Service identification – an explorative evaluation of recent methods

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Abstract

Since the advent of service-orientation various scholars have proposed methods to identify services. Some of these methods were developed as parts *of proprietary SOA frameworks others were purely theoretical research. However, the task of deriving service candidates from heterogeneous inputs has not yet been sufficiently solved. Within this article an explorative evaluation of one of the most recent approaches in the field is conducted. The approach is consecutively applied to two real-world cases. Finally the current state of service identification with regard to the investigated approach is drawn and an outlook on future research is given.*

1. Introduction

While developing information systems (IS) various designs patterns can be used. One of the most heavily discussed design patterns of the internet era has been the service-oriented architecture (SOA) design pattern. The OASIS defined the term SOA as "a paradigm for organizing and utilizing distributed capabilities that may be under the control of different ownership domains." [1]

Service orientation promises a maximum of flexibility through loosely coupled components that can be dynamically linked and invoked at runtime of a system. The paradigm also promises a high level of reusability. SOA has long been postulated as the most useful means to build flexible information systems. Unfortunately there is no standard service identification method that would lead to an ideal amount of services. Every company has to decide on the most efficient method of service identification in their specific environment, therefore.

2. Goals and structure

In the following section we will describe the used research method and our research design. After a general introduction to service identification we describe a recently published complementary collection of methods provided by Birkmeier in detail [2]. Thereafter, we motivate the selection of a decision / evaluation model and propose a criteria catalog based on the aforementioned method collection. The model is applied to two briefly described service identification cases. Finally we draw conclusions on our research findings and give an outlook on future work. The research goal of this article is to exploratively test one of the latest scientific results in the field of service identification against two real world scenarios in order to evaluate its applicability and potential constraints with regard to these concrete scenarios.

3. Research method and design

In order to evaluate the usefulness of the integrated collection in real service identification scenarios we derived hard and soft preconditions. Implicit as well as explicit decision criteria are distilled from the work of Birkmeier [2] for each of the three collection elements (derivation method, process model, quality framework). An interview with the author of the collection is conducted to strengthen those preconditions and to eliminate misunderstandings.

Along with the good practice in design-science research [3] the development of the evaluation framework is our main research artifact. This decision framework is being used to purposefully judge on the capabilities, constraints and limitations of the integrated collection on service identification provided by Birkmeier [2]. In order to deepen the evaluation results we use our artifact and apply it to two real-world service identification scenarios.

4. Related work

The process of building a SOA consists of three general steps: *identification*, *specification* and *realization* of services [4]. Especially the identification of applicable services is still a major research topic [5]. The body of literature provides a

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variety of different approaches for service identification with different underlying assumptions and principles. Since not every approach is equally applicable for different use cases and specific business environments, no standard method exist.

Most approaches need very specific prerequisites such as the modeling of the underlying business processes or system landscapes in a specific modeling notation or the usage of specific frameworks. Nevertheless, recent theoretical approaches have shown a common trend to provide flexible methods that are applicable to different models and business situations [2]. In this chapter we provide a scientific overview of the design and strategic possibilities of current service identification methods. Subsequently we describe a specific recent approach in detail. The described approach forms the basis for the decision model we provide in chapter **5**.

4.1. Service identification in general

Following the service identification survey conducted by Birkmeier, Klöckner and Overhage [6] and a systematic literature review from Gu and Lago [5] several heterogenous service identification approaches exist in literature. The spectrum of different approaches is determined by classification criteria and characteristics such as the conceptual foundation and the underlying model [6]. Used input types and the classification of resulting services [5] are additional differentiating criteria. In [6], Birkmeier et al. perform a systematical classification and analysis of 13 state of the art service identification approaches. Altogether, a wide set of approaches (for example *Service Oriented Analysis* [30]*, Enterprise Service Design Guide* [31]*, Modularity criteria* [8] and *Identification and design of services* [32]) have been discussed. In their associated investigation Birkmeier et al. name and describe the main advantages and disadvantages of each of these approaches. Based on the summarized deficiencies of current approaches Birkmeier developed new approaches, which we describe in section 4.2. Due to the systematic removal of the identified deficiencies the new approach provided by Birkmeier [2] can clearly be seen as an improvement with regard to the previous state of the art.

