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Service productivity in different industries – an empirical investigation

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Abstract

Purpose – The purpose of this paper is to quantitatively evaluate of the current status of productivity management of industrial and non-industrial service companies in Germany. Based on that knowledge, best practices and needs regarding tools and methods can be identified.

Design/methodology/approach – In two qualitative pre-studies the theoretical foundation of service productivity was built. Using this knowledge, a quantitative empirical survey was conducted, including almost 2000 service companies. The sampling frame was based on a company database provided by Hoppenstedt. Samples were randomly selected using proportionate stratified sampling.

Findings – The findings show the economic importance and meaningfulness of service productivity management, independently from the industry.

Research limitations/implications – Due to the chosen population, the findings are limited to Germany. Furthermore, a more detailed comparison of service industries beyond industrial and non-industrial services was not feasible.

Practical implications – The data contained evidence that companies conducing productivity management are more successful than those who are not. This underlines the economic importance service productivity management.

Originality/value – The paper provides reliable, quantitative insights of the current status, demands, and benefits of service productivity management in the industrial as well as non-industrial sector.

Keywords Germany, Industrial services, Performance measures, Service engineering, Service productivity

Paper type Research paper

Introduction

The concept of service engineering as a structured approach for the development and management of services is increasingly applied in business practice (Fähnrich and Meiren, 2007). This leads to a higher professionalism of methods and tools, especially with regard to innovation and modelling of services (Bullinger *et al.*, 2003). Similarly, the phase of service provision needs to be supported adequately. Thereby, the measurement and improvement of productivity of provided services are economically important aspects (Heshmati, 2003), so that profit for the service provider and a high value for customers can be created (Grönroos and Ojasalo, 2004).

Although analysing productivity is an established discipline and integral part in production processes in the domain of industrial engineering, the specifics of services lead to various challenges regarding productivity (Grönroos and Ojasalo, 2004). The basic productivity formula – the ratio of output to input – originated from the domain of industrial engineering but is also widely used in the domain of services

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(Li and Prescott, 2009). Emerging general problems are the identification of meaningful input, respectively, output factors (McLaughlin and Coffey, 1990), measuring and quantifying "soft" factors like customer satisfaction and the deduction of corresponding optimisation activities.

Besides these general challenges, further aspects shape the required approach for productivity management. Depending on the type of service, various service specifics emerge from industry-specific characteristics. Such characteristics are, for example, whether services are product or person-related, the degree of customer involvement or whether the services are cooperatively provided (Cook *et al.*, 1999; Alonso-Rasgado *et al.*, 2004). It can be assumed that these characteristics have influence on the tools and methods used for the management of productivity (Becker *et al.*, 2011). Therefore, comparing approaches, challenges and trends of different industries might help to draw a complete picture of the management of service productivity and to identify industry-specific demands and best practices.

To evaluate the area of research, two qualitative pre-studies were conducted. In a first step, interviews with 14 industry experts were carried out to get a first impression of the state of the art of business practice in regard to the productivity-oriented structuring of service portfolios and the use of the concept of modularisation. The results were published as a collection of theses and anecdotal insights, as a basis for discussion and further research (Böttcher and Meiren, 2012). In a second step, a working group was established to widen the focus on the topic of service productivity. This group comprised almost 30 participants from various institutions of the fields of business, science and intermediaries. In three workshops, the topic "productivity of service systems" was addressed and future scenarios, best practices regarding methods and tools and a collection of recommendation for actions concerning science, business and politics were compiled. The results were published as a qualitative analysis of productivity of service systems, both from a scientific and business point of view (Böttcher *et al.*, 2012).

Since both pre-studies focused on technical and industrial services in a qualitative manner, a complementary intersectoral, quantitative study was designed consecutively. The findings of the pre-studies supported the development of the corresponding questionnaire. The aim was to be able to make empirically validated statements about the status quo of service productivity in Germany. This includes used methods and tools, the identification of service specific challenges and the collection of trends and demands regarding service productivity. The presentation of the quantitative study forms the core of this paper, extending and validating the anecdotal findings of the pre-studies.

As stated above, service characteristics may differ widely between different industries. Therefore, the scope of this paper includes an intersectoral comparison of the management of service productivity.

