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Identification of Services - A Stakeholder-Based Approach to SOA Development and its Application in the Area of Production Planning

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IDENTIFICATION OF SERVICES – A STAKEHOLDER-BASED APPROACH TO SOA DEVELOPMENT AND ITS APPLICATION IN THE AREA OF PRODUCTION PLANNING*

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Abstract

A successful implementation of a service oriented architecture demands for a systematic identification of the information system functions to be implemented as services. In contrast to other approaches attempting to transfer each existing function in a company into a service, the method presented in this paper proposes a selective identification of services from a business point of view, based on process models. Functions are rated due to their outsourcing and visibility potential for stakeholders. Functions are only implemented and provided as a service, if both business potential and technical feasibility have been verified. Having been evaluated in a medium-sized manufacturing company, the approach and the results of the evaluation can also facilitate a sound service identification in other companies.

Keywords: SOA, service identification, process model analysis, production planning, stakeholder

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1 DEVELOPING A METHOD FOR SERVICE IDENTIFICATION AS DESIGN SCIENCE

The identification of business functions to be provided as services is a basic precondition for a detailed specification and implementation of services in a Service Oriented Architecture (SOA). Summarizing objectives of SOA implementation, issues referring to both business strategy and IT can be identified, e.g. integrating business processes and a broader reuse of implemented functionality. By combining both points of view, an integrated method for identifying services is constructed.

With respect to the business context in which a company acts in, not only are the relations with customers crucial, but the relations with other relevant stakeholders (e.g. suppliers, subsidiaries, commercial representatives or service providers) are just as important. When developing an approach for service identification, it is therefore essential to extend the perspective of the approach to important stakeholders. Designing an approach for service identification based on stakeholders is a matter of the design science paradigm. For the characterization of results presented in this article, the design science guidelines proposed by Hevner et al. hence can be applied (see Table 1).

Guideline	Characterization of the results presented in this article
1. Design as an artefact	In the focus of the development is a methodical approach for identifying services. Core to this approach is an integration of a business analysis (incorporating the relation towards stakeholders) and an information technology point of view.
2. Problem relevance	One substantial driver for implementing SOA is the improvement of relations with important stakeholders. A corresponding method for service identification is considered as a substantial research contribution for the conceptual design of a SOA.
3. Design evaluation	The envisioned approach was applied to company-specific models of a production planning system, as well as to widely diffused reference models. The application has proven the applicability of the method in a real-life context. Consecutive research should enhance the empirical foundation of the evaluation procedure with respect to the number of cases and the diversity of the scenarios to be evaluated.
4. Research contribution	A unified methodical approach for identifying services has not yet been reached, even though SOAs have been in debate for several years and services identification is a crucial part for conceptualizing a SOA. Even so, a variety of –more or less substantiated– methods has been proposed. The approach proposed in this article especially entwines a process model based analysis of stakeholders with the information technology related task of conceptualizing SOAs.
5. Research rigour	The proposed approach combines methods from marketing literature with SOA design principles that have been introduced by other authors. The outcome is a generalized and consolidated method. Its usefulness is evaluated by case studies (see Guideline 3).
6. Design as a search process	The project is designed as a search process, because results of the evaluation are used to enhance the method and improve its applicability.
7. Communication of research	In this paper, the proposed method is presented by using a procedure model. For in-depth analysis, the method is applied to detailed process models in the domain of production planning. Furthermore, outcomes will be presented more exhaustively in a scientific book in more detail.

Table 1: Consideration of Design Science Research Guidelines (Hevner et al. 2004)

The remainder of the paper is organised as follows: The developed approach for service identification is introduced and discussed in Section 2. Afterwards, the applicability of the method is shown by presenting a case of a medium-sized manufacturing company in Section 3. Section 4 comprises a comparison to other existing approaches for service identification and shows that the proposed method is unique due to its consequent comprehension of stakeholders and its exhaustive analysis of process models. Finally, subsequent tasks of service identification are made explicit and further research needs are identified in Section 5.

2 A METHOD FOR SERVICE IDENTIFICATION

The proposed method for the identification of services can be mainly divided into the three phases *preparation*; *service analysis*; and *service categorisation* (cf. Figure 1).

2.1 Phase 1 - Preparation

During the *preparation* phase, basic decisions regarding scope and purpose of the service analysis are to be made, as service analysis does not necessarily account for all organisational units of a company. Instead, when launching a SOA project, it makes sense to restrict the analysis to core business areas, in which a number of visible benefits and their potential to be reused in other areas can be pre-estimated. The area of service analysis may be documented by a framework, identifying the most important functions of the domain and showing their interrelationships. This framework can act as a starting point for the process model based service analysis procedure.

