Leverage Productivity Potentials in Service-oriented Procurement Transactions: E-Standards in Service Procurement

Peter Weiß¹, Maik Herfurth², Jörg Schumacher³

¹International Business School of Service Management (ISS), ²FZI Forschungszentrum Informatik, ³eCl@ss e.V.

The paper highlights best practices and a systematic approach to analyze service-oriented procurement processes and transactions. Approach, methods and applied techniques are shown which allow analyzing service procurement processes. 18 use cases have been categorized and analyzed in detail. The measurement has been conducted using a set of simple metrics such as total processing time, allocated resources, media breaks, etc. As a result, concrete cost, time, and resource savings could be measured. First measurements has shown possible total annual cost savings ranging from some 100 kEUR to 1,6 million EUR. Amount of savings is contingent on the type of service rendered and degree of standards’ supporting flexible transactions and interactions. In this way, a framework could be realized which allows benchmarking of product-related services with focus on industrial maintenance services.

1. Introduction

Standardization and automation of service delivery and procurement processes are of top priority on larger companies’ e-business agenda. Establishing a common understanding of collaborative business processes showed the highest productivity gains. The paper looks at derived requirements and best practices from a set of hand on examples of product-related services. A toolbox of e-standards for services could be elaborated including classification standard for services, business reference process as well as a portable, flexible e-business format eBusiness for Services (eBuS-XML) aiming at the flexible integration and better support of typical business interactions along the service value chain.

The project consortium of eBusInstand kicked off a standardization process and benchmark initiative which is supposed to enter its second phase in early 2012 to deploy and roll out elaborated standards on a broader scale.¹ Product-related services in the domain of renewable energy plants such as photovoltaic will then be one particular thematic priority. The developed eBuS-reference-format supports all phases and concepts along the value creation and service delivery process, namely, service catalogues and configuration of service packages (combining and reusing pre-

¹ Project eBusInstand supported by the Federal Ministry of Economics and Technology: http://www.ebusinstand.de, last visited 10. August 2011.
configured service units or modules (packages)). In this way, simple/elementary but as well complex service offerings can be described and broken down into smallest building blocks.

Last but not least, foundations of a service operations measurement and process benchmark were laid comprising indicators and variables. Furthermore, flexible integration scenarios are looked into striving for increased productivity and highly integrated service value chains. The remainder of the paper is structured as follows. First conducted research is motivated and the research objectives are stated. After a brief summary of the context of research, research design and approach is looked at. Subsequently, selected use cases are described and the need and purpose of service classification in the context of service procurement is motivated. Service-oriented procurement transactions promise significant cost and time savings in service-related procurement processes. It is looked at state-of-play, requirements and a solution is proposed to overcome existing shortcomings in service procurement. Finally, results yielding from the measurement of cost and time savings are shown. The paper ends with a summary and conclusions.

2. Objectives

Business processes have great influence on productivity of services besides qualifications and competences of service employees.\(^2\) Standardization and automation of service delivery is seen as important growth driver for service industry. Service procurement processes today are thus still source of high cost and lack efficiency. Service procurement processes are characterized through lack of standardization, resulting in numerous media breaks, increased transactions cost, inefficient interactions of business partners as well as poorly connected IT systems. Latter are often only reflecting the specific needs of customers (larger enterprises) and are missing characteristics of service operations and processes. Integration of products, services and IT will be more demanding in future and is expected to have considerable impact on growth and productivity of service operations and productivity (Herfurth, Schuster, Weiß, 2011). In the remainder of the paper results of our research cannot be presented in full detail. Therefore an overview and summary of research findings is given which yielded from research conducted during the previous four years on productivity gains through optimization of service-related procurement processes and transactions. Throughout the paper it is linked to previously published research papers which can be consulted to achieve more details of presented research and yielded results.

3. **State-of-Play in Service Procurement**

Service-oriented transaction processes in procurement and IT systems today still lack a clear understanding of the special characteristics of services and related service process logic (Lindberg, Nordin, 2008). Service procurement and services have become top priority on executive’s strategic agenda. IT can be seen as one major driver of change in service business. Productivity in service operations offers potential for improvements, foremost service procurement operations (see KSRI, 2009). Procurement processes and service operations are far from level of transparency and quality already achieved in operations in material or goods procurement. Related administrative processes are source of numerous errors and flaws, which results in increased transaction costs. (KSRI, 2009) describes a clear gap between procurement and line of business strategies. Procurement managers complain about a lack of visibility and transparency of service providers cost structure and capabilities. State-of-the-art in service procurement has been assessed and presented in detail in (Weiß, Herfurth, 2011), (Herfurth, Weiß, 2010a,b), (Herfurth, Weiß, Rudolf, Kern, 2010), (Herfurth, Schuster, Weiß, 2011). This paragraph reviews above mentioned material and summarises major issues and points raised. Interested readers are recommended to consult referred publications to achieve further details and insights.