For providing a comprehensive review of the study, this paper is structured as follows. First, insights about issues in measuring service productivity are presented in the next section. This theoretical background is followed by the presentation of the design of the study. Subsequently, the state of the art regarding management of service productivity is illustrated in four parts: the segmentation between providers of industrial and non-industrial services, the characteristics of surveyed companies, the usage of productivity management in general, and the usage of specific methods and tools. Following, needs and trends of companies are presented and the dependencies between productivity management and company success is analysed. To conclude the paper, limitations of the study are shown and the paper is summarised.

Productivity of services

Based on the two qualitative pre-studies and a literature review, this section presents insights about the management of service productivity. The focus is on presenting challenges for measuring productivity. Consecutively, these challenges are validated according to their practical relevance in the empirical study.

Since measuring and managing productivity has its origins in manufacturing, it has been neglected in the service domain for quite some time (Vuorinen *et al.*, 1998). In addition, no common understanding of either services or service productivity exists (Spohrer *et al.*, 2007). Some authors even deny the possibility to agree on a common understanding, c.f. (Martin *et al.*, 2001).

Though no common understanding of service productivity exists, several authors analysed approaches for measuring productivity. In comparison to industrial engineering, measuring service productivity faces various challenges. Generally, productivity is measured using an input-output-ratio (Diewert and Nakamura, 2005). Several authors argue that it is challenging to determine service inputs and service outputs, e.g. (Klassen *et al.*, 1998; Li and Prescott, 2009; Sahay, 2005). As Johnston and Jones (2004) state, the challenges arise due to different representations. While outputs are often represented as physical values (e.g. the number of produced goods), inputs, for example, represent employee skills or working hours.

As Dücker *et al.* (2011) state, the problem is worsened by the fact that input-output-ratios are not sufficient for measuring service productivity. In their opinion, a measure needs to take all influencing factors into account. These factors are, for example, customers that modify the service provision process, the demand for a service, and perceived service quality (Grönroos and Ojasalo, 2004).

Additional challenges emerge from the well-known service characteristics inseparability, heterogeneity, intangibility, and perishability, c.f. (Edvardsson *et al.*, 2005). Due to intangibility, the possibility to quantify and evaluate services is hampered (Johnston and Jones, 2004; Klassen *et al.*, 1998). Furthermore, it might be impossible to measure the number of produced services (Sahay, 2005). According to Johnston and Jones (2004), and Klassen *et al.* (1998), inseparability and perishability hamper measuring inputs and outputs as well as separating marketing and operations expenditures from each other. In addition, it is hard to estimate the ability of an organisation to prepare services without immediate demand. Finally, heterogeneity leads to the fact that service instances cannot be seen as equal services (Klassen *et al.*, 1998).

Another issue in analysing service productivity is highlighted by McLaughlin and Coffey (1990). According to them, service companies are smaller than industry companies resulting in a lack of willingness and ability to measure productivity. This also leads to the fact that professional associations for service companies do not focus on productivity, too.

The discussion above can be summarised as follows. First, the importance of measuring productivity is known in industrial engineering. However, in the domain of services, productivity management is not popular due to several reasons. Second, since measuring productivity has its origins in industrial engineering, methods and tools from this domain are used. However, this leads to the question how productivity of completely immaterial services is measured, e.g. for architectural services, advertising, and consulting.

Empirical study

Since both literature and workshops provided only a qualitative view on the topic of service productivity, a nationwide survey of service providing companies was conducted. Therefore, 1990 German companies, which belong to service-providing

industries such as ICT, architecture, promotion, machine building industry, tax and business consultancy or research and development, were surveyed.

Table I provides an overview of the various numbers regarding the sampling process. Due to limited sample size of 2000 and an address database diverging significantly from official data provided by the government, it has been indispensable to define the population precisely. Therefore, it was determined which industries should be investigated. The identification of relevant industries was done based on the NACE Classification, published by the OECD ("Organization for Economic Cooperation and Development") (Eurostat, 2008). The company profiles were extracted from the German company database "Hoppenstedt" in spring 2012. Thus, the conclusions from the data to the population are representative for certain German service companies, only. The empirical research attributes different relevance to the term of representative samples (Kauermann and Küchenhoff, 2010). In its essentials, a sample is meant to be a downscaled image of the interesting population. It has to be ensured that the distribution in the random sample is equal to the distribution in the population. As the distribution can be extracted from government-provided data (Statistisches Bundesamt, 2009), this requirement is easily met. Using this information, the sample was designed in a way which allowed for drawing valid inferences regarding the population. Therefore, sample selection bias and correlations that are not randomly can be avoided (Kauermann and Küchenhoff, 2010).

