities in service provision are bound to persons or personal knowledge, KIPOs design is complicated. The analysis reveals several gaps in SE research. In particular, identified shortcomings of existent approaches are an insufficient level of detail, i.e. no concrete actions or methods for deployment are described, a lack of practical corroboration as well as insufficient IT support. Further, current approaches are not sufficiently equipped to handle the interplay between people-bound activities and technical components. This paper contributes to IS research by clearly identifying these gaps in SE methods. It further provides researchers with ideas for future research activities and guides practitioners in selecting methods that serve as candidates to be integrated into KIPOs development in order to leverage IT potentials more systematically and efficiently.

Keywords: service science, service engineering, knowledge-intense services, person-oriented services, literature review.

1 Introduction

Services dominate western economies, accounting for about 70% of employment and gross value added. Moreover, services are the only part of western economies to have expanded in terms of employment in recent years, as manufacturing, mining and agriculture continue to contract (Maglio and Spohrer 2008). Due to increased competition in many service markets, differentiation through innovative service offerings is developing into a key unique selling point (Maglio and Spohrer 2008). Much of service innovation today is about the adoption and effective implementation of IT (Zysman 2006). The potentials of the IT-usage in business are well-known. Amongst others, IT allows standardization and support of processes, automation or integration (Davenport 1993). The use of IT also bears vast potential for services. On the one hand, IT enables new forms of cooperation and communication in service systems (Rai and Sambamurthy 2006), on the other hand it enables automation, standardization and new concepts for customer integration (Fitzsimmons and Fitzsimmons 2005). In other words, automation by IT is a result of increased industrialization of the established service economy (Fitzsimmons and Fitzsimmons 2005). Furthermore, entire services today are increasingly delivered using IT (Rust and Kannan 2002).

The innovative application of IT varies among service industries though (Sheehan 2006). Knowledge-intense person-oriented services (KIPO) in particular, predominately existent in health care or education, are still lagging behind on intelligent use of IT. Typical KIPOs are for instance nutritional or health counseling. They are highly individualized, knowledge-demanding and generally delivered face-to-face. Enabling IT potentials for such services raises problems existing design methods do not address (Patrício et al. 2008). This is partly due to the fact that KIPOs face certain specific specialties, e.g. regulatory issues or retentions upheld by service providers and consumers, which leads to the prevalent notion that KIPOs are not suitable for systematic service engineering (Menschner et al. 2010). In the case of health counseling, e.g., such specialties include that customers are sick and reluctant, relinquish privacy or are at risk (Berry and Bendapudi 2007). Yet, several new technologies have been developed and introduced, which might lead to IT-enabled service innovations also in these sectors (Menschner et al. 2011). Despite this fact, only little of these innovations have been put into practice (Cho et al. 2008; Essén 2009).

Essential to the successful design of services is that they are underlined by a reasonable service process and design. Beginning in the 1990s, the research discipline of service engineering (SE) emerged especially in Germany (Ganz 2006). It traces back to concepts of new service development and service design, which evolved in the Anglo-American region in the 1980s. Those concepts mainly relate to the research field of services marketing (Bullinger et al. 2003; Zeithaml and Bitner 2003). SE, in contrast, focuses on adopting concepts which are successfully implemented in product and software engineering to the field of services. It is defined as the systematic design and development of services by deploying engineering methods and practices, and by using tools of the engineering design field (Bullinger et al. 2003). Although in the beginning most of the contributions to service engineering came from engineering research (Fähnrich and Meiren 2007), there is an increase of contributions from IS-related research (Rai and Sambamurthy 2006; Spohrer et al. 2007; Buhl et al. 2008). This is due to the fact that the rise of new information and communication technologies changes services in two ways: first, the use of IT can make a contribution by adding faster and more structured development processes (Leimeister et al. 2009; Rubleske and Kaarst-Brown 2009), secondly new services arise from using these technologies. So far, most of recent service engineering literature deals with development of IT services, e-services, or product-service bundles (Böhmann and Krcmar 2005; Knebel et al. 2007; Becker et al. 2008; Orman 2008). A variety of models for SE have been developed, although a common critique is that most of them still lack appropriate method and tool support that would allow a better penetration of concepts in practice (Zhou and Tan 2008). Hence, SE is still an emerging discipline (Bullinger et al. 2003; Chesbrough and Spohrer 2006).

Regarding KIPOs, the increase in technologies over the last few years additionally offers enormous potential for improving services and creating new services. If the same increase in productivity, quality and growth wants to be achieved with KIPOs as has been experienced during the industrial revolution around manufacturing products, intelligent IT support and structured development methods and routines become crucial enablers for industrializing KIPOs. The vision is thus that KIPOs will be IT-enabled, which incorporates automation of certain routine and manual functions, but also IT complementing the effective use of human insight, intelligence and knowledge (Zysman 2006).

The objective of this paper is to assess and evaluate existing service engineering and design methods with regard to their applicability for the development of KIPOs. The paper is structured as follows: first, we derive a set of key attributes that distinguish KIPOs from other services and identify challenges for SE. These attributes are then integrated in a framework for analyzing SE literature. This analysis is discussed and future research opportunities are outlined.

