Towards a Reference Model for the Identification of Strategic Supply Chains for Value Bundles

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Abstract

Enterprises search intensely to the avoidance of low pricing strategies for new ways to differ in a global market competition. Value bundles offer a promising response as a possibility to expand existing offers of independent products and service into an integrated problem solving for specific customer requirements. This differentiation strategy leads to a rising dependence between the offering enterprise and his suppliers. Strategic supply networks (SSN) offer enterprises the possibility to realize sustainable added value in the creation, deployment and disposal of such integrated solutions. Modeling of SSN encloses the main functions identification, evaluation and choice of supply networks for a specific demand of a value bundle. In this article we provide a reference model for the identification of SSN for value bundles. Therefore we evaluated existing reference models for the strategic sourcing of goods and services and identified lacking issues for the specific needs for value bundles. The derived model is evaluated by applying it to selected case studies.

1. Introduction

Global market scenarios lead to the fact that offers are easily comparable. This applies in the range of offers of production enterprise as well as from service enterprise. In such comparable offer situations a price leadership is often the key to win shares of the market. The enterprises which achieve market shares mainly through price leadership have less strategic developing elbowroom. A strategically significant possibility to differentiate towards the competitor in comparable markets is the offering of value bundles [1]. Besides, value bundles put an integrated combination of physical products and immaterial services with a focus on solving a specific customer problem [2]. Supply networks exist of several suppliers independent of each other from which one of these suppliers is designated as focal supplier. The focal supplier is the supplier who creates the offer of the customers. The focal supplier organizes all aspects of the value bundle in the supply network. In spite to the complexity of organizing supply networks the advantage of this organization form in offering value bundles is huge: The main attention on this organization form lies in the connection of commercial processes and, hence, displays a valuable method to organize value bundles. If one looks at high integrated value bundles, delivering such offers occurs within the scope of a service process which is integrated seamlessly into the relevant customer processes.

Current research results show that the management of value bundles leads established commercial processes to new challenges in information systems. Thus value bundles can be managed only insufficiently in commercial processes as for example supply chain management. The research in the range of the hybrid added value concentrates upon models and methods of the construction of such solutions. The discussion about the behavior of value bundles in supply networks is still pending.

The central research question for the present article is: how can the identification of strategic supply network be modeled with respect to the special requirements on value bundles? The practical use of such a model was recognized by present discussions with different experts about already existing models for the development of strategic networks.

The article is structured as follows: in the second chapter the current research state is displayed to the
subjects supply networks, strategic procurement, value bundles and the modeling of strategic supply networks. In chapter 3 existing models are evaluated. Based on the results of this evaluation a reference model which describes a development of strategic supply networks for value bundles is introduced. In chapter 4 the reference model is applied to two different case studies. Chapter 5 gives a summary and indicates future research need.

2. Current research state

2.1. Supply networks

In 1961 Forrester [3] considered material flow and the reduction of total inventory before these issues were submitted within the term “supply chain management” (SCM). SCM was purely concerned with the external logistical integration of customers and suppliers (see also [4]). The logistical literature essentially presumed rational co-operation between buyers, suppliers and service providers and on this basis strived to find optimal solutions for inventory, transportation, information flow etc. In contrast SCM also considered the behavioral and political dimensions of trust and power, conflict and dependence between supplier and buyer. Logistics research focused on minimizing total cost, while SCM was concerned with long-term profitability of serving customers and customers’ customer [5]. Finally, the traditional focus of logistics was often intra-organisational, while SCM became inherently inter-organisational [6]. Hence [7] used the term “supply chain” to represent an alignment of firms. They defined SCM as: “The integration of business processes from end user through original suppliers that provide products, services, and information that add value for customers.” As the concept of SCM evolved the term “network” came into use – predominantly because firms were generally part of a number of supply chains. They had several customers and alternative suppliers. Introducing the term “network” into SCM arena has extended the SCM concept into more strategic areas. One proposition was that competition occurred not only between firms but between supply chains and network, see [8] and [9]. In a supply network perspective a focal company views its whole supply network (see Fig. 1) in order to compare performance in its multiple supply chains; to identify potential competitive problems and opportunities; and to identify overall process improvements through supply chain thinking. Viewing a supply network at a whole enables much more improvements. For example the de-coupling point between making to order and making to stock can be moved backward along the chain to a point where overall supply chain stocks are minimized. This allows late customization of products and increasing the agility of the customer.