Thus, the sample was randomly selected from a data sheet using stratified sampling. In doing so, the weighting of stronger represented companies in the population is increased and vice versa. This means, probabilities are allocated proportionally to the size of the stratification criteria (PPS-method, see (Kauermann and Küchenhoff, 2010, p. 138f.)). The stratification was done based on the two criteria industry affiliation and headquarters location. Due to the small sample size, stratification according to the federal state was not feasible. Therefore, solely the categories West- and East-Germany were used for stratification. Separated samples out of each stratum were taken and afterwards merged for evaluation. This is beneficial because the population mean of a feature can be estimated more efficiently, i.e. with smaller variance (Münnich *et al.*, 2012).

To ensure correctness regarding the content and design of the questionnaire, a pre-test with various industry partners was conducted. The finalised questionnaire was sent by mail to all participants. To simplify the response process, a self-addressed and prepaid envelope was included. Alternative response options were fax or an online answering of the survey. To increase the response rate a follow-up letter was sent. 120 of the returned questionnaires were evaluable. The losses not specific to the sample (neutral non-response) comprised 88 companies because of wrong addresses,

	Number of companies
Companies in the relevant industries – population (government-provided data)	613,795
Registered companies in the German database Hoppenstedt	54,756
Maximum sample size	2,000
Realised sample size (adjusted – duplicates, insolvent)	1,990
Dead letters	88
Explicitly non-participation	8
Participants	120

Table I. Overview of population, sampling and responses

bankruptcy of the company, etc. Furthermore, not all received questionnaires contained sufficient data for analysing, due to the lack of missing values. Likewise, eight companies explicitly refused to participate. Thus, the response rate amounts 6.44 per cent which is considered typically for mail surveys (Diekmann, 2007; Häder, 2010).

In terms of content, the focus was on the ascertainment of the status quo of the management of service productivity in business practice. This comprises the pervasion of productivity analysis, the used methods for measurement and optimising productivity, existing problems as well as expected trends.

Industrial vs non-industrial services

To allow for a comparison between different industries, the companies are segmented into two different groups. The first includes companies focusing technical, respectively, industrial services, such as ICT and the machine building industry. The second comprises all non-industrial services, such as consulting, accountants, architects or advertising. Since the last group of services features no homogenous characteristics but rather is an aggregation of different kind of alternative service industries, it is referred to as "non-industrial services". Table I gives an overview of included industries and their mapping to the two groups.

An analysis of the responses shows that the weighting of the two groups is almost balanced. This allows for a statistically comparative view of the two groups. Due to the otherwise small number of cases, a further segregation of the combined groups is not feasible.

In order to be able to describe the offered services of the companies not only by a sectoral classification, the companies were asked to describe their typically offered services by certain characteristics. These included the degree of standardisation, the offering of customer-specific service adaptations and product, respectively, person relatedness. In the following, using these characteristics a clearer picture of the service offers of the two groups is drawn.

To allow for a higher independency of a fluctuation in demand of products, product-related services are increasingly offered in the industrial domain (Bitran and Pedrosa, 1998). This leads to the constitutive definition of industrial services as mainly product-related (Homburg and Garbe, 1999; Winkelmann and Luczak, 2006). To ensure the conformity of the analysed two groups regarding this aspect, the participants should specify, whether their company offers product-related services. Since a clear segregation without exception is an unrealistic scenario, the results described in Figure 1 are in accordance with the expected tendencies.

Correspondingly, a complementary question covered the degree of person-related services offered by the companies. As expected, a very low amount of industrial companies do offer person-related services (see Figure 2). Companies offering non-industrial services show an almost balanced ratio.

Altogether, these characteristics facilitate a more precise service classification of the analysed sectors. The product and person relatedness indicates a more heterogeneous composition of non-industrial service companies. This corresponds with the selected industries described above, as non-industrial services represent rather a conglomerate of industries than a specific service sector.

Companies profiles

To be able to classify the questioned companies, various common attributes were surveyed. These characteristics were the basis to gain further insights by creating and analysing specific clusters within the dataset.