2 What makes KIPO services different?

2.1 Definition of services

The concept of service has been defined in different business fields with varying definitions. Service definitions in literature can be classified by three types of definitions: negative definitions, enumerative definitions and constitutive definitions (Zeithaml and Bitner 2003). The negative definitions position services by dissociation from real assets or goods, while enumerative definitions use listings of examples for a specification of services. Both classes of definitions are rather unsuitable for research (Buhl et al. 2008). The third category, constitutive definitions, formulates fundamental characteristics of services.

In information systems (IS), the term service can be regarded from two perspectives: from a business view and a technical view (Buhl et al. 2008). Services in a business sense are characterized by intangibility, immateriality, simultaneity of production and consumption (uno-actu-principle), as well as the integration of the consumer as external factor in the process of creation. Service from a technical perspective is a software realized artifact that offers some functionality. Similar findings can be found in (Chesbrough and Spohrer 2006; Rai and Sambamurthy 2006). For the case of the business-oriented services, information science can make contributions by supporting service provision by intelligent usage of information and communication technology. The focus of this paper is the IT-based realization and provision of services from a business view. Other works introduce the concept of service systems (Spohrer et al. 2007). Service systems are value-creation networks composed of people, technology, and organizations (Maglio et al. 2006).

2.2 Characteristics of KIPO services

Knowledge-intense services are defined as follows: during production or process the generation or the use of novel knowledge accounts for a large proportion of the service (Hauknes 1999). These services are predominantly found in the industries communication, financials, research and consulting, health care, or education. Other authors use the expression “information-intense” with a quite similar definition: information actions amount for the largest proportion of value created by the service system (Apte and Mason 1995). Examples are vocational education, consulting, or emergency and surgical healthcare (Glushko 2009). KIPOs are additionally characterized by a high degree of customer interaction and are bound to persons or personal knowledge (Menschner et al. 2010). To define KIPOs, we adopt the concept of service systems. These systems combine and integrate different service design contexts (Maglio et al. 2006; Spohrer et al. 2007). Based on those works, Glushko (2009) introduces seven contexts for service design (“person-to-person”, “technology enhanced person-to-person”, “self-service”, “multi-channel”, “services on multiple devices or platforms”,

"backstage intense or computational services" and "location-based and context-aware services") which he applies on information-intensive services. Following this approach, we define KIPOs as follows: A KIPO is a knowledge-intense service system, which incorporates one or more person-to-person-encounters as fundamental and integral part of the service.

We argue that certain distinct characteristics of KIPOs mandate a customized service engineering approach. These are: individual history of customers, emotional tie, high degree of implicit knowledge and people-boundness (Menschner et al. 2010).

Every customer has an individual history: A fundamental key attribute is the high degree of individualization in KIPOs, caused by the huge amount of information necessary for service provision. Every customer has his or her individual biography, medical background, lifestyle etc. As KIPOs need to be designed to fulfil the specific needs of each customer, this results in a challenge for service providers. Every time they are facing a customer, they have to adapt themselves to the individual situation of the person in front. If the customer is not willing or capable to interact with the service provider, no service production will be possible. Due to this, the practical and emotional knowledge (empathy) of the service provider is essential to get access to the customer and to understand his needs. For example, knowing medical and personal history helps a nutrition counsellor to get a better understanding of the life situation of a patient and is indispensable for prescribing adequate treatments. This interaction and detailed knowledge of the patients' situation is also prevailing responsible for the service quality perceived by the patient. This poses an enormous challenge to the development of KIPOs, as establishing an adequate information basis is very time-consuming and additionally relies on information directly communicated by the customer. Recent works try to overcome this deficit by establishing electronic data capture by customers or patients themselves (Knebel et al. 2007; Menschner et al. 2011), yet this is not possible for all kinds of information. With regard to KIPOs, we conclude that a specific information basis for each customer is a fundamental key characteristic, which has to be considered during the development of such services.

Emotional tie and stress: A direct consequence from the need of acquaintance is that delivering KIPOs can be emotionally daunting. The service provider needs to fully understand a person's history, life-style and emotional being, in order to be able to provide the service accordingly. This can be stressful as, e.g. in home care or life counselling, customers are sometimes incurably sick, have encountered strokes of fate, or sometimes just possess a difficult personality (Berry and Bendapudi 2007). Yet building up an emotional relationship is often inevitable for service provision. For SE, this encompasses certain challenges with regards to resource or personnel allocation. On the one hand, service providers need to be emotionally stable, on the other hand, once an emotional tie is established between an employee and a customer, the customer cannot easily be served by another employee. Thus, flexibility issues arise that have to be coped with. A SE method hence needs to be able to handle such individual person-oriented settings.