But this perspective (see Fig. 1) also unveils a host of customer-supplier relationships that no company could seriously manage without the aim of modern information and communication technology (ICT). It is necessary to make a structured analysis of the network; to identify opportunities and risks, identify those relationships that should be actively managed, those that need to be monitored, those that may be ignored and why.

![Image](Figure 1. Customer-supplier relationships in a supply network [5])

Talking about supply networks we first and foremost focus on a network that is formed by flow of material, services and associated information. Our scope is on supply networks including the intra-organisation activities to connect purchasing departments with new product engineers in the choice of component supplier. The research on inter-organisational activities between customers and supplier firms leads to the strategic position of a firm in its value in the supply networks. In this sense we talk about strategic supply networks which cover long-term aspects of the customer-supplier relationship.

2.2. Strategic sourcing of value bundles

For a long time procurement was considered exclusively as an in intra-company executive organ which had to fulfill production-political and distribution-political decisions [10,11]. Today, however, the high strategic importance of the procurement function is widely recognized in practice and science [11,12,13]. This is reflected
especially in the consideration of the order volume which the procurement function is responsible for and justifies the key role within a company. For example the proportion of total purchases in the gross output of manufacturing industry in the year 2000 amounted to an average of 69.0% [14]. The strategic procurement as a part of the entire procurement function has as a major task the analysis and goal-oriented creation respectively influencing of sourcing-relevant factors [15,16]. These factors can be classified in three areas: market, suppliers, and the company itself [15,17,18]. In this paper focus lies on the supplier-related tasks, explicitly to the tasks for the development and management of an effective supplier base. This implies the existence of methods for the identification, selection and qualification of potential suppliers. In current literature, a multitude of contributions for the strategic sourcing of products or services can be found. But as the economic importance of pure products and services tends to decrease because of lacking differentiation, combinations of physical products and services being offered as bundles become more and more important in the industry. These combinations are called value bundles and are a combination of physical products, services as well as immaterial values as for example guarantees. These combinations are specially tailored to solve an individual customer problem [19,20]. Value bundles can be segmented in standardized physical products, standardized services as well as customized product and customized services (fig. 2).

The division of these four elements is not dichotomous, but the transitions between these elements are linear in the sense that there are several possibilities to combine these elements to a value bundle. Integration is a key component of value bundles. This integration means not only the bundling of products and services for the purpose of a combined solution, but also the process integration on customer and supplier side [21]. The degree of integration between services in kind and services is variable [22] and has a direct impact on the services. With a high degree of integration between the two units the provision of the service component is strongly dependent on the service in kind component. These highly integrated value bundles are often offered to customers as service agreements and from a customer view it is not possible to separate the services in kind from the services (fig. 3).

The customer orientated creation of value bundles offer companies the possibility of diversification and lead them to significant market advantages. But it also represents new challenges for the sub-processes along the value chain. A key design feature of hybrid value-added process is the formation of network structures. Reiss and Präuer [23] show in an empirical study, that the cooperative organizational forms, such as strategic value-added partnerships, networks and cross-company project-orientated cooperation are the most suitable organization forms to offer value bundles. Because of the high dynamic customer orientated variations of value bundles they cannot produce as bulk goods so the network must be created by the offering company at the beginning of the manufacturing process. But this means also that a value-added network might not be used for another value bundle. The cooperating companies have to join forces in dynamic networks that can be configured according to requirements of a specific value bundle at its added-value processes (fig. 4).
3. Modelling the identification of strategic supply networks for value bundles

To be able to grasp the present state of the modeling for the strategic procurement, models and her analyses were analysed according to the current literature.

Becker et al. [24] could identify a total of 13 reference models for the range of the production as well as 15 reference models for the range of the services. Only three of the identified models refer to aspects of hybrid value bundles ([25,26,27]). However, they find out that these models are aimed merely on special branches and with it the explanation article to the field of the value bundles covered to the integrated view of value bundle and product life cycle only very much is delimited [24].

In the range of the strategic procurement of services eight contributions were identified by [28]. He criticizes all together the low attention of research and practice which is dedicated to the strategic service procurement in spite of ascertained deficits. The main focus of the publications is to be found in the range of the surgical procurement [28]. The selected publications deal predominantly with concrete strategies, draughts and problem analyses, a transfer on value bundles and their strategic procurement is strongly limited. There are only three contributions to strategic sourcing dealing with aspects from the suppliers view [28,29,30,31].