In regard to the size, the questioned companies can be divided into three groups. Half of the questioned companies have between ten and 49 employees. Almost 25 per cent of the companies have a workforce number lower than ten employees, respectively, above 50 employees. There is no significant difference between the industrial and non-industrial service companies.

To be economically successful in a competitive environment, a precise matching of customers' demand is necessary. Therefore, service offers are configured based on customer-individual requirements. Almost all participated companies have realised the importance of a customer orientation, so that 94 per cent of them characterising their offered services as customer-individual service offers. Likewise, 90 per cent of the companies assess a high degree of customer-interaction as characteristically for their offered services. This emphasises the crucial role of customers in services, which have a great influence as co-creator for the productivity and, therefore, the economic success of a service.

Driven by an increasing competition regarding manufactured goods, many product-oriented firms have extended their portfolio by offering additional services. Advantages are a higher independence from a fluctuating product demand, higher margins in services or increasing customer loyalty through combining products and services (Baines *et al.*, 2007; Evanschitzky *et al.*, 2011). To include these so-called product-service systems and identify sectoral differences, the companies were asked to quantify the ratio of service revenue compared to total turnover. Correspondent to the business focus of the two sectoral groups, the service share of sales is much lower in industrial service companies than in non-industrial firms (see Table II). Furthermore, the heterogeneity regarding this characteristic is much higher in the domain of

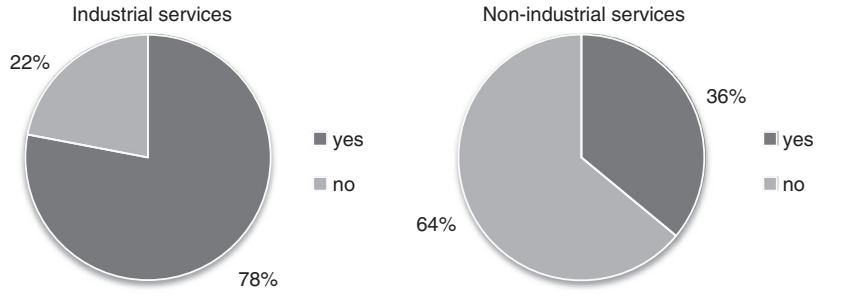

Figure 1.
Does your company offer product-related services?

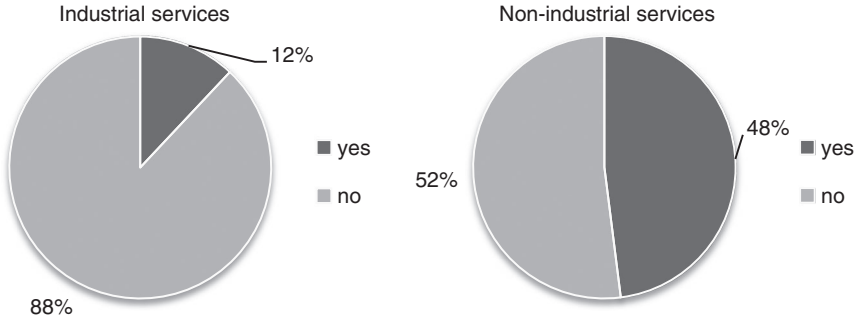

Figure 2.
Does your company offer person-related services?

Group	Industry	Subset of NACE profile	Distribution in the survey
Industrial services	Machine building industry Metal products ICT	C, K, G, I	43%
Non-industrial services	Consulting Accounting Research and development Architects Advertising	K	57%

Table II.
Sectoral structure of the survey

industrial services. This leads to the assumption, that companies pursue the shift from products to services with different intensity.

To be able to describe the economic success of a company, the survey included the collection of the evolution of the three operational figures profit, total revenue and number of employees over the last three years. These three performance indicators were qualitatively captured using a scale of five potential values (highly increased, increased, unchanged, decreased, highly decreased). Based on this scale a numeric sub-index was built for each indicator. Consecutively, these sub-indexes were aggregated to form an index indicating the holistic success of a company. A numeric index value of "3" represents an unchanging success, whereas higher (lower) values indicate a growing (diminishing) success. By applying this approach for quantifying the economic success, two thirds of the companies surveyed can be assessed as successful companies (see Figure 3). A further, individual processing of the three factors was not conducted, since the expressiveness of a single factor is limited and an additional differentiation within a factor is not sensible due to the subjectivity of those values.