High degree of implicit knowledge: KIPOs rely on a high degree of implicit knowledge that is accumulated and used during service provision. As an example, the working staff within the home care sector needs to evaluate and react on the patients' needs and health status. There are different forms of implicit knowledge. It can derive from personal experiences with a certain customer, including emotional insights, a customer's individual history or impressions obtained during interactions. Other forms are experiences on how to read or interpret certain persons, how to interact with them or talk to them (Menschner et al. 2010). Usually there is no documentation of this knowledge, yet it is essential for efficient and effective service provision. Further, documentation of implicit knowledge faces some limitations. On the one hand, it is very time-consuming and therefore often economically unreasonable. On the other hand, implicit knowledge is sometimes tacit, e.g. of emotional type or a sort of personal experience, which is difficult to document and thus challenging to transfer from one person to another. This complicates standardization and automation of such services. A further consequence of insufficient documentation is that it is hard to implement quality management and assurance measures.

Service delivery is people-bound: KIPOs are performed at people and the dominant factor for perceived service quality is the person providing the service. Thus, it can be concluded that KIPOs contain at least some partial processes that must remain as they are: person-to-person encounters that can hardly be standardized or automated. Therefore, a service engineering method needs to be able to identify such "must-have" personal encounters. It further has to be able to cope with two different settings: such that must remain personally delivered and such that can be standardized and automated. Thus, it needs to develop criteria on how to distinguish between those two.

Although automation is difficult, IT can be used to either assist the person in charge of service provision, or to enhance the interactions between customer and provider (Fitzsimmons and Fitzsimmons 2005). A service engineering method has to consider to which extent technology should be used and for which process steps. Yet, the use of IT generates even more challenges. As (Glushko and Tabas 2009) point out, different interaction channels have an impact on customer perception and service quality. Service engineering methods have to cope with the fact that services are complemented or replaced by automated services. Also, the extent of customer integration into the service provisioning processes has to be examined. Only then, the optimal trade-off between customer integration and IT usage can be determined which is the key to an increase in perceived service quality.

3 Analyzed Aspects

Based on the key characteristics elaborated above and their impact on service engineering, we have developed an analysis framework. We have derived challenges and translated them into applicable questions. This framework has been used to review existing literature on their suitability for KIPO SE.

As SE involves the systematic development of services using models, methods and tools, it is important to define these terms. According to Brinkkemper (1996), a method is an approach that describes the conduction of an entire development process or project. It provides a detailed prescription of how to perform a collection of activities. A technique can be defined as a part of a method that gives concrete and tangible instructions for how to conduct the work of an activity. Brinkkemper (1996) defines a technique as "a procedure, possibly with a prescribed notation, to perform a development activity." Thus, a method provides a systematic approach of how to use different techniques. A tool is an automatic way to support a part of the development process.

Thus, in order to be a SE method, an analyzed approach needs to cover the entire development process and the steps have to be described in detail. Based on this, the following aspects require further analysis:

- Life-cycle coverage: Are all phases of the engineering process included in the method or just selected phases such as analysis or idea generation?
- Granularity of approach: Are there defined techniques and guidance for the engineering of services? Are the steps described in detail?

As the focus of this paper is IT-enabled KIPOs, requirements also derive from the integration of certain design elements, the application of IT, and integration of customers into service provision, which is also partially enabled through IT. Yet, a closer analysis shows that KIPO service settings contain processes that should be continued to be delivered personally, as they are the most value creating activities (Essén 2009). Furthermore, IT can make a contribution by supporting these processes with IT systems, e.g. by providing information or templates that make the provision more efficient. Additionally, there are typical service candidates for automation, e.g. services that contain sub-processes or activities that are partly standardized for several clients or do add value. These could be automated and delivered by IT systems to enable scalability. Therefore, the following aspects are in need of consideration:

- Does the approach consider the information and knowledge intensity of the studied KIPOs?
- Does the approach support the development and design of person-oriented service processes?

- Does the approach support the integration of IT, resp. modeling of IT and software components?
- Does the approach provide decision support on automation and customer integration? Does the approach allow the identification of must-have person-to-person encounters and potentials for automation through IT?
- Does the approach support the interaction of technical components and people-bound process steps?

Additionally, integration of new technology leads to completely new and unknown services. As the development of such innovations is computing within a user's changing environment, it is important to determine user needs at a very early stage of development (Iachello et al. 2006). User needs are to be reflected in more specific requirements which in case of fulfillment satisfy the user's needs. Recent studies underline the potential of involving users, specifically in the process of mobile service innovation (van de Kar and den Hengst 2009). Involving users as innovators can result in more innovative services that have greater user value (Magnusson 2003). Additionally, as user requirements are often "sticky" information, significant costs are involved in eliciting these requirements in non-participatory design settings (Oliveira and von Hippel 2009). Hence, participatory design and prototyping approaches have proven to be valuable to the development of mobile or ubiquitous computing services (Resatsch et al. 2008) and are also paramount for high acceptance of IT-enabled KIPOs. This leads to the last aspect:

- Participatory development: Is customer integration provided for the entire engineering process of services? Are there concepts, findings or methods for systematic customer integration in the approach?

The following sections present the choice of the examined body of literature as well as the results these sources revealed in terms of the analyzed aspects.