Service operations are typically characterized through integrated and intensified buyer-seller interactions along the service processes (van der Valk, 2008). These interactions require effective communication and structured information exchange with representatives of supplier and customer either line of business or procurement. (van der Valk, 2008) proposes interaction patterns which are contingent on the type of service and differ concerning structural and process dimension (Weiß, Herfurth, 2011). Interactions require involvement and information exchange with representatives of supplier and customer who possess critical capabilities supporting service operations and determining service success. Representatives are either coming from line of business or procurement functions. (van der Valk, 2008) proposes four basic service types: (1) component, (2) semi-manufactured, (3) instrumental and (4) consumption. Dependent on the determined type of service representatives are selected and involved in service operations and value creation, in service foremost co-creation processes.

Current state-of-the-art IT-systems do not offer adequately support of service-related business processes. The components of e-procurement are shown in the figure below.

<table>
<thead>
<tr>
<th>Role</th>
<th>Component</th>
</tr>
</thead>
<tbody>
<tr>
<td>Buyer</td>
<td>Back-end-system</td>
</tr>
<tr>
<td></td>
<td>E-procurement system</td>
</tr>
<tr>
<td>Supplier</td>
<td>Electronic catalogues for service specifications</td>
</tr>
<tr>
<td></td>
<td>Back-end-system</td>
</tr>
</tbody>
</table>

Table 1: Components of Service e-Procurement (Herfurth, Weiß, Rudolf, Kern, 2010)
“E-procurement can be further subdivided into e-ordering and e-sourcing in correspondence with its support to operational and strategic procurement” (Herfurth, Weiß, Rudolf, Kern, 2010). E-ordering aims at faster, easier and decentralized operational procurement processes at least possible cost striving for reduction of procurement process costs and in this way leveraging productivity gains.

E-Procurement offers high saving potentials by using automation technologies and e-business standards. State-of-the-art and ongoing developments and changes are addressed in various articles and reports, such as (Ponsignon, Smart, Maull, 2007), (Böhmann, Bremerich, Taurel, 2009), (Teboul, 2006), (KSRI, 2009), (Lindberg, Nordin, 2008), (van der Valk, 2008), (Johannson, Olhager, 2003), (Kagermann, Oesterle, Jordan, 2011). A strong influence can be seen by the use of new technologies in service delivery systems, mainly driven by IT and internet-driven channel, resulting in increased complexity (Ponsignon, Smart, Maull, 2007). IT can be seen as one major driver of change in service businesses (Kagermann, Oesterle, Jordan, 2011), (Zetzl, Käuper, 2006). The missing support of IT systems for service e-procurement systems lead to a lack of transparency. A recent study highlighted service procurement managers estimate that service costs could be reduced by 10 to 25 per cent if “they had transparency similar to goods procurement” (KSRI, 2009). Foremost, standard enterprise information systems follow wrong process logic and are far from achieving similar maturity levels for service operations as for materials and goods. Furthermore, the absence of shared standards and lack of standardization in service operations (especially business processes, transaction formats and information models) has led to a variety of incompatible and individual platforms and solutions. Due to the development of individualized software solutions and architectures, service procurement is characterized by high manual efforts and interventions as well as numerous media breaks, both at the existing interfaces between internal functions and systems and/or interfaces to exchange information with external actors. Small and medium enterprises (SME) suffer from these effects. Flexible and standardized solutions for the integration of SMEs to IT-systems of large enterprises in collaborative networks are scarcely available (see Fig. 1).

Fig. 1: Example of typical constellation and value creation in service ecosystems

(KSRI, 2009) interviewed a total of 306 managers: 272 procurement managers and 34 line of business managers.
Personal effort in service processes and the time needed along the transaction of the whole processes is mostly underestimated and no or only limited support is offered in the electronic mapping of service to e-procurement processes (Herfurth, Weiß, Rudolf, Kern, 2010). Especially, object-related maintenance is still a source of high costs (KSRI, 2009) and inefficiencies.

As already highlighted service-related procurement transactions differ from material-related procurement transactions. Service-related procurement transactions can be drawn in specific procurement phases. The transactions require more interactions for the specification (configuration) or activity reporting (bill of quantities) (see Fig. 2). Service procurement processes possess similar phases as material-oriented processes but differ in process phases “offer” and “measurement” from material processes through process cycles resulting from more interactions between actors. Resulting process cycle constitute the peculiarities of service logic.

![Process-cycles as major differences from goods-dominant logic: enhanced interaction required to configure and deliver industrial services](image)

The physical product testing of good in the phase of goods received cannot be applied for services. The result of a service can only be approved afterwards. This has an impact on the business processes and business objects. The material components have to be part of procurement transactions and included into electronic description of services as well as in related business processes.

The paragraph has highlighted that interaction patterns are contingent on the type of service and differ concerning structural and process dimension of buyer-seller interaction. Enhanced interaction is required to configure and deliver services resulting in above mentioned process cycles. Interaction are directed by interfaces between service providers and service consumers. For adequate IT support of service procurement, there is a need for more flexible interfaces to integrate service providers in value creation. Subsequently, the research approach chosen is looked at in further detail.
4. Research Approach

Overcoming described shortfalls and address the challenges highlighted before, research needs to follow a holistic approach including all processes phases and transactions from planning to accounting. Analysis of collaborative business process is expected to show up saving potentials and allows reducing some of existing errors and flaws in current service procurement practices, reaching from redundant tasks, unplanned manual interventions, and exception handling to not preferable side effects as “maverick buying.” The analysis aims at reduction of resources in current administrative processes and to lower administrative workload primarily through reduction of media breaks.

