Enterprise Modelling and Information Systems Architectures
Vol. 6, No. 2, May 2011

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Pricing of Value Bundles

A Multi-Perspective Decision Support Approach

Value bundles are compositions of physical goods and related value-added services that are put together to solve customer problems. Pricing value bundles constitutes a complex decision problem, since it requires the consideration of three perspectives: From the point of view of the provider, the available price corridor is limited downward by the costs for engineering, marketing and delivering a value bundle. From the customer's point of view, the upper limit of the price corridor is imposed by the expected customer value and corresponding willingness to pay. From a competitive perspective, the upper limit of the price corridor is marked by the price of a comparable competitor's offer. To provide companies with sound decision support, an integrated multi-perspective modelling language that accounts for all three perspectives simultaneously is presented. Based on the developed modelling language, an integrated decision support tool, i.e., the pricing workbench, has been designed.

1 The challenge of pricing value bundles

Over the last decades, we have been witnessing a transition from a primarily goods-based to a more and more service-based economy in most developed countries (Wölfl 2005; Zeithaml et al. 2009). Today, services account for more than 80% of the gross domestic product and total employment of the United States (Zeithaml et al. 2009).

Following this major economic shift, many traditionally product-centric companies strive to integrate services into their value propositions (Oliva and Kallenberg 2003; Stille 2003; Tuli et al. 2007). Examples can be found in the automotive industry (e.g., automobile plus insurance, maintenance, trade-in etc.) or telecommunication industry (e.g., mobile phone plus calling plan, messaging and data services, media downloads, etc.), but also in B2B markets like the mechanical engineering industry (e.g., machine tool plus integration, start-up, training, operating personnel, etc.).

The rationale for this development can be put forth along three lines (Oliva and Kallenberg 2003). First, there are company-internal arguments, e.g., substantial revenues can be generated from providing services related to a large installed base of products, even more so since services often yield higher margins than physical goods. Second, there are customer arguments, e.g., the ongoing outsourcing trend and the demand for integrated problem solutions. Third, there are competitive arguments, e.g., in markets where the sole production of 'things' is more and more becoming a commodity, services represent means to provide customers with more differentiated and difficult to imitate value propositions – which is a necessary precondition for creating a sustainable competitive edge.

However, there is empirical evidence (Neely 2008; Reinartz and Ulaga 2008; Sawhney et al. 2003) that not all companies pass smoothly through this 'servitisation' (Vandermerwe and Rada 1988) process. A number of companies struggle to turn a profit from their service business. Manufacturers often fail to realise a price premium for bundling value-added services with their products, as – especially for capital-intensive investment goods – many customers expect to receive such add-ons free of charge (Gebauer et al. 2005).

Exploiting the profit-increasing potentials of integrated value bundles to the full requires a multi-perspective analysis of price margins. This paper identifies different perspectives on the task of pricing value bundles and reveals that respective method support is seldom used in an integrated manner (Sect. 2). An integrated multi-perspective support for pricing value bundles requires an integrated modelling language being able to serve as a common basis for a comprehensive analysis of the available pricing corridor (Sect. 2). For this purpose, the fundamental language constructs for modelling the structure of value bundles will be introduced first. Consecutively, necessary language extensions for the pricing of value bundles are developed. The concept of a pricing workbench introduces a possible application of the developed modelling language, which, in parts, has already been implemented (Sect. 4). A discussion of limitations and further extensions concludes this paper (Sect. 5).

2 Status quo of pricing value bundles

Value bundles can only yield positive returns for suppliers, if the costs of provisioning are at least covered by the price a customer accepts to pay. Therefore, to determine whether a value bundle can be offered with sufficient profit, providers first need to estimate the lifecycle costs for providing a value bundle. Hence, from the supplier's point, the lower limit of the available pricing window (Diller 2007; Mazumdar et al. 2005) is constituted by the accumulated cost for engineering, marketing, and delivering the value bundle.

