Flexibility of Resources in Global After-Sales Service Networks in the Context of Service Individualization

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ABSTRACT

Industrial after-sales services are an important business for traditional manufacturing companies. The design and the provision of services can be approached through a three layer service system model.

Customers of service providers are more and more willing to externalize operations, such as maintenance of a machine and at the same time become more demanding. Service providers themselves are urged to offer service variants in order to fulfill specific customer requirements and thus remain economically successful. The service system model allows to approach this business need.

The present paper highlights the opportunities and limitations service providing companies face, when striving for efficient service variants through exploiting the flexibility of their resources. After introducing the economic relevance of the topic and the service system model, possible generic attributes specifying service variants are delineated. The outcome of this paper shows a qualitative analysis of the flexibility of the service system resources that allow the offering of service variants.

Keywords: after-sales service networks, service system, service variants, modularization of services, resource flexibility, service science

INTRODUCTION

Economic pressure on manufacturing companies gets more and more intense in their traditional market with tangible products. New competitors from low-cost countries such as some parts of Asia or Eastern Europe succeed in offering similar products at much lower prices. Product related services offer a way out of the competitive pressure. They allow offering additional value to the customer over the entire life-cycle of the tangible good. The perceived value added for customers is high, resulting in higher margins on services on the one hand side and high customer loyalty on the other [1]. Thus traditional manufacturing companies are highly interested in becoming more and more service providers for their customers.

The offering of a service provider can be seen as a service system. The elements of the service system are entities of the service provider and his customer, such as used resources. The elements of the service provider and his customer interact within processes, resulting in an added value. Some of the elements can be controlled precisely while others feature high variability. However, customer and service provider strive for defining a service result precisely with low variability. Hence, after-sales services can be seen as a service system.

The practical focus of this paper lies on service providing companies traditionally manufacturing industrial equipment, such as machines and plants. These companies usually manufacture cost-intensive high-tech equipment. In order to reach economies of scale and to be less dependent on one single industry, the companies aim at selling their product globally and to different industries in need of the technology they provide. Thus they have to deal with customer companies from different countries, different sizes and active in different markets. As a consequence the customers' specific requirements differ during the after-sales phase. While some customers themselves work under extreme cost pressure as they are selling their products to a highly price-sensitive industry, others may have a stronger focus on high precision and quality of their production.

Accordingly, the requirements on the after-sales service offered by the service provider differ. For maximizing the service turnover, service providers need to offer different variants of service in terms of cost, lead times, availabilities and other performance metrics meeting specific customer needs.

However, offering variants increase complexity within the service system of the company, leading to higher cost and thus affecting the profit. On the one hand side, offering a broad variety of services increases turnover while on the other hand side the additional efforts may decrease the profit. This leads to the need for service providers to find ways to offer service variants efficiently.

PROBLEM STATEMENT

Meffert and Bruhn describe services through a three level model [2]. The top level is the service result, i.e. the result of a service operation visible to the customer. It can be specified through performance metrics.

The second level offers a perspective on the processes enabling the service result. The processes comprehend a description of the interaction between the elements in the service system. Performing these processes is necessary for the service provider in order to deliver the service result. However, the required processes may not be visible or known completely to the customer or the service provider. As a consequence, the service provider may have different options to design the processes to achieve a certain service result.

The third level of the model addresses the required resources for performing the processes leading to the final result. Barney [3] identifies three categories of resources being used for performing services: First, human resources, e.g. the personnel or workforce bring in their labor. Second, physical resources, e.g. equipment, facilities, tools or hardware are used by the workforce within the service processes. Third, information, e.g. data, checklists or technical documentations, are used by the workforce within the processes in order to use physical resources correctly or to bring in their labor in the right way.

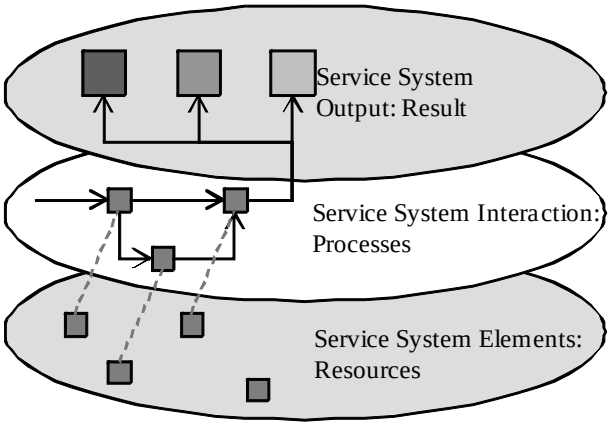

Figure 1: Service System

The three level model shows the interrelation that offering a special service (result) requires appropriate processes and the determination of necessary resources. This interrelation is crucial to designing new service products. Approaches, methods and tools supporting this service development process are described in literature in the field of service engineering [4] and recently in service science [5]. In the following, the process level and the resource level will be considered as a service system with an outcome on the result level.