With the investigation of reference models to the modeling of strategic supply networks is merely the beginning from [32] of "Strategic Supply Network Planning" (SSND). In the center of the model stand two functional aspects of the strategic procurement: the strategic need planning and the modeling of strategic supply networks. However, the model refers in the core merely to tradable goods. Applicability on services or value bundles is not given in the form. Indeed, applicability could be reached by an extension of the views of the existing model for the management of value bundles.

For the modeling of complex value bundles [24] deliver already the first basic scaffolding for the data view, this counts of checking it according to the requirements of the strategic procurement and of customizing if necessary or of extending.

To summarize there exists no immediate (reference) - model support in the range of the strategic procurement for value bundles. However, existing models may be used as a base to close this gap. To identify the best-fitting model to be used as an initial starting point an evaluation of the existing models is made (table 1).

We use the following metric to evaluate the existing models: 0 stands for no support, 1 stands for rudimental support, 2 stands for basic support, 3 stands for complete support. We calculate the sum from the single evaluations to aquire the total support of the considered model for the strategic sourcing of value bundles.

Following the evaluation it is clearly that the reference model for the development of strategic supply networks according to [32] in conjunction with the reference model for value bundles according to [24] will be the best base to develop a model for strategic supply networks.

Table 1: Classification of existing (reference)models

<table>
<thead>
<tr>
<th>(reference)-model</th>
<th>Suitable for value bundles</th>
<th>Suitable for strategic sourcing</th>
<th>Integration in customer processes</th>
<th>Support for decomposition of value bundles</th>
<th>Total support</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quality Information Systems [25]</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>PPS, Personel, Facility Management [26]</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Quality Information Systems [27]</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Supplier analysis [29]</td>
<td>1</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>Quote design [31]</td>
<td>1</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>Quote design [30]</td>
<td>1</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>5</td>
</tr>
<tr>
<td>SSND [32]</td>
<td>1</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>6</td>
</tr>
<tr>
<td>Data view for value bundles [24]</td>
<td>3</td>
<td>0</td>
<td>2</td>
<td>2</td>
<td>7</td>
</tr>
</tbody>
</table>

These existing models are customized in the present article around the specific requirements in the management of value bundles and are extended. The central aspect of strategic supply networks – the establishment and the management of long-term relations among different suppliers does not change by the consideration of value bundles. The organization form is an added value net. Hence, it is renounced at this point a consideration of the organization view. There is essential adaptation need, however, in the functions need planning and network modeling. Hence, these functions are lighted up in this article closer and described by adaptations and extensions in the data view, by the function view and the control view. To the description of the extensions of the reference model of strategic supply networks for value bundles at first semantic data models are modeled (figures 6, 7). In addition the commercial process of the identification of strategic supply
networks is displayed (figure 8). We use the ARIS notification [33] to formulate the new model. For this we use the different views in the ARIS architecture to illustrate the model.

3.1. Functional view

The functional tasks of strategic supply network development are defined in the following. Those tasks will be derived from the main tasks of strategic sourcing. The most evident changes are expected for functions with cross-company focus. The functional tasks of strategic supply network development have been illustrated in a function decomposition diagram (see Fig. 5). Processes and tasks that are in the focus of this article have been shaded. Following, only selected tasks will be described, focusing on changes to current tasks of strategic purchasing.

Plan strategic demand

Strategic planning is mainly focused on intra-company processes i.e., analyzing, scheduling and grouping of long-term demand. There is no significant change when using supply networks in strategic sourcing or dealing with value bundles.

Model strategic supply network

The process supplier selection from strategic purchasing undergoes the most evident changes in the shift to a supply network centric perspective with value bundles. The expansion of the traditional frame of reference in strategic sourcing requires more information than merely data on existing and potential suppliers in tier-1. Instead, the supply chains connected with those suppliers have to be identified and evaluated, e.g. by comparing alternative supply chains in the network. As a consequence, the task supplier identification is part of the process that leads to the modeling of strategic supply networks.

Qualify strategic supply network

In addition to the selection of suitable supply chains and composition of alternative supply chains, the performance improvement of strategically important supply chains is one of the major goals of strategic supply chain development. Main prerequisite is the constant evaluation of the actual performance of selected supply networks by defined benchmarks. The application should support respective evaluation methods and enables the user to identify imminent problems in the supply network and to initiate appropriate measures for qualification of supply network partners.