Crucial is also a meaningful documentation of existing business processes, ideally in the form of hierarchical process models. Such process models often already exist in companies, e.g. as an output of formerly conducted Business Process Management (BPM) projects. To form a sufficient foundation for the identification and definition of services, process models however should correspond to service-specific modelling conventions, which are specially designed for the service identification approach presented in this paper:

- Process models shall describe the degree of IT support for each function in the business process (automatic, semi-automatic/dialog or completely manual).
- Organizational units involved in the business process shall be annotated, so that external process interfaces are made visible in the model as well.
- Models can be hierarchically divided into several layers. From a top-level perspective, process models represent core business actions. On a more detailed level, the core business functions are split up into more detailed functions, which can be assigned to a specific organisational unit.

Besides determining the scope of the analysis and analysing process models, relevant stakeholders are to be identified as external business partners (e.g. customers, suppliers or service providers) or internal business partners (e.g. subsidiaries, other facilities or the company headquarters). Stakeholders will later be incorporated into the analysis and therefore are a constitutive aspect of the approach proposed in this paper.

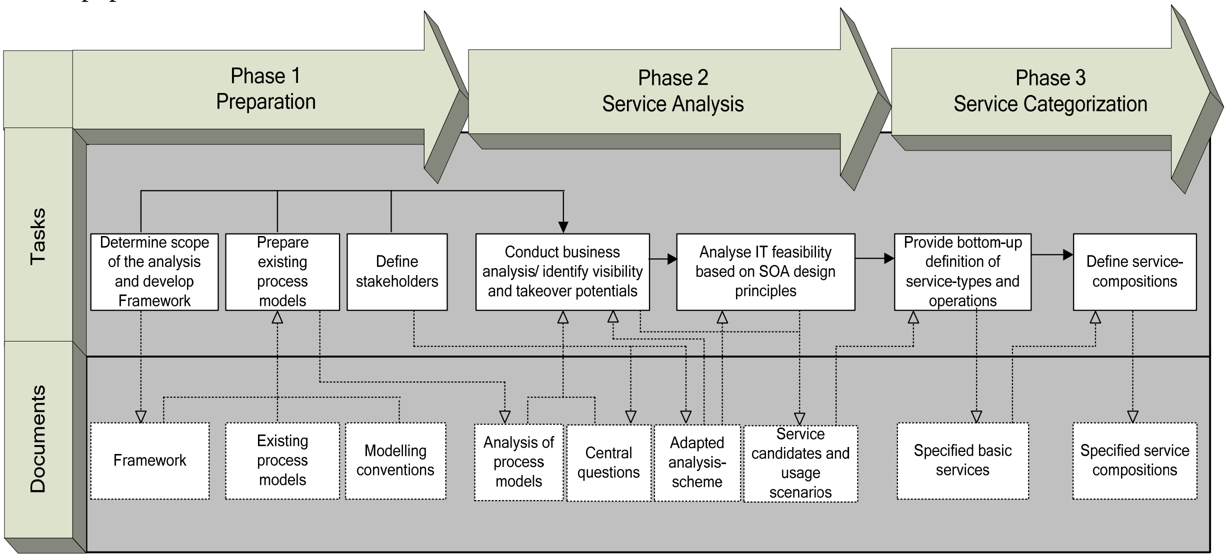

Figure 1: Procedure model for service identification

2.2 Phase 2 - Service Analysis

After completing the preparation phase, the *service analysis* is conducted. The analysis is carried out in two steps: At first, service candidates are identified (by applying criteria) from a business point of view. Secondly, the feasibility to implement these candidates as services is analysed from an IT perspective. Addressing service marketing in a traditional sense as rather manual processes, methods of process based analysis and the integration of the customer into the companies' business processes have been a focal point in marketing related literature (Shostack 1981, Zeithaml & Bitner 1996, Kingman-Brundage 1989, Kleinaltenkamp 2000, Fließ 2001). These approaches facilitate an integration of the customer into the companies' service processes by describing so called 'lines'. These fundamental findings can be identified as the theoretical foundation of the business criteria proposed for service identification in this paper. In this context, an adjustment of the two lines 'line of interaction' and 'line of visibility' can be identified as the major parameters for customer integration:

- The 'line of interaction' determines the division of the area of activities between the company and its customers. An adjustment of the line towards the company assigns activities formerly carried out by the customer to the company itself. Accordingly, the line may be adjusted in the other direction, thereby adding tasks to the sphere of responsibility of the customer.
- On the other hand, adjusting the 'line of visibility' determines the level of insight the customer has into its suppliers' business processes. By extending visibility, customers can e.g. gain a better understanding of service processes and related activities. As a result, they may thus better comprehend why service processes require the scheduled (long) cycle times to be completed, thereby preventing misunderstandings and potential dissatisfaction related to longish delivery periods. Even so, visibility for customers should be restricted to areas, which are of strong interest to the customer and which are carried out by the supplier with a high level of perfection.