Contrariwise, customers can only justify their investment decision if the expected customer value of a value bundle exceeds their total cost of ownership. The upper limit of the pricing window is hence constituted by the reference price that customers apply to guide their buying decisions. This can be an internal (i.e., based on perceived customer value) or an external (i.e., based on competitor prices) reference price (Mazumdar et al. 2005). Hence, the pricing of a value bundle has to be based – besides considering the costs of providing a value bundle – on the customer's willingness to pay (internal reference price) and on competitor prices (external reference price).

To sum up, determining a price for a value bundle requires the application of a multi-perspective analysis of price margins (Backhaus et al. 2008), (for the following, see Fig. 1):

- *Customer Perspective:* The absolute upper price limit is constituted by the consumer's willingness to pay.
- *Supplier Perspective:* The lower price limit is determined by the costs for engineering, marketing, and delivering the value bundle for a particular customer.
- *Competitor Perspective:* In case a value bundle can be delivered by alternative providers (which is far from being the norm, since value bundles, by definition, are customised to fulfill a particular customer's needs), a provider needs to identify the lowest of all competitive prices. A competitive price, identified through market research or forecasts, which lies below the customer's willingness to pay, will also lower the supplier's upper price limit. If, however, the competitive price lies above the customer's willingness to pay, the upper price limit will not change.

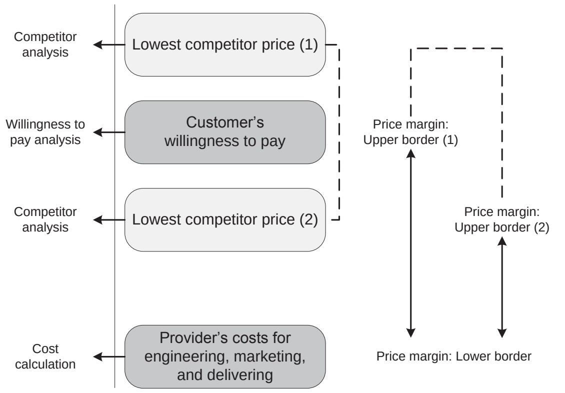

Figure 1: Pricing corridor

We conducted an empirical study in the German mechanical engineering industry in late 2007 to survey the status quo of method support for pricing value bundles. We chose this industry because it is the largest industry sector in Germany, and also its leading export sector, is strongly committed to innovation (more than 30% of turnover are generated by innovations), and last but not least provides particularly advanced and custom-fit physical products and related services (VDMA 2010).

The survey was carried out by a market research institute using computer-assisted telephone interviews (CATI). Overall, representatives from 100 German manufacturers were interviewed. Each of the interviewees was asked to indicate which methods they were applying for pricing their value bundles. The majority of respondents (88%) asserted to apply a cost-oriented perspective on pricing. 55% of the companies surveyed incorporated competitor prices into their pricing procedures. Only 22% of the respondents explicitly considered information about their customers' willingness to pay.

Figure 2 presents a more detailed analysis of the empirical data. Here, we distinguish between those companies that exclusively follow one pricing perspective only (costs, willingness to pay, or competitor prices only) and those who attempt to consider two or even all three perspectives in combination. The data suggest that at the time only very few businesses applied a comprehensive multi-perspective pricing strategy. It is, therefore, fair to say that the status quo of pricing value bundles is characterised by an insufficient integration of methods.

The goal of this paper is to demonstrate how the distinct perspectives on pricing can be combined into an integrated multi-perspective modelling language based on which appropriate software tool support for pricing value bundles can be developed.

3 A multi-perspective modelling language for pricing value bundles

3.1 Core language for modelling the structure of value bundles

The abovementioned pricing methods should operate on the basis of an integrated modelling language for representing value bundles in order to deliver consistent results. This requirement is in line with the idea of multi-perspective enterprise modelling as proposed by Frank (1994, 2002): Reusing common constructs at the meta-level, e.g., a modelling language for value bundles, leads to integrated models at the type level, e.g., to integrated value bundle models.