Service productivity in business practice

The measurement of productivity is an important factor for the analysis of the efficiency of service provision and effectiveness of strategy implementation (Amir *et al.*, 2010). Despite the growing economic importance of services, around a third of all companies does not conduct productivity analysis, with no significant difference between the industrial and non-industrial sector (see Figure 4).

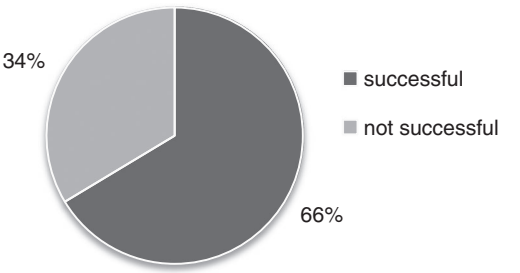

Figure 3.
Economic success of questioned companies

Looking next at the reasons why no productivity analysis is conducted, a more differentiated picture emerges (see Figure 5). Whereas the lack of demand differs only slightly, the industrial service companies state a much higher demand regarding adequate tool support. Likewise, a missing acceptance for service productivity measures on the part of employees, respectively, customers is much more prevalent in industrial services than in the non-industrial sector. Both are crucial aspects to enhance productivity, since staff acceptance of productivity measures is an important prerequisite (McLaughlin and Coffey, 1990). Similarly, the intensified integration of customers in the process of service provision also increases their possible impact on service performance (Bettencourt, 1997). The differences might result from a shorter history of service productivity analyses in the industrial domain, since services were included in the portfolios only recently. Therefore, a lack of practical experience and, thus, adequate tools seems likely. Other, sectoral more balanced reasons for not analysing service productivity are the lack of suitable methods, no acceptable cost-value ratios and problems with quantifying input and output factors.

In contrast, around two thirds of all respondents analyse productivity. Considering how long productivity analyses have been done, industrial services show a tendency for a recent implementation in the last five years. Extending the focus to the last 15 years, no significant difference between industrial and non-industrial services can be found (see Table III). Regarding the departments responsible for productivity analysis a mixed picture is shown. In both groups no single department being solely responsible for productivity analysis can be identified. In the majority of all companies,

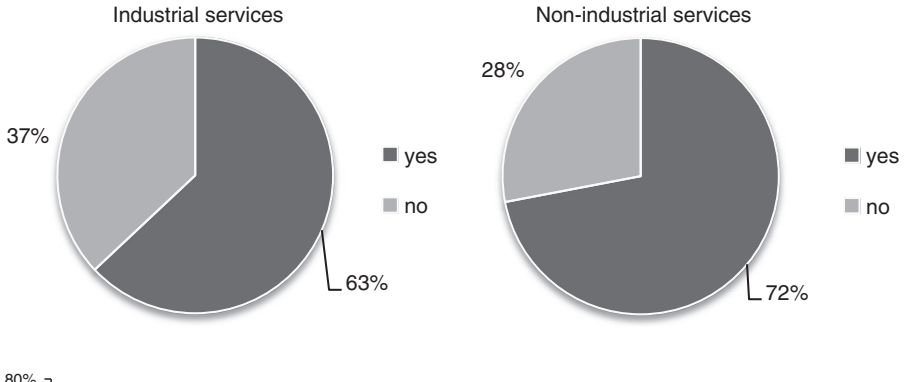

Figure 4.
Does your company analyses the productivity of their services?

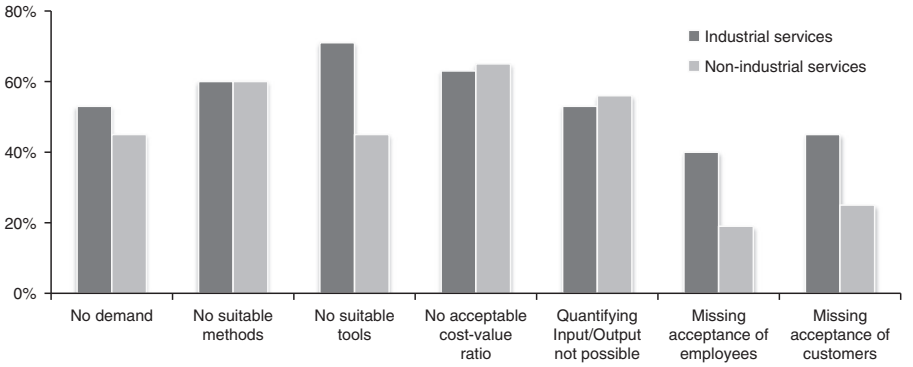

Figure 5.
What are the reasons for not analysing service productivity?