Use cases were classified into groups, subgroups and commodities on basis of typical service variables and properties. Starting from a standardized reference business process, selected use cases were analyzed in detail, showing interfaces between business partners (third-party service providers) and document/data flows along the service value chain. A measurement has been set up which allows to substantiate concrete productivity potentials and gains per use case.

For analysis of the selection of use cases a systematic approach was applied (see figure below).

![Systematic Analysis Approach](image)

The analyzed use case scenarios represent typical sector-specific value chain constellations from the area of industrial maintenance services and are related to facility management, industry waste disposal, asset management, cleaning and renewable energies (photovoltaic plants) (Herfurth, Schuster, Weiß, 2011).

In our holistic approach, we were analyzing use cases from planning to payment of different kind of service types. The use cases could be classified into service type groups like small projects, service call or single interventions. Each of the service type can be characterized by different characteristics. Out of these characteristics we could develop conceptual data models for the (1) design of services unit, (2) the environment of service transactions (specifications) and the (2) order transaction of dif-

---

4 Maverick buying bypasses established decision procedures and/or existing IT-systems and tools for spent analysis through declaring related processes and transactions justifiable to run manual or not standardized procedures to process related orders or cases.
ferent service types. The detailed analysis of internal and company-wide business processes of service and order transactions allowed us to gain more detailed characteristics.

In order to surpass the described problems and challenges for service e-procurement, service procurement networks were evaluated by looking at a set of real life use cases (18 in total). Internal and company-wide processes were analyzed with regard to document and data flow, as well as used IT-systems (Herfurth, Schuster, Weiß, 2011). For the conceptual design of electronic services for service procurement networks, two essential elements were identified: (1) service business processes (supporting required interaction phases) and (2) flexible IT systems (Herfurth, Schuster, Weiß, 2011). The applied methodology has been described in (Herfurth, Schuster, Weiß, 2011).

A detailed analysis of the business processes starts with reference process modeling (1) in order to realize mayor differences and discrepancies of process instances of selected use cases.

The reference process model defines typical collaborative interfaces between contractors and ordering parties. In a detailed analysis of use cases (2), the business processes are analyzed, media breaks are marked and scrutinized, redundant activities like repeated manual input of business data in company’s IT-system. An analysis of documents (3) aims at better understanding of information flows in the service network. Existing interfaces (4) connecting the various IT-systems were looked at and data flows were analyzed in depth. Internal and company-wide processes were assessed to measure processing time of transactions and processes, total cycle time for processing service orders and required amount of man-hours and days (5). Finally, the results of analysis of realized measurement leads to re-engineering of value or business processes (6) which need to be accompanied by an appropriate change management to achieve required sustainability (7) (Herfurth, Schuster, Weiß, 2011).

As a major result yielding from this analysis, a tool box was developed to achieve required functionality. The following elements are contained in the tool box: reference models of service-related procurement processes, standardized e-business interfaces/transaction formats (Herfurth, Weiß, Rudolf, Kern, 2010), service classification system and universal service master data (data types in typical transactions) in electronic document exchange and data flow. In the remainder, the support of business process by EA\(^5\) and SOA\(^6\) are in focus (Herfurth, Schuster, Weiß, 2011).

As highlighted chosen research approach aims at measuring the unexploited potential to leverage productivity gains in current service procurement processes. The major part of procurement processes looked at is related to administrative activities. Typically administrative tasks require entering or processing data in IT systems such as ERP systems or individual/ specific IT systems for maintenance management and planning (typically the case on supplier side). As a result measurable targets are provided to companies which allow comparing their individual operations on the level of use cases with data gathered in the sample. Last but not least, in the remainder it is

\(^5\) Enterprise Application Integration.  
\(^6\) Service-Oriented Architecture.
motivated to achieve better transparency and to increase companies’ ability to spend analysis through application of the new service segments of eCl@ss-Standard (in current version 7.0) (eCl@ss, 2011).

5. **Detailed Analysis of Use Cases**

Use cases have been taken from the domain of industrial maintenance. The cases include both preventive and corrective maintenance scenario. “Maintenance is a fundamental service offering during the life cycle of industrial plants and capital goods” (DIN PAS 1047, 23). Based on DIN EN 13306:2001 (DIN, 2001) maintenance can be defined as a “(...) combination of all technical, administrative and management actions during the life cycle of an item to keep it in, or restore it to, a state in which it can perform its required function” (DIN PAS 1047,23).

The subsequent table overviews selected use cases for the analysis. The use cases have been selected prior to their relevance to the company’s business, frequency of operation and typical cost range. Even if only small savings can be realised per case, in summary over a longer time period, small savings show to turn out into considerable cost and time savings. Use cases have been selected jointly through customer and supplier. In this way the relevance and importance of analysed use cases has been granted. For the analysis in total 18 use cases have been looked into.

