A Roadmap for the Development of a Generic B2B-Service Productivity Model

Michael Dücker[1], Silke Balzert[2], Matthias Bertram[1], Peter Fettke[2], Ralph Lichtner[1], Peter Loos[2], Thomas Kleinert[2], Wolfgang Knöll[3], Horst Kutsch[1], Harald von Kortzfleisch[1], Gianfranco Walsh[1], Thomas Wildt[3]

[1]Universität Koblenz-Landau; [2]Institut für Wirtschaftsinformatik im Deutschen Forschungszentrum für Künstliche Intelligenz GmbH; [3]Assembly & Test Europe GmbH

The business press and the economic literature have argued in recent years that more research should be directed at the services sector, especially services between companies (business-to-business, B2B). Despite their economic relevance the markets for B2B-services still remain underexplored. The authors introduce the CustomB2B research project which aims to develop new approaches and models for measuring service productivity and present the underlying research design as a Roadmap. In this project we address challenges in researching customized B2B-services by using various methods of social research, design-oriented management theory and information systems research. Our objective is to establish a broader understanding of the tension between individualization and standardization of innovative B2B customization processes and in the end to develop a generic productivity measurement model for B2B-services.

1. Introduction

A giant shift towards service dominance continues to take place in the business world. An increasing demand for customized goods and services has forced industries to expand service interactions between customers and employees (Oliva; Sterman, 2001). Moreover, the increasing technical complexity and homogeneity of consumer goods causes companies to offer additional services to differentiate themselves from competition (Höck, 2005). Today, the service sector accounts for nearly two thirds of the global GDP (Lovelock; Wirtz, 2011). Highly developed countries like the U.S. and Germany have a service value of GDP over 70%, respectively, which places them among the largest service economies in the world (BMWi, 2011; The World Factbook, 2011).

As the global service market continues to grow, the current century is going to be the age of services (Godlevskaja et al., 2011). In light of a growing service economy practitioners and scholars seek to better understand efficiency aspects of service creation and delivery. In fact, Drucker (1993) saw increasing service productivity as the key challenge for the economy of the 21st Century. Extant scientific studies addressed this topic and substantially improved understanding of service productivity (Bartsch et al., 2011). In recent years, research in service marketing focused on service quality and primarily dealt with its importance to businesses and consumers

(Bartsch et al., 2011). Given the dominance of the service sector, companies need to better understand how to capture service productivity comprehensively and achieve improvements for their whole business processes.

Till now, no comprehensive productivity analysis has been conducted in the service sector and subsequently little research efforts have been taken until the end of the twentieth century (Jones; Johnston, 2004; Rutkauskas; Paulavičienė, 2005). In this respect Reichwald and Möslein (1995) assume a "productivity gap" in the service sector. It is supposed that there is no general understanding of service productivity and no entirely consistent approach to measure the productivity of services yet (Baumgärtner; Bienzeisler, 2006; Lasshof, 2006). Reichwald and Möslein (1995) see no mechanism that is able to measure or to reflect service productivity adequately. However, different perspectives show that one cannot proceed on the assumption of a “global” productivity gap in the service sector (Tengler; Hennicke, 1987). This is based on the diversity of services. Differentiation between task-oriented and personal services shows the varieties of services (Corsten, 1997). While task-oriented services can record improvements in productivity using technology or through organizational changes (Lehmann 1989), the development in personal services is difficult to measure (Corsten 1997). The reason for slight service productivity (Corsten, 1994; Grönroos; Ojasalo, 2000) is the productivity gap within personal intensive services (Meyer, 1987).

Several reasons for the lack of productivity measurements can be stated. Foremost because of the unique characteristics of services that are highlighted by several authors (Meffert, 2003; Johnston; Jones, 2004; Höck, 2005; Lasshof, 2006; Parasuraman, 2010):

- *Intangibility* (the product or service cannot be touched),
- *Heterogeneity* (the same services are not equal to each other),
- *Inseparability* (services cannot be stored, produced and consumed at the same time),
- *Multi-dimensionality* (capability dimension, process dimension and performance dimension),
- *and the inclusion of the customer* (the customer is always involved in a service process).