These options of letting customers participate in the conduction of business processes can be generalized when expanding the focus to other stakeholders as well, such as internal (e.g. corporate headquarters, other facilities) and external (e.g. service providers, suppliers, commercial representatives) stakeholders. With respect to the 'line of interaction' the approach proposed in this paper determines, which tasks can be taken over by stakeholders. The transfer of activities can have substantial consequences on the restriction or augmentation of information flows. When adjusting the 'line of visibility', stakeholders can be provided with more detailed information about pending business processes. In either way, functions are identified as service candidates from a business point of view. Supporting a business-driven approach for service-identification, we provide some central questions as a means to ascertain the potential of functions more reliably during the identification process (see excerpt in Table 2).

Aspect	Central questions
Takeover	1. Is the function eligible to be outsourced to a stakeholder (outsource non-core functions only)? 2. What are potential losses of knowledge after outsourcing the function to a stakeholder? 3. Which activities is the customer capable to provide in a timely manner and with a high level of quality? Which information technology configuration is necessary for a successful cooperation? 4. What problems are related to stakeholders not contributing in a required timely, qualitative and quantitative manner (e.g. exceeded time and cost constraints)? 5. Can the outsourced function be governed in a sufficient way?
Visibility	1. Which aspects of the function are currently made visible to stakeholders (as-is state)? 2. Which aspects of the function should be made visible to demonstrate effectiveness and efficiency in the companies' own business processes? 3. Which business processes does the customer need to track in order to provide his own goods and services (process evidence)? 4. Access on which processes and data must be constrained (e.g. compliance to legal directives and contracts)? 5. Which channels (internet, mobile devices etc.) should be used to provide customers with the required information? 6. Should a push or pull concept be used when transferring data?

Table 2: Excerpt of central questions for both areas of analysis

After identifying suitable service candidates, their feasibility to be implemented as services has to be evaluated as well. As a trivial requirement, the function must (at least partially) be supportable by IT systems. Whereas answering the central questions supports ascertaining the potential of adjusting the line of visibility or line of interaction from a business point of view, we derive criteria to evaluate the service feasibility from an IT perspective based on SOA design principles (cf. Figure 2).

SOA design principle	BASKERVILLE ET AL. 2005	BOOTH ET AL. 2004	DOSTAL ET AL. 2005	ERL 2004	FRITZ 2004	KLESSE, WORTMANN, SCHELP 2005	KRAFIG, BANKE, SLAMA 2005	MCGOVERN ET AL. 2003, 40f	NEWCOMER, LOMOW 2004	PAPAZGLOU ET AL. 2006	RICHTER, HALLER, SCHREY 2005	Category	Derivation of technical service criteria
Abstraction from service-implementation	X	X	X	X	X		X	X	X	X	X	Interface orientation	Chance to establish an interface Umambiguous definition of input and output parameters
Comprehensive service-specification	X	X		X		X	X	X	X		X		
Solid service-contracts			X	X	X	X	X		X		X		
Technical standardisation	X	X	X		X		X	X	X	X	X	Interoperability	Conformity with web service technology and standards None-time-critical functions Data volume to be transferred is low
Functional standardisation			X						X				
Use of open standards	X		X		X				X	X	X		
Strong cohesion and loose coupling	X			X	X	X	X	X	X	X		Autonomy and modularity	Autonomy of functionality Use of functionality beyond business context
Loosely coupled communication			X	X			X	X	X	X	X		
Business-oriented granularity		X					X	X	X		X	Requirements-orientation	Top-Down-Analysis Reuse of functionality
Generalisation of service performance			X	X			X	X	X				

Figure 2: Formal derivation of criteria to evaluate the service feasibility of functions

In the SOA context, scientific literature implicitly and explicitly outlines design-principles, which can be subdivided into four categories: *interface orientation*, *interoperability*, *autonomy and modularity*, and *requirements-orientation* (cf. Figure 2, according to Schemm et al. 2006). Design principles related to *interface orientation* demand the interfaces of services to be described explicitly and completively. Furthermore, interfaces must abstract from implementation details, from the service consumers' point of view. Therefore, service interfaces as constituting parts of a SOA must represent stable and binding contracts, which are stored and administrated in a central repository and are only updated with respect to clearly defined modification cycles.