3.2. Data view

3.2.1. Demand. The first function of the model is the strategic demand planning. The first commercial process of the function strategic need planning is the classification of all goods to be procured and services with a consistent, unequivocal identification. Then
this unequivocal identification can be communicated to all suppliers. For standardized shopping goods and standard services established classification methods are able to as for example eCl@ss [34] are used. It is a matter to customized goods and services of introducing a suitable, network-far unequivocal identification. Thereby it is made sure that all nodes of the future network are able to process the information about the value bundle and his components. In addition, single components are grouped more differently of value bundles according to defined criteria. Criteria are, on this occasion, for example, the whole purchase volumes or the importance of the component for the enterprise. Therefore it is a matter of developing suitable procurement strategies specifically for enterprise. To support this development a semantic data model for the central information object is provided (fig. 6).

With the starting point of the specification of the customer demand which displays an initialization of a value bundle data are collected by the direct suppliers as well as by all sub-suppliers to support the strategic network modeling. The specific customer demand consists of a specific configuration of modules and capacities which are in the solution space of the value bundle. Besides, the solution space corresponds to all allowed configurations of a value bundle and is designated in the chart as value bundle (type). Value bundles are composed from modules and capacities. Modules are building blocks which can abstain themselves and enclose a certain amount in capacities. These modules can be reused in different value bundles. Outcomes are the result of an economic process and, hence, can be physical goods, services or customer resources. Modules and outcomes are described about attributes. The combinations of different modules and outcomes may be limited. To display these restrictions, configuration rules are used. These configuration rules limit the solution space and guarantee the consistency of the value bundles.

### 3.2.2. Supply network identification

To the structured modeling of strategic supply networks this article follows the suggestions in [32]. Besides, the single functions of the modeling of a possible net of delivery are segmented in three sub-segments: identification, evaluation and choice of supply networks. For the identification of a possible supply network the demand is specified for a value bundle and is communicated to potential or existing suppliers in the supply network. First, the focal supplier sends the demand for the value bundle to the suppliers in tier 1. These suppliers check whether they can fulfill the demand or, if this does not apply, send a need for their part to their sub-suppliers in tier 2. Besides, it is a possible situation that the supplier cannot fulfill the whole demand and forwards this completely to his suppliers in tier 2 in tier 1. On the other hand it is possible that the supplier can only partially fulfill the demand and forward the part he cannot fulfill, to his sub-suppliers in tier 2. This procedure continues subsequent on every available level inside the supply network. At last the information requested by the focal suppliers over the supply network are collected, aggregated and at least the supply network can be visualized.

This procedure possibly leads to several supply networks which would be able to cover the demand of the value bundle. In this case the focal supplier must decide which of these possible supply networks is selected to cover the specified need. In illustration 7 the semantic data model from paragraph 3.2 was extended to the components which are relevant for the identification of the supply network.
The shaded objects connect the different semantic data models together. Outgoing from the customer demand which is displayed with an instance of a value bundle it is necessary to collect all supplier’s information of tier 1 to tier-n. The supply network which was selected by the focal supplier to fulfill the customer demand is a network on supplier who transmits information to the customer. This information is used for the development of supply network. In the data model the network of suppliers is represented as a complex monitoring object and every single supplier is displayed as an elementary monitoring object. At a special time every supplier delivers information about the service stamping, the product stamping, the configuration of the value bundle, finance data and other relevant data. This information is designated supplier-generated data. Supplier-generated data can be planning data or current performance data.

3.3. Process view.

The process of identifying supply nets follows the...
process of the strategic demand planning in the overall process of the development of strategic supply networks.

Starting with a bundled strategic demand the first step is to fulfill a value bundle assignment. The strategic demand is represented as a value bundle instance which leads to a specific configuration. The configuration is used to realize a value bundle decomposition. In this step the specified configuration will be decomposed in modules. These modules are not only single parts in the sense of a bill of materials but might also be a value bundle instance. The decomposition of a configuration in modules marks the granularity for the sourcing of the single parts. Therefore modules might be regarded as the smallest unit to source the demand. This step needs some competence in the possible decomposition variants and is therefore mainly done by an engineering department. The result is an identified module demand which can be communicated to the supply network.

The module demand is communicated to the supply network. This will be done by the purchasing department. When the demand is communicated the purchasing department awaits the quotes from the different suppliers form the supply networks. Incoming quotes will be checked weather they fulfill the requirements of the certain modules or not. This step repeats until there are quotes for every module for the specific demand.