<table>
<thead>
<tr>
<th>No.</th>
<th>Use Case Description</th>
<th>Service Type</th>
<th>Classification</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Maintenance of a ventilation system</td>
<td>P</td>
<td>Maintenance (frame contract)</td>
</tr>
<tr>
<td>2</td>
<td>Inspection and repair of air conditioning equipment in buildings</td>
<td>P, C</td>
<td>Inspection/ repair (frame contract)</td>
</tr>
<tr>
<td>3</td>
<td>Exchange of containers</td>
<td>C</td>
<td>Disposal (single contract)</td>
</tr>
<tr>
<td>4</td>
<td>Provision and collection of container systems as part of factory disposal system</td>
<td>P</td>
<td>Disposal (frame contract)</td>
</tr>
<tr>
<td>5</td>
<td>Material supply and logistics in facility management</td>
<td>P</td>
<td>Material supply (frame contract)</td>
</tr>
<tr>
<td>6</td>
<td>Cleaning and maintenance of a dry fan</td>
<td>P</td>
<td>Cleaning/ Maintenance (frame contract)</td>
</tr>
<tr>
<td>7</td>
<td>Maintenance and inspection of fire doors</td>
<td>P</td>
<td>Maintenance (frame contract)</td>
</tr>
<tr>
<td>8</td>
<td>Repair of a double leaf fire door</td>
<td>C</td>
<td>Repair (frame contract)</td>
</tr>
<tr>
<td></td>
<td>Description</td>
<td>Code</td>
<td>Contract Type</td>
</tr>
<tr>
<td>---</td>
<td>------------------------------------------------------</td>
<td>------</td>
<td>-----------------------------------</td>
</tr>
<tr>
<td>9</td>
<td>Repair of a steel frame</td>
<td>C</td>
<td>Small project (single contract)</td>
</tr>
<tr>
<td>10</td>
<td>Remote monitoring and control of a photovoltaic system</td>
<td>P, C</td>
<td>Remote service (frame contract)</td>
</tr>
<tr>
<td>11</td>
<td>Repair of a photovoltaic system</td>
<td>C</td>
<td>Repair (frame contract)</td>
</tr>
<tr>
<td>12</td>
<td>Maintenance of a photovoltaic system</td>
<td>P</td>
<td>Maintenance (frame contract)</td>
</tr>
<tr>
<td>13</td>
<td>Improvement of a photovoltaic system</td>
<td>C</td>
<td>Small project (single contract)</td>
</tr>
<tr>
<td>14</td>
<td>Yield control of a photovoltaic system</td>
<td>P</td>
<td>Analysis and diagnosis (frame contract)</td>
</tr>
<tr>
<td>15</td>
<td>Inspection Lighting</td>
<td>P</td>
<td>Inspection (frame contract)</td>
</tr>
<tr>
<td>16</td>
<td>Maintenance and air-conditioning</td>
<td>P</td>
<td>Repair (frame contract)</td>
</tr>
<tr>
<td>17</td>
<td>Inspection and repair of heating</td>
<td>P, C</td>
<td>Small project (single contract)</td>
</tr>
<tr>
<td>18</td>
<td>Commissioning of a technical building system</td>
<td>C</td>
<td>Major project (single contract)</td>
</tr>
</tbody>
</table>

**Legend:** C = Corrective; P = Preventive

Table 2: Overview of Analysed Use Cases: Industrial Maintenance Services

Corrective maintenance requires in general more interaction between supplier and customer than preventive maintenance activities. Preventive maintenance activities as well as corrective maintenance activities are typically regulated through an existing frame contract. Operations related to corrective maintenance require higher flexibility and standardized business processes. Service procurement systems and especially service catalogues add value and help to reduce administrative burdens due to coordinative actions and communications between involved parties in and outside the company. IT-Systems need to support the interactions between supplier and customer.

For each use case the collaborative business processes have been modelled and analysed with the aim to identify commonalities and synergies between administrative processes. In this way a reference business process for service related procurement transactions could be derived spanning from planning to invoice/ payment. The collaborative modelling assumes that supplier and customer have independent internal business processes which are linked through interfaces to exchange data and information along the administrative service processes. Accordingly a set of common
business documents and transactions have been derived which occur typically in service operations according to the analysis of selected use cases.

The usual cost range of investigated use cases can be estimated in average to 2,500 Euro per use case. In average use cases in our sample are typically operated up to 6,000 times per year. Potential cost savings have been assessed jointly through customers and suppliers between 100 to 200 Euro per use case. Accordingly, cost savings can be esteemed in total in the range of 600 thousand to 1,2 million Euro per year through optimization of administrative services processes. Subsequently, it is argued and evidence is given that these figures are realistic and achievable in a real business context. Conducted collaborative analysis of business processes substantiated estimated cost savings. This was done by a joint evaluation of available savings potentials through suppliers and customers based on agreed criteria. Criteria have been amongst others simple metrics such as amount of media breaks (interfaces to exchange data or business documents between business partners), amount of double work (manual input of data into information systems such as enterprise resource systems), number of manual intervention (due to incompatibilities of service interactions and system processes), stand-by or idle times, etc.