These characteristics induce a variety of difficulties to measure service productivity (Bienzeisler; Löffler, 2006). Several authors emphasize the integration of the customer as a crucial external factor (Rutkauskas; Paulavičienė, 2005). The influence and uncertainty caused by this external factor during the creation process is a challenge for companies (Corsten, 1994). Additionally, service characteristics also prevent the adaption of existing approaches measuring productivity of the tangible goods industry (Lasshof, 2006). Beside these restrictions, the classical productivity measurement for goods is difficult to express because of the different measurement units of each factor of services (Jones, 1988; Parasuraman, 2002; Lasshof, 2006).

Therefore approaches measuring service productivity face several challenges which need to be considered. Albeit the mentioned problems and the diversity of existing approaches, research has already built a foundation to handle those challenges in

the area of business-to-consumer (B2C) markets (Jones, 1988; Corsten, 1994; Parasuraman, 2002; Johnston; Jones, 2004). Nevertheless, little research has been conducted in business-to-business (B2B) relationships in this context. In this regard, our research project focuses on B2B services in two important engineering industries in Germany: mechanical engineering and software engineering. The remainder of the paper is organized as follows. Section 2 introduces the research setting and its objectives. Building on that introduction we describe the underlying research approach in section 3 in form of a generic research Roadmap. The paper closes with preliminary results in Section 4 and concluding remarks in Section 5.

2. Research Setting & Objectives

Our research efforts take place in the context of the CustomB2B project, sponsored by the Federal Ministry of Education and Research and administrated by the German Aerospace Center. CustomB2B is designed for a period of three years and organized as a consortial project with partners from scientific research and practice. In this project, the Institute of Management at the University of Koblenz-Landau, the Institute of Information Systems (IWi) at the German Research Center for Artificial Intelligence (DFKI), and the company Assembly and Test Europe (GmbH) work together to develop new approaches and models for measuring service productivity for the business practice in innovative B2B customizing services. The research project thereby contributes to the objectives of the research program of the Federal Ministry of Education and Research “Innovation on Services” and the Strategic Partnership "Scientific Base und Service Science”. Figure 1 illustrates the main research framework of our project.

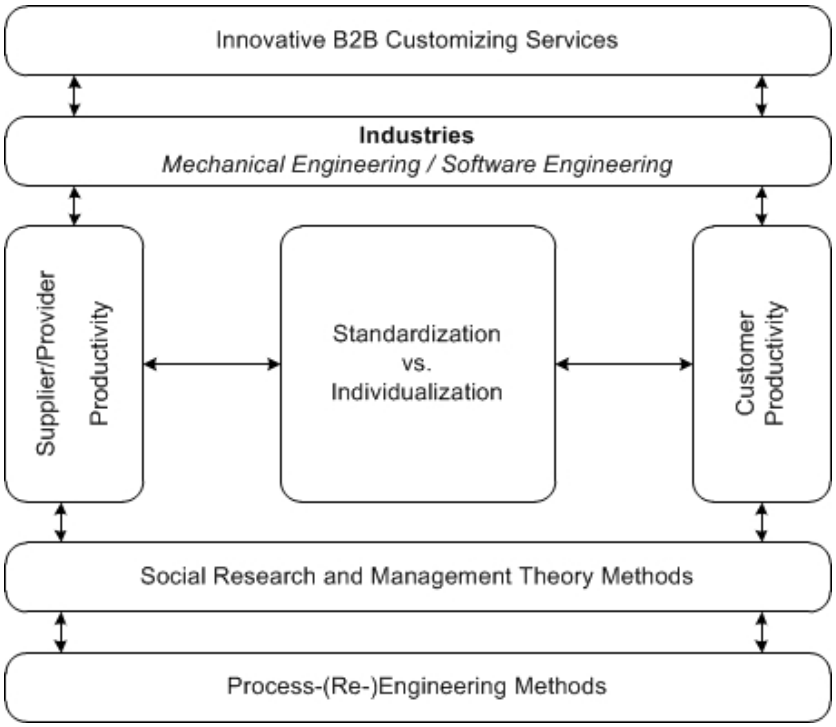

Fig. 1: Reference Framework for the CustomB2B research project

This project framework serves as an important starting point for the development of a generic service productivity measurement model in the B2B sector. Thus we propose a Roadmap that takes into account the essential tension between standardization and individualization in innovative B2B services.

Like our initial research objective in the project, the first objective in the Roadmap is to get a broad understanding of all determinants that significantly influence service productivity and its measurement. With the focus on the two distinct industries, software engineering and mechanical engineering, it provides a broad approach to identify many determinants of service productivity. Both industries incorporate a large variety of technology-driven services, where customers co-create products and services with different levels of involvement, which in consequence may or may not boost service productivity. For that reason, the Roadmap includes these two industries as a starting point for the research efforts.

