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# DEVELOPMENT A SERVICE ENGINEERING CONCEPT FOR SMES

**Summary:** Many SMEs still face a problematic fact that their corporate structures and processes are not designed for efficient development and market positioning and there is a lack of appropriate methods and tools. SMEs are often inefficiently targeted to the internal or external demands for services. The goal of the research regarding contents and methodology was to investigate the practice of strategic planning and the implementation and application of service engineering in young SMEs on the one hand, and on the other hand specifically for young SMEs, whose performance and the probability of success can be increased by its application. These two goals have been achieved.

**Keywords:** service engineering, SMEs.

## 1. Introduction

The increased complexity and dynamics of the business environment and the problems of a young organization are treated extensively in the literature [Bleicher 2002, p. 34; Malik 1996, p. 86; Ulrich, Probst 1990, p. 23ff; Gomez 1999, p. 65]. This complexity is the core of the leadership role in a company [Malik 1996, p. 184]. Stüttgen [1999, p. 8] states in this regard that: "A satisfactory answer to the question, according to which patterns complex social systems are to be designed to meet the proliferating environmental complexity facing an adequate intrinsic complexity of the company can be, in this context, a critical success factor for management". How can young SMEs solve strategic problems with service engineering in their companies?

## 2. The service engineering discipline

The service engineering discipline is concerned with the selection and provision of appropriate methods to develop new services using appropriate process models and tools. While in science and in practice, the issue of service development has been discussed for some time, there is still a strong need for appropriate methods, practices

and further exploration of the systematic, method-based service development [Fähnrich et al. 1999, p. 82].

Empirical evidence suggests that there exists a positive correlation between the degree of formalization of the development process and the success of companies. This allowed Fähnrich et al. [1999, p. 74] to show that successful companies regularly develop new services and have a more formalized development process than less successful companies. As many as 73% of the companies surveyed indicated a business need for service engineering and 51% would like to see organizational concepts.

In the field of service development Luczak et al. [2003, p. 7] assume that 80% of future production costs are determined in the early stages of development. Other authors speak of a "significant proportion" of the costs incurred in the development [Eversheim et al. 2003, p. 418]. Thus, besides including the exact scope of a new service, the complexity of products is determined and the kind of resources needed is decided on. "The earlier an error is detected, the more time benefits take to materialize, but the greater the benefit is in the end" [Gundlach 2004, p. 17].

The long-term security is regarded as one of the most important objectives for SMEs. Another goal is not surface growth, but a moderate and healthy growth. "Entrepreneurs found a way to manage growth rather than allow the growth to manage them" [Hisrich et al. 2002, p. 501]. Stability can be guaranteed at a moderate growth policy. Investments must be carefully considered and planned for the long term.

Sustainability is a perspective showing the management the way to a strategic business plan. "For sustainability as a strategic business plan considers all those critical factors that are relevant to the future profitability of a company and that are therefore of vital importance to ethically and ecologically motivated and even conventional investors when making their decision" [Hardtke, Prehn 2004, p. 75]. Hardtke, Prehn [2004] note a relationship between sustainability management and competitive advantages. This is referred to by the authors as visionary leadership and is the result of a correlation of high performance respectively high commitment and high competitive advantage.

Service engineering is concerned with the "development and design of service products using appropriate process models, methods and tools" [Bullinger, Schreiner 2003, p. 70].

Process models are supposed to illustrate and structure, "what" is to be done, while methods are to show "how" something must be done. The tools are designed to support and optimize the application of methods and should help to make the development process more efficient and to avoid errors. This definition is similar to definitions of product development, such as the one stated by the Association of German Engineers VDI offering in its 2221 policy recommendations for the development and design in the production area.

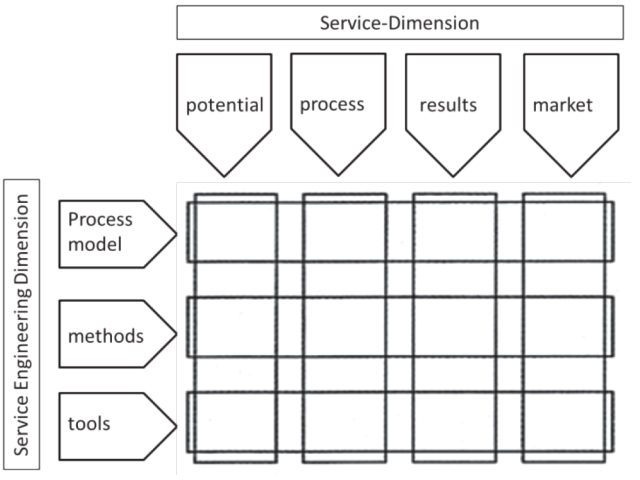


**Figure 1.** Service engineering framework

Source: [Bullinger, Scheer 2006, p. 75].

The use of methods and tools is used to increase the effectiveness and efficiency of the development process as well as to reach the goal of producing high-quality services. Service engineering is not only interesting for the industrial environment, but is also applicable to all industries [Luczak et al. 2003, p. 7ff]. The services dimensions are divided into potential, process, profit and market dimensions. The interaction of these service dimensions with the dimensions of service engineering forms the service engineering framework.

As a comprehensive discipline, service engineering concerns the holistic design of the service process up to the customer, taking into account strategic and organizational design factors. The aim of service engineering is also to take all necessary, clearly defined steps for the development of services and to implement them together with the customer in a process of interaction. A crucial factor for service engineering is the fact that the development of services should be systematic. The background to this is that in the development of materials and equipment or software, a systematic approach has achieved tremendous progress in the quality of products [Schwengels 2003, p. 39]. This focus is very important, because in the past, in the development phase the quality did not matter and errors were only corrected in the rendering phase [Yang 2005, p. 22; Meiren, Barth 2003, p. 11]. The German Institute for Standardization [DIN, p. 18] defines quality as "the quality of a unit on its ability to satisfy stated and implied needs". According to Edvardsson, Olsson [1996, p. 140], 70 to 90% of the errors are occurring in the provision of the rendered services. Surely, it should be mentioned that the quality of service, apart from the provider, also depends on the customer and his or her integration and interactivity potential, but nevertheless the provider should definitely contribute his or her part

to the successful development of services. Implementing a service process aims at improving innovation and increasing the competitiveness of a company.

Research on service engineering usually assumes the composition of a performance from three dimensions known from the service marketing [Engelhardt et al. 1993, p. 398]: service provision, service creation process and service results.

In this respect, it should be noted that systematic method-based service engineering must consider all three dimensions, which results in product models, process models, and resource models being used, which together represent development methodology [Fähnrich, Opitz 2003, p. 95].

### 2.1. Methods

"Method" is the term for a rule-based, systematic approach when executing specific activities to achieve set targets. Three main aspects of methods are relevant in this regard [Lindemann 2005, p. 48]:

- Methods are prescriptive, i.e. understood as a requirement.
- Methods are goal-oriented, therefore focused on solving a problem.
- Methods are operational differing, for example, from a process model.

The implementation of methods in practice is often supported by tools so that the tools can be called means to operationalize the methods [Ehrlenspiel 2003, p. 15]. The action-oriented approach of the systems theory, which describes a method as a system with defined input and output quantities, is important for the understanding of the mode of action of methods [Gausemeier et al. 1996, p. 49]. Input parameters, such as information, are transformed into output parameters via the transition function that is both method- and application-specific [Gillig 2006, p. 15].

The use of methods is very common in product development in engineering science [Fähnrich et al. 1999, p. 53]. The transferability of the product development to the service sector is quite possible, since in both areas methods are being used.

To begin with, the initial conditions of methods application are explored, since the target is at the beginning of the analysis. What resources are available? In the selection of methods, required input variables (input) are determined and it is checked whether a method can provide desired results (output). With respect to permanent adaptation, resources, such as staff experience, will make a decisive contribution. Finally, tools and equipment will support the selected method to be effective (i.e. the application of the correct method for the selected question) and efficient (i.e. goal-oriented, fast and resource-efficient use of the method through specific adjustments).

Since service engineering seeks to develop services systematically, there is a question of how this process can be structured. In addition, one must consider the design dimensions of a service and view these as a system [Eversheim et al. 2003, p. 422; Luczak et al. 2003, p. 17; Jaschinski 1998, p. 51]. In the literature and in practice, different approaches can be found. The term of service engineering approaches in the field of engineering design will be used for such tasks [Bullinger, Scheer 2006; Bullinger, Meiren 2001].

Since service processes sometimes have a high degree of complexity, a standardized approach is difficult because so-called "wicked problems" [Rittel, Weber 1973; Rittel 1972] occur especially in service processes. The term "wicked problems" is used to describe a class of problems that have a particular level of complexity, i.e. they are difficult to structure and require subjectively interpreted divergent solutions. To avoid this, policies and actions are needed to accompany these processes and to support the integration of different perspectives and information, as well as the structuring of a problem. In the design of service processes, it is necessary beforehand to look at so-called constitutive characteristics of services. These are in some respects relevant to the planning process.The integration of external factors [Scheer et al. 2003; Kleinaltenkamp 2001] is characteristic of services. There are customer-specific requirements and organisational/technical conditions to be taken into account [Fließ 2004]. Combining and coordinating the above factors makes these processes difficult to plan. Furthermore, qualified employees [Bullinger, Meiren 2001] are necessary. This means that in the design of service processes not only idealized business processes [Scheer et al. 2003; Klein 2003], but also work processes have to be considered as determinants for successful implementation [Kunau et al. 2005]. Additional conditions include limitations of available resources, such as time, money and infrastructure [Maleri 2001]. Therefore, it is appropriate to use a semi-structured model when designing service processes [Herrmann et al. 2000], since by doing so different approaches are considered. Designing service processes different requirements, such as customer needs, country specific conditions, different sources of information and resources have to be coordinated. This complexity also entails that problems which are hard to structure and seem to be subjectively divergent must be solved. The problem is to apply not only linear and standardized methods, but to integrate the solution in a social context with the help of the people involved in order to support the complex coordination processes.

To sum up, a method can be understood to be a "detailed and systematic action rule that determines how a given goal can be reached according to certain principles" [Stickel et al. 1997]. In business and engineering, there are numerous methods that can be used for service engineering. Different methods can be used, such as feasibility studies, cost-benefit analysis, competitive analysis, SWOT analysis and creative techniques. Methods used in engineering science, such as process modelling, prototyping methods, object-oriented modelling, FMEA or QFD, are used to a lesser degree.

When compiling the above methods in an empirical study, Fähnrich et al. [1999] come to a conclusion that the number of methods that can be used for the development of services can be described as small. A major reason is the intangibility of services, as the application of methods and tools appears to be much more abstract when dealing with an intangible development object than with a physical good. Therefore, mainly economic methods are being used.

The methods must be selected according to a given situation; they are dependent on the type of company and the complexity of the services to be developed and the experience of employees with methods used. Bullinger, Meiren [2001] recommended to focus on the range of service types.

### 2.2. Tools

Tools support specific applications of methods at the lowest detail level [Bullinger, Schreiner 2003, p. 72; Warnecke, Stammwitz 1996, p. 4]. Companies that want to use the methodological support of service development service engineering must, in order to be able to apply appropriate tools for the process steps of service engineering, adjust the organizational structure of a company to meet the needs of service engineering. In service development, tools are defined as information and communication systems that support the design of a service [Meiren, Liestmann 2002]. Tools that enable service processes can be specified, e.g. be used in business process management [Schreiner 2001]. The specifications and process models can be used in the form of instructions and visual aids, to qualify the employees involved in a process. Furthermore, even in a test phase, the analysis and simulation function of tools can be used to identify vulnerabilities such as long lead times or bottlenecks. With the help of CRM (Customer Relationship Management) systems important information is obtained about the customer. By means of using project management software, the service development process can also be supported.

At the highest level of stakeholders, different stakeholders are assigned appropriate roles forming the starting point for the rights concept and task-specific access to materials in the development of services. At the second level, the tool level, different work contexts are centralized in rooms, in which materials are processed with suitable tools in a task-specific way. The data base is the level at which the materials are stored and made available for the work in different rooms.

In practice, the following tools are mainly being used: groupware systems, project management software, office tools, software for process modeling [Bullinger, Schreiner 2003]. A prototype of a comprehensive support tool was developed in the research project CASET-service Computer Aided Engineering Tool, another one in ServCASE: Computer Aided Engineering for IT-based services [www.caset.de/ www.servcase.de].

### 2.3. Process models

Process models play an especially important role in the development of new services dividing the process of developing a service at different stages, from the initial idea to the final realization. The individual phases must be systematically run through and executed step by step. The literature provides a variety of concepts that differentiate between linear process models, iterative process models and prototyping models [Schneider, Daun 2006, p. 117].

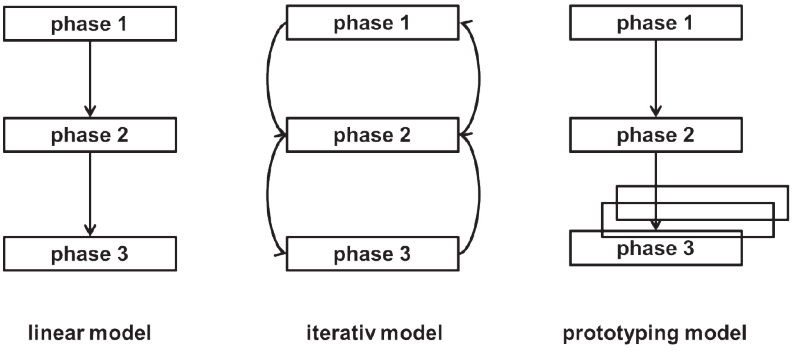


**Figure 2.** Manifestations of process models

Source: [Bullinger, Meiren 2001].

In the linear model, the development steps required to be taken when creating a service are described in a sequential order. In the iterative model, an error can be traced back to the previous phase, when it occurs to eliminate these errors and to run through the next phase again. In the prototyping model, a preliminary version is developed in advance so that the features and functions can be tested. Services can be complex and, hence, a linear method is not always productive. Therefore, room for the integration of different perspectives must be provided. Phase models are the most widespread in service engineering. This may be because in the development of services less time is invested than in the development of materials and equipment and therefore simple and efficient process models can be used [Meiren, Barth 2003, p. 16; Hofmann et al. 1998, p. 22].

According to Freitag [2004, p. 108], in Germany the majority of services is developed within three to six months. In the US and Japan the development of services takes between six and twelve months. Another possible distinction of process models is to distinguish them according to their focus:

- service planning,
- service design,
- implementation planning [Luczak et al. 2003, p. 451].

## 3. Phase models in service engineering

As part of a research project of the BMBF a software prototype has been developed to establish service engineering systematically differentiating it clearly from the model for product development. The process model is based on three steps to service development [Hohm et al. 2004]:

- service creation,
- service design,
- service management.

As shown in Figure 3, there are, in addition to the actual three main process steps (service creation, service design and service management), sub-process steps that are processed sequentially. Each of the main phases of the process is divided into the sub-processes "design" and "review" [Hohm et al. 2004]. The service creation phase is divided into idea generation and idea evaluation. The service design phase is divided into service concept and concept evaluation. The service management phase is divided into introduction and service provision as well as service assessment (evaluation of a service).

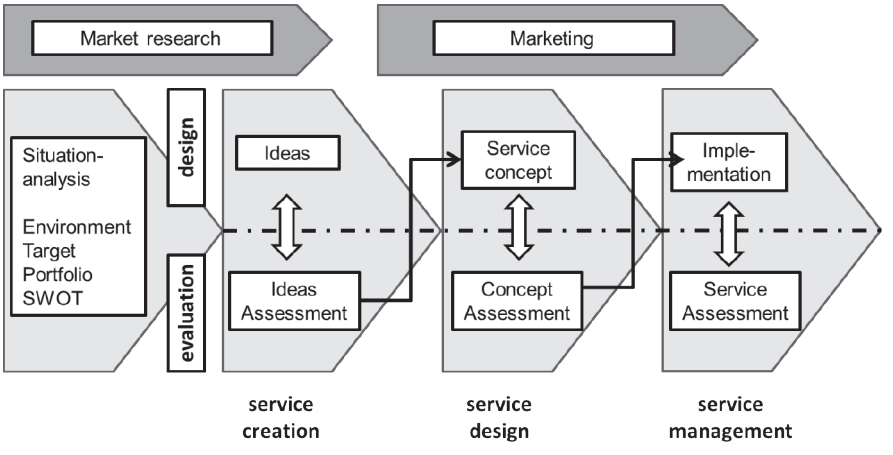


**Figure 3.** Phase model

Source: [IZT 2004].

Due to this breakdown, within a major phase of the process work packages can be repeatedly evaluated and improved. It is also suggested in the study to carry out topics marketing research and marketing concepts as cross-process measures and to design them separately. The research study conducted by the Institute for Future Studies explains [IZT 2004]: "Furthermore, it is important to give market research a fixed place as a mainstream function in exploring customer requirements, which was usually only a special aspect of service management in the previous models. Another cross-sectional task is the development of a marketing plan that affects all phases of service engineering".

The initial phase preceding the first process step (service creation) serves as an introduction to the process of service engineering. Within this start-up phase, a situation analysis is performed by using SWOT analysis, which can finally provide appropriate starting points for the generation of ideas. The initial phase is considered to be the most essential and the most critical step in successful service engineering.

What type of process models is used depends on several factors. For example, the complexity of the development object, the degree of innovation of a service

to be developed, the time available and the experience of the developers involved play a significant role. Perechuda [2010, p. 39] described a "five-phase model of knowledge creation" based on NONAKA/TAKEUCHI, which can be represented in the following phases: dissemination, concept creation, concept approval, pattern construction and knowledge harmonization.

## 4. Results of the research

For planned development of services and to ensure comparability of experience, it is helpful to use process models. By means of such process models, the following potential improvements can be developed, such as:

- introduction of a development guideline for quality assurance,
- representation of resource requirements,
- determination of cross-sectoral integration potential,
- planning of customer integration.

In addition, process models allow the testing of their effectiveness in practice contributing to theory building model development by evaluating obtained findings.

Modern management performance can be seen as a result of the process of business development. According to Nita (2010, p. 21), there must be an orientation towards new methods and a multi-dimensional performance orientation. New conceptual tools/models are also beneficial. To use a more basic model, the DIN-model serves as a basis. In the context of standardization, the task group "service and regulation" developed a DIN technical report within the project "service 2000 plus", which proposes a standard phase model to develop services. This DIN-phase model, see Figure 4 for the development of services, consists of 6 phases:

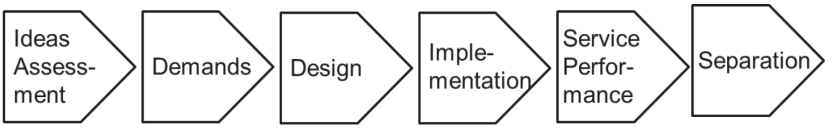


**Figure 4.** DIN-phase model for the development of services

Source: [DIN 1995].

Since it is kept very general with respect to concept and content, it should prove to be flexible enough for a variety of industries and business situations. The DIN-phase model goes well together with the Stage-Gate methodology. The Stage-Gate Model is an optimization model of development processes developed by Cooper [2002, p. 128]. Starting from the VDI guideline 2221 (methodology for the development and the design of technical systems and products), a procedure model can be developed, emphasizing the project character of service developments. These projects start with an idea and ultimately result in (service) performance that is of interest to customers.

To use the DIN-practice model effectively, it was expanded by the CASET model kit and also made more flexible. The combination of a phase model and a variable checklist modules can be chosen from according to the project (result of the CASET project), has already proved successful with financial services. It also seems to be flexible enough to be applied to different types of services. In the construction phase, it is very similar to the DIN model. The contents, however, are understandable and therefore should be also more relevant in practice. In particular, the names of the phases and the modular contents in the form of checklists offer a clear orientation as regards structure and content for service development projects.

When integrating systematically various fields of business and tasks (product development, production, marketing, sales) into the phases of the project, it becomes apparent, however, that the continuous application of the integration approach can only be achieved through a matrix structure. This is done by the inclusion of dimensional analysis, as suggested by Meiren [2001]. His matrix representation has many similarities to the modular system, but allows a more dynamic view of the dimension within the phases. For example, the market dimension is effective throughout all phases and can therefore be flexibly adapted to the content and enables the integration of market information in the entire project.

To organize the content of the phases, especially the systematic integration of the market dimension, elements of the model according to Ramaswamy [1996], see Figure 5, are used that takes into account the value orientation in the development of services.

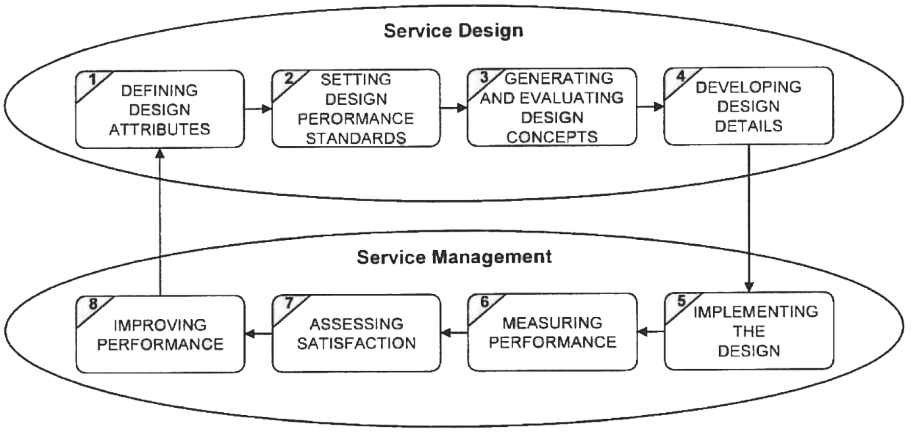


**Figure 5.** Process model

Source: [Ramaswamy 1996].

In this case, two key elements are being considered that are not used in other models sufficiently or have been neglected entirely:

The (virtual or real) separation of market power in attributes as a prerequisite for the determination of performance standards, and the cyclical nature of service development, with each cycle ending with the task of "performance enhancement", while at the same time also starting the next cycle by searching for improvements. By asking for a (cyclic) improvement of the services offered, the model supports the innovation approach of service development.

Due to the previously analysed process models, the following procedure model can be developed to handle all relevant aspects, especially for start-ups, see Figure 6. The process model formed a matrix and has a total of six phases. In each case three of them can be related to service design (definition, requirements, design) and service management (implementation, launch, control), respectively. During the various phases, tools that are relevant for SMEs are used over a period of several weeks taking into account the individual dimensions of the potential, the processes and the results of the market. Each phase must be executed before the next begins.

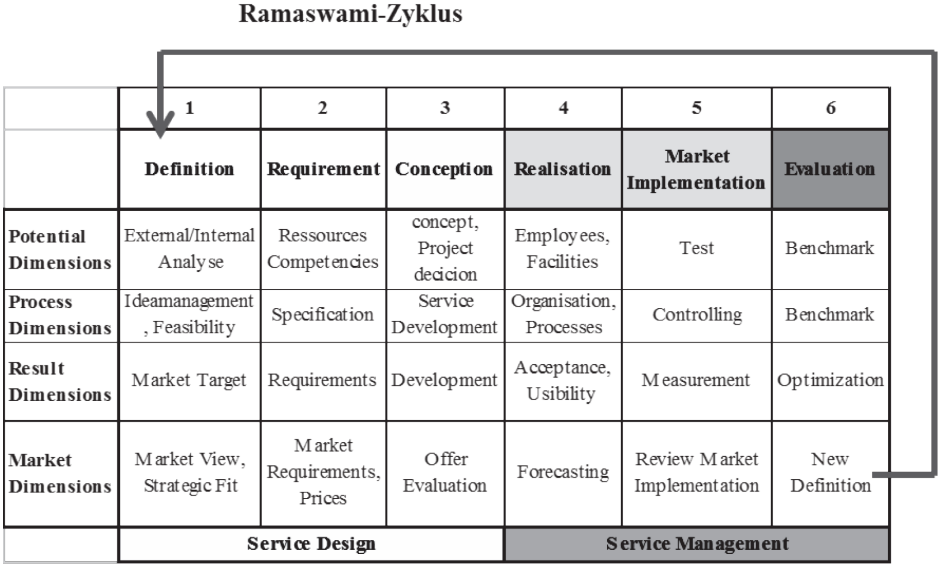


**Figure 6.** Applied process model for service development

Source: own elaboration.

The exact description of the process and the basis for planning the service engineering concept can be illustrated as follows:

## Process description and basis for planning

For the actual implementation of the process model it is necessary to define work packages within the phases, as well as to translate their planning into a real-time

model. The proposed process model will help both to clarify the content and to ensure the consideration of all factors (described by the dimensional analysis).

**Definition phase (6−8 weeks):** The results of the internal and external situation analysis define the search area for possible service offerings, which are then searched and evaluated. In this case, a feasibility check is just as necessary as the verification of compliance with the corporate goals. Thereafter, appropriate marketing objectives and derived policy options can be limited.

**Requirements analysis (4−6 weeks):** In the second phase, the market performance is described and verified in the form of a "preliminary" study in terms of the resources and expertise needed. Previously, the significant value attributes must be defined with regard to content and predetermined regarding their characteristics. Then a comparison with the anticipated market requirements and the company's strategic goals has to be made. First price proposals are derived from the requirements of a service. Data and descriptions are based initially on solid estimates.

**Service conception (8–12 weeks):** This phase corresponds to the detailed study. It begins with the project approval for the development of services. Requirements (for service design and process) and the need for resources are recorded in requirement and functional specifications. The business model is based on facts and figures, in particular, market opportunities must be analyzed and a conception of market development must be designed. This is possibly the last chance to establish contacts with external partners. The quality of the work of this phase largely determines the success of the project.

**Service realisation (6–8 weeks):** In this phase implementation begins. The more precisely the work packages and the process were planned, the easier and more accurate the implementation will be. A critical success factor in this phase is the consistent provision of necessary resources and the use of internal or external expertise. Once the processes have been implemented, they must be verified by simulation. In parallel, (based on prototypes or with lead users) the acceptance of the offer and the use processes can be submitted to an initial assessment. The planning of the launch must be concretized and the organization of acceptance tests must start.

**Market implementation of a service (8–10 weeks):** The market launch begins with a validation of customer requirements. For this purpose, an appropriate customer group must be selected that participates especially in the service and is willing to be involved in the elimination of start-up problems. Those customers should then be used in the general market launch as opinion-formers or at least as testimonials. The actual launch is accompanied by a systematic strategic planning, which can quickly respond to potential problems, and immediately collect data for future performance increases.

**Evaluation (15–20 weeks after the market launch):** From the outset, it must be made clear that service offerings need to be developed further just like physical products. The controlling system provides data by firstly performing a comparison of targets and actual figures with the intended project objectives, while additionally

organizing a performance-enhancing benchmarking. The results of these processes provide opportunities for decision templates for possible performance improvement or even for a replacement of the service if an improvement cannot deliver desired results.

## 5. Summing-up

The goal of the present research regarding contents and methodology was to investigate the practice of strategic planning and the implementation and application of service engineering in young SMEs on the one hand, and on the other hand specifically for young SMEs, whose performance and the probability of success can be increased by its application. These two goals have been achieved.

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## OPRACOWANIE KONCEPCJI INŻYNIERII USŁUG DLA MAŁYCH I ŚREDNICH PRZEDSIĘBIORSTW

**Streszczenie:** Wiele małych i średnich przedsiębiorstw konfrontuje się z problemem polegającym na tym, że ich struktury i procesy uniemożliwiają skuteczny rozwój i pozycjonowanie na rynku. Brakuje właściwych metod i narzędzi do osiągnięcia tego celu. Często dostarczają one nieefektywnie informacji na potrzeby wymagań zewnętrznych i wewnętrznych interesariuszy. Celem niniejszego badania pod względem treści i metodologii jest rozpoznanie praktyki planowania strategicznego i stosowania inżynierii usług w młodych MŚP, w szczególności w tych młodych, małych i średnich przedsiębiorstwach, których dokonania i prawdopodobieństwo sukcesu może być zwiększone przez zastosowanie wymienionych metod.

**Słowa kluczowe:** rozwój usługi, małe i średnie przedsiębiorstwa.