The new perspective of looking at this subject arises from several research projects carried out with industrial participation. People from service marketing highlight the fact, that the service products show varying economical performance in different markets and different industries. The objective and the approach of exploiting the economical potential of this situation is evident to many companies: Service diversification. They adapt existing service products to specific customer requirements in other countries or industries, in order to become economically more successful. The new portfolio of offered services would comprise as many variants as needed, derived from the original service products.

The application of the model of Meffert and Bruhn shows, every variant introduced will have impact either on service processes, or on service resources, or both. Consequently every variant will finally result in higher or lower cost compared to the standard service product. Knowing this cost is a necessary prerequisite for the decision, if a new service variant shall be introduced. This is the economical relevance of the question addressed by the research.

Three different design options for realizing a service variant have been identified. First, the service process can be altered. Second, additional resources can be acquired and employed. Third, the flexibility of the existing resources can be exploited. Even though different measures can be combined at the same time, it is helpful to analyze all measures one by one, to which extent it can contribute to the realization of service variants.

This paper puts the focus on the measures of the category “using resources in a more flexible way”. The objective is to contribute to answering the question:

How and to which extent can the flexibility of resources be used to implement service variants?

The paper contributes to solving the struggle manufacturing companies face, when striving to offer individualized product-related after-sales services (B2B). The challenges lie in the configuration of resources in the service network in order to be able offer service products with different performance levels. The contribution of the paper consists in presenting the different types of resources required in after-sales service operations and discussing their characteristics in terms of their flexibility for being used in individualized service products.

When offering service variants and designing related processes, the efficiency of service operations in terms of the ability to reuse resources is crucial matter. The resources used by the individualized processes need to cover different levels of performance at the same time. This flexibility needs to be explored in order to design after-sales resources efficiently.

In common sense flexibility is the ability to adapt. Schönsleben [6] distinguishes more in detail *qualitative*

flexibility from *quantitative flexibility*. Qualitative flexibility determines, if resources can be used for different or for very specific tasks. Schönsleben states that employee qualification and the scope of possible use of production infrastructure both contribute to qualitative flexibility. Quantitative flexibility encompasses the possibility to use resources flexibly in respect to time. Schönsleben notes that human resources seem to have a higher quantitative flexibility.

For the research within this paper, qualitative and quantitative will be covered conjointly. Depending on the operational target, one of the two flexibility types will be more prominent and will be addressed appropriately.

METHODOLOGY

The paper gives insight into a research project carried out with several industrial companies active in investment goods industry. The commercial goal of the project is to allow the participating companies to establish a variant rich service portfolio. Different workpackages address the practical needs of the companies, from the identification of useful service variants to the estimation of cost and risk for introducing one.

State-of-the-art methods are used and adapted where necessary to ensure a reproducible outcome. The goal of the research performed is to develop a method based approach to allow companies to design and evaluate service variants within their service system.

There are two main objectives the methods and the approach must fulfill. First, the emphasis lies on achieving reproducible outcomes in order to be scientifically correct results. Second, and evenly important, the findings must be applicable in real life conditions, for a variety of companies. Hence our target is to design the approach and the methods with a fair balance between high precision results and a reasonable effort for application.

The collaboration between theory and practice happens in action research cycles. Ideas and approaches are developed based on literature research after having a workshop with industrial partners. Through presentation of the findings, industrial partners are confronted with the ideas, and validate the correctness and applicability.

Following the collaboration with other companies the relevance beyond the special need of one industrial project partner was identified. Thus, the characteristics and requirements of action research [7], [8], [9] were considered.

The research process was aligned along the following steps: Identification of generic service result variants and the appraisal of flexibility of the service system resource categories, as identified by Barney [3].

Within the appraisal step, each category of service resources is analyzed in regard to its inherent flexibility. The analysis comprises two aspects: First, possible actions, or measures to exploit the flexibility of a resource are highlighted, to give a practical context. This can directly be used by practitioners in after-sales service management in order to identify possible ways making use of service resources flexibility.