To reach *interoperability*, components should be standardised from a technical (e.g. transfer protocols and data formats) and conceptual (e.g. clearly and uniformly specified terms and standardized data models) point of view. These standards are most useful when open, platform independent and widely diffused, e.g. as industry standards. Design requirements regarding *modularity and autonomy* require the grouping of functionality and resources, according to the principles of high cohesion (strong similarity within the same category) and loose coupling (weak dependencies between different categories). According to the design principles of *requirements-orientation*, the functionality provided by services shall be designed based on business processes or business objects.

On the basis of these design principles we have derived criteria for assessing the service feasibility of business functions from an IT perspective: Design principles related to *interface orientation* demand for well-defined interfaces. Relevant input and output parameters have to be specified clearly and unambiguously. Moreover, services can be administrated and used more easily if these interfaces are not subject to unpredicted modifications.

Principles of *interoperability* are currently being addressed by web services technology and are manifested in standards like SOAP, WSDL and UDDI. However, these technologies are closely connected to XML, data volumes to be transferred may be significantly enlarged by additional mark-up elements (e.g. Burghardt 2004, p. 35). Also it has to be noted, that executing conversion processes when sending or receiving data using SOAP messages can impose additional workload on IT systems (Dostal et al. 2005, p. 42). Thus, when assessing the service feasibility of automated processes, performance issues have to be taken into consideration.

The principles of *modularity and autonomy* require that process model functions have to be autonomous to a certain degree. Following this line of argumentation, functions shall as well be useable outside their original timely and logical context. From the design principles related to *requirements orientation* it can be inferred, that the discovery of service candidates should be carried out as a top-down process. This approach shall ensure findings do correspond to meaningful business requirements, as adequate services usually have significant potential to be reused in other contexts.

In order to document the results of the business and information technology analysis, we use the evaluation sheet depicted in Figure 3. The sheet comprises the potential of functions that are to be taken over by stakeholders (takeover) and the potential of making their business processes visible to customers (visibility). The identification of sufficient business potential is marked (X) in the corresponding column. Footnotes near the marker can be used to state specifics or constraints. For example, enlarging visibility of business processes for customers can be constrained to quotes regarding the customer's own activities.

Service feasibility of functions is assessed from an information technology perspective to detect whether existing business potential can be reaped by an IT service (cf. Figure 3). This decision is derived from the values related to the criteria *interface orientation*, *interoperability*, *modularity and autonomy*, and *requirements orientation* (cf. Figure 2). If service feasibility prevails, the corresponding rectangle is shaded grey. In this case, the corresponding functions are service candidates and shall be subject to further steps of analysis.

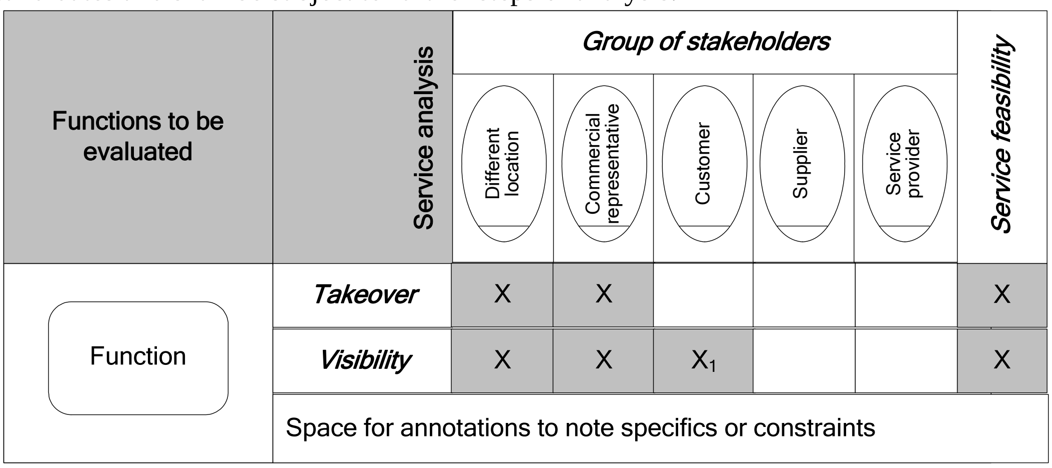

Figure 3: Evaluation sheet summarizing the service feasibility of functions

2.3 Phase 3 - Service Categorization

In contrast to the presented top-down approach of business process model analysis, the phase *service categorization* (cf. Figure 1) focuses the IT point of view in a complementing bottom-up approach. Accounting for the need to align business and IT, this step thus shall enable companies to reap takeover and visibility potentials, which have been identified during the *service analysis* phase by implementing and providing IT services. Facing a lack of widely accepted classification schemes for services (as will be shown in Section 4) a basic distinction of elemental services and composed services (process services) is proposed here.