A variety of modelling languages has been proposed to address the particular modelling requirements of services. As a starting point, we compiled and thoroughly reviewed a collection of these languages in a comprehensive multi-method approach (Becker et al. 2009b, 2010). However, none of the modelling languages under investigation provided sufficient support to satisfy all three decision parameters to be accounted for during the pricing task. This was far from being surprising, since these modelling languages had been designed for other purposes. Consistently, the investigated modelling languages were found to be focused on the service process itself (as opposed to our focus on the structure of value bundles), on engineered-to-order value bundles (as opposed to our mass customisation approach), or were strongly focused on either physical goods or services (as opposed to our focus on the outcomes of integrated value bundles, comprising both physical goods and services).

Therefore, we developed a new modelling language to represent a modular structure and configuration of value bundles (Becker et al. 2009a). Consecutively, we extended the basic language with additional modelling constructs and relationships to fit the abovementioned decision problem. The constructs and relationships needed to represent the compositional structure as well

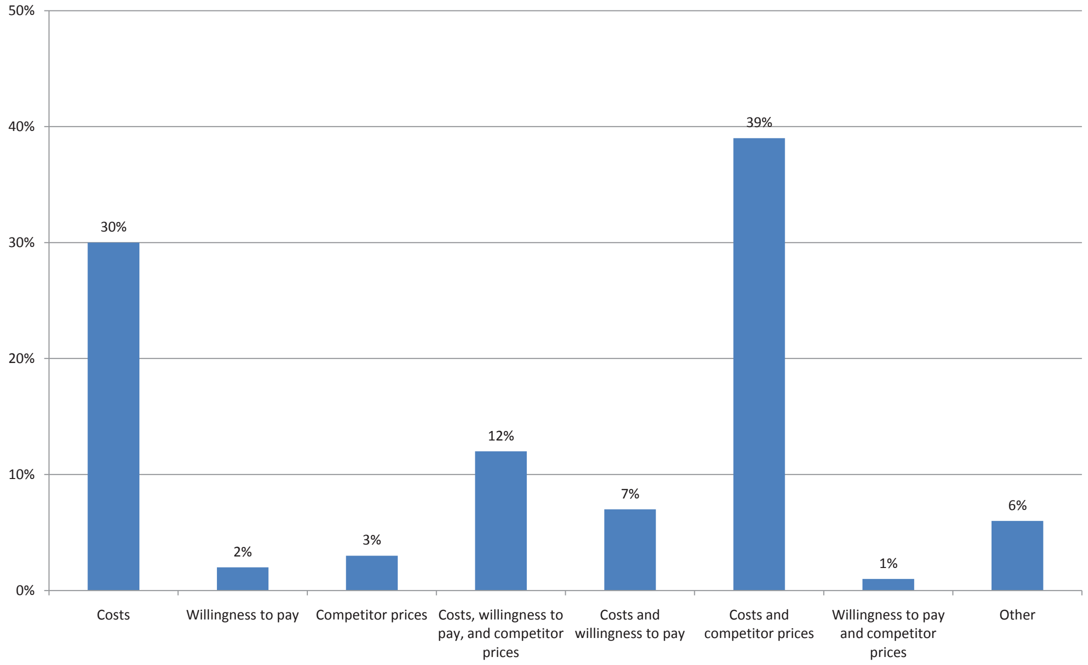

Figure 2: Statistics for pricing value bundles

as the lifecycle of value bundles are depicted in Fig. 3.

The starting point for the modelling of value bundles is the construct *value bundle (type)*. This construct projects all variations or possible configurations of a generic bundle (e.g., a specific machine model and related services) from the point of view of the supplier (see also the concept of a generic product model in Scheer 2006). The construct also comprises the bundle structure by linking to available modules of physical goods and services and rules that restrict selection and combination options. It furthermore delineates the projected lifecycle of a value bundle, which determines the sequence of the individual outcomes included. A bundle type, therefore, contains the complete configuration knowledge with regard to an abstract value bundle. This opens up a solution space from which a customer-specific value bundle instance can gradually be derived.

To allow for the reuse of generic products or services in different value bundles, a provider may follow a mass customisation strategy. In this case, a bundle type is defined by *modules*. A module is a self-contained unit that consists of a set of products or services that may be reused in different bundles. The idea here is to make the definition of bundle types as simple and efficient as possible by combining predefined model components.