Second, the degree of flexibility is evaluated by the three factors: the *effort to exploit flexibility*, the *limitation of flexibility* and possible *consequences* if overstraining the flexibility inherent to the respective resource category. The effort to exploit resources flexibility aims at revealing ease of making use of the respective resource flexibility. The limitation shall address important factors inhibiting a more flexible use of resources. The consequences are addressed in order to clarify, why the limitation exists. This can either be a strongly negative effect further measures to use flexibility would have. Alternatively, exceeding the limitation would result in using a different measure, such as a process change or an investment in additional resources which is not within the scope of this paper. All factors are appraised in a qualitative way, yet allowing valuable findings.

RESULTS

Three generic target areas that specify an operational result were identified and adapted elaborated in regards to

Variable Attributes of a Service Result (Performance indicators)		
Time	**Content**	**Price**
• Reaction time (e.g. interval between provider notification and technician arrival) • Service execution time (e.g. mean time to Repair) • Availability time (e.g. opening hours for a hotline)	• Horizontal range of service (e.g. specified objects on which a certain service operation is performed) • Vertical range of service (e.g. specified operations that are performed on a certain object) • Service quality (e.g. first time right)	• Level of price (e.g. amount providers invoice) • Mode of charge (e.g. payment terms)

Table 1: Variable Attributes of Service System Outcome

the research context. Each target area comprehends several sub-targets that can be linked to operational performance indicators.

First, there is the target area *time*. Time is crucial for industrial after-sales services since downtimes of a machine are costly. The faster a problem on a machine is being solved, the fewer cost the problem causes. The *reaction time* is defined as the interval of time between application of a stimulus, e.g. a customer call and detection of first response. The *service execution time* is defined as the time a service operation requires to fulfill a customer need. The attribute reaction time must be differentiated from service execution time, since its requirements to necessary service resources are very different. Additionally there is the *availability time* that indicates to which timely extents a service system is operated.

Second, the *content* of a service describes the activities carried out. The *horizontal range* indicates on which and how many objects, e.g. machines, a certain service operation is performed. The *vertical range* specifies which service operations are carried out in detail on one service object. The *quality* of a service result indicates to which extent an inferiority or superiority of the service result will be accepted by the customer.

Service System Resource	Service Result Attribute	Action / Measure	Degree of Flexibility of Service System Ressource	
			Required Effort	Limitations / Consequences
Human Resources (e.g. service technician, call center employee)	Reaction time	Optimize personnel location	Medium / High	Regionally limited / potential loss of employees
	Service execution time	Train personnel	Medium	Reachable execution time limited / process necessities
	Availability time	Adapt working hours / shift work	Medium / High	Working time regulations / discontent of personnel
	Horizontal range	Adapt work instructions	Low	Employee qualification / additional training effort
	Vertical range	Train personnel	Medium / High	Effort excessive / loss of operations profitability
	Service quality	Train personnel	Medium / High	Effort excessive / loss of operations profitability
Physical Resources (e.g. spare parts, measurement tools, equipment, material)	Reaction time	Optimize resource location	Medium / High	Cost for dispersal / loss of operations profitability
	Service execution time	--	--	Investment in additional resources/ advanced resources needed
	Availability time			
	Horizontal range	Adapt physical resources	Low	Technical specifications of physical resources / investment in new, additional resources may be needed
	Vertical range	--	--	Investment in additional/advanced resources needed
	Service quality			
Information (e.g. data, checklists, service documentation)	Reaction time	Optimize indexing / filing	Medium	Information complexity, technological insufficiency / investment in technology needed
	Service execution time	Optimize presentation / embodiment	Low	Information complexity, technological insufficiency/ technological investment needed
	Availability time	Adapt access to information	Medium / High	Technological insufficiency / investment in IT may be needed
	Horizontal range	Adapt work instructions	Low	Similarity of task / additional information may be required
	Vertical range	Adapt work instructions	Medium / High	Similarity of task / additional information may be required
	Service quality	Optimize presentation / embodiment	Low	Information complexity, technological insufficiency / investment in technology needed

Table 2: Flexibility of service system resources

Third, the target area of *price* is important for the service provider and his customer. The *level of price* which is the amount invoiced by the service provider will affect the buying decision of the customer. The *mode of charge* indicates that e.g. payment terms may be varied to make a service offering more attractive.

The attributes of the target area price will not be considered in the following steps due to the dependence of the other attributes and an unspecific relation to the use of service resources. The level of price can be chosen as high as wanted, independently of the other attributes or the service system settings. Downwards it is limited by the cost which is dependent on the service system settings. The mode of charge can be adjusted without any interrelation to the service system settings. Hence the ways resources are used has no direct impact on the price, but influence it indirectly through the other considered variables.

The qualitative estimation of the effort and the limitations of flexibility highlight that different resource categories allow a specific service system variation more easily than others.