Elemental services cannot be divided any further, because they comprise atomic operations. However, they can be distinguished into entity services and task services (Erl 2005, Krafzig & Banke & Slama 2005). Entity services contain operations, especially for reading and writing data that is meaningful to the company (such as quotes, orders, customers, or suppliers). As processes related to business entities usually use similar elemental operations, we defined the four elemental operations create(), modify(), view() and delete(). If necessary, additional operations can be added. On the other hand, task services comprise special operations, e.g. calculations of an estimated delivery date. Due to the individuality of the tasks to be conducted, no default operations can be defined for this type of service.

Compared to elemental services, process services are more complex and incorporate operations of basic services as building blocks. Due to their modular structure, they can be set up rapidly and with a high degree of flexibility. Being designed more sophisticatedly, process services support rather comprehensive tasks as self-contained units of the company's business processes.

3 APPLICATION OF THE METHOD IN THE PRODUCTION PLANNING OF A MEDIUM-SIZED MANUFACTURING COMPANY

The proposed approach was evaluated at a medium-sized manufacturing company in the plant engineering and construction industry sector. Being divided into several production plants across Europe, products provided by the company are manufactured according to individual customer requirements. For the company, it is therefore crucial to develop a technical specification for the product in close cooperation with the customer. In this context, services can be used to facilitate a close interaction with customers and other stakeholders, despite heterogeneous IT infrastructure. Based on services, internal business units (e.g. subsidiaries) and external partners (e.g. customers or suppliers) can work together and execute business processes more efficiently. The resulting services and scenarios provide a basis for the deployment of SOA across the company.

Applying the procedure model presented in Section 2, the following phases were accomplished. During the *preparation* phase the scope of the analysis was restricted to the following core business processes: Processing of Requests For Proposal (RFP) and quotes, sales order processing, construction, material management, capacity management, production and shipment. For these processes, process models in the form of event-driven process chains (EPC) did already exist as an output of formerly conducted BPM projects. Process models were altered with respect to applicable modelling conventions (cf. Figure 4).

As potential addressees of services, five stakeholder groups were identified. Besides the obligatory relations with *customers* and *suppliers*, a variety of connections exist to external *service providers* (e.g. supporting the functional areas of construction and galvanizing) and *commercial representatives*, who guarantee a pan-Europe customer service for the complex products. The numerous interrelationships between production plants and subsidiaries as well as affiliated companies were combined to form the stakeholder group *other facilities*.

The phase of *process model analysis* can only be presented here by describing a sample process. This is done by introducing an analysis of detailed process models concerning the function of designing a quote (cf. Figure 4). In this process, especially delivery dates, prices, delivery conditions and payment conditions are determined. Quotes may also be processed and issued by subsidiaries, commercial representatives or company internal sales representatives. The customer him/herself may also conduct calculations of the price or delivery date (e.g. by utilizing a web-shop interface). These stakeholders greatly benefit from taking over the function of order processing, because they can calculate customer specific prices and delivery dates in real-time and are not dependent on the operational availability of a commercial representative. On this basis, stakeholders are able to provide more detailed and up-to-date information to their own customers. Visibility potentials are present because customers, commercial representatives and other facilities should be enabled to gain information about their processes, irrespective of time or space constraints. Service candidates from the analysis of detailed models might be consolidated to form more complex process services.