Based on the service-related scientific research and person-to-person expert interviews with top management employees in the two industries, the second objective is to develop a service productivity measurement model. An important challenge exhibits the consolidation of both the supplier/provider and the customer perspective to discover the main determinants that influence service productivity of innovative B2B processes. In our research project we have chosen to conduct person-to-person interviews with top management in the two industries to get the deepest insights. As in our project, the Roadmap should include a large online survey for the validation of the initial results.

The third objective in our project concentrates on getting a sound understanding of all services and innovation processes to develop a service blueprint (Fließ et al., 2004). This service blueprint is based on a thorough business process analysis in different firms. Therefore the service blueprint adds an essential scientific pillar for the final Roadmap objective to develop, validate and implement a generic B2B service productivity model.

All previous research efforts and the enrichment by the continuous dialog with researchers and practitioners, fortify the research structure to build a valid and reliable model. Thus the Roadmap Research Design incorporates decisive research pillars to succeed in developing the service productivity model. The findings of our project will give executives the additional insights to better understand and manage service productivity.

3. Research Approach

Our research follows a straight forward approach similar to Crewell's Sequential Exploratory Strategy (Creswell, 2009). Figure 2 illustrates an outline of our research design which will be described in the following sections.

After an (1) initial literature review (2) several expert interviews to prepare (3) two case studies are conducted. These case studies are conducted in the mechanical engineering industry in collaboration with the practical project partner and at an organization of the software engineering industry. The case studies include qualitative interviews and process analysis with key informants on provider as well as on client

side. (4) Based on the results of the qualitative research, process models and the service productivity measurement model will be developed. (5) By applying methods from the information systems research the process models will be generalized and extended to a business service blueprint. The service productivity measurement model will be validated and evaluated by conducting quantitative research methods and empirical analysis. (6) The last step in our design is the publication of conclusions and findings based on the results

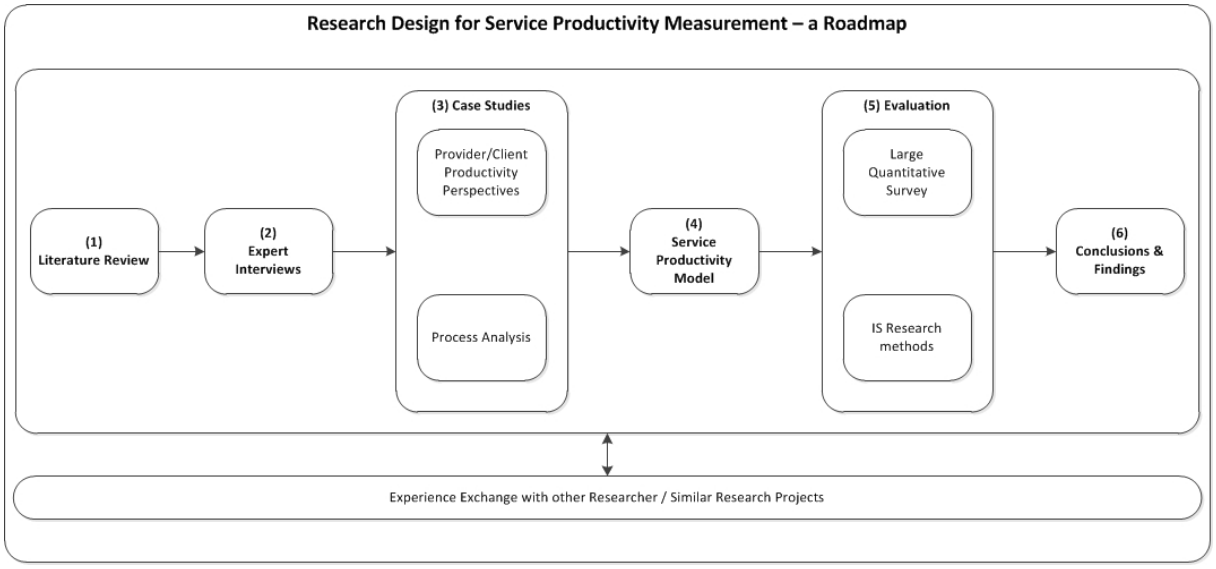

Fig. 2: Roadmap Research Design

Literature Review

As a preparation, the first research effort is a literature review. It describes a fundamental research synthesis to summarize and classify the existing understanding of knowledge of a specific research area. Thereby, as defined by (Cooper, 1998, 4), the "research synthesis hopes to present the state of knowledge concerning the relation(s) of interest and to highlight important issues that research has left unsolved".