4.2. Service identification approach of Birkmeier

The complementary collection of service identification approaches proposed by Birkmeier [2] is the basis for our evaluation framework provided in chapter **5**. The method of Birkmeier essentially comprises three independent components that together form an integrated collection of methods towards service identification. These are:

- "a development method […] that describes several general steps and how they can be designed to incorporate a catalog of existing services." [2] – called **process model** for service identification.
- A reflective **derivation method** and
- "a framework to assess the quality of business process models" [2] – called **quality framework** or 3QM.

In the following three sections we describe the key aspects of each of these components as they are the basis for the collected and processed requirements in chapter **5**.

Process model

The service identification process can be described as "a general development process for a top-down identification of services from business process models" [2]. It is therefore a general approach that defines a coarse-grained process model for systematic service identification that can be further specified into sub-processes. The concretization with sub-processes is necessary in real-world scenarios since "[t]he process model defines an overall process to identify services from business process models that does not rely on specific modeling techniques or architecture maturity levels." [7].

In terms of implementation the approach delivers only an abstract schema of necessary activities, but a concrete responsibility- or role model and clearly defined in- and outputs for each process phase. "The process model defines an overall process to identify services from business process models […]" [7] with six general phases which is shown in the upper section of figure 1.

The six general phases of the "overall process" [2] can be summarized as follows:

1. Identify and summarize required functionalities from the activities of the business process models which should be automated.
2. Add non documented but required implicit functionalities like archiving, encryption, …
3. "[...] [I]dentify reusable existing services and new services which jointly provide the required functionalities." [2]

4. Identify and mark functionalities and services which are not described in the service catalog.
5. Validate the newly identified services in alignment with the business architecture "[...] and update the service profiles if necessary." [2]
6. Classify the new services with respect to their relevance for the entire organization.

The third phase is a challenging and simultaneously critical success factor for the identification of services. For this reason the authors extended the third phase into four sub-phases, as shown in the lower part of figure 1.

The sub-phases can be described as follows:
1. Remove functionalities (from the list of required functionalities) "[...] which can be realized through existing services[...]". [2]
2. Adapt the business process models by removing all realized functionalities.

3. Identify the service candidates based on the reduced business process models.
4. "[...] [E]valuate each service candidate on the basis of several guidelines [...]". [2] (to find the best candidates)

Derivation method

In reference to the general classification of service identification approaches shown in section 4.1 the reflective derivation method of business components from conceptual models can be described with the following three key citations:

- "It provides a semi-automatic, optimizing derivation method, which can be applied for different input models and is customizable to the individual project's preferences;" [2]
- "It methodically integrates and guides the system designer throughout the process by implementing an Analytic Hierarchy Process to derive preferences and a sensitivity analysis to
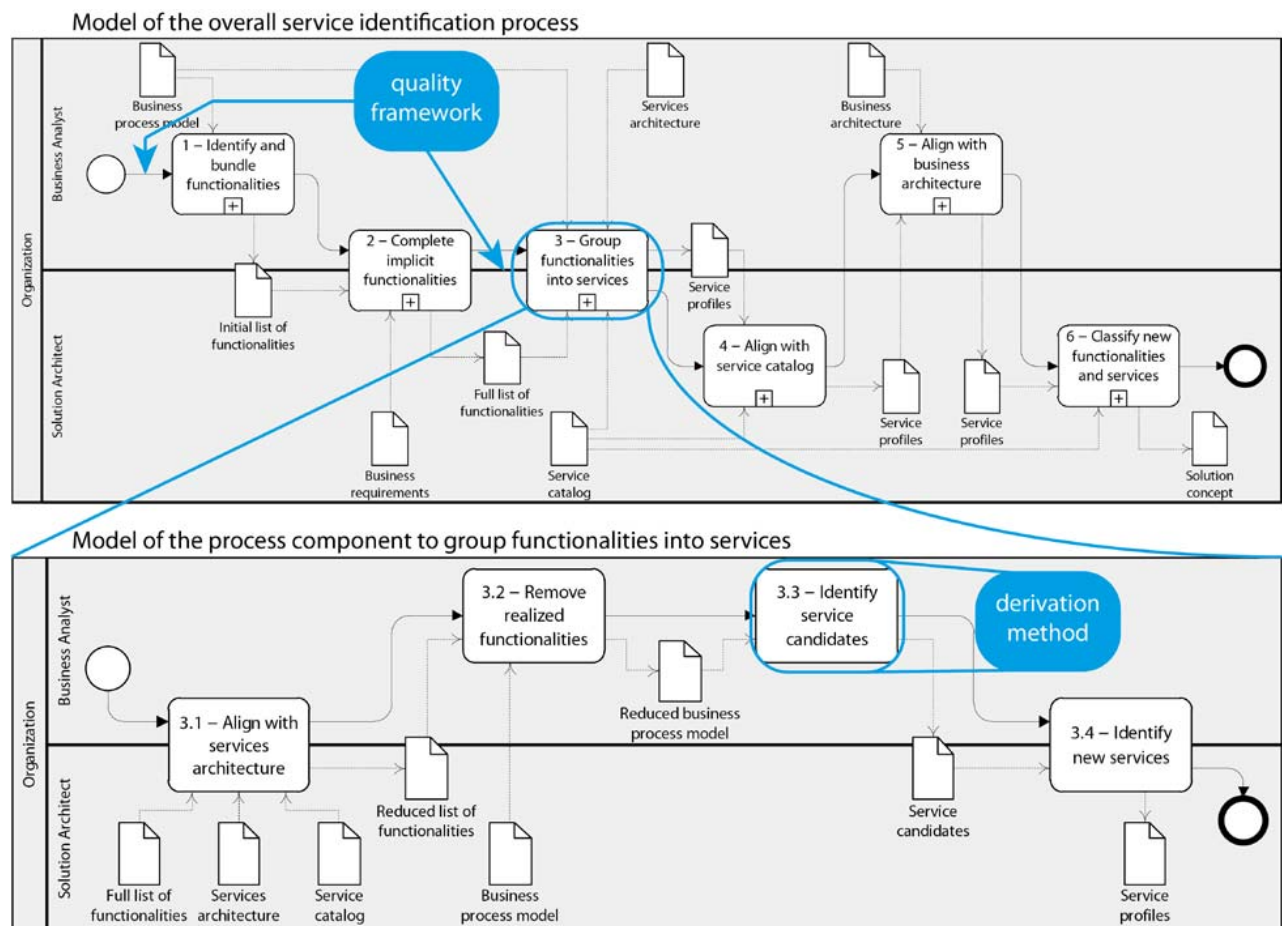

Figure 1: Overall process and sub process of the service identification process model, adopted from [7]

evaluate the stability of the results" [2]

- "In so doing, it combines and enhances advantages of both, manual and fully automatized approaches, into a reflective derivation method." [2]

Despite the fact, that the derivation method identifies business components rather than services according to an SOA understanding, the authors "describe an approach that is equally applicable to the derivation of business components and services." [2] We would agree, since the terms components and services are considered largely synonym [8].

To determine the optimal granularity of the resulting components and services the derivation method follows the "principle of minimizing coupling (i.e. the interfaces to other components) and maximizing cohesion" [9].

Based on a four phases workflow model for the reflective derivation method and additional extended sub-steps, presented by Birkmeier and Overhage in [9], three characteristics of the method can be deduced as follows:

- The method is graph-based
- It essentially contains an automated optimization step
- The designer can influence the method at the beginning and end of the identification phase

In the context of the previously described process model the derivation method can be interpreted as one concrete phase in the service identification process [2]. More precisely the derivation method is conceivable as an implementation of the third sub step "identify service candidates" (see figure 1).