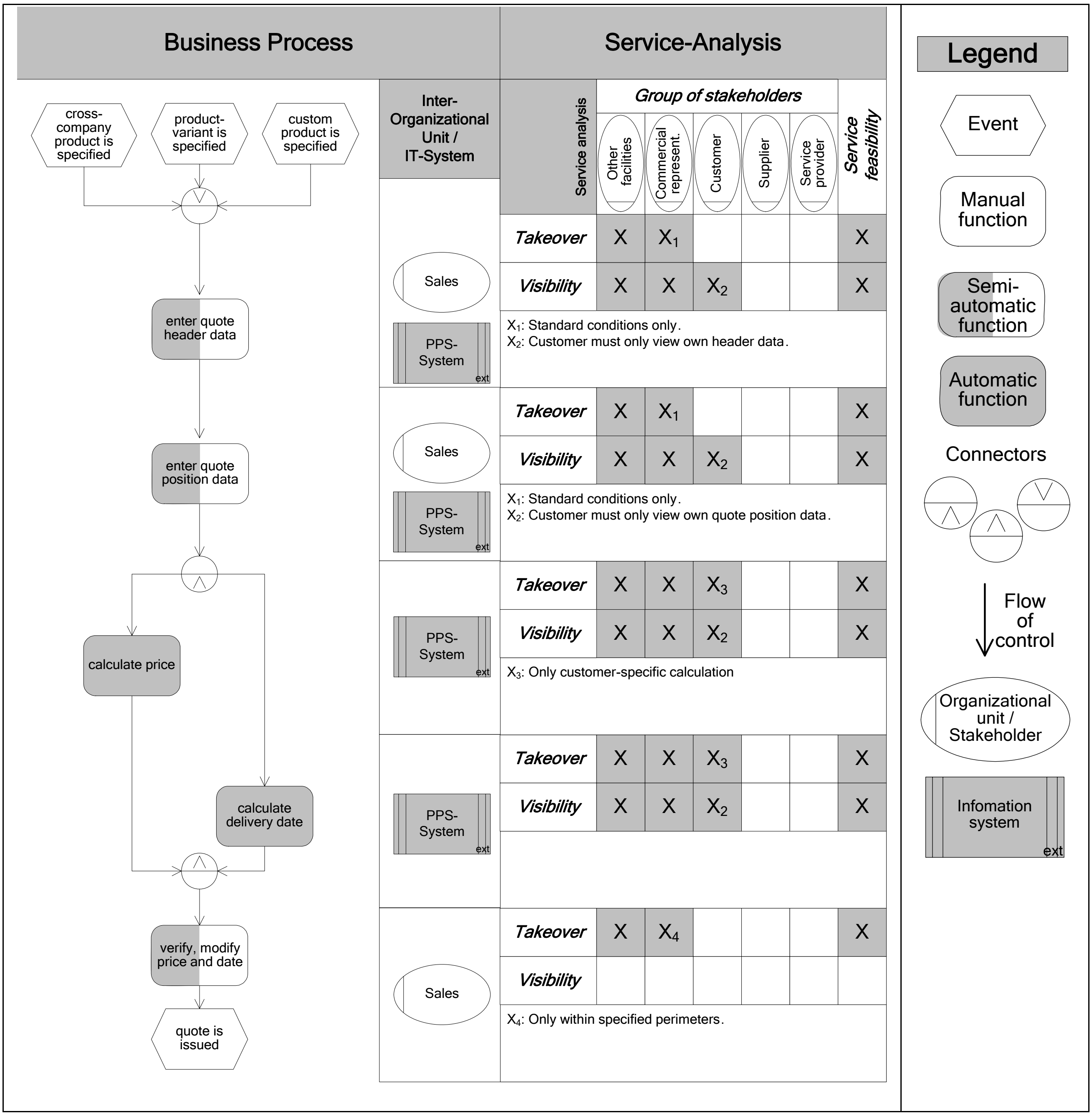

Figure 4: Detailed analysis of issuing quotes

For service candidates of functions that have been analysed with respect to their detailed process models, it has to be assessed how they shall be implemented from an information technology point of view.

The results of the *service categorization* phase with respect to basic services are presented in Table 3. Commercial representatives or other facilities might takeover the functions *enter quote header data* and *enter quote position data*. Thereby, they utilize the entity service *quote* and the included default-operation *create()*. As input parameters, the operation expects quote header data (e.g. customerID and delivery date) and the corresponding quote position data (especially productID and related values). Optional input parameters are delivery and payment conditions (on header and position levels). The potential for visibility of this function is implemented by the entity service quote as well. This time, the default operation *view()* grants access not only to other facilities and commercial representatives but also to customers.

The service potential of the task services *price calculation* and *delivery date calculation* is implemented by two task services, comprising the operations *calculatePrice()* and *calculateDeliveryDate()*.