For our research project the literature review furthermore builds the theoretical foundation for further research and also develops a common understanding for a solid communication in the project teams.

As described in several research design sources there is not one single way to conduct a literature review (Creswell, 2009, 29). Furthermore, it is important to plan the review according to the research objectives and the chosen research approach. In our project, the literature review is primary the base for the initial qualitative research and the case studies. Therefore we did not limit our initial literature research to specific journals or a distinct field of research. We conducted the research based on initial keywords and used the search engines of scholarly online databases like Google Scholar or ISI Web of Knowledge to identify relevant articles. Thereby we were able to cope with a relatively broad area of scientific literature sources. In the process, we identified three outstanding research fields and grouped them: service productivity models in B2B, the tension between customization and standardization with custom-

er participation, and the role of reference models for the service engineering. A brief summary of our literature review is presented in section 4 of this paper. Table 1 (on page 10) displays an extract of the most interesting literature from the current point of view. The literature review is still an ongoing process in our research project. In addition, we will constantly review newly published literature that has not been considered yet, as for example Parasuraman (2010) or Meffert and Bruhn (2011).

Process Analysis

As described above a detailed analysis of the business processes is crucial for the development of service blueprints. For the procedure model presented in this contribution in form of the Roadmap, the work begins with a process model inquiry. The raised process models are brought together to generate a model which incorporates different perspectives. Afterwards the new aggregated process model is iteratively generalized to generate reference process models (Fettke; Loos 2004; Fettke, Loss 2007) (service blueprints) of segments of that process model. This way the service blueprints are getting impartial enough to transfer the insights into other businesses.

By analyzing the processes in the supply chain of a custom engineering and machinery manufacturer we deepened the understanding of their implementation of innovation and customization in a B2B scenario. We decided to use moderated management interviews to raise the relevant process data and enriched our insight through informal process documentation provided by the corporate management. The management interview is one of the methods that are described in the scientific literature.

Interviews were held with two project managers, one software engineer and one mechanical engineer. From these interview-protocols process models in Event-driven Process Chain (Keller, Nüttgens, Scheer 1992) (EPC) were derived for each of the work-processes described by the interview participants. Since the interviews aimed for an overview of the whole supply chain, the processes started with the first contact of the person with the project and ended with the finalization of all project related work. The results were two process models of the entire project-supply-chain from the project managers and two process models for specific work processes realized by the two engineers.

In a further process analysis these four different views on elements of the same process were put together in one generic process model for the entire project-supply-chain. This new model contains elements of all four views on the process and provides a slightly lower level of detail then the four single models. Thus it combines the views of four process experts in one model and is therefore valuable for all four of them.

In a last step parts of the new process model were further generalized and universal reference models for business processes in custom engineering and machinery manufacturing were derived. A detailed evaluation of the validity of these process fragments will be conducted as a next step. In this context it is planned to carry out another process model inquiry and anlaysis with a company from the software engineering sector. Similar to the procedure described above, process models will be derived and generalized based on management interviews. These process models will then be compared to the already existing models from the custom engineering and machinery manufacturer in order to derive service blueprints for the respective industries.

Expert Interviews

As a primary part of the Roadmap expert interviews are proposed to be conducted in the two industries software engineering and mechanical engineering. This qualitative research approach through expert interviews generally allows a very deep and detailed collection of information, because the experts usually possess special knowledge about circumstances that may not already be expressed or analyzed in the research field (Mieg; Näf, 2005; Gläser; Laudel, 2006). Interviews with these key informants like CEOs, CIOs or project managers should give valuable insights for the development of the generic productivity measurement model. This essential approach incorporates both perspectives' of the provider/supplier and the customer as well.

In our project, we realize this by conducting person-to-person interviews based on an interview guide which was developed through the initial literature review. This means that no categorized answers are formulated, but predefined questions are used. In approval with the interview partners the interviews are transcribed for an extensive content analysis. This is done using exploratory and literature based categories (so called codings) as described by Cresswell (2009) and Gläser and Laudel (2006). The qualitative data analysis is supported by using a software tool which allows in depth analysis, evaluation and management of the transliterated interviews. To conclude, we promote to a use a quantitative approach to validate the results to ensure the ability to generalize the statements (Patton, 2002).