6. Classification of Services

In literature a variety of approaches to classification of services exist. An overview of various classification approaches can be found in (Johansson, Olhager, 2006), (Ponsignon, Smart, Mau1, 2007), (Teboul, 2006), (KSRI, 2009), (Lindberg, Nordin, 2008), (van der Valk, 2008), (Johannson, Olhager, 2003), (Lee, Park, 2009), (Boyt, Harvey, 1997). Most authors and approaches use matrices and/or continuums to position service offerings according to assigned values to a set of defined service attributes or variables (especially (Johannson, Olhager, 2003), (Lee, Park, 2009)) (Weiß, Herfurth, 2011).

Industry demand standardized description of industrial services (Herfurth, Weiß, 2010b). Interactions between buyer and seller of services are dependent on the type of service rendered. In literature a variety of approaches to classify services are proposed (for an overview of existing classification systems please consult (Weiß, Herfurth, 2011) and (Herfurth, Weiß, 2010a).

Subsequently, it is focussed on industrial maintenance services which include product and service aspects, respectively. (Teboul, 2006, 20) differentiates four different types of services and proposes two perspectives, namely back and front stage. Service aspects are related to front stage activities whereas product aspects are related to back stage activities. Service operations need to take into account both perspectives. Goods- and information-intensive services are subject of productivity gains through simplification and standardization of customer interactions e.g. through IT or internet solutions and routines (Kagermann, Oesterle, Jordan, 2011).

The table below shows appropriate variables to classify services. Most relevant variables to look at in the context of industrial services are degree of interaction, degree of customer contact and frequency to purchase as well as degree of customization and necessity of offline. Services can differ significantly concerning outcome, process and resources in companies and same service can be shaped completely different.
Previous paragraphs highlighted that service operations are characterised through integrated and intensified buyer-seller interactions along the service processes (van der Valk, 2008). Typical flaws and errors in service operations can be related to “goods-dominant” logic and procedures in IT-systems and business processes. Thus, services properties of services need to be standardized. Classification systems such as eCl@ss offer new possibilities and applications to describe industrial maintenance services. It can be argued that the current lack of transparency in service procurement can be related to the absence of a standardised classification system for industrial maintenance services. eCl@ss offers now in version 7.0 new ways and possibilities to describe industrial maintenance services in standardised way by specifying commodity classes and linked properties based on its eight-digit coding system. In current version industrial maintenance has been assigned a separate segment.

| Traditional service variables | • Criticality for customer  
|                             | • Importance of professional knowledge  
|                             | • Degree of labor intensity  
|                             | • Degree of interaction  
|                             | • Degree of customer contact  
|                             | • Necessity of membership relation  
| Online goods variables      | • Frequency to purchase  
|                             | • Features of search goods  
|                             | • Price  
| Variables relevant to both  | • Degree of customization  
|                             | • Necessity of offline  

Table 3: Variables for classification of services (Lee, Park, 2009)

The figure below shows the basic structure of segment “industrial maintenance services” which is new in eCl@ss current version 7.0. Displayed excerpt of the classification structure for industrial maintenance services provides the basis for the development of specifications and service catalogues for IT reference solutions solutions.

This can be seen as a major breakthrough and important step forward to cope with new developments and increasing requirements in service businesses. A shift and trend from product-related after sales services to solutions business can be observed which are combining product or material and service components to new so called hybrid service offerings (Kagermann, Oesterle, Jordan, 2011), (Teboul, 2006). By the way, services offer higher profit margins and constitute therefore an important and attractive future market segment not only for capital goods and production industry.
Figure below shows an example how industrial services can be differentiated and typed. Procurement systems and e-catalogues require additional features to search for service properties (service master data).

![Classification of services/ type of service (example inspection and repair fire door)](image)

E-Catalogues building the core of procurement systems require a certain frequency of purchasing service offerings to run efficiently and to justify related IT investments. Service specifications are part of negotiated frame contracts or agreements (technical appendix) between customer and supplier. They specify and describe config-
ured service offerings as negotiated with service suppliers. Today, service specifications still lack standardization and are created on individual basis. This hampers e-business capabilities of companies. Suppliers see resulting lack of transparency as an advantage and possibility to claim higher prices for rendered services. Customers use internally configurable service specification (e.g. structured and built on basis of GAEB hierarchical coding system, specification format and structure for building/construction field and facility management sector). However similar standards are currently not available in other branches such as logistics, disposal or new emerging markets as renewable energy.

Large enterprises tend to store standardised service specifications in their ERP systems (such as SAP). Portal technology is used to offer service suppliers possibilities to enter data and to interact with customers. However, portals optimize primarily business processes on customer side, not taking into account the requirements of service suppliers. Typically such portals cause additional administrative burden to suppliers as they have to enter data and information twice (as well in their own IT systems). Process errors caused mainly through IT systems following a goods-dominant process logic in consequence increase transaction costs, as service suppliers tend to interact with line of business and procurement function of their customers. Thus, internal coordination efforts and interactions increase to cope with emerging errors and unforeseen events (such as delay of payment, deviation of offer from bill of quantities, or required additional service tasks not regulated through frame contracts etc.).

