

## Potentials and Barriers of Technology Deployment in Services

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### Abstract

In an economy with a fast growing demand for services, productivity and innovation become crucial for the survival of service companies. In order to keep up with the change, these companies have to adopt new technologies in the service deployment. This is the only possible way to higher productivity as well as innovation and to serve an increasing amount of customers - even worldwide. Especially when it comes to the management of technologies and innovations, there seem to be major differences between leading companies and their followers. However, due to budget restrictions, investments in new technologies have to be well considered and guarantee a swift return of investment and increase in productivity. This can only be achieved by choosing the right technology to reach the potentials. In order to determine and increase the productivity of service deployment, the impact of different technologies on services has to be thoroughly studied. In this paper, empirical results from different industries are presented. A cluster analysis is used to divide the participating companies into two groups. They are either identified as champions (innovative companies) or as followers (less innovative companies) in order to show their differences. The results provide information about the significance of technology deployment in services and the potentials and barriers which go along with it.

### Keywords

Technology Management; Innovative Ability; Services; Productivity; Innovation

## 1 INTRODUCTION

It is beyond question that services as well as the economic performance are important challenges for companies in Europe. According to a study by Roland Berger the importance of services will increase in the future. In addition, efficiency of industrial services will be increased by optimizing the deployment [1]. The management of these services is confronted with ever new challenges. Due to the competitive pressure the companies need to face the necessity of lowering costs, increasing productivity and ensuring a constant quality level. Furthermore, the managing directors have to deal with the problems of demographic change, internationalization and the use of new technologies [2, 3]. To meet the competitive pressure, companies need to distinguish themselves from possible competitors by offering new solutions and individually designed services [4]. This way, it is possible to satisfy costumers' needs and, in doing so, exploit competitive advantages. Over the last years, many companies mentioned the development of new services as one of their most important investment focuses [5, 6, 7].

On the one hand, the use of new technologies can support the production of goods and services as well as the efficiency of service provision. On the other hand, innovative services can often only be enabled by the use of new technologies. Remote services in mechanical and plant engineering [8], the connection of different people in the field of healthcare [9] or the use of RFID in logistics [10] are only a few examples that should be mentioned in

this context. Ensuring the own competitiveness within the current market by increasing productivity and innovation is of high importance [11].

It needs to be considered, that decisions for or against the use of technology can have severe consequences for a company [12]. These decisions do not only entail costs in the short term, they can shape a company in the long term as well. Therefore, the use of new technologies ought to be well considered. Thus, a well-defined technology management is essential to support the decision process [13].

## 2 OBJECTIVES

The aim of this paper is to demonstrate the status quo of technology management for service providers. A cluster analysis is used to divide the participating companies into two groups. According to their innovative strength, they are either identified as champions (innovative companies) or as followers (less innovative companies) in order to show their differences. The results of the cluster analysis are supposed 1. to show the necessity of using technologies to increase productivity and 2. to demonstrate the importance of innovation in services. Furthermore, the aim is to indicate how companies deal with the arising challenges of new technologies and how they get used to new fields of application. In addition, the use of various technologies in services is to be collected to identify appropriate future fields. The potentials as well as the barriers of using technologies need to be well considered to meet this change at an early stage. A

matrix analysis is used to identify the correlations of the specific potentials/barriers and the different technologies.

### 3 THEORETICAL BACKGROUND

#### 3.1 Productivity of Service Provision

In the context of material goods production, the concept of productivity fundamentally resembles a concept for the determination of economic capacity, which is comprehensively studied and thoroughly discussed by business studies [13, 14, 15, 16, 17]. The general translation of these approaches, which predominantly originate from the field of production management, is compromised by the distinguishing characteristics of services, first among them being the integration of external factors [14, 15, 16]. Contrary to the production of material goods, the service productivity has only been studied to a rather small extent so far. An implementation into methods and tools, which are adoptable closely to business, can rarely be observed up to now. Only a few basic approaches regarding measurement, evaluation, and configuration of service productivity are known from service research and service literature [14, 15, 16, 17, 21, 22]. Concerning this matter, the investigated state of the art comprehends the relevant literature for quality and production management in services as well as for service controlling and management in general [18, 19, 20]. However, the approaches found hardly live up to the task of the intended project and, thus, to business practice. Only partial aspects of service specific characteristics are dealt with, while integrated customer solutions are widely disregarded