Quality framework

Overhage, Birkmeier and Schlauderer "propose the 3QM-Framework as an approach that supports a methodical determination of the quality of business process models." [10] The 3QM-Framework therefore belongs to the category of analytical approaches and "defines quality metrics which can be used to quantify the various quality marks." [10] Based on semiotic theory the 3QM-Framework adopts the "syntactics, semantics, and pragmatics as fundamental quality marks of business process models and systematically operationalizes them further." [10]

The authors do not integrate the quality framework with the previously described process

model. In this regard the quality framework is an additional concept which could be used at two different points as shown in figure 1.

In order to provide a consistent quality level of the business process models across the entire process the quality framework should be used as a prerequisite for the overall process. If this, due to project constraints or other external factors, isn't possible the quality framework can also be used as a pre-step for the third phase ("group functionalities into services"). This would at least assure high quality models for the service derivation, because these are an explicit precondition for a successful application of the derivation method. [2]

General conclusion

In their preparatory work Birkmeier et al. examined thirteen different approaches on service identification [6]. The authors took defects as well as improvement potentials into account during the design and development of their derivation method. Therefore we consider their derivation method as an advanced method of service identification that is superior to all its predecessors.

5. Decision model

Decision making in the context of complex socio-technical systems frequently involves a multitude of decision criteria. As Robert Solow first pointed out IT often doesn't deliver measurable economic benefit [11]. Its payoff regularly occurs through changes in business models, in entirely different business units or with certain time delay [12]. Carr provocatively claims that IT itself has largely become a commodity and doesn't matter as strategic asset any longer. The majority of scientists and practitioners, however, still herald the strategic value of IT [13]. Being able to derive appropriate services from existing business processes can create competitive advantage. As such it is not about the technology itself but about the
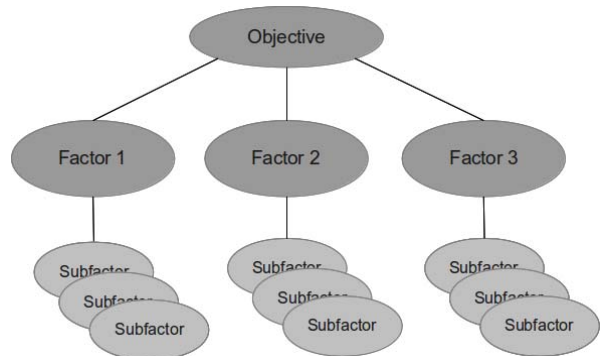
Figure 2: Example AHP-Hierarchy

ability to combine commodities (the services) to scarce strategic value.

Hence, complex evaluations such as the one discussed in this article, need to take a variety of relevant criteria (i.e. model related requirements, skill requirements, formal requirements) and project unique weightings into account. Integrating different criteria into one evaluation method is known as multi-criteria decision making (MCDM). MCDM are usually applied if unidimensionality would be misleading.

Various decision methods such as Promethee [14], Utility Analysis [15] or the Analytic Hierarchy Process (AHP) [16] have been proposed to support MCDM. The AHP got widespread attention as it has been successfully applied to IT related decision problems [17; 18] as well as various other industries and branches [19]. Within the frame of this work we have chosen to apply the AHP as evaluation method.

Central elements of the AHP are a decision tree and the pairwise comparison matrix on each of the tree levels. Each criteria is then compared to every other on the same decision tree level in a sequential chain of pairwise comparisons (see figure 2). This significantly reduces the decision complexity and cognitive pressure. In doing so the preference relation will be iteratively developed rather than subjectively defined all at once. By means of Eigenvector and Eigenvalue computation a preference vector is calculated (see result weightings in table 3). The calculated preference vector is subsequently tested for consistency. Thus the method is less prone to relative over- or underweighting than for example the Utility Analysis. Its consistency check and the pairwise comparison render the AHP superior to scoring methods like the Utility Analysis [28] and other MDCM methods such as Promethee [29]. A good example of an applied AHP method can also be found in the work of Chou et al. [20] for further detail.