the management conducts productivity analysis, but particularly in industrial services specialist departments and a dedicated controlling have assigned partial responsibility, too. The high proportion of management representatives as survey participants might be a reason for an overrepresented management responsibility. Generally, neither industrial nor non-industrial service companies conduct productivity analysis in one specialised department.

Tools and methods

A holistic productivity management of services comprises two different phases. First, the actual productivity of the service needs to be measured and quantitatively described. Based on these numbers, productivity can be improved in a second step. Thus, the gathering of methods for productivity management in this survey is divided into the two phases of measurement and improvement. The selection of listed methods and tools is based on experience gathered in workshops with various business representatives (Böttcher *et al.*, 2012).

Methods that are used for the measurement of productivity are mainly limited to the direct measurement of key performance indicators as well as the calculation of indicators based on the relation between input and output. Thus, primarily approaches originally developed the industrial domain are used. Additional or service specified approaches like Simulation (Swart and Donno, 1981; Silberholz *et al.*, 1991), balanced scorecards (BSC) (Kaplan and Norton, 1992) or data envelopment analysis (DEA) (Charnes, 2001) play only a minor role (see Figure 6). The differences between industrial and non-industrial service companies are only marginal in this context, so that only an aggregated view is given.

The reasons given for not applying the mentioned methods are missing skills, high costs and lack of knowledge about the methods. While the majority of the questioned companies classifies BSCs, simulation and input/output-analysis as known but inappropriate, the statements about DEA are the opposite. The main reason for not applying DEA is that this method is unknown to more than the half of the companies. The introduction of one of the methods is planned in few cases only.

Table III.
Percentage of service revenue of total turnover

Industry	Arithmetic mean (in %)	SD
Industrial services	60.45	31.6
Non-industrial services	92.48	17.9

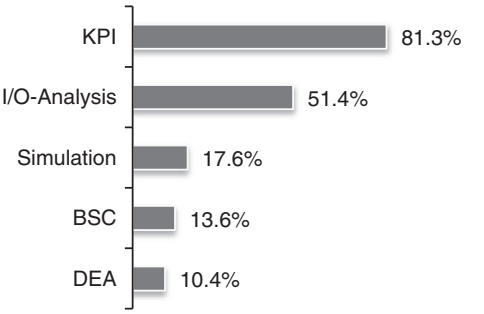

Figure 6.
Which approaches are used for productivity measurement?

Regarding the approaches used for the improvement of service productivity the very generic method of standardisation is the primarily implemented method. In combination with the also commonly used modularisation, these approaches form the basis for mass customisation to overcome the dichotomy of customer individual configuration and intended economies of scale (Pine, 1999; Da Silveira *et al.*, 2001). The integration of customers in the process of service provision is an option for companies to substitute employee labour with customer labour and thereby increase the internal productivity of services (Bendapudi and Leone, 2003). This is done by almost two thirds of the questioned companies. Other approaches of productivity improvement like outsourcing, automation, or six sigma are increasingly specific and, therefore, only used in a smaller portion of the questioned companies (Figure 7).

Looking at the differences between industrial and non-industrial services, it can be found that the approaches of customer integration, six sigma, and automation are slightly more popular in the domain of industrial services. It can be assumed, that between different industries further differences regarding used methods and tools can be identified. However, the limited number of responses in this study does not permit a finer segregation of industries. Therefore, the deduction of such implications would not be accurate in this case.

Needs and trends

To be able to define future demands more clearly and derive corresponding research and business actions the study contained the gathering of various expected trends. Basically, almost every company expects a constant (21 per cent) or growing (78 per cent) relevance of productivity management for services. This shows the importance of service productivity, independent of the industry. Sectoral differences emerge when analysing possible reasons for the expected growth of relevance. As Table IV shows, more than 80 per cent of all industrial service companies consider better technical possibilities, a growing complexity and an increasing economic relevance of services as drivers for the gain of importance of productivity management. Although the agreement in the non-industrial sector regarding those aspects is a little bit more reserved, the majority of companies are still consent to these arguments. A growing competition is another factor for the relevance of productivity management, regardless of the industry.