Service production comprises two phases: the creation of service potential and the process of service production. Hence, it is necessary to distinguish productivity of service potential from productivity of production and to measure the corresponding profitability. With regards to productivity of services, various particularities arise from the specific characteristics of services. Through integration of the external factor, the customer takes a significant influence on the profitability of the production process. This further allows the evaluation of productivity from both the provider's and the consumer's point of view. Specific indicators of productivity, like produced quantities or perceived quality of services, are different standards for evaluation of service providers and consumers. To this effect, realized or rather realizable profits and the costs involved regarding productivity measurement, evaluation and design are of imminent importance from the economic perspective. From the consumer's point of view, the same applies to partial processes of provided services. Type and extent of customer integration and the use of technology - as an additional

parameter for customer participation - are essential cornerstones for the design of productivity.

Concerning this matter, the service research and literature states a concrete need for research in the field of design- and control measures for the improvement of service productivity [15, 21]. However, the existing approaches are insufficient when it comes down to essential points of interest. Corsten [14], for instance, argues in favor for an approach for service productivity management with three elements: process organizational measures, external factors and use of technical utilities. Yet, these elements do not comply with the initial described real needs of the here mentioned companies. From the perspective of the solution provider, the sole regulation of internal processes and interfaces is thus insufficient for a continuous improvement of productivity. Alternating the angle of view from operating figures of product related business like sales volume, market share or marginal return towards describing characteristics of service systems resembles a challenge for the companies. Particularly the transfer to new operating figures and instruments for regulation comes with great risks. Through allocation of service potentials as well as through participation in the service provision process, the consumer has a substantial influence on productivity. Correspondingly, in order to ensure a continuous improvement in productivity, an integration of the external factors of the customer has to follow [15, 22]. Especially in the field of multilevel service systems, where physical products, technologies and services collaborate constantly, the purposeful use of technology is further endowed with a massive potential for productivity. On the one hand, these are factual-technical utilities, which are supposed to assist the interaction between customer and solution provider [14, 23, 24]. On the other hand, these technologies constitute the basis for the provided solution.

#### 3.2 Technology Management

Technology management as a part of the company's management includes various tasks. The following paragraph gives an overview of the most relevant fields of activity.

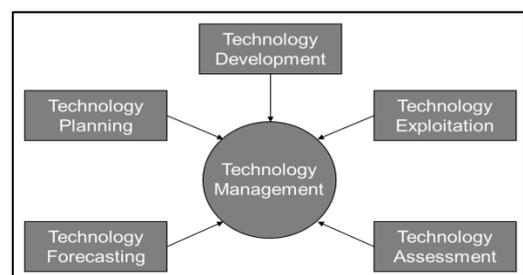


Figure 1 - Selected fields of activity in technology management (own illustration, imitation of Schuh/Klappert)

The first field of activity is the technology forecasting. Here, technological potentials need to be analyzed and prognosticated to build a transparent information basis and to identify relevant developments at an early stage [12].

Technology planning is the second essential field of activity. Its goal is to implement the internal technology strategy. Thereby, a suitable strategy needs to be consistent with the strategic goals of the company as a whole. The point in time a technology should be introduced to the market also resembles a crucial success factor [12].

Within technology development, the choice of the technology's source is a huge challenge. Companies are often confronted with the "make-or-buy"-decision. Internal sources of development grant the companies the advantage of having exclusive rights to emerging knowledge and skills. The great freedom in the possible fields of application of the new technology is mostly associated with the prestige advantage of the technology leader. It needs to be noted that the internal technology development is always linked to a huge risk for the companies. This can be greatly reduced by involving suitable development partners. However, the risks that might arise from the dependence on the external technology supplier need to be taken into account. There is no catch-all solution for this problem, since the issue of the technology source depends on too many factors that need to be considered case specifically [12].

It is also of high importance that companies are flexible and dynamic concerning the technology exploitation. The capacity to efficiently adopt technologies and to quickly drop them in case of a wrong decision is essential for the competitive ability. Another important factor concerning technology exploitation is a working technology transfer not only within, but also outside the company. This way, the technology transfer can provide benefits by forming standards [12].

Within technology management, the necessity to evaluate technologies is important in almost all the fields of activity. Therefore, it is essential to have well suited valuation methods which assure the quality of decisions. To analyze the competition against the background of technological issues is another possibility of classifying the own company's position regarding these issues in terms of benchmarking [12].