In our example the decision hierarchy is developed from the explicit and implicit requirements of the three elements of the integrated collection of Birkmeier [2]. We conducted an expert interview per case with our counterparts (the responsible employees in both investigated cases) in order to derive the pairwise comparisons on the decision categories as well as additional information on the fulfillment of the requirements per case (grade of fulfillment).

5.1. Criteria catalog

Structure

As already mentioned the process model, the derivation method and the quality framework are three complementary but formally independent components that are strongly related to service identification. It is not obligatory to use all three components always together in every use case and every scenario. Sometimes the concrete situation and environmental constraints might require using just one or two of them if, for example quality is assured elsewhere throughout the project. Hence, we consider the three components as independent parts in the context of their formal requirements.

The advantage resulting from the splitting in separated components is the possibility to use every part of the catalog of criteria independently and in cooperation with other frameworks, approaches or use case specific conditions. The main disadvantages are some redundant requirements between the parts of the criteria catalog.

Every evaluation scheme (see tables 1, 4 and 5) is based on a table structure composed of the following attributes:

- Category – a distinguishing feature which divides the requirements in 3 major types:
  - M – model based requirements: specific content aspects that are covered by a model or a scheme
  - P – personal requirements: requirements that address the competences or tasks of a person or group
  - F – formal- structural requirements: requirements that demand the presence of objects or information in a specific form or structure

The classification of the examined requirements into the three categories is directly derived from the requirements and the underlying documentation. The categories are just an indication for the form and assignment of the requirements for example in an enterprise context. Some personal requirements are substitutable. For example the knowledge about the rules and conditions of the underlying modeling notation is substitutable by a given documentation or handbook. This should be taken into account during the application of the criteria catalog. [27]

- Key term – a compact and shortened version of the requirements to render the identification and comparability of

requirements within different evaluation schemes easier

- Description – a verbal description of the requirements with some additional information
- Mandatory – a classification attribute to distinguish between obligatory and qualitative requirements. Obligatory requirements are necessary to apply the examined method. Qualitative requirements try to ensure a high quality result of the current method.

Evaluation metric

Due to the distinction between obligatory and qualitative requirements two different rating scales are necessary. Obligatory requirements can either be fulfilled (true) or not fulfilled (false) hence framing a nominal scale. In contrast the qualitative requirements are measured by an ordinal scale.

Consequently we propose to firstly evaluate the obligatory requirements (i.e. a gatekeeper function) and secondly to measure the degree of fulfillment of the qualitative requirements.

6. Case Study

6.1 Background

In preparation for each of the cases a concrete business process was chosen. Information material regarding the selected business processes was exchanged and the common examination goal has been set. The goal was to obtain a well-grounded statement of applicability for each of the collection components. To get all needed information for the evaluation of applicability an interview with the business contact person of each case has been conducted.

The first use case took place in cooperation with Fujitsu Technology Solutions for a supply chain management process, more specifically the order fulfillment process. At the time of the use case (April 2013) no services had been identified or implemented for the order fulfillment process so far.

The second use case was performed in cooperation with the Otto-von-Guericke-University Magdeburg in the context of a project for the implementation of an integrated service-oriented campus management system [24]. The chosen business process was "solicitation and approvals".