4 Analyzed Literature

As mentioned above, we were mainly interested in identifying articles that contribute to the body of knowledge of SE, i.e. articles providing methods or approaches that guide the systematic development of services. We started with a systematic literature review which was performed on the online databases EBSCOhost, ACM and AISLIB. Thus, we cover a broad range of high-quality, peer-reviewed publications. The search comprised the key words "service engineering", "service design", "(new) service development", "service innovation" and their corresponding abbreviations. This was due to the fact that especially the term "service engineering" is rather uncommon in international literature, and a sole usage of this term would exclude relevant works. The search has been limited to the fields "title", "keywords" and "abstract". The review time period was from 2000 to 2010. For the time prior, we meta-reviewed several literature reviews and included suitable approaches (Johne and Storey 1998; Fähnrich and Meiren 2007; Zhou and Tan 2008). The initial search returned over 700 articles. Accounting for duplicate results and after a preliminary scan of the article abstracts, the number of articles to be included was substantially reduced. Reasons for excluding articles were, among others, a different understanding of the term service, e.g. a solely technical view (e.g. web-services, SOA), as well as articles that did not focus on engineering aspects, i.e. they did not provide prescriptions, guiding or processes for systematic development of services. Moreover, several cross-referenced articles and books not found in those databases were included. This set of existing literature was further extended by a comprehensive review of relevant academic conferences (e.g. ECIS, ICIS, RESER) that we expected would have published articles on service engineering. For the conferences we applied the same selection processes. Finally, 26 relevant journal and conference articles, as well as books and book chapters, were included in the review.

For our analysis, we decided not to include some conventional approaches as service blueprint, Quality Function Deployment (QFD), Failure Mode and Effects Analysis (FMEA) etc. Reasons are: (1) several reviewed articles build open these methods, (2) they have already have heavily been

reviewed (e.g. (Zhou and Tan 2008)), (3) their limitations for developing IT-enabled services are known (Patrício et al. 2008).

5 Results: Comparison of existing SE approaches

In this section a detailed overview of the analyzed aspects is outlined. In order to assess the approaches, the construction of a table deemed appropriate. Therefore, all approaches are assigned to a respective row. All seven analyzed aspects have dedicated columns. Thus, each approach is assessed by following the aspects from left to right in the table's rows. For the aspects life-cycle coverage and granularity of the approach, trivalent scales (0, +, ++) are used with the following semantics: 0 stands for no life-cycle perspective at all, while + marks approaches which integrate a life-cycle perspective, but do not cover it in a comprehensive manner. Finally, ++ represents approaches which cover the whole life-cycle. Therefore, we define Bullinger and Schreiner (2006) as our reference life-cycle model that dictates the completeness criterion, as their model is a reference model based on other approaches. Considering the granularity of the approach, 0 is used for approaches that only present very light-weight approaches and are limited to the presentation of meta-levels and major process steps. + represents approaches who clearly describe their main process steps, but in contrast to ++ do not elaborate on actionable advice regarding the according process steps. For all other analyzed aspects, the heterogeneity and unpredictability of potential assessments suggested a mere textual evaluation which allows an adequately flexible reflection.

The analysis of the 26 SE approaches as reflected in Table 1 was conducted independently by two coders. The second coder restricted the analysis to a random control sample. The results of the coding process of the control sample were consistent with the results of the original coder. In the following, we describe our observations that resulted from the analysis of the approaches.

The analyzed articles can be allocated to different groups. The first group comprises approaches that can generally be classified as frameworks and process models. Identified shortcomings of these approaches are an insufficient level of detail, i.e. no concrete actions or methods to be deployed are described, a lack of practical corroboration as well as insufficient IT support (Patrício et al. 2008). The second group encompasses approaches that focus mainly on sub-categories of service engineering, e.g. user experience or service quality. Only a few articles present comprehensive approaches. Some works compare different approaches on a specific service and contribute to service engineering theory, yet they do not present novel methods or guidance. Additionally, we identified a range of works that analyze the impact and challenges that arise through technology infusion into the service encounter. Yet, these approaches, e.g. (Simons and Bouwman 2005), focus mainly on multi-channel service delivery and mainly focus on the service encounter, neglecting back-office processes.

	Life-cycle Coverage	**Granularity of approach**	**Information- or knowledge-based perspective**	**Design of personal encounter**	**Design of technical components**	**Identification of personal encounters and IT potentials**	**Integration of technical and personal components**	**Participatory Development**	**Comments**
(Alam and Perry 2002)	++	0	no	no	no	no	no	yes, customer feedback for all stages identified	proposal of 2 new NSD processes
(Bitner et al. 2008)	+	++	no	yes	no	no	no	partially, focus on employees	extension of service blueprint
(Booz et al. 1982)	++	+	no	yes	no	no	no	yes	
(Bullinger and Schreiner 2006)	++	0	no	no	no	no	no	partially	reference model
(Chai et al. 2005)	0	++	no	no, focuses on problem elimination	no	no	partially, as this can be modelled via the function diagram	no	uses principles for problem solving
(Chuang 2007)	+	++	no	yes	no	no	no	yes	based on service blueprint and FMEA
(Edvardsson and Olsson 1996)	++	+	no	yes	no	no	no	yes, customer focus	
(Fließ and Kleinaltenkamp 2004)	0	++	no	yes	no	no	no	no	extends service blueprint
(Froehle and Roth 2007)	yes	0	partially - intellectual	no	no	no	no	not explicitly, covered by	combines resource and process based approaches