Modules comprise *outcomes*. Outcomes are the result of an economic factor combination and can be physical products or services. As the differentiation between products and services becomes increasingly difficult, we will here refrain from making a clear distinction between the two (for a detailed discussion of the problem see, e.g., Teboul 2006; Vargo and Lusch 2008). Particularly in the industrial sector, services (e.g., repair) often involve physical products (e.g., spare parts) and vice versa. Products and services assigned to a module are to be regarded as functionally equivalent, i.e., they are alternatives from which the customer can choose during the configuration process. Frequently, the outcomes of a particular module will only differ in their non-functional

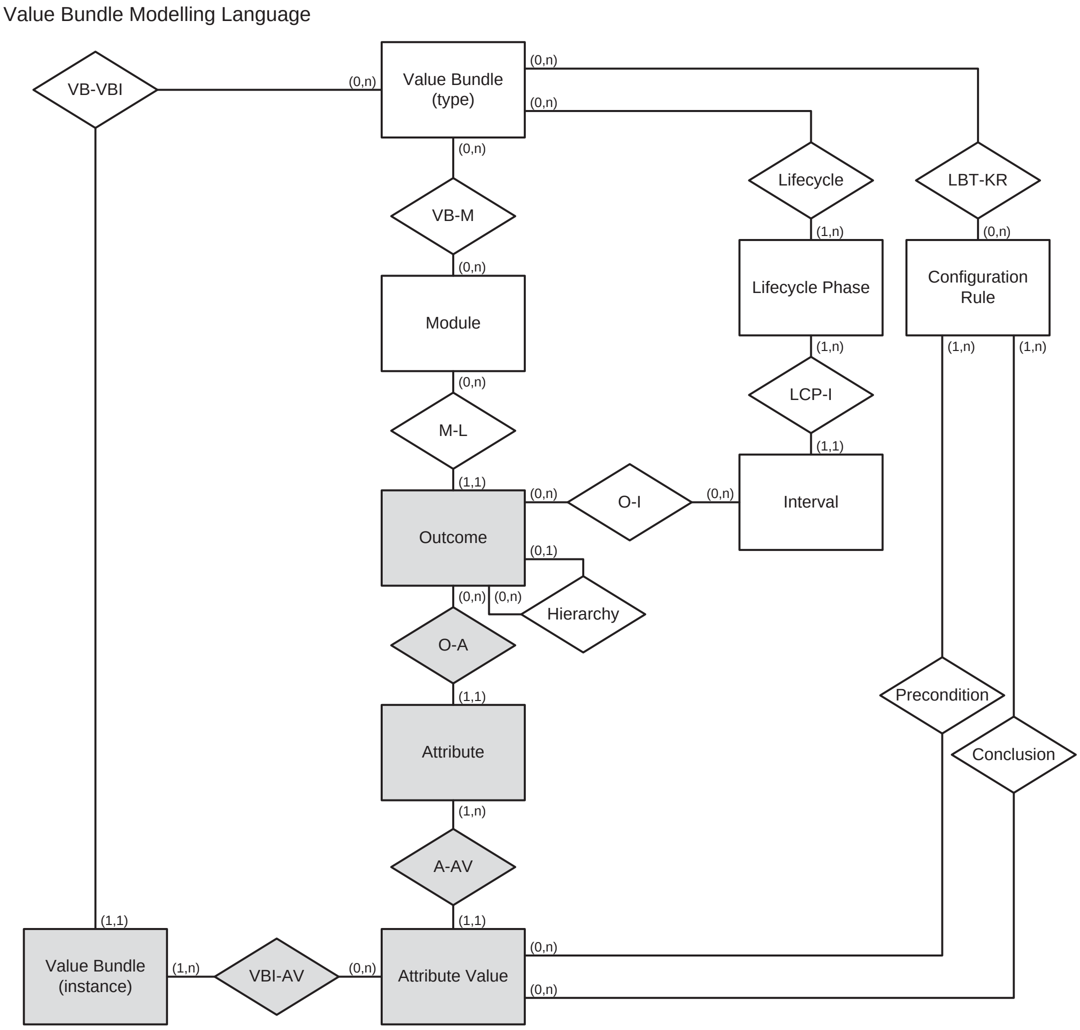

Figure 3: Value bundle structure

attributes (such as quality, availability, and price). One could, for instance, think of a logistics module which comprises a set of various logistics services (e.g., road, rail, sea, or air transport).