In summary, the development of the market is the main reason for a growing importance of productivity management. To provide a competitive service portfolio, companies need to include the possibility for customer-individual configurations of

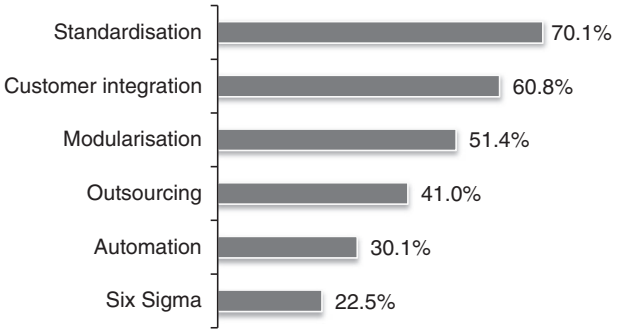

Figure 7.
Which approaches are used for productivity improvement?

Table IV.
Company practice regarding productivity analyses

	Industrial services	Non-industrial services
Analysing productivity for	in %	in %
< 5 years	46.9	26.5
6-10 years	28.1	36.7
11-15 years	6.3	18.4
16-20 years	15.6	10.2
> 20 years	3.1	8.2
Responsible department for productivity analysis		
Specialist department	88.9	43.2
Controlling	71.4	52.8
Management	93.9	93.9
Quality management	50.0	37.1
Human resources management	25.9	31.4

service offers. Since this increases the complexity of the services, appropriate approaches such as mass customisation need to be applied (Böttcher and Klingner, 2011). Likewise, a competitive market requires an efficient provision of these services, which can be achieved only by a comprehensive productivity management.

To be able to conduct productivity management and thereby control the efficiency of service provision, adequate methods and tools are required. To be able to identify specific demands, the participants were asked to specify methodical and software related gaps along four phases of service productivity management. The first phase is the identification of performance indicators (respectively, input and output factors), which adequately represent the facts to be examined. The quantification of these KPI is done in the second phase. In the last two phases, the calculated KPI need to be interpreted and corresponding actions are to be deduced.

As indicated in Table IV, both industrial and non-industrial service companies specify a need for tools and methods for all four phases. However, it is worth to note, that industrial service companies generally show a stronger agreement to the corresponding demand along these four phases. This indicates a lack of adequate methods and tools, especially in the industrial service domain. As mentioned above, this might be a result from the shorter history of services in this domain.

Productivity and success

As mentioned above, the survey included the collection of various indicators for business success. These are the basis for the calculation of an aggregated index describing the economic success of a company. Using the index the impact of conducting productivity management on the economic success can be estimated. This is done by means of a linear regression analysis.

The development of the regression model is based on a few assumptions. First, based on the experience from industrial engineering, it can be assumed, that companies analysing and improving the productivity of services are more successful. Second, various external factors have influence on business success. Therefore, the effect of the companies' location on success needs to be tested in the model. Third, the economic surrounding differs widely between industries. Thus, sectoral effects need to be considered as well.

These assumptions lead to the following two ordinary least squares (OLS) regression models, divided in industrial and non-industrial service companies (see

Table V). The models contain only effect sizes with a statistical significant explanatory power. Therefore, the model quality is relatively low, describing only 18 per cent, respectively, 15 per cent of the variability of the economic success (Table VI).

Independent from the industry it can be stated, that conducting productivity management has a significant positive effect on the business success of a company. Whereas industrial services are slightly less successful (success index of 3.059) than non-industrial services (success index of 3.282), the conduction of productivity management has a much greater effect in this sector. This shows that the rather stagnating economic situation of industrial service companies can be considerably increased by the conduction of productivity management. Regarding non-industrial services a similar conclusion can be drawn, although the positive effects are not as strong as in the industrial service domain.

Regarding the company location no significant effect can be shown for industrial services. However, for non-industrial service companies location is a highly significant success factor. East-German companies, which are offering non-industrial services, are 0.611 index points less successful. Therefore, those companies have a success index of 2.671, which means a declining success over the last three years.