Basic Service (Service-type)	Operation	Input-Parameter	Output-Parameter	Service consumer
quote (Entity)	create()	quote header data, quote position data, [payment and delivery conditions]	quoteID	OF (other facilities), CR (commercial representative)
	modify()	Quote header data, quote position data, [payment and delivery conditions (delta)]	notification	OF, CR
	view()	quoteID	quote header data, quote position data	OF, CR, CU(customer)
	delete()	quoteID	notification	
price calculation (Task)	calculatePrice()	materialID, values	price	OF, CR, CU
	modifyPrice()	quoteID, quote position, new price	notification	OF, CR
delivery date calculation (Task)	calculateDeliveryDate()	materialID, values	delivery date	OF, CR, CU
	modifyDeliveryDate()	quoteID, quote position, new delivery date	notification	OF, CR

Table 3: Basic services for issuing quotes

Further implementation aspects might consider the composition of services by combining already specified basic service operations. Therefore, functions and services should be combined with respect to workflows as depicted in the corresponding process models. Table 4 presents service compositions supporting the *quote* business process.

As all functions related to a sub-process of issuing quotes have been identified to hold takeover potential for important stakeholder groups (e.g. other facilities and commercial representatives), the process of issuing quotes can be carried out by these stakeholder groups completely. Therefore, they utilize the process service *enter quote*. This process service is composed of the formerly defined basic service operations.

An additional service composition is the process service *calculate quote*, which enables other facilities, commercial representatives and customers to calculate actual prices and delivery dates autonomously, without the involvement of an internal sales representative. These calculations can be subject to special product specifications of stakeholders. If the potential customer is satisfied with the calculated prices and delivery dates, the sub-process *enter order* is initiated, which is not presented here.

Process Service	Service consumer	Function	Service	Operation
enter quote	OF, CR	enter quote header data	quote	create()
		enter quote position data	quote	create()
		calculate price	price calculation	calculatePrice()
		calculate delivery date	delivery date calculation	calculateDeliveryDate()
		modify price, delivery date	price calculation	modifyPrice()
			delivery date calculation	modifyDeliveryDate()
calculate quote	OF, CR, CU	calculate price	price calculation	calculatePrice()
		calculate delivery date	delivery date calculation	calculateDeliveryDate()
		enter quote header data	quote	create()
		enter quote position data	quote	create()

Table 4: Process services for issuing quotes

4 RELATED WORK

Although the concept of SOA has been intensively debated in recent years, a unified methodical approach for identifying services has not yet been reached. Instead, a variety of heterogeneous approaches have been proposed (cf. Table 5, according to Klose (2006)). Approaches especially vary in terms of service hierarchies and analysis objectives. Thus, methods are proposed to identify services by utilizing the information systems in place in a bottom-up approach (e.g. Nadhan 2004) or follow a procedure of analysing business requirements in a top-down approach (e.g. Erl 2005, Quartel & Dijkman & Sinderen 2004). Other approaches integrate both perspectives into a hybrid strategy, referred to as 'meet-in-the-middle' approach (e.g. Zacharias 2005, Ivanov & Stähler 2005). The lack of a consolidated approach also becomes obvious in a deviant regard of service categories. In terms of service hierarchies, some approaches generally identify services (e.g. Zacharias 2005, Ivanov & Stähler 2005), while other approaches distinguish different service categories (e.g. Nadhan 2004, Erl 2005, Quartel & Dijkman & Sinderen 2004). Furthermore, methods are based on different SOA philosophies, such as SOA as a comprehensive middleware approach (e.g. Gold-Bernstein, Ruh 2005), or SOA as a concept for a flexible configuration of information systems (e.g. SAP Enterprise Services Design Guide 2006).

Moreover, some approaches address all SOA lifecycle phases (e.g. Erl 2006, SAP Enterprise Services Design Guide 2006), while other approaches restrict themselves to early SOA phases, such as service identification or service design (e.g. Zacharias 2005). Additionally, approaches vary in forms of documentation as well as in use of IT criteria to support the service identification. Approaches make different use of process models: Instead of deducting services from process models systematically as a meaningful representation of business processes, some approaches restrict themselves to formulating general guidelines for identifying services. A consolidation of these approaches seems beneficial to guide the procedure of service identification more thoroughly.

Compared to existing approaches, the procedure presented in this paper introduces a strong business perspective into the derivation of service candidates. This is done by integrating stakeholders as important participants when deriving services from business process models in a top-down approach. On the other hand, service categories are consolidated to form more complex services in a complimentary bottom-up approach. Therefore, the procedure integrates both perspectives. After assessing their business potential, suitable service candidates are evaluated due to their technical service feasibility by applying SOA design principals. In this way, the proposed approach is a valuable asset to identify suitable services from a business and IT point of view in an integrated perspective.

5 OUTLOOK

A sound specification of basic services and process services identified by utilizing the approach presented in this paper is essential to successfully design and implement the concept of SOA. Before a detailed specification and a technical implementation can be accomplished, a profound prioritization of services should be carried out first. In this analysis costs and benefits of conglomerates of services shall be analysed and weighed up.