Outcomes can be organised in *hierarchies*, i.e., outcomes can again be composed of other outcomes. On the one hand, this allows for the representation of common hierarchical structures for products (e.g., bill of materials). On the other hand, the process dimension of services can be mapped out (e.g., corrective maintenance as a sequence of fault isolation, fault repair, and test run).

Outcomes are further described by *outcome attributes* and *outcome attribute values*. For tangible outcomes, common physical (e.g., dimensions, weight), mechanical (e.g., revolutions per minute), or technical (e.g., bandwidth) attributes can be used. The specific character of services (in particular: intangibility, heterogeneity), however, makes these attributes less suitable for rather intangible outcomes. In this case, functional and non-functional attributes might be more useful. Functional attributes describe the result of a service. This result can be a change in the customer himself (e.g., after a training) or in one of his objects (e.g., the state of a machine after a repair process has taken place). Non-functional attributes exhibit constraints over the offered functionality of a service. Typical examples are: quality of service, physical and temporal availability, or other terms and conditions (for a detailed listing, see O'Sullivan 2006).

To define selection and combination options among the available outcomes, the *configuration rule* construct will be employed. Configuration rules possess at least one condition and several conclusions. Both relate to a specific outcome attribute value. Logical connectives (AND, OR) as well as relational operators (>, <, >=, <=, !=) and appropriate comparative values can be modelled as attributes. Just like modules, the configuration rules enable an easy reuse of outcomes in different value bundles.

To project the temporal frame of a bundle, delivery *intervals* (day, calendar week, month, and year) are allocated to the individual outcomes of a bundle. Intervals are again aggregated to *lifecycle phases*, which relate to the lifecycle of a specific bundle type.

A concrete *value bundle (instance)* can be derived by selecting and combining available outcomes from the solution space, while adhering to the applicable configuration rules. A value bundle instance is not an abstract offering, but is a concrete solution to solve a particular customer's problem.

3.2 Language extensions

Since each of the analytical perspectives on the price margin (customer, supplier, and competitor) requires the application of distinct methods, an overarching integration of all decision-relevant data is desirable. The constructs introduced in the previous section form a common modelling language and assure that all three analyses operate consistently on predefined value bundles.

For all three perspectives, the additional modelling constructs to be added to the core modelling language will be introduced in the next subsections. Also, concrete examples for applying all three analyses will illustrate the functionality added to the core modelling language. All of the examples assume that a machine manufacturer wishes to offer a variety of value-added services in connection with its machine tools, and is therefore forced to thoughtfully price the resulting value bundles.

3.2.1 Upper price limit: Measuring customers' willingness to pay

The upper limit of the price corridor is determined by a customer's willingness to pay for a specific offering – reflecting the perceived value of the solution. In general, this metric is defined as the maximum amount of money a customer would be willing to sacrifice for a good. Besides determining optimal list prices, an analysis of willingness to pay also enables opportunities for implementing dynamic pricing strategies. Dynamic pricing allows companies to adjust the prices of identical goods or services for individual customers and is frequently used for online selling in B2C and B2B markets (Elmaghraby and Keskinocak 2003).

To determine a customer's willingness to pay, various methods have been proposed. Especially conjoint analysis has gained widespread acceptance as a preference and willingness to pay measurement tool in marketing theory and practice (Gustafsson et al. 2007). Furthermore, it has been proven to be particularly valuable to assess a customer's willingness to pay for bundled goods or services (Bouwman et al. 2007).

A conjoint analysis typically comprises three consecutive steps: First, a collection of distinguishing attributes (such as brand, performance, and price) of an item under study (such as a machine tool) is identified. Based on permutations of these attributes, a set of conjoint cards is created, each representing a fictional item. Second, the conjoint cards are presented to a potential customer. The customer is asked to evaluate the

