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# Towards practical applicability of Service Engineering: A literature review as starting point for SE method design

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**Abstract:** Several methods for developing services have been published in research, but only few find their way into practical application. In this study, which is also the first part of a superordinate DSR project, we conduct a literature review and analyze service engineering methods. The results will be used to derive practically tested methods and implement a supporting tool.

**Keywords:** Service Engineering Method, Design Science, Literature Review, Workshop

## 1 Introduction

Induced by the intensifying globalization and interconnectivity of markets and competition, especially small and medium sized enterprise (SME) strive for improving their business models to gain a sustainable competitive advantage [Kf18]. Since mechanical engineering is a leading industry in Germany, one strategy for product-centred offering is by integrating services to supply a solution-bundle instead of a physical product solely (often referred to as product-service system, PSS) [Lc16]. Offering services can imply significant opportunities for companies to stay competitive [Pl18]. Henceforth, the management and engineering of services has been a frequent subject of discussion in literature. Initial studies on the impact of services on economies can be found in scientific literature in the 1970s and 1980s [Co84] and developed over time to today's research discipline of Service Engineering (SE) [SM10]. According to [Pg09], SE strives for the "systematic development and design of services using suitable models, methods and tools as well as the management of service development processes" and many methods have been developed yet to support this process. However, only few SE methods are used in practice [Mt06], even though they support companies in improving their business, which questions the applicability of the SE methods developed so far.

Therefore, our superordinate research aims at enabling companies to apply systematic approaches to develop their service offerings by designing suitable SE methods and implementing appropriate supporting tools. As a starting point, we conducted a study (expert interviews) confirming the results from [Mt06] and revealing requirements on the usage of SE methods in German SME (currently in review) and performed an extensive literature review regarding the current state-of-the-art of SE methods, which will be described in this contribution. By doing so, we want to provide results for the superordinate research and answer the following research questions within this

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contribution: (1) Which SE methods have been developed in science so far and (2) how do they perform when being assessed against practical applicability (which resulted from the previous study interviewing experts)?

## 2 Research Method

For the paper at hand we conducted a structured literature review (LR) according to [WW02], examining 3,361 results from six databases (ACM, AISEL, EBSCOHost, ScienceDirect, Web of Science, SpringerLink). We applied the search term “Service Engineering” in combination with “Tool”, “Method”, “Model”, “Framework”, “Methodology”, “Approach”, “Design” and “Procedure” and limited the results to the years 2000 to 2018 since the term SE has primarily emerged after 2000. Furthermore, we have restricted our results to the original, first-time publication of each method. No further restrictions were made. Figure 1 shows the assessment of the publications found. The final 29 publications were transferred into a concept matrix and analysed in detail, by highlighting similarities within the applied components of each SE method (e.g. phases) and characteristics originating from previous studies with a similar scope (c.f. section 3).

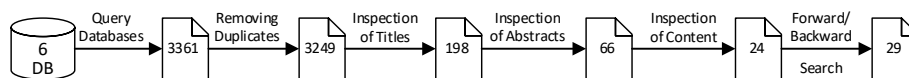


Figure 1: Literature review research approach

In combination with the interviews stated in the introduction, the presented research marks the first phase of a superordinate DSR project, illustrated in Figure 2. Based on the results of the LR, we will evaluate promising SE methods in distinct workshops with both researchers and practitioners, in order to assess whether a method is suited for an application in practice and how they have to be adapted or combined to provide most benefit (phase 2). The resulting SE method will then be implemented as a software tool (phase 3) which guides engineers through the service development process. In accordance to DSR, we will then evaluate and improve the prototype in the later phases. The dotted rectangle in the figure marks the scope of our current research.

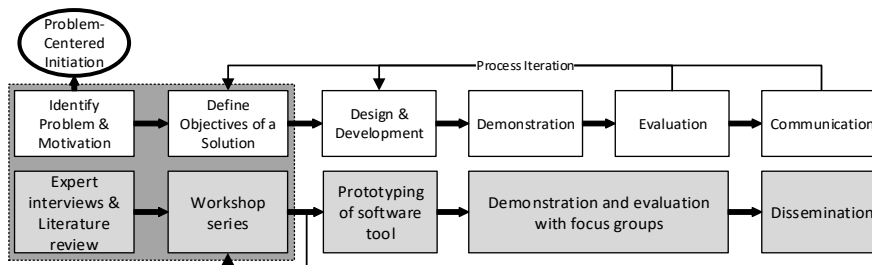


Figure 2: Research framework according to [Pk08]

### 3 Results of the Literature Review

To fit the scope and purpose of this research proposal, we demonstrate an excerpt of our LR, which in total consists of many more characteristics and analyzed publications (c.f. section 2). We therefore focus on the main findings related to practical applicability of SE methods which we derive from characteristics like *tested in practice (1)*, *concrete realization suggestions (2)*, *interfaces to other disciplines (3)* and *sufficient description (4)*. With respect to different phases of SE, we distinguish between: *(5a) strategy/planning*, *(5b) development*, *(5c) organizational aspects*, *(5d) reusable documentation* and *(5e) evaluation and adaption of the method*. The reduced concept matrix is given in Table 1, a partly-filled circle marks a characteristic which is partly-fulfilled by the corresponding method. All descriptions and conclusions of the results in this contribution refer to the matrix in Table 1, but also apply to the findings of the entire study.