Limitations

The survey is restricted by the lack of control on the answering person. Only one employee of each company has been questioned. Therefore, the reply is probably affected by subjective perception and might result in a response-bias. In addition,

	Industrial services	Non-industrial services
Reasons for an increasing relevance of productivity analyses	*in %*	*in %*
Growing competition	84.4	84.9
Better technical possibilities	88.9	61.1
Growing economic relevance of services	88.9	71.7
Growing complexity	88.9	71.7
Demand for methods or tools regarding […]		
Identification of adequate KPI	87.5	54.2
Quantification of KPI	75.0	59.2
Interpretation of KPI	75.0	52.9
Deducing recommendations	84.4	64.0

Table V. Trends and demands of productivity management

Variable	Coefficient	Standard error	*p*-value
Industrial services			
Constant (success index)	3.059	0.183	0.000
Conducting productivity management	0.705	0.227	0.003
$R^2 = 0.175$			
Non-industrial services			
Constant (success index)	3.282	0.184	0.000
Conducting productivity management	0.355	0.212	0.099
East-German company location	−0.611	0.212	0.005
$R^2 = 0.146$			

Table VI. OLS-regression

also the high ratio of managers as respondents can lead to distortions. To prevent this, it would be necessary to question additional employees of the company and recheck the answers.

Since the creation of the success index was based on the development of business indicators of the last three years, long-term effects of productivity management on success could not be analysed. Likewise, the identification and integration of further parameters may benefit the quality and explanatory power of the constructed models. Furthermore, a more fine-grained local and sectoral segregation of companies could support the identification of effects of regional industry clusters. To make this possible, the sample size needs to be significantly increased. Similarly, a further division of companies regarding size could lead to more insights. One hypothesis would be correlations between company size and used tools and methods for productivity management. The existence of such dependencies can be assumed based on the results of the survey, e.g. DEA, simulation or six sigma are only used by companies with more than ten employees. However, these effects are not statistically significant due to the limited number of responses.

Conclusion

The aim of the survey was the deduction of valid quantitative statements regarding service productivity in Germany by comparing industrial and non-industrial services. Thereby, the business as well as the scientific community can profit from the results of the survey. On the one hand companies can use the findings for benchmarking their approaches against the state of the art in other industries and, if applicable, deriving corresponding recommendations for action. On the other hand the results allow for identifying theoretical and methodical demands for scientific research.

The management of service productivity contains manifold challenges. Identification, measurement, quantification and interpretation of KPI are common problems for many companies, due to various service-specific characteristics. The usage of key performance indicators as the central element of productivity analyses requires quantifiable facts. Because of the prevailing high intensity of costumer contact and the intangibility of the service results, a quantitative description is difficult for many of the characteristics. However, the usage of KPI or an input-output-analysis for services requires the challenging quantification of so-called "soft factors". This fact marks a clear need for scientific research in this area. First approaches can be found in the work of Lamberth (2013), for example. Likewise, the identification of adequate KPI marks another area with research potential. For example, the identification of appropriate KPI can be supported using categorised KPI-libraries (Freitag *et al.*, 2011). Furthermore, the collection and publication of reference values for KPI would support the interpretation of the measurement results. However, this approach is often confronted with the nondisclosure of company-internal information.

Generally, these challenges are intensified by a lack of tools and methods, which are adapted corresponding to service specific requirements. Mainly methods adopted from the production industry are used, which are not adjusted to the specifics of services. This can be counteracted by the development of new approaches or the enhancement of existing service-specific approaches, focusing a higher level of practical applicability.

Comparing industrial and non-industrial service industries, generally similar demands have been found regarding tools and methods. However, industrial service companies express more intense needs in this area. This might be a result of less experience due to a shorter history of service provision in these industries.

Despite the challenges regarding the implementation, the survey revealed that the relevance of productivity management of services is realised by almost all companies, independent of the industry. This is remarkable insofar, as a third of all companies do not undertake any productivity management of their services. Searching for reasons unveils a demand for adapted methods and supporting software as well. These are prerequisites for an effective and efficient controlling of service productivity.

The importance of productivity management is underlined by the finding, that productivity analysis and business success are strongly linked. It can be applied to reduce negative effects of industry or company location. Thus, the vast majority of companies are identifying analysing and improvement of productivity of their services as a relevant fact for the success in a market environment characterised by increasing business competition.

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