Recent studies show that procurement managers strive for more transparency and better comparability of service offerings (KSRI, 2009). Procurement managers estimate that service costs could be reduced by 10 to 25 per cent given that transparency increases to a comparable level similar to goods procurement (Weiß, Herfurth, 2011), (KSRI, 2009). An important requirement is therefore to use implemented modes and procedures as well as existing IT systems to deal with service procurement. Service procurement is currently too often handled in exception mode and thus subject of maverick buying and tricking installed procurement systems.

Only a minority of companies are using service master data in their ERP systems for internal data exchange to develop service specifications or data exchange with external suppliers. Service master data describes all services an enterprise purchases, offers and delivers. Service master data builds the base for creating service specifications, which are used for inquiries. Standard service specifications are service catalogues containing general service descriptions based on standardized text blocks (often based on a structure or coding system).

The creation of service positions or items is typically linked to a standard service specification. Service items are used for electronic data exchange with external suppliers which in turn requires electronic transaction formats or standards. However, current transaction standards are not adequately or only partially supporting service-related procurement transactions and related administrative processes (Herfurth, Weiß, 2011). Hierarchical coding systems such as GAEB are used to organise and order service positions. eClass codes are typically used to link service specifications and related frame contracts to ERP commodity classes which in turn are often related to real objects such as plants or facilities. They are subject and target of maintenance services and related activities.
Classification systems are offering hierarchical tree structures and coding systems to support spend analysis and information management. In order to achieve better transparency in ERP systems master data for industrial servicers has to be available on comparable maturity level as for materials and goods. In literature only little evidence and recommendations concerning service master data can be found. Service master data has not yet achieved a comparable maturity level – if even available at all – in industry due to the diversity and complexity of service offerings. Service related electronic business processes and transactions are not yet standardised. IT application offer only rudimentary support for service master data, often no or only limited support to manage coherent master data along the whole value creation process.

Therefore it is important to use service catalogues to improve processes and transactions related to procurement of services. (Herfurth, Weiß, 2010) presented a conceptual design of service procurement.

7. Service-Oriented Procurement Transactions

Service Procurement between service providers and service consumers causes high complexity of business processes and data transfer. Due to the specific characteristics of services, the design of procurement systems has to support a close interaction between the involved players. Even more complex scenarios result from emerging collaborative networks in the service industry. The better integration of service supplier into their business processes and information systems still lacks. The electronic procurement processes supported by information systems during the close interaction like negotiation, configuration, communication and activity reporting during the different procurement phases can effectively improve service e-procurement. The paradigm of Service oriented Architectures (SOA) offers the possibility of a flexible binding of business processes. In (Herfurth, Weiß, 2010a) a conceptual model for service procurement in collaborative networks was presented.

In this paper, it is focused on functional view on IT system level. To support the integration of service providers and interaction in collaborative networks, the paradigm of SOA promises to be a flexible solution.

7.1. State-of-Play

Today industrial services are typically specified in individual service specifications or service catalogues of companies. It lacks an interoperable and standardized description of industrial services.

Today’s procurement systems are mostly focused on material procurement and based on material related business processes. The systems don’t really support service procurement. The design of adequate service procurement systems must focus on two essential parts: business processes and business objects (data transfer transactions). Mostly the following reasons are responsible for problems, weaknesses and lack of support:

- services are intangible goods (business objects)
the complexity of service description requires more interaction (processes)

the service consumer and the external factor must be integrated (processes and business objects)

Problems having an influence on the design of business processes and business objects in procurement systems are

- lack of harmonization and standardization of service transactions
- lack of service characteristic-oriented e-business standards
- heterogeneous architectures, interfaces and data transfer
- heterogeneous business processes in complex collaborative service networks

Solutions for a harmonization of service e-procurement as well as a specific support of integration and interaction of service consumers and service providers is still missing.

7.2. Requirements

(Weiβ, Herfurth, 2011) propose reusable service units as elementary building blocks to describe and configure service offerings. eBuS-XML serves as format to describe service units. Proposed conceptual design supports design of new or re-engineering of existing e-procurement systems suitable for service-related transactions and processes. Therefore the following service-related elements are required to facilitate the re-engineering and implementation of enterprise information systems:

- business process reference model
- data models for hybrid services (see Figure below)
- service transaction-oriented data type library for data exchange
- standardized interfaces for collaborative business processes
- technical support the electronic description and identification of services

Figure below shows the concept of reusable service units or items (Weiβ, Herfurth, 2011).

7.3. Solution Design and Elements

To fulfill the requirements, reference concepts for the design of service procurement systems were developed. The reference concepts are based on a fundamental analysis of uses cases. As a result out of the analysis of collaborative company-wide and internal business processes, we designed a reference process. Existing e-business standards have been analyzed like transaction standards, e-catalogue standards, classification standards and process standards. The analysis revealed that no single standard fulfills the requirements of a holistic service e-procurement process.
EBuS-XML offers a service-specific data type library for service transactions and the description of business objects in information systems. eBuS-XML consists out of the parts eBuScommontypes (library of data types), eBuStrans (definition of transaction documents), eBuScat (definition of service specifications in electronic catalogues) and eBuSxchange (definition of service transaction interfaces). The reference process and eBuS-XML are given a methodical base for the development of a flexible solution for the integration of architectures in collaborative networks. We developed eBuScollab (E-Business for collaborations), a service oriented design based on web services.

eBuScollab defines standardized interfaces based on Web Service Description Language (WSDL), operations based on synchronous and asynchronous message design patterns, and message types based on XML schema. eBuScollab defines five interfaces and web services (Information, Service Specification, RFQ, PurchaseOrder and Invoice) corresponding with the procurement transaction phases of the refer-
ence processes. eBuScollab uses eBuStrans for the definition of message types as well as the service library eBuScommontypes.