Human resources reveal easy to exploit flexibility in respect to extending the *horizontal range* of a service. For example can service technicians easily be instructed to perform the same operation on a slightly different machine, such as changing a printed circuit board. All other target areas are more difficult to reach through the flexibility inherent to human resources. An explanation is that human resource is most likely employed with high capacity utilization due to cost issues so that flexibility will already be exploited extensively in most cases. Additionally, laws and working time regulations limit the options companies have when striving for extending the working hours. It can be summarized that most companies will hardly be able to make employees work faster, longer or more precise but will rather have to invest in additional resources or changing processes. Consequences for overstraining the resources flexibility range from cost excess through extensive trainings and resulting loss of operations profitability to growing dissatisfaction of employees with the risk of losing workforce.

Physical Resources show less flexibility than human resources or information. Again, the *horizontal range* of a service can be altered through using a physical resource in a flexible way. For instance, a measuring device can be used to measure similar values on a different machine. Yet, the flexibility of applying physical resources faster, more precisely or for a totally different purpose is very limited due to technical specifications. Exceeding the given limitations would result in the consequence of investments into additional resources, which is excluded from the scope of this research.

Information shows the highest degree of flexibility compared to the other two resource categories. Next to the horizontal range of services, *service execution time* as well as *service quality* can be influenced easily. The information embodiment, the way information is presented to its user is seen as a powerful measure for enabling a faster and more correct way of performing service operations. Different structures of a checklist, work instructions or reports are practical examples of this measure. A limitation is the complexity of the required information itself. As soon as the information relevant for a service operation is highly complex, finding another way of embodiment will require a change in technology, such as switching from paper to electronically presented information which requires additional hardware. The necessary investment is a possible consequence of excessing the given flexibility of information.

CONCLUSION AND OUTLOOK

The research on the flexibility of resources in after-sales services networks highlights the design opportunities and limitations of individualized service products.

It could be shown how the offering of service products with variants can be specified by three target areas with sub-targets linked to operational performance indicators. Additionally, three generic resource categories were appraised in respect to their inherent flexibility that can contribute to the realization of service variants. The resource categories information and human resources show high potential for realizing service variants, while physical resources appear very limited in their flexibility.

The research presented in this paper is a systemic view at a practical problem. Service operations are delineated as a system consisting of elements (resources) interacting in a process that leads to an outcome (result). One way of influencing this system is to modify the included elements as far as they are flexible be use more or less intensively or extensively. The opportunities and limitations are highlighted systematically, encouraging interdisciplinary research on service systems.

The outcome of the paper can be used by practitioners to facilitate the process of designing new service products as variants of existing ones. The specifying targets offer a basis for identifying possible service variants. The measure of using resource flexibility to realize a service variant is substantiated with practical examples. Additionally, the limitations of measures to exploit flexibility are indicated as well as consequences overstraining flexibility may have.

In the future the other possible design option for realizing service variants, such as, process adaptations and the investment in additional resources are to be analyzed in a similar way. Then the combination of different design options and the resulting impact on cost is to be

characterized more in detail. The future work aims at contributing to service science as a young, interdisciplinary approach to services as services systems.

REFERENCES

[1] P. Koudal, **The Service Revolution in Global manufacturing Industries**, Deloitte Research, 2006.

[2] H. Meffert, M. Bruhn, **Dienstleistungs-Marketing**, Gabler, Wiesbaden, 1995.

[3] J. Barney, **Firm Resources and Sustained Competitive Advantage**, Journal of Management, 17, 1991, pp. 99–120.

[4] H-J Bullinger, **Service Engineering – Entwicklung und Gestaltung innovativer Dienstleistungen**, Springer, Berlin, Heidelberg, 2005.

[5] J. Spohrer, P. Maglio, J. Bailey, D. Gruhl, **Steps Toward a Science of Service Systems**, Computer, vol. 40, no. 1, 2007, pp. 71-77.

[6] P. Schoensleben, **Integrated Logistics Management**, Taylor & Francis, Boca Raton, 2007.

[7] G.I. Susman, R.D. Evered, **An Assessment of the Scientific Merits of Action Research**. Administrative Science Quarterly, Vol. 23, 1978, pp. 582-603.

[8] C. Eden, C. Huxham, **Action Research for Management Research**. British Journal of Management, Vol. 7, Issue 1, 1996, pp.75-86.

[9] R. Baskerville, **Distinguishing Action Research from Participative Case Studies**. Journal of Systems and Information Technology Vol. 1, Issue 1, 1997, pp.25-45.