Table 1: Evaluation framework for the process model

Category	Key term	Description	Manda-tory
	busines process analysis	requires a business process analysis with the following results:	
M	visualisation of a process view	structured visualisation of a process view for the examinated (business-) region	✓
M	divide into subprocesses	processes are divided into basic* subprocesses	✓
M	activities and information objects	the visualisation must consist at least of activities and information objects	✓
P	knowledge of the subprocesses	knowledge and modelling of all processes und subprocesses of a business task, so that all requirements are recognised	✓
M	described business needs	Detailed described and consolidated information about the needed business functionalities (explicite functionalities) are necessary.	✓
P + F	implicite functionalities	Knowledge of the implicite functionalities that may influence the task. Normally they cannot be derived directly from the process model!	✓
F	business architecture (business model)	structured visualisation of the domain specific and cross-sectional business tasks including their business processes and subprocesses	✓
F	service architecture (service model)	Overview and functional description of all relevant (realized and planned) services.	✓
F	service catalog	business oriented documentation („functional specification") about all services that have already been implemented	✓
F	name-giving and common structure	To retrieve and compare services a common structure and name-giving rules are needed.	
	competence rolls	According to the role concept are two different competences of the process executive needed:	
P	competence of the business analyst	"The business analyst role represents the knowledge and competency of an organization's business unit."	✓
P	competence of the solution architect	"The solution architect represents the knowledge and the competencies of the IT department."	✓
P	modelling competences	The business analyst and the solution architect needs comptences and capabilities in modelling and adaption of the business modell e.g. to provide a uniform granularity of the functionalities through adation of the models.	
F	guidelines for evaluation	To evaluate the service candidates are valid and binding guidelines necessary that are aligned with the managerial goals. These includes e.g. costlimits, consideration of existing services and structures, ...	✓

* not further useful divisible from a business perspective (Bettina Friedl. Zur optimalen Granularität von IT-Services – Eine Analyse relevanter ökonomischer Einflussfaktoren. In Wirtschaftsinformatik, Februar 2011)

6.2 Results of the cases

The summarized results of both use cases are shown in table 2 (for obligatory requirements) and table 3 (for qualitative requirements).

6.3 Interpretation of case results
Fujitsu case

As shown in table 2 not all obligatory requirements are fulfilled. For the derivation method and the quality framework deficits that would prevent the application of approaches do exist. Just the process model would be already applicable in respect to the obligatory requirements. The same applies to the qualitative requirements (see table 3). Some selected deficits are: missing modeling conventions, insufficient naming and structuring conventions for existing and new services and a not adequate level of detail for nearly all examined process models.

Despite the formal applicability based on the requirements a major question is the relevance of the examined method for the specific use case. The order fulfillment process is almost entirely realized and depicted in an SAP-Enterprise-Resource-Planning (ERP) System. So, a restrictive condition for the service identification in the Fujitsu context (as in most of the Fortune 500 companies as well) is that new services can also be mapped via the used SAP landscape. The following relevant question is: "How does SAP define and handle services?"

Based on an examination of [26] and [25] the key findings of the comparison of the understanding of service between SAP and the previously described Birkmeier et al. approaches are:

- the process steps and the requirements of the derivation method does not match with the comparable SAP processing
- the SAP process components have a technical and business oriented perspective, the business components just a business view
- the description needs (in regard to the services) and the capabilities of the SAP Enterprise Service Repository (ES Repository) - as the central tool for modeling and declaration of enterprise services [26] - are not sufficiently examined
- Enterprise services are described and defined under the perspective of a company-wide relevance [25]. The Birkmeier approaches are not able to ensure a company-wide relevance of the identified services.

With regard to these findings it is not ensured that the Birkmeier approach can deliver service candidates that are implementable in a SAP- driven environment at present.

OvGU case

The results of the second case, in reference to the applicability, are slightly better. All obligatory requirements for the three components are fulfilled and for the qualitative requirements deficits are almost exclusively related to the approach specific qualitative requirements (e.g. knowing of the relevant edge types for the graph mapping). Thus all three components are applicable in this use case from a formal perspective.

However, even for this case the question of relevance can still not be answered. In reference to the already mentioned project an application of the process model and the quality framework is not necessary, since the procedure of the project is determined by reference architecture (as the ideal state of the campus management system) and the process models are already quality assured. Also a set of services and their range of functions are suggested by the reference architecture but in fact the services are not predetermined. The question is thus "How to use the derivation method meaningfully under such conditions?"

A possible field of application for the derivation method is to use the identified services as an additional reevaluation for the suggested services of the reference architecture or to come up with other possibly more efficient service candidates.