#### **4 RESEARCH QUESTION AND METHODOLOGY**

Based on the research's background and the outlined challenges, the following research question will be answered in this paper:

"What distinguishes the use of technology in services and by which potentials and barriers is it affected?"

To determine the status quo of technology management in service companies a cluster analysis concerning the company's innovative strength was performed within the first part of the study. A cluster analysis is a heuristic procedure to classify objects. According to their characteristics, similar objects are divided into clusters. Within themselves these clusters should be as homogeneous as possible while obviously differing from other clusters. Hereby, the definition of the similarity of the objects is essential for the result of the analysis. In the study at hand two clusters were identified: champions and followers [25]. In the second part of the study companies were asked about the current and the future significance of different technologies. Potentials and barriers were identified. In addition, the potentials and barriers were opposed to the technologies. Afterwards, their correlations were identified using a matrix analysis [26].

### **5 RESULTS**

#### **5.1 Participants of the Study**

The results presented in this paper were gathered throughout the service study "facts and trends in service in 2011" [11], which was executed as an online survey from July to August 2011. The survey involved a total of 190 companies. 84% of the participants hold senior positions in management and service management or are active as associates. Thus, they possess a sufficient amount of knowledge to assess the current situation, but also to estimate the future development within the service area.

#### **5.2 Success Factor**

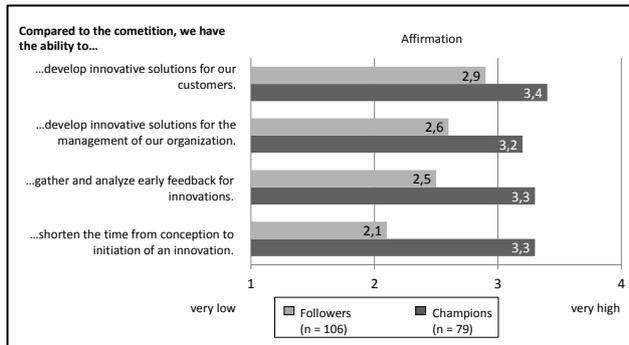
The constitution of a successful technology management can only be indicated, if it is clarified with which factors successful companies can be explained. Against this background, a criterion for the measurement of success was defined. The skill of a company to use new technologies, to develop new services based on these technologies, and to successfully establish these services crucially depends on the innovative ability of the company. For this reason, "innovative ability" has proven to be the most suitable factor for this paper's analysis regarding the differentiated evaluation of success [27].

To determine this factor, a factor analysis was conducted which serves the purpose of highlighting individual performance-related abilities that can be combined into one superordinate factor.

The strongest influence on the factor "innovative ability" has the ability to gather and analyze early feedback for innovations. This points out the importance of the feedback loop for the innovation process. These results allow the innovative ability to be extracted as a significant success factor.

### 5.3 Cluster Analysis

The cluster analysis enabled the evaluation of the participants according to the success factor. Figure 2 shows the differences between champions and followers in terms of their innovative abilities.

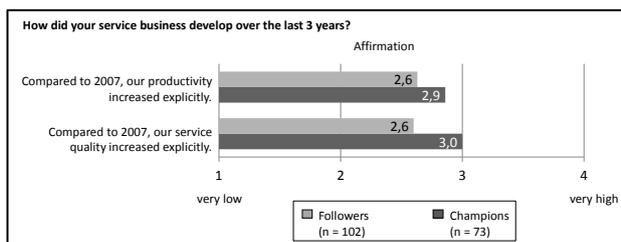


**Figure 2 - Characteristics of the success factor in terms of innovative ability**

The graph illustrates the results, which show that there are major differences between champions and followers in all four characteristics of the success factor. Thus, in terms of innovative ability, there are significant differences between the two groups of champions and followers. The champions especially differ from the followers in the ability to shorten development times.

Based on the total number, the composition of the two groups is as follows: A total of 79 companies belong to the group of champions, 106 companies to the group of followers.

The analysis of the data demonstrates that innovative companies manage to significantly increase their productivity while simultaneously improving the quality of service.