Fig. 8: Reference process and associated services

eBuScollab offers a flexible integration of architectures and therefore of service providers. For the evaluation of our approach, we implemented a reference scenario based on a supplier self service portal (SAP Netweaver\(^7\)). Based on our defined use cases, we integrated a service supplier and service providers in a buy side scenario for service e-procurement. The services can be implemented by service providers. The data harmonization is given by using eBuS-XML-based data types. For small companies, we developed a client software based on JAVA to integrate web services. Since small companies of service provides usually don’t use ERP systems and work most with standard office products, then can still use csv\(^8\)-based files. The client converts the csv-based data into the eBuS-XML format which can directly imported by the portal solution.

With this solution, the information management, especially the transparency and the harmonization of business processes and business objects (data transaction) can be improved and lower transaction costs. The integration of service suppliers through a direct service-oriented integration supports the interaction in specific service procurement phases.

8. Results and Benefits

In this section the results of undertaken measurement are presented. The analysis of the use cases aimed at the measurement of potential cost and time savings per use case. In order to quantify potential savings selected use cases have been analysed and measured based on the criteria/ metrics: (1) number of media breaks, (2) flow time/ lead time, (3) working hours, (4) cost savings (personal), (5) number of employees involved, (6) number of functional units/ departments, (7) number of internal and external interfaces.

Figure below show the time savings per sub process of the developed reference business process. Noticeably most significant cost and time savings are achievable in process phases inquiry, execution and bill of quantities. In these phases more intense interactions are required in comparison to materials procurement. Typically, IT systems follow a not suitable goods-dominant logic in these phases and are in this

\(^7\) http://www.sap.com/germany/plattform/netweaver/components/netweaverportal/index.epx

\(^8\) comma-separated values
way cause of emerging flaws and errors in underlying business process (Weiß, Herfurth, 2011).

Excerpts of achievable cost savings are shown in the table below. The table indicates the range of cost savings through minimum and maximum values. For example use cases of type “small order/ project” here shown for supplier B motivates potential cost savings between 46 to 196 Euro per processed and completed service order. If 1000 orders are assumed the cost savings are in total in the range of 45,833 to 195,833 Euro. This constitutes already a significant potential for cost and time savings. Cost saving have been calculated based on applied metrics. Identified causes and problems have been identified and analysed each. Solutions have been proposed how identified inefficiencies can be resolved through better support of IT systems and usage of eBuS-XML to overcome existing media breaks and to reduce manual interventions as well as working time (e.g. through reduction of double work through entering data in supplier IT-systems and customer portals).

Fig. 9: Analysis of use cases: savings in sub processes

<table>
<thead>
<tr>
<th>Company</th>
<th>Savings (%)</th>
<th>Cost savings (estimate: 50€ hourly rate)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>min</td>
<td>max</td>
</tr>
<tr>
<td>Supplier A (Main Process: Disposal factory)</td>
<td>14,65%</td>
<td>18,10%</td>
</tr>
<tr>
<td>Supplier A (Sub process: Invoice)</td>
<td>2,22%</td>
<td>3,13%</td>
</tr>
<tr>
<td>Supplier A (Sub process: weighing)</td>
<td>1,95%</td>
<td>2,16%</td>
</tr>
<tr>
<td>Supplier B (large project)</td>
<td>6,53%</td>
<td>7,75%</td>
</tr>
<tr>
<td>Supplier B (small order/ project)</td>
<td>1,82%</td>
<td>9,46%</td>
</tr>
<tr>
<td>Supplier C (Remote monitoring)</td>
<td>13,33%</td>
<td>18,75%</td>
</tr>
<tr>
<td>Supplier D (Maintenance)</td>
<td>8,64%</td>
<td>11,08%</td>
</tr>
<tr>
<td>Supplier D (Repair)</td>
<td>17,80%</td>
<td>17,91%</td>
</tr>
</tbody>
</table>

Average: 10,98% | 13,95% | 11,04% | 113 € | 164 € | 113,290 € | 163,976 € |
Max: 21,43% | 24,55% | 18,75% | 232 € | 267 € | 231,667 € | 266,667 € |
Min: 1,82% | 2,16% | 2 € | 3 € | 2,083 € | 3,333 € |

Table 4: Analysis and Benchmark Use Cases: Excerpt of potential cost savings
Table below shows the reduction of media breaks yielding as a result of the collaborative business process analysis. Media breaks are a major flaw in current service-related transactions and business processes.