Model Development

The aim of the central part of the Roadmap is to develop a generic measurement model for service productivity. In this context generic means that the classical productivity measure is extended to the service sector. Methodologically, the model is based on the analysis of service and innovation literature and the previous findings from the providers' and customers' perspective in the B2B sector.

The measurement model is expected to consist of three groups of variables. First, there are impartial measurable productivity-related variables from a providers point of view (e.g. number of person hours per day, number of served customers per day, etc.) to capture the productivity of the provider. Here, it is primary a matter of the classical input and output related productivity coefficients which can be prompted through literature review, interviews and investigations in companies. Second, there are subjectively measurable productivity-related variables from the customers' perspective (e.g. time used for service, customer satisfaction, perceived service quality, etc.) to capture the customers' productivity. This step captures relevant input and output values through literature review and qualitative methods with customers as well as the analysis of existing models of service productivity. Third, variables taking account of customer participation, which expresses those customers operate in the service provision as "co-producers".

Qualitative methods (e.g. focus group interviews with producer and client) try to capture input and output variables from the producers' and customers' perspective. The survey of businesses and customers is necessary, because both groups might have different opinions regarding the impact of productivity on customer participation. For example, customers could assume that their active role in the provision of services increases productivity for the company. However, companies could consider that

customer participation induces a decreasing productivity because they slow down the service delivery process.

During the development of the model, perceptions of the range between a closed progression with a low level of customizing up to outstanding and cooperative progressions should be consulted. The influencing variables of the model will be both, directly observable variables (e.g. man hours) and latent variables (e.g. customer satisfaction).

In practice, the measurement model's overall productivity can be collected through several indicators, the qualitative and quantitative productivity. Both types of indicators would measure the one-dimensional construct of service productivity, which is modeled as an additive linkage of qualitative and quantitative productivity. Basically these two indicators would incorporate with the same influence in determination of productivity. On standardized, low-interactive services or those with low customer participation, cost productivity would have a stronger influence. By contrast in customized, highly interactive services or those with intense customer participation, customer productivity has a stronger influence.

The result of the model development is a model measuring customer productivity and total factor productivity for innovative customizing processes. This model is the foundation of the empirical verification.

Service Re-Design

Also as part of the Roadmap introduced in this contribution, the insights of the process analysis and the measurement model have to be used to improve the service quality afterwards based on the idea of continuous process improvement.

We promote a step by step improvement of service processes. As for the process lifecycle in Business Process Management for an implementation of productivity raising changes have to happen in a cyclical approach. Changes have to be derived from e.g. the service blueprints. They have to be implemented into the processes of the business, they have to be checked on their performance improvement influence and from that point further improvement potentials have to be identified.

In the Custom B2B project we will build upon the insights from the qualitative interviews, the questionnaires, the process models and the service productivity model to identify improvement potentials for the practice partners. Redesigning the service- and innovation processes will happen alongside the customer-integration-improvements. Not only the customer integration will be improved concerning the needs of the service provider but also along the needs identified at the perspective of the customer. The practice partner has agreed to implement service process changes developed this way. This will give us the chance to evaluate our theoretically designed service blueprints.

This continuous improvement process has to be separated from radical process reengineering approaches as promoted. There, the entire existing process is deleted and new "To-Be" processes are developed from the scratch. In our approach it is important, that well working existing segments of the service process remain and get a chance to become best practices for others. Implementing changes and renewing

process structures is just as important as identifying well working process segments that can be turned into impartial service blueprints.

Quantitative Analysis

Quantitative research strategies can be subdivided into experiments and surveys (Cresswell, 2009, 11). Survey research provides estimators for population parameters like measures of location or dispersion for survey variables of interest by studying a sample of that population. Data is collected with questionnaires to be able to generalize from a sample to a population (Babbie, 1990).

Main objective of the quantitative analysis in our research project and the proposed Roadmap is the empirical validation of the designed measurement model for service productivity. In this context validity means that the model contains the true values of the relevant input and output factors. For further information on validity see Hahn and Jerusalem (2003).