			resources are included					several identified constructs	
(Goldstein et al. 2002)	0	+	no	yes	no	no	no	no	focus on service concept
(Jing-Hua et al. 2009)	++	+	no	yes, but focus on quality	no	no	no	yes	based on Gap-Model and QFD
(Kindström and Kowalkowski 2009)	+	0	no	no	no	no	no	only stating that customer input is essential	focus on managerial implications
(Kingman-Brundage and Shostack 1991)	++	+	no	yes	no	no	no	yes	focus on developer teams
(Matthing et al. 2004)	0	+	no	no	no	no	no	yes, focus of the study is to highlight the importance of customer integration	focus on idea generation
(Meiren and Burger 2008)	++	+	no	yes	no	no	no	Only in testing	focus on testing services
(Meyer et al. 2008)	++	0	no	no	partially	no	yes	yes	integrate software and service engineering
(Opitz 2008)	++	+	no	no	partially	no	yes	yes	
(Patrício et al. 2008)	+	++	no	yes	yes	no	Yes	partially	focus on multi-channel encounters, based on service blueprint
(Qi and Chuan Tan 2009)	++	0	partially	no	partially	no	no	no	incorporating a knowledge dimension
(Ramaswamy 1996)	++	+	no	yes	no	no	no	yes	includes service management
(Scheuing and Johnson 1989)	++	+	no	no	no	possibly in specific test phases		no	very detailed phases
(Simons and Bouwman 2005)	+	+	no	yes	yes	no	yes	yes	addressing multi-channel, compares several approaches to QFD
(Smith et al. 2007)	++	++	no	yes	no	no	no	Employees only	based on QFD, Service Blueprint and Stage Gate Model, rather testing methods than providing new methods
(Stevens and Dimitriadis 2005)	++	+	no	yes	no	no	partially	yes	incorporates learning process
(Torsi et al. 2009)	0	0	no	yes	yes	no	yes	yes	only preliminary work
(Yang and Hsiao 2009)	++	+	no	no	no	no	partially	yes	based on TRIZ

Table 1. Comparison of the analyzed approaches

6 Discussion

The importance of SE for successful development of services is being increasingly recognized. The number of publications that deal with the issue of SE has increased in recent years, but to the best of the authors' knowledge, a comprehensive analysis of the coverage and specific characteristics has not been conducted yet, particularly, the evaluation of the approaches' fit regarding requirements resulting from the specifics of designing IT-enabled KIPOs. Their design incorporates both, the design of people-bound activities and IT components as well as their interrelation. With regard to KIPOs, no methods could be found that are capable of treating such complex services as a whole. That is a lack in current literature, as none of the analyzed methods provides engineering tools that can serve as a bridge between automation and social aspects. Systematic approaches to develop KIPOs that cover all aspects and characteristics could not be found.

In this paper, we developed a framework and applied it to a significant sample of SE approaches, in order to describe and differentiate these approaches in more detail. One benefit of our framework is that it supports selection of different approaches for organisations trying to leverage IT potentials for KIPOs. A second benefit is that our results are suitable to provide starting-points on how to address identified gaps and shortcomings. For example, a variety of approaches for SE have been proposed that provide no actionable details. Most of them also lack appropriate method and tool support that would allow a better penetration of concepts in practice. To fulfil this, these methods need to be specified and elaborated in more detail. Other methods are already mature, yet they only cover distinct aspects of engineering KIPOs. Thus, we conjecture that currently there is a lack of methods that meet the requirement of a comprehensive SE approach for developing IT-enabled KIPOs, which was the starting point of our research. A comprehensive method should further provide guidelines on how to identify those process steps that need to remain personally delivered, and other process steps that can subsequently be supported or even automated by IT. There is currently no method or approach that systematically addresses this issue.

To overcome the lack of methods to systematically develop economically reasonable and user-friendly IT-enabled KIPO services and processes, we provide suggestions of how our results can inform the design of an improved SE method. Analyzing the deficits of the analyzed approaches, the concepts of method engineering (Brinkkemper 1996) could be used to outline how a consolidated method may look like. Concepts of method engineering are amongst others method integration or best of breed approaches to combine different fragments or steps of existing methods. Some of the analyzed approaches already follow this approach, e.g. by combination of service blueprint with FMEA (Chuang 2007), or by integrating QFD with Gap-Analysis (Jing-Hua et al. 2009). Other works successfully extend existing approaches by integrating other views and techniques, e.g. by extending service blueprinting (Patrício et al. 2008) or the TRIZ method (Chai et al. 2005). Those articles present good starting points for further considerations of method integrations. Further, several commonalities of analyzed methods could be identified. Despite most approaches are following a different life-cycle, complementary aspects, e.g. common starting points or similar phases, can be identified. Some works try to integrate and consolidate these differing life-cycles, yet those works still lack appropriate method support. Future research could try to assess existing methods on their suitability for certain life-cycle phases and provide a matching. This could serve as a basis for selecting the appropriate methods within each phase. A challenge thereby lies, however, in formulating and detailing the interrelation and interfaces of the existing methods.