7. Results and Outlook

Table 2: Result summary of obligatory requirements for both cases

requirements	Fujitsu rating	Fujitsu comment	OvGU rating	OvGU comment
process modell				
visualisation of a process view	1		1	
divide into subprocesses	1		1	
activities and information objects	1		1	
knowledge of the subprocesses	1		1	
described business needs	1	processes are SAP oriented, functionality is dermined and covered by SAP	1	replacement of legacy systems, implicite functionalities are documented
implicite functionalities	1	are documented and implemented in SAP	1	rough, not completely modelled
business architecture (business model)	1		1	
service architecture (service model)	1	interfaces are documented, no chart	1	
service catalog	1	given by SAP (SAP- manual)	1	
competence of the business analyst	1		1	
competence of the solution architect	1		1	
guidelines for evaluation	1	everything must be depicted in SAP	1	project budget and scope
derivation method				
visualisation of a process view and subdivison in subprocesses	1		1	
informationobjects	1		1	
composition of business functions	0	no general overview	1	
separated visualisation of input model elements	1		1	
quality framework				
documentation of the real world excerpt	1	no written documentation, verbal description possible	1	reviews of the models by the business domains and documentation about the functionalities
modelling competences	1		1	
syntactical model analysis	0		1	
carriers of meaning	1	process modelling determined and documented by SAP	1	
labeling conventions	0		1	

Table 3: Result summary of qualitative requirements for both cases

requirements	Fujitsu rating	Fujitsu weighting	Fujitsu comment	OvGU rating	OvGU weighting	OvGU comment
process modell						
name-giving and common structure	1	83,3%		4	50%	business domains are modelled, IT architecture not
modelling competences	4	16,6%		2	50%	
derivation method						
adequate level of detail	2	15,7%	core elements are available, logical linking is missing	4	24,7%	
modelling competences	4	26,5%		4	11,3%	
selection of suitable models	4	3,8%	condition formal met, specified by SAP	1	5,9%	condition formal met, not relevant
types and meaning of edges	0	4,0%		4	5,9%	
relevant edge types	0	6,0%		4	5,3%	
BPS and io of existing services	4	16,4%	are known, processes are implemented in SAP	4	15,7%	derivable, models contain links to legacy systems
interpretation of results	0	27,7%	service landscape is also given by SAP	2	31,2%	
quality framework						
project specific weighting of criteria	0	50%		0	75%	
modelling specific weighting criteria	0	50%		0	25%	not relevant

approaches presented within the frame of this paper is that they are flexible enough to be applied in different scenarios. This is due to the abstract schema of the process model and quality metrics which are, for instance, not limited to a specific modeling notation. [2] Furthermore, they can be used as a complex of different methods which cover a comparably larger area in service identification than any other approach. The criteria catalog and consecutive case study we provided primarily attempt to determine the formal applicability of the presented approaches in real world scenarios. The results of these scenarios are shown in table 2 and table 3. Besides the formal applicability of the approaches the utility of their application has still to be considered. As the use cases have shown, this

The predominant advantage of all three

questions cannot easily be answered by just fulfilling

formal preconditions. Hence, we provided additional reasoning on the utility of the application in section 6.3.

The OVGU case unveiled total compliance regarding the obligatory formal requirements of the approaches. For the Fujitsu case a global composition of business functions does not exist. Moreover, the non-existence of common labeling conventions and a syntactical model analysis do not fulfill the obligatory requirements. With regard to the qualitative requirements both use cases show a lack of knowledge. This is due to the fact, that regardless of the used business process modeling notation, information must be transformed into a graph based representation to be used with the derivation method. Neither of the cases unveiled usage and / or good understanding of quality metrics. In the case of Fujitsu available business process models are still not granular enough. Moreover, both cases show scarce knowledge regarding the interpretation of the results of the derivation method.