As mentioned before, a major challenge in constructing the measurement model for service productivity is that qualitative input- and output-factors as well as the customers‘ influence have to be taken into account. The creation of services differs from the production of material goods in the matter of customer integration. To a certain extent the customer is an active part of the service process as services are created and consumed at the same time (Bieger, 2004, 11). The level of customer integration and its impact on productivity is dependent on different aspects like how individually, unique or standardized the considered service is. Therefore it has to be analyzed how the „external factor customer” affects measuring the productivity of services. For the measurement and calculation of a valid value of service productivity it is necessary that the observed values of all relevant quantitative and qualitative input- and output-factors from the providers‘ and customers‘ point of views do match together.

To proof the validity of the measurement model the validity of each single relevant input- and output-factor will be examined. In a large quantitative sample survey among B2B service providers and customers each relevant input- and output-factor included in the measurement model will be evaluated. The constructed model is valid if there are no significant differences between the relevant input- and output-factors of the providers‘ and customers‘ estimated values.

Populations for the sample survey will be B2B software and mechanical engineering service providers and their customers in Germany. A suitable sampling method (i.e. random sampling, quota sampling or stratified sampling) will be used to draw samples from the target populations that satisfy the necessary requirements like sample size, unbiasedness etc. for further statistical analysis. For detailed information on sampling methods and quality criteria for samples see Kutsch (2007, 87).

Statistical hypothesis testing and other appropriate methods from inductive statistics based on Fisher, Neyman and Pearson‘s probability theory (Fisher, 1925; Fisher, 1926; Pearson, 1927; Neyman, 1933; Neyman, 1934; Fisher 1936) will be used for the analysis of the observed data.

4. Preliminary Results

Basic findings of literature research so far are that no adequate methods, standards or models do exist to measure productivity of services. Main reason for the lack of such a model is that, in contrast to material goods or products, services are much more intangible and integrative to a certain extend. I.e. services are less easy count- and measurable compared with products, and the customer is much more involved in the service provision process than in the production process of material goods. Therefore the definition of productivity as the ratio of output and input without including the customer as well as the quality of the outcome is not directly applicable to measure the productivity of services. Measuring service productivity needs a much broader approach that takes into account the influence of all the service characteristics mentioned above.

On the basis of the literature research, interview guidelines for a qualitative pilot study with experts from software and mechanical engineering companies and their customers were developed. The main objective of the interviews was to get a fundamental knowledge and understanding of customizing processes in these companies as a major example for services and to identify the methods used in companies to actually measure and evaluate service productivity.

Topic	Author		Description
Service productivity	Corsten (1994)		Productivity consists of pre- and endcombination.
	Vourinen et al. (1998)		Quality and quantity of input/output
	Parasuraman (2002)		Customer and company view on service productivity
	Johnston and Jones (2004)		Service productivity consists of operational and customer productivity
	Grönroos and Ojasalo (2004)		Service productivity as a function of internal efficency, capacity-efficency and external efficency
	Rutkauskas and Paulavičienė (2005)		Service productivit as a combination of qualitative and quantitative input/outputs
	Lasshof (2006)		Sevice productivity consists of customer independent and -dependent inputs.
Customization and standardization	Baalbaki and Malhotra (1991)		Standardize or not. True question?
	Lampel and Mintzberg (1996)		Customization and standardization as two poles of the strategy continuum
	Kalyanaram and Krishnan (1997)		Customizing the product definition process
	Gosh et al. (2006)		Customer vs. vendor control in Customization
	Squire and Cousins (2006)		Resource-Based View on collaboration for customization
	Salvador et al. (2009)		Fundamental capabilities for mass-customization
	Reichwald et al. (2009)		Perspectives on interactive value creation
	Piller and Tseng (2010)		Mass-customization and personalization
	Franke et al. (2010)		Creating customer value through the self-design process
Reference models	***IT-Services***	Hochstein and Hunziker (2003)	IBM IT Model (ITPM)
		Hochstein and Hunziker (2003)	HP IT Service Managment (HP ITSM)
	Product Service Systems	Schneider et al. (2008)	InCoCo-S Reference Model
		Gajewski (2004)	Reference Model of After-Sales-Services
	Financial Services	Pousttchi (2005)	Mobile Payment Reference Model (MPRM)
		Rohloff (2008)	Reference Model by Rohloff
	Other Services	Chikova et al. (2009)	Reference Model by Chikova/Leyking/Martin
		Thomas et al. (2007)	Reference Model by Thomas

Table 1: Literature Review on service productivity, customization and reference models (selected examples)

Content analysis was used to identify reoccurring themes in the interviews (e.g. Krippendorf, 2003, Kassarjian, 1977). The aim of the analysis was to find differences and similarities in how the interview partners define the measurement and influence of service productivity with focus on customizing processes. In detail the following interviews were planned and are in progress: 10 interviews with firms of the mechanical engineering and software industry, to check if the results from the literature review can be validated, 30 interviews with customers of the projects practical partners to survey the firms and customers view on (customer-) productivity and 20 interviews with typical customers of the software and mechanical engineering industry to validate the former results in a second step. The interview partners‘ quotations provided below are representatively chosen as examples for different findings.