One of the main challenges in engineering IT-enabled KIPOs is in the duality of people-bound activities and IT components, as engineering approaches so far could not be successfully applied to individual and personal services. First starting points on how this conflict could be addressed can be derived from works trying to design multi-channel service encounters (Simons and Bouwman 2005; Patrício et al. 2008). These works could potentially be extended to analyze the whole service process, as in their current states they are only addressing the service encounter. Other interesting starting points for dissolving this duality are the approaches of (Chai et al. 2005), who apply the TRIZ method to overcome conflicting design issues. Yet, they do not explicitly address technology infusion.

For integrating an information and knowledge dimension, only the approaches of (Froehle and Roth 2007) and (Qi and Chuan Tan 2009) present starting points. Customer integration is provided by most of the approaches. This supports the fact that customer integration has been recognized as being essential to successfully develop services, although hardly any work could be found that analyzes the degree of customer involvement in service provision.

Once a first idea of a service concept is identified, it might also seem meaningful to integrate methods from other disciplines into the field of service engineering. Especially, as increasing parts of KIPOs will be delivered using electronic means, the integration of methods from software engineering or, especially when mobile or ubiquitous elements are considered, from participatory design approaches such as prototyping will be inevitable to ensure customer acceptance. Future research needs to demonstrate how a comprehensive method that suits the needs of KIPOs can be developed and show the utility and applicability of such a method in practice.

7 Limitations and conclusion

As any literature review, this paper faces limitations that are due to the literature selection process. By integrating relevant works from cross-references and earlier reviews related to SE or NSD, as well as by the choice of the key words, we tried to reduce the risk of missing out on relevant works. Also, other streams of research might be suitable to address some of the key issues identified for SE of IT-enabled KIPOs. These include, e.g. software development and prototyping approaches targeted for developing pure IT-services. Hence, more detailed and thorough analyses are required.

According to Webster and Watson (2002), a contribution of a literature review is to identify critical knowledge gaps in existing research and making a chart for future research. Thus, the results we presented in this paper are a first step towards filling the research gaps as have been proposed in recent

research appraisals in the field of service science, calling for development of suitable methods. Our results support the presumptions that SE is still a young discipline, and further work has to be done on the elaboration and particularization of existing methods. As a lot of approaches are still too general and abstract to be widely employed and accepted in practice, practical corroboration could be ensured by making the approaches more accessible through case studies, design patterns or more detailed prescription of actions. To meet the challenges for the case of IT-enabled KIPOs, methods are needed that support those services as a whole. The main gap we identified is a lack of methods that are capable of handling the interaction between people-bound activities and automation by means of IT. We have further pointed out initial considerations for integrating and combining existing approaches by means of method engineering to develop a comprehensive SE method for KIPOs through future research.

References

Alam, I. and Perry, C. (2002). A customer-oriented new service development process. Journal of Services Marketing, 16 (6), 515-534.

Apte, U. M. and Mason, R. O. (1995). Global disaggregation of information-intensive services. Manage. Sci., 41 (7), 1250-1262.

Becker, J., Beverungen, D., Knackstedt, R., Glauner, C., Stypmann, M., Rosenkranz, C., Schmitt, R., Hatfield, S., Schmitz, G., Eberhardt, S., Dietz, M., Thomas, O., Walter, P., Lönngren, H.-M. and Leimeister, J. M. (2008). Ordnungsrahmen für die hybride Wertschöpfung. Dienstleistungsmodellierung: Methoden, Werkzeuge und Branchenlösungen.

Berry, L. L. and Bendapudi, N. (2007). Health Care: A Fertile Field for Service Research. Journal of Service Research, 10 (2), 11.

Bitner, M. J., Ostrom, A. L. and Morgan, F. N. (2008). Service Blueprinting: A practical technique for service innovation. California Management Review, 50 (3), 66-94.

Böhmann, T. and Krcmar, H. (2005). Modularisierung: Grundlagen und Anwendung bei IT-Dienstleistungen. Konzepte für das Service Engineering, 45-83.

Booz, Allen and Hamilton (1982). New Products Management for the 1980s. Booz, Allen & Hamilton, Inc., New York.

Brinkkemper, S. (1996). Method engineering: engineering of information systems development methods and tools. Information and Software Technology, 38 (4), 275.

Buhl, H. U., Heinrich, B., Henneberger, M. and Krammer, A. (2008). Service Science. Wirtschaftsinformatik, 50, S. 60-65.