- in order to improve the reliability of the process it should be investigated whether the removal of realized functionalities (see figure 1, second sub-phase) implies an unintended loss of information
- quality framework
  - knowledge and qualification of the interpreter should be taken into account
  - the size of the examined model(s) should be taken into account
  - the quality framework can be improved with a full plan, do, check, act (PDCA) cycle, rather than just measuring quality analytically
- derivation method
  - in order to better reflect reality, the method must consider an installed ERP-system base

Table 4: Evaluation framework for the quality framework

Category	Key term	Description	Manda-tory
F + M	documentation of the real world excerpt	The documentations of the real world excerpt (e.g. in natural language form), represented by the model, shall be sufficiently detailed as to allow the identification of mistakes and carriers of meaning.	✓
P	modelling competences	extensive knowledge about the formal rules of the uses modelling language	✓
M	syntactical model analysis	complete and structured analysis of the modell e.g. to determin the number of word syntax violations	✓
P	carriers of meaning	Knowledge about the characteristic and non- characteristic carriers of meaning for the modelling notation is necessary.	✓
F	labeling conventions	Rules and standards for labeling (of model elements) must be available and compulsory.	✓
M	project specific weighting of criteria	The weighting of the evaluation criteria must be project specific and in coordination with all relevant user groups.	
M + F	modelling specific weighting criteria	For (own) project specific or modelling notation specic evaluation criteria an introdtuction of own rules, comformed with the framework metrics, is necessary.	

Altogether the integrated collection of methods proposed by Birkmeier is moving away from a separated or isolated view and considers three different but complementary aspects of top-down driven service identification. However, by conducting our case studies, we identified the following improvement potentials:

- process model
  - the process model defines clear in- and outputs for every phase but the concrete content of the artifacts (e.g. service catalog, service profiles, …) are not defined so they are currently rather an indication where to record the outcome of a single process phase

  - the method should provide means to evaluate company-wide relevance of the identified services

Amongst the aforementioned improvement potential the application of formal training and consideration of the knowledge of the interpreter can immediately yield additional insight within the frame of future research. Even if much more complex the extension of the approaches with a systematic consideration of an installed system landscape would greatly improve the practical relevance of the approaches.

Table 5: Evaluation framework for the derivation method

Category	Key term	Description	Manda-tory
	business model	requires the presence of a conceptual model (also called busines model) which is - "describes the users' world in a modeling language independently of implementation technology and constraints."[2] – with the following features:	
M	visualisation of a process view and subdivison in subprocesses	visualisation and separating of business processes and subprocesses	✓
M	informationobjects	representations and models contains information objects (io)	✓
M	composition of business functions	information and visualisations about the compostition of the business functions	✓
M	separated visualisation of input model elements	To consider bunsiness functions and information objects during the identification process they must be present as individual (not aggregated) elements in the input models.	✓
M	adequate level of detail	adequate level of detail of all relevant models, business processes, subprocesses and linked information objects	
P	modelling competences	The designer ought to be able to add additional models, model elements and relations into the derivation process. In this context is knowledge about the formal modeling language rules and the underlying processes necessary.	
P	selection of suitable models	The designer needs experience in the selection of suitable input models for the service identification process. With detailed described business needs and process models the amount of needed experience can be reduced.	
	weighting process	For a adequate and projectspecific weighting the designer needs a lot of experience. This includes especially:	
P	types and meaning of edges	knowledge about the meaning and influence of the queried edge types by the integrated AHP	
P	relevant edge types	The designer ought to know which edge types and subtypes are needed and relevant in the specific project context.	
P	BPS and io of existing services	The designer ought to know the BPS (business process step) and io of allready planned or existing services. They have to be marked in the process so that they are not considered during patition.	
P	interpretation of results	For a decent interpretation and analysis of the results (sensitivity analysis and partition) is a lot of practical experience of the designer needed. (Birkmeier, Interview)	

* here: for the specific project adequate or necessary. A adequate granularity refers to the depiction of conceptional workflows for single activities of business processes under a level of detail perspective. Often, a detailed description „what to do" but not „how to do" is necessary. (Hermann Gehring and Andreas Gadatsch. Ein Rahmenkonzept für die Modellierung von Geschäftsprozessen und Workflows. 1999).

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