**Figure 3 - Productivity and quality development in services**

### 5.4 Technology management in the service

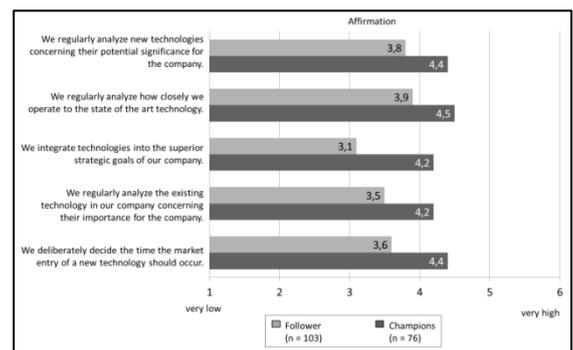
As previously described, decisions about the use of a technology have far-reaching consequences for the development of a company. At this point, technology management gets important as a discipline for the company that forms a suitable basis for the decision making. It further empowers them to secure and strengthen their market positions in the long term. The focus in services is thereby the selective use of technology in regards of service provision.

The analysis shows that especially in technology management, champions and followers significantly differ from one another at all issues. For this reason there is a differentiated consideration of champions and followers in technology management. The champions basically show a statistically significantly higher approval than the followers regarding all technology management issues. Thus, it can be generally noted that the innovative companies are using all the mentioned measures and methods of technology management more intensively than the less innovative companies.

For all further figures the following scale (1-6) is used for the x-axis:

- 1 "very little approval"
- 2 "little approval"
- 3 "rather little approval"
- 4 "rather high approval"
- 5 "high approval"
- 6 "very high approval"

A first overview of specific aspects in selected fields of action regarding technology management is shown in the following figure.



**Figure 4 - Technology management in services I**

In the first field of action (the technology forecasting), the champions are characterized mainly by the fact that they regularly examine how closely they act to the current state of the art (mean = 4.5). This also confirms their statement that they analyze new technology in terms of their potential importance to the company on a significantly more regular basis than the followers (mean followers = 3.8, mean champions = 4.4). The champions have implemented a technology radar and are regularly scanning various technological fields for new developments relevant to their company.

In technology planning, the champions recognize relevance of the point in time when to enter the market with a technology much better than the followers (mean followers = 3.6, mean champions = 4.4).

Technology development in a company is to be considered case-specifically. In this field, the champions are once again well set up and distinguish themselves from the followers. They

state that they consciously and individually decide for every new technology, whether it is related to be obtained internally or externally (mean = 4.5).

The champions show much more flexibility in the field of action "technology utilization". This is especially evident in the ability of integrating technologies fast and efficiently while also being able to quickly drop these technologies in case of possible wrong decisions. Even if it is worth noting that the champions can certainly still improve in the area of external technology transfer, the followers have significant backlog demand here.

The champions also prove to be much stronger in technology assessment: they are better in finding and implementing appropriate methods of assessment (mean followers = 3.3, and mean champions = 4.2).

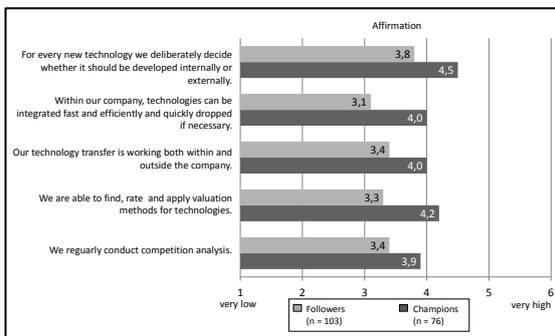


Figure 5 - Technology management in services II

### 5.5 Potentials and Barriers of Technology Deployment

In the further course of this paper, potentials that companies expect from technology deployment but also barriers that stand in the company's way of possible technology deployment will be analyzed. In a first step, different potentials and barriers will be evaluated in order to show their general relevance. These potentials and barriers will subsequently be evaluated in correspondence to the particular technologies.

#### 1) Potentials

First it should be noted that almost all of the mentioned potentials for the use of technology were rated high. Figure 6 gives an overview about all the assessments.

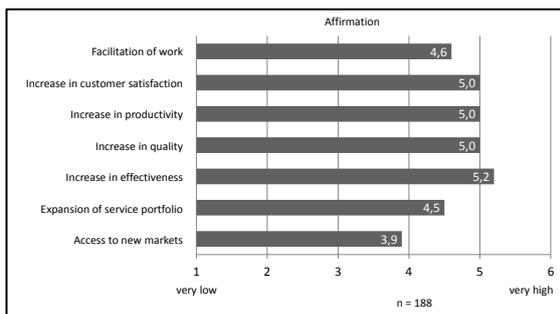


Figure 6 - Potentials of the use of technologies

The participating companies see the biggest potential for the use of technology in the increasing effectiveness with the goal to ensure the own competitiveness within the market. Especially the issue of ensuring and improving the quality of the service provided is very important.