Bullinger, H.-J., Fähnrich, K.-P. and Meiren, T. (2003). Service engineering—methodical development of new service products. International Journal of Production Economics, 85, 13.

Bullinger, H. and Schreiner, P. (2006). Service Engineering: Ein Rahmenkonzept für die systematische Entwicklung von Dienstleistungen. Service Engineering, 53-84.

Chai, K.-H., Zhang, J. and Tan, K.-C. (2005). A TRIZ-Based Method for New Service Design. Journal of Service Research, 8 (1), 48-66.

Chesbrough, H. and Spohrer, J. (2006). A research manifesto for services science. Communications of the ACM, Volume 49 (Issue 7).

Cho, S., Mathiassen, L. and Gallivan, M. (2008). Crossing the Chasm: From Adoption to Diffusion of a Telehealth Innovation. Open IT-Based Innovation: Moving Towards Cooperative IT Transfer and Knowledge Diffusion. G. León, A. Bernardos, J. Casar, K. Kautz and J. De Gross, Springer Boston. 287, 361-378.

Chuang, P.-T. (2007). Combining Service Blueprint and FMEA for Service Design. Service Industries Journal, 27 (2), 91-104.

Davenport, T. H. (1993). Process innovation - reengineering work through information technology. Harvard Business School Press, Boston.

Edvardsson, B. and Olsson, J. (1996). Key Concepts for New Service Development. The Service Industries Journal, 16 (2), 140 - 164.

Essén, A. (2009). The emergence of technology-based service systems: A case study of a telehealth project in Sweden. Journal of Service Management, 20 (1), 98-121.
Fähnrich, K.-P. and Meiren, T. (2007). Service Engineering: State of the Art and Future Trends. Advances in Services Innovations, 3-16.
Fitzsimmons, J. A. and Fitzsimmons, M. J. (2005). Service management : operations, strategy, and information technology. 5th. McGraw-Hill/Irwin, Boston.
Fließ, S. and Kleinaltenkamp, M. (2004). Blueprinting the service company: Managing service processes efficiently. Journal of Business Research, 57 (4), 392-405.
Froehle, C. M. and Roth, A. V. (2007). A Resource-Process Framework of New Service Development. Production & Operations Management, 16 (2), 169-188.
Ganz, W. (2006). Germany: service engineering. Commun. ACM, 49 (7), 79-79.
Glushko, R. J. (2009). Seven Contexts for Service System Design. Handbook of Service Science. P. P. Maglio, C. A. Kieliszewsk and J. Spohrer. New York, Springer.
Glushko, R. J. and Tabas, L. (2009). Designing service systems by bridging the "front stage" and "back stage". Information Systems and E-Business Management, 7.
Goldstein, S. M., Johnston, R., Duffy, J. and Rao, J. (2002). The service concept: the missing link in service design research? Journal of Operations Management, 20 (2), 121-134.
Hauknes, J. (1999). Knowledge intensive services – what is their role? OECD Forum on Realising the Potential of the Service Economy. Paris.
Iachello, G., Truong, K. N., Abowd, G. D., Hayes, G. R. and Stevens, M. (2006). Prototyping and sampling experience to evaluate ubiquitous computing privacy in the real world. Proceedings of the SIGCHI conference on Human Factors in computing systems. Montreal, Quebec, Canada, ACM**:** 1009-1018.
Jing-Hua, L., Lei, X. and Xiu-Lan, W. (2009). New service development using GAP-based QFD: a mobile telecommunication case. International Journal of Services Technology & Management, 12 (2), 146-174.
Johne, A. and Storey, C. (1998). New service development: a review of the literature and annotated bibliography. European Journal of Marketing, 32 (3/4), 184-251.
Kindström, D. and Kowalkowski, C. (2009). Development of industrial service offerings: a process framework. Journal of service Management, 20 (2), 156-172.
Kingman-Brundage, J. and Shostack, L. (1991). How to design a service. The AMA Handbook of Marketing for the Service Industries. Hrsg.: CA Congram, ML Friedman, New York, 243-261.
Knebel, U., Leimeister, J. M. and Krcmar, H. (2007). Personal Mobile Sports Companion: Design and Evaluation of IT-Supported Product-Service-Bundles in the Sports Industry. Proceedings of the 15th European Conference on Information Systems (ECIS2007), June 7-9 2007, St. Gallen, Switzerland (University of St. Gallen), 81-92, St. Gallen.
Leimeister, J. M., Huber, M., Bretschneider, U. and Krcmar, H. (2009). Leveraging Crowdsourcing: Activation-Supporting Components for IT-Based Ideas Competition. Journal of Management Information Systems, 26 (1), 197-224.
Maglio, P. P. and Spohrer, J. (2008). Fundamentals of service science. Journal of the Academy of Marketing Science, 36, 3.
Maglio, P. P., Srinivasan, S., Kreulen, J. T. and Spohrer, J. (2006). Service systems, service scientists, SSME, and innovation. Commun. ACM, 49 (7), 81-85.
Magnusson, P. (2003). Benefits of involving users in service innovation. European Journal of Innovation Management, 6, 228-238.
Matthing, J., Sandén, B. and Edvardsson, B. (2004). New service development learning from and with customers. International Journal of Service Industry Management, 15 (5), 479-498.
Meiren, T. and Burger, T. (2008). ServLab: Visualising And Simulating New Services. RESER Conference papers. Stuttgart.
Menschner, M., Prinz, A., Altmann, M., Koene, P., Köbler, F., Krcmar, H. and Leimeister, J. M. (2011). Reaching into patients' homes – participatory designed AAL services - The case of patient-centered nutrition tracking service. Electronic Markets, 21 (1), 63-76.

Menschner, P., Hartmann, M. and Leimeister, J. M. (2010). The nature of knowledge-intensive person-oriented services – challenges for leveraging service engineering potentials. The Second International Symposium on Service Science ISSS 2010 Leipzig, Germany.
Meyer, K., Böttcher, M., Apitz, M. and Opitz, M. (2008). Vorgehensmodelle im Kontext IT-basierter Dienstleistungen. Entwicklung IT-basierter Dienstleistungen, 103-126.
Oliveira, P. M. and von Hippel, E. A. (2009). Users as Service Innovators: The Case of Banking Services. MIT Sloan Research Paper No. 4748-09.
Opitz, M. (2008). When innovating services, are 12 Ps enough? Towards a design oriented framework. International Journal of Services Technology & Management, 9 (3/4).
Orman, L. V. (2008). Service Semantics, Structure, and Design. eService Journal, 6 (2), 21.
Patrício, L., Fisk, R. P. and Cunha, J. F. (2008). Designing Multi-Interface Service Experiences: The Service Experience Blueprint. Journal of Service Research, 10 (4), 17.
Qi, Z. and Chuan Tan, K. (2009). Towards an integrative service design framework. Proceedings of the QUIS 11, Wolfsburg.
Rai, A. and Sambamurthy, V. (2006). The Growth of Interest in Services Management: Opportunities for Information Systems Scholars. Information Systems Research, Volume 17 (Issue 4).
Ramaswamy, R. (1996). Design and management of service processes : keeping customers for life. Addison-Wesley, Reading, Mass.
Resatsch, F., Sandner, U., Leimeister, J. M. and Krcmar, H. (2008). Do Point of Sale RFID-Based Information Services Make a Difference? Analyzing Consumer Perceptions for Designing Smart Product Information Services in Retail Business. Electronic Markets, 18 (3), 216-231.
Rubleske, J. and Kaarst-Brown, M. (2009). On the Prospective Value of ICTs to New Service Conception. AMCIS 2009. Proceedings of the Fifteenth Americas Conference on Information Systems, San Francisco, California August 6th-9th 2009.
Rust, R. T. and Kannan, P. K. (2002). E-Service : new directions in theory and practice. M.E. Sharpe, Armonk, NY.
Scheuing, E. E. and Johnson, E. M. (1989). A Proposed Model For New Service Development. Journal of Services Marketing, 3 (2), 25-34.
Sheehan, J. (2006). Understanding service sector innovation. Commun. ACM, 49 (7), 42-47.
Simons, L. P. A. and Bouwman, H. (2005). Multi-channel service design process: challenges and solutions. International Journal of Electronic Business, 3 (1), 1.
Smith, A. M., Fischbacher, M. and Wilson, F. A. (2007). New Service Development: From Panoramas to Precision. European Management Journal, 370-383.
Spohrer, J., Maglio, P., P., Bailey, J. and Gruhl, D. (2007). Steps Toward a Science of Service Systems. Computer, 40 (1), 71-77.
Stevens, E. and Dimitriadis, S. (2005). Managing the new service development process: towards a systemic model. European Journal of Marketing, 39 (1/2), 175-198.
Torsi, S., Nasr, N., Wright, P. C., Mawson, S. J. and Mountain, G. A. (2009). User-centered design for supporting the self-management of chronic illnesses: an interdisciplinary approach. Proceedings of the 2nd International Conference on Pervasive Technologies Related to Assistive Environments. Corfu, Greece, ACM**:** 1-4.
van de Kar, E. and den Hengst, M. (2009). Involving users early on in the design process: closing the gap between mobile information services and their users. Electronic Markets, 19 (1), 31-42.
Webster, J. and Watson, R. (2002). Analyzing the past to prepare for the future: Writing a literature review. MIS Quarterly, 26 (2), 13-23.
Yang, H.-L. and Hsiao, S.-L. (2009). Mechanisms of developing innovative IT-enabled services: A case study of Taiwanese healthcare service. Technovation, 29 (5), 327-337.
Zeithaml, V. A. and Bitner, M. J. (2003). Services marketing : integrating customer focus across the firm. 3. McGraw-Hill Irwin, Boston.
Zhou, Q. and Tan, K. C. (2008). A bibliographic analysis of the literature on new service development. Management of Innovation and Technology, 2008. ICMIT 2008. 872-877.
Zysman, J. (2006). The algorithmic revolution---the fourth service transformation. Commun. ACM, 49 (7), 48.