Costs of implementing services are highly subject to the IT systems in place. Benefits can be derived from takeover and visibility effects gained from identified potentials during the service identification phase. To transfer these potentials into action, implementing IT services at low costs and generating high returns is most beneficial. The operationalization of costs and benefits estimation, as well as the choice of suitable service granularity for service prioritization on the other hand requires further scientific investigation.

Concerning the conceptual IT implementation of the prioritized services, input and output parameters of services are to be specified and must be transferred into a formal interface definition. During this process a complete signature of operations (including e. g., data types, input and output parameters of service invocations) and the SOA standards to be used have to be selected and defined.

Approach / Author (Year) Criteria	Zacharias (2005)	Event-Driven Service Design Gold-Bernstein, Ruh (2005)	Ivanov, Strähler (2005)	Sprot et al. (2004, 2005)	Nadhan (2004)	SOAD / Zimmermann, Krogdahl, Gee (2005)	SAP Enterprise Services Design Guide (2006)	Service-oriented Analysis / Erl (2006)	SOA Blueprints / OASIS (2005, 2006)	*Proposed approach* *(2006)*
Background and starting point	bottom-up: Functional Division of IS in components	top-down: Starting point are business events and hence business processes	top-down: Starting point are business processes	no original approach, Criteria regard IS and business processes	bottom-up: Analysis of current IS and their functionality	meet-in-the-middle: parallel analysis of business processes and IS	meet-in-the-middle: Criteria for business processes and information system	meet-in-the-middle: parallel analysis of business processes and IS	top-down: Derivation and decomposition of a service model	*top-down: Business processes are decomposed*
Employed SOA concept	flexible, process-oriented IS configuration	comprehensive middleware (focus on EAI)	flexible, process-oriented IS configuration (implicit)	flexible, process-oriented IS configuration and comprehensive middleware	comprehensive middleware, vertical tiered architecture	ad-hoc configura-tion of IS	flexible, process-oriented IS configuration	flexible, process-oriented and ad-hoc configuration, middleware, tiered architecture	vertical software architecture, IS-configuration (implicit)	*horizontal software architecture and exhaustive middleware approach*
Service hierarchies and classification scheme	3 hierarchies: functional components, functional services and data entities, operations	-	3 service hierarchies: service, port-type, operation	none, implicit distinction of elemental and composed services	none, implicit distinction of elemental and composed services	5 hierarchies: Functional Domain, Business Process, Business Services, SW-Services, SW-	2 hierarchies: enterprise services, service operations. 4 functional categories of enterprise services	11 service types are proposed (partially hierarchical, partially orthogonal)	initial distinction of business servics and supporting services, 6 service types in the context of service pattern blueprints	*2 service-hierarchies: process services, basic services (comp. of tasks and entity services)*
Covering of SOA design phases	service identification and design	service identification and design	service identification as part of the BPM lifecycle	no classification possible	focus on service development. Service identification is a minor stage	all SOA phases	all SOA phases	all SOA phases	service identification and esp. design	*service identification and functional specification*
Documentation of the method	basic idea, some examples	exhaustive documentation, tables and examples	basic idea, no consistent example	criteria presented in a table	7-phase approach, short documentation, few examples	basic idea, consistent example. Approach is regarded as a basis for further	exhaustive, 16 criteria for identification of Enterprise Services, 10 design guidelines	exhaustive documentation, 2 consistent examples. Case studies, guidelines, process model	2 documents; specification as draft. Numerous comments and gaps	*process model, formal criteria, case study*
Proposal of IT criteria for service identification	2 criteria high cohesion, loose coupling	2 criteria high cohesion, loose coupling	-	5 groups of criteria: potential of web services	consolidation of seldom used or similar services	numerous so called qualitative factors	numerous technical criteria for IS and business processes	numerous technical design guidelines for categorization of services (cand.)	no, primarily technical blueprints for design of identified services	*derived from SOA principles*
Application of process models for service identification	derived and specified by functional components	implicit, as they trigger business processes	process models are divided into detailed process models and job steps / activities	implicit, as criteria are partially used on process models	for definition of functional areas only, to enable code reengineering or	low substance, basis on business services and service	criteria are applied on business processes	are initially decomposed into service candidates	low significance, process models are a starting point for service models	*process models as foundation*
Regard to stakeholders for service identification	-	-	-	implicit by defining process interfaces	-	-	implicit by defining process interfaces	-	yes, by domain external actors. No advice for service identification	*uncovering of takeover and visibility potentials*

Table 5: Comparison of approaches regarding service identification

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