Likewise, the possibility to increase the customer's satisfaction by using technologies is a relevant fact for companies. The high meaning of customer loyalty has already been proven as substantial and therefore priority of action.

A facilitation of the service provision and the expansion of the possible service portfolio are also potentials that can be achieved by using technologies. They rate the possibility of gaining access to new markets a little less high than the previous point (mean = 3.9).

#### 2) Barriers

There are often various reasons that count against the use of a special technology. Barriers that can obstruct the use of technology will be explained in the following paragraph.

At first figure 7 shows how possible factors in general, related to their negative influence on the use of technology, are evaluated. Later on, these factors will also be analyzed on a technology basis.

Even though the negative influence of the mentioned factors on the use of technology is not estimated as strong, there are clear tendencies which factors can be classified as barriers and thus counter a use of technology. According to the companies, the main problem of the use of technology is the high financial investment (mean = 4.2). The integration in existing operations, processes and the infrastructure are also seen as a barrier (mean = 4.1). This integration can be very complex and time-consuming, especially because the complexity cannot be predicted in advance.

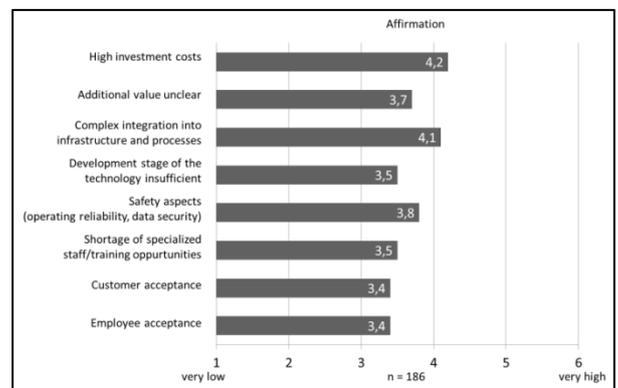


Figure 7 - Barriers in the use of technologies

It seems that one essential barrier is that the companies cannot estimate the concrete additional value of a certain technology. This barrier can be reduced by stronger highlighting the performance possibilities and limits of the technologies.

Especially nowadays safety aspects play an important role for the companies, particularly for their customers. Especially new technologies can lack safety standards, which is often problematic and can obstruct the use of new technologies. Problems regarding the acceptance of new technologies among employees or customers seem to be less important.

To conclude, there generally is a positive view regarding the use of technology in services. The results show that even if there still is an essential amount of backlog demand concerning technology management (not only in the group of followers); the main challenges were identified by the companies. It also has to be positively highlighted that companies rate the opportunities and potentials, which come with increased use of technology, significantly higher and are not discouraged by possible barriers. However, the results also show the areas where, according to the companies, technology developers and providers need to improve in order to guarantee a smooth use of technology and to enable the exploitation of the various potentials.

## 6 DISCUSSION

Due to the increasing competition there are new challenges for the companies: performances always need to be more efficient and new performances need to be developed and offered. As a consequence, the innovative ability is considered a success factor and becomes more and more important for companies in the service sector – also with regard to the strategic alignment. The results of the research verify the views of the companies: innovative service providers were able to significantly increase their productivity as well as their service quality within the last three years.

Generally, the results show that the champions overall possess a considerable stronger technology management. This is essential for the successful implementation of new technologies. The separate fields of action of technology management are technology forecasting, technology planning, technology development, technology exploitation and technology assessment, which are far better implemented by the Champions. Thus, for instance, they make specific use of technology radars in order to recognize demands at an early stage; regular analysis regarding the significance of new technologies sustains their innovative leadership.

## 7 CONCLUSION

The results of this paper and further analysis in form of development strategies as well as a road map of future research and innovation fields for the use of technology in services contribute to the discussion of further development of the research area “service science”. They are especially available to the evolution of the research area “services”. This will be achieved by the integration of relevant

stakeholders and the distribution of publications which will particularly be created for this purpose.

## 8 ACKNOWLEDGMENT

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## 10 BIOGRAPHY



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