The checked quotes are taken from the engineering department and are composed to all possible configurations. This leads to all possible configuration variants which might be derived from the checked quotes. To illustrate this process an example for a selected criteria e.g. service level agreement is used (fig. 9). The example is display as supply network with the corresponding suppliers and the criteria linked to every single supplier.

Depending on which supplier delivers one or more modules for the specific demand there might be different possible configurations. To ensure that there is the right selection among all possible configuration variants there is a check of the variants if they fulfill the needs of the specified demand. All configuration fulfilling the demand will be entitles as valid configurations. By taking these valid configurations and the checked quotes the purchasing department generated the possible supply network set. This step leads to a list of identified possible supply networks which are able to fulfill the demand of the specified demand. Following this the next process step will be the supply network evaluation.

4. Application of the reference model

To evaluate the derived model it is applied to two selected case studies.

4.1. Bid proposal management for hybrid products in the IT-industry

As the first case study the described model is applied to a bid proposal management process for hybrid products in the IT industry. This case study is described in [35]. The enterprise offers products with co-ordinated services close to product, indeed, no preconfigured solutions. Hence, this range of articles leads to a complex bid proposal management process. An analysis of the case study covers five problems in connection with the bid proposal for hybrid products from which at this point two observations are relevant for the model introduced in this article.

For nearly every customer every offer consists of an individual configuration. Still it is possible in case of consideration of all configurations, the single elements or modules of the offer exist several times. Therefore it would be possible to achieve suitable scale effects with the procurement. The requirement moreover is that there must be an outcome catalogue which is built up from modular hybrid modules. It must be possible to carry out automatically a decomposition from a complex value bundle which corresponds then to the not further divisible modules from which a outcome catalogue could be built up.

The second observation is that there are media breaks with the transformation of contract contents in capacities. These media breaks lead to the fact that by contract agreed outcomes are not produced correspondent to the service level agreement. This leads to problems in the business connection. The requirement derived from it is that an automatic takeover of the contract contents takes place in
suitable working plans and resource management. With the performance of services through cooperation partner this means that the contract contents of every cooperation partner, i.e. of a participant must be consolidated in the suitable supply network by the focal supplier and be transmitted to the customer.

4.2. Customer service reports

As the second case study the described model is applied to the subject complex "customer service reports" at the example of an enterprise from the sanitary, heating and climate technology. This case study is described in [36]. The performance of customer service capacities in the case study occurs in the teamwork of a plant manufacturer who is basically a producer of material goods as well as small and mid-size service providers who are responsible for the management of the installed plants. The successful realization of the activities in connection with the maintenance and maintenance of the plants requires the availability of suitable and correct information. Short products development cycles and new technology cause an informational infrastructure conformist in quick updates which supplies everything in the customer service process according to partner with the relevant information. The customer service is done by a customer service engineer on site. He must be able to determine the suitable necessary capacities from the value offer. A decomposition of the value offer is necessary. With this decomposition the single capacity modules are determined which can be delivered then either to the involved partners (e.g., spare part order to the manufacturer) or the customer service engineer can be supplied with suitable information. Goal also is here like in the case study under 4.1 the performance of a service within an agreed service level. To reach this, a desegregation of the single contractual arrangements of all partners must also take place at this point to be able to perform the suitable service towards the customer.

5. Summary and outlook

Aim of this article is to provide a model for the identification of strategic supply networks. First existing models were examined for their applicability concerning value bundles and strategic sourcing. It could be shown that deficits insist on illustrating the specific requirements for the management of value bundles. Two existing reference models which fulfill the specific requirements best served as a base to develop a new model for the identification of strategic supply networks for value bundles. Function view, data view and process view is provided to illustrate the new model. For evaluation purposes the model is applied to two selected case studies.

The results of this article serve as a base for the advancement of the modeling of strategic supply networks with main focus of value bundles which leads to stable and long-term relations between the involved enterprises. In addition, economic advantages are achieved by efficient management of value bundles in strategic sourcing processes.

More research is necessary concerning an entire reference model of a strategic supply network for the management of value bundles. Thus is to be determined, on the one hand, by the application of the existing results to a bigger number of application cases, to what extent additional modeling need exists for the completion of a reference model. On the other hand special issues e.g. risk management, capacity management or contract management need to be modeled to improve the range of applicability of the model.

6. References


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