<table>
<thead>
<tr>
<th>Company</th>
<th>Media breaks</th>
<th>Process</th>
<th>Process optimized</th>
<th>Savings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supplier A (Main process: disposal factory)</td>
<td>6</td>
<td>4</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Supplier A (Sub process: invoicing)</td>
<td>5</td>
<td>4</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Supplier A (Sub process: weighing)</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Supplier B (Large project)</td>
<td>11</td>
<td>4</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td>Supplier B (Small project)</td>
<td>7</td>
<td>2</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Supplier C (Remote monitoring)</td>
<td>11</td>
<td>1</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>Supplier D (Maintenance)</td>
<td>7</td>
<td>4</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Supplier D (Repair)</td>
<td>7</td>
<td>4</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Supplier E (Small project)</td>
<td>10</td>
<td>1</td>
<td>9</td>
<td></td>
</tr>
<tr>
<td>Supplier E (Troubleshooting)</td>
<td>9</td>
<td>0</td>
<td>9</td>
<td></td>
</tr>
<tr>
<td>Supplier E (Maintenance 1 x year)</td>
<td>9</td>
<td>0</td>
<td>9</td>
<td></td>
</tr>
</tbody>
</table>

Table 5: Comparison of media breaks of analysed use cases

Current e-business standards lack some transaction documents and do not adequately support service-related transactions and business documents such as bill of quantities. Often service master data and properties can only partially be represented and stored in existing catalogue and transaction standards. For example hierarchical order systems are not adequately supported and service configurations and positions cannot be reused in catalogue (procurement systems) and service specifications (supplier self-service portals focused on optimization of customer processes). Most interestingly, to suppliers the total costs of administrative business processes are not transparent. Better transparency supports decisions concerning if an inquiry and related order value is below or above the total amount of administrative process costs. The application of transaction standards and a higher automation of administrative processes, results in productivity gains and better planning decisions. Suppliers see the need to standardise and streamline their business processes. Interaction intensity can be decreased through standardised, structured interfaces and more routines along the value creation process.

9. Conclusions

Service procurement is still source of high costs to companies. Enterprise information systems today do not adequately support electronic data exchange and transaction between business partners. The paper explained why service operations (especially service procurement) causes today still significant problems to industry. The paper has further highlighted how to exploit existing potentials to leverage productivity in service-oriented procurement transactions through application of e-business standards. It has been argued that current IT systems only partially ease business opera-
tions in the service field. The paper has focused on industrial maintenance services which constitute an important industry sector (one of the biggest and fast growing markets today). The paper summarized and presented research results yielding from previous research activities and publications during the last three years. Major challenges in current service procurement systems have been argued. A major flaw of service operations are that “service descriptions are not harmonised and cannot be transferred between various IT systems and players along the service value chain” (Weiß, Herfurth, 2011). Presented solution offers required features to service-related transactions and processes. Furthermore, an information model based on eBuS-XML has been introduced. State-of-the-art IT systems do not adequately address the need of consistent and cross-organisational information flow. The analysis of 18 use cases showed that service operations suffer from numerous media breaks and manual exception handling. Connecting and integrating service providers is a source of considerable cost of purchase-oriented transactions. Systems in place are not interoperable and impose additional efforts to all actors along the value chain to enter data into underlying SAP systems and business documents. The solution presented aims at the reengineering of existing IT solutions e.g. through offering standardised, shared services (e.g. supplier self-services). The availability of standardised transaction documents allows to realise motivated flexible connection and integration of service providers. Currently, main concepts are being implemented in real life business scenario and through IT providers which see and address the service domain as one strategic activity field to develop their future business. In this paper, we presented a systematic approach for service procurement in collaborative service procurement networks. In total we analyzed 18 use cases which allowed us to validate the achieved results. Next steps will foresee further evaluation of the reference model and designed standards package in a tool box (interested readers are recommended to consult (Herfurth, Schuster, Weiß, 2011) for further details. It is planned to continue ongoing validations of results. This will be realised by implementing, running and evaluating additional pilot applications preferably in other domains then already covered by the set of use cases. The produced standards (eBusInstand) have already attracted a core community which is willing to sustain, maintain and continue to develop described solutions and related standards. The community comprises large international companies (on customer side) from automotive, chemical and industrial service sector as well as suppliers linked to these companies.

References


(Herfurth, Weiβ, 2010a) Herfurth, M.; Weiβ, P.: Conceptual Design of Service Procurement for collaborative Service Networks, Collaborative Networks for a Sustainable World: 11th IFIP WG 5.5 Working Conference on Virtual Enterprises, PRO-VE 2010, October 2010, St. Etienne, France.


Author address

Author(s):

Peter, Weiß, Prof. Dr.
International Business School of Service Management
Service Operations Management
Hans-Henny-Jahnn Weg 9, D - 22085 Hamburg, Germany
weiss@iss-hamburg.de

Maik, Herfurth,
FZI Forschungszentrum Informatik
Software Engineering
Haid-und-Neu-Straße 10-14, D-76131 Karlsruhe, Germany
herfurth@fzi.de

Jörg, Schumacher,
eCl@ss e.V.
Postfach 10 19 42, D-50459 Köln, Germany
joerg.schumacher@basf.com