The preliminary results of the qualitative study show consistence with previous literature findings. There is no unique definition of productivity among the interview partners, especially of customer productivity in the service sector. Nevertheless, most of them share the opinion that the simple ratio of output and input is not a satisfying measure for service productivity – it should go beyond that. They recognize the difficulty of measuring service productivity, and understand the need of taking both aspects into account, service quality as well as customer participation effects:

> “Sure there is an influence [on service productivity], namely the customer relationship and the employees that work with the customer, as well as the behaviour of the customer impacts the productivity and the price.” - Provider Software Engineering

> “Naturally, the efficiency of such projects handlings is a very thrilling topic, because it is about speaking to people and not foremost about the engineering science.” - Provider Mechanical Engineering

To decipher the “black box” service productivity, companies may have found different approaches to measure it – fundamental financial statistics, project duration time, or alternative indicators like the intense personal interaction with the customer, or the handling of requests during the project:

> “For each project a calculation is made – The margin based on the market price and the base price with the cost of production. These are the tough parameters the project lead assess the performance.” - Provider Mechanical Engineering

> “That what we actually measure is time and certainly the result. Time is a very big factor, we use for comparisons.” - Client Software Engineering

> “That is a criterion: the reaction time between raising the question and getting the answer. It may be that between both lie five minutes or possibly two months.” - Provider Software Engineering

When asked about customization, the interview partners acknowledged its importance while underlining that a variety of different implementations of “customizing” exist in their business:

> “The total revenue from customizing can be seen as very high; over 50%.” - Provider Software Engineering

> “[Customization…] is always important. That means, everything begins in our construction. Our customers do have the product, the know-how. We must

know the product as good as the customer, perhaps even better. We must have all conceptual thoughts of the product characteristics to develop it." - Provider Mechanical Engineering

5. Concluding Remarks

Customization is an important subject in the service sector especially for B2B services in the highly innovative fields of software and mechanical engineering. To measure the productivity of customizing activities or service productivity in general no adequate productivity model exists so far. The Roadmap in hand provides a scientific research approach to develop a generic B2B service productivity model to close the research gap to proper model and measure service productivity that takes service quality as well as customer productivity into account. Based on process analysis, case studies, qualitative and quantitative studies with service providers and customers in the software and mechanical engineering sector a measurement model for service productivity can be constructed, implemented and validated. The resulting model is supposed to be generalized and transferred and made applicable for other service sectors as for consulting, insurance, governmental, financial, or the medical sector for example.

Support for the research project is provided through the research grant from the "Service Innovation" Program of the Federal Ministry of Education and Research. This Program is designed to support the efforts in service research in Germany. Our ongoing research efforts are strengthened by the valuable input of experts form the software and engineering industries, exchange with other researchers in the field, and the support of our project administration, the German Aerospace Center.

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Authors addresses

Michael Dücker; Matthias Bertram; Ralph Lichtner; Horst Kutsch Dr.;
Harald von Kortzfleisch Prof. Dr.; Gianfranco Walsh Prof. Dr.
Institute for Management
University of Koblenz-Landau
Universitätsstraße 1
56070 Koblenz, Germany
{michael.duecker|matthias.bertram|lichtner|kutsch|
harald.von.kortzfleisch|walsh}@uni-koblenz.de

Silke Balzert; Peter Fettke PD. Dr.; Peter Loos Prof. Dr.; Thomas Kleinert
Institute for Information Systems
at the German Research Center for Artificial Intelligence, DFKI GmbH
Stuhlsatzenhausweg 3
Building D3 2
D-66123 Saarbruecken, Germany
{silke.balzert|peter.fettke|peter.loos|thomas.kleinert}@dfki.de

Wolfgang Knöll; Thomas Wildt
Assembly & Test Europe (GmbH)
Carl-Borgward-Straße 11
56566 Neuwied, Germany
{wknoell|twildt}@ATWAutomation.com