Authors / Characteristics	(1)	(2)	(3)	(4)	(5a)	(5b)	(5c)	(5d)	(5e)
Alix, Vallespir (2010)	○	◐	○	○	x			x	x
Vasanth, Komoto, Hussain et.al (2013)	○	○	○	●	x				x
Berkovich, Leimeister et al. (2014)	○	○	◐	●	x	x		x	
Pezzotta, Cavalieri, Gaiardelli (2012)	◐	○	○	●		x		x	
Gangadharan, Luttighuis (2010)	◐	○	◐	●	x	x			
Kersten, Kern, Zink (2006)	○	○	○	○	x			x	
Kunau, Junginger, Herrmann et al. (2005)	○	○	○	●		x	x		x
Spath, Demuß (2006)	○	○	○	○		x	x		
Bullinger, Schreiner (2006)	○	○	○	○		x			
Scheuing, Johnson (1989)	◐	○	○	○		x			
Modell nach DIN (1998)	○	○	○	○	x	x			x
Kingman-Brundage, Shostack (1991)	○	○	○	○		x	x	x	x
Mont (2001)	◐	○	○	○	x	x	x		x

Table 1: Excerpt of the concept matrix of the literature review

In terms of the *practical evaluation (1)* of the examined SE methods, it becomes obvious that only few methods have been tested on use cases in practice. In addition, these evaluations usually neither take place in firms nor are they executed by practitioners, but are applied by scientist to known examples. However, one has to note that our assessment only involves first-time publications of the SE methods, rather than all succeeding submissions in which more detailed evaluations might have been conducted. Nevertheless, the findings imply that practical evaluation does not play a key role in SE method development, which is questionable considering the long-term objective to apply such methods in practice.

The second characteristic, *concrete realization suggestions (2)*, refers to descriptions or references to well-known and accepted methods or tools (e.g. BPMN for process modelling or business model canvas for business modelling), which are used in the context of the superior SE method. This is a valuable indicator for whether the method can be easily applied in practice, since one can use predefined methods to accomplish the

development of new services, rather than having a generic description of an approach and thus having to implement it by oneself. As the results show, only very few methods suggest concrete tools or artifacts to realize the proposed SE method. In addition, the suggestions often do not cover the complete method and only focus on several steps/phases. This result goes along with the *sufficient description (4)* of the phases, tasks and structures of the SE method if there is no reference to an external approach. If the SE method has its own approach for the different phases, they need to be described extensively and sufficiently, which does not hold in most cases.

*Interfaces to other disciplines (3)* refers to the (intended) capabilities of a method to integrate (with) other engineering fields (e.g. software engineering). Due to the increasing integration of products, services and other fields (c.f. introduction), it is important that SE methods promote or support such interactions. Despite the importance, only few methods partly consider the integration to other engineering tools or methods to allow a seamless development of a solution offering. However, this link usually does not refer to specific methods but implies the adherences of the other disciplines (e.g. “Since multiple departments [...] participate in the creation of the user requirements document [...]” [Bm14]).

The last characteristic described in this excerpt is divided into several values. In general, the characteristics (*5a-5e*) indicate which priority or focus a method sets. This is important for the next step in our research and therefore for the practical applicability, since a method should be able to cover the whole cycle of SE development. Within this contribution, the characteristics (*5a-5e*) do not seek to exhaustively describe all aspects of a SE method, but seem to be the most important ones. We do not assume that for every project all phases are required. However, for a generic approach, which will be used as a basis for a prototype, an extensive view is important. The analysis shows that two core areas are covered in almost every SE method: *strategy and planning (5a)* as well as *development (5b)*. This seems consequential, due to the meaning of development procedures. Other facets however, like the consideration of (*5c*) *organizational aspects*, the (*5d*) *documentation of the results* or the (*5e*) *evaluation and potential adaption of the method*, are considered only scarcely.

## 4 Conclusion and Future Research

The results of the LR show that, from a scientific point of view, no SE method seems to be fully applicable in practice yet. However, one has to notice that the aim of scientific methods is not always to satisfy practitioner’s needs, but in an application-oriented field of research, this aim should be implied. Therefore, based on the insights we gained from our previous study (expert interviews), the literature review shows that it is challenging for companies to find adequate and usable SE methods. Especially in rapidly changing times, a suitable method can be of big value for companies to continuously improve their business model. However, the study also reveals information regarding beneficial aspects

of the methods examined which we use to carry on our superordinate DSR project. Based on the results of the interviews from practice, requirements regarding service development, and the complete LR, we compile a comprehensive method for SE development, which especially fits the requirements of practitioners. Since this method already builds upon practical requirements, we expect it to already be more applicable in industry. However, to improve the new method even further, we will apply it to real-life use cases with practitioners and evaluate it accordingly. So far, an initial search regarding suitable workshop concepts has been carried out, which will be used to prepare a generic workshop concept. Subsequently, this allows for evaluating different SE methods. In a first step, we will test the workshop concept with a group of researchers (pre-test) from different disciplines to obtain information about the workshop concept in general and a first glance at the applicability of one SE method. The results will be used to finalize the concept and apply it in several workshops with practitioners (second step). In an iterative process, we evaluate SE methods and improve our newly designed method continuously. We have terminated the first workshops for May 2018. Finally, we want to implement a supporting tool which guides engineers through the process of the evaluated SE method and provides useful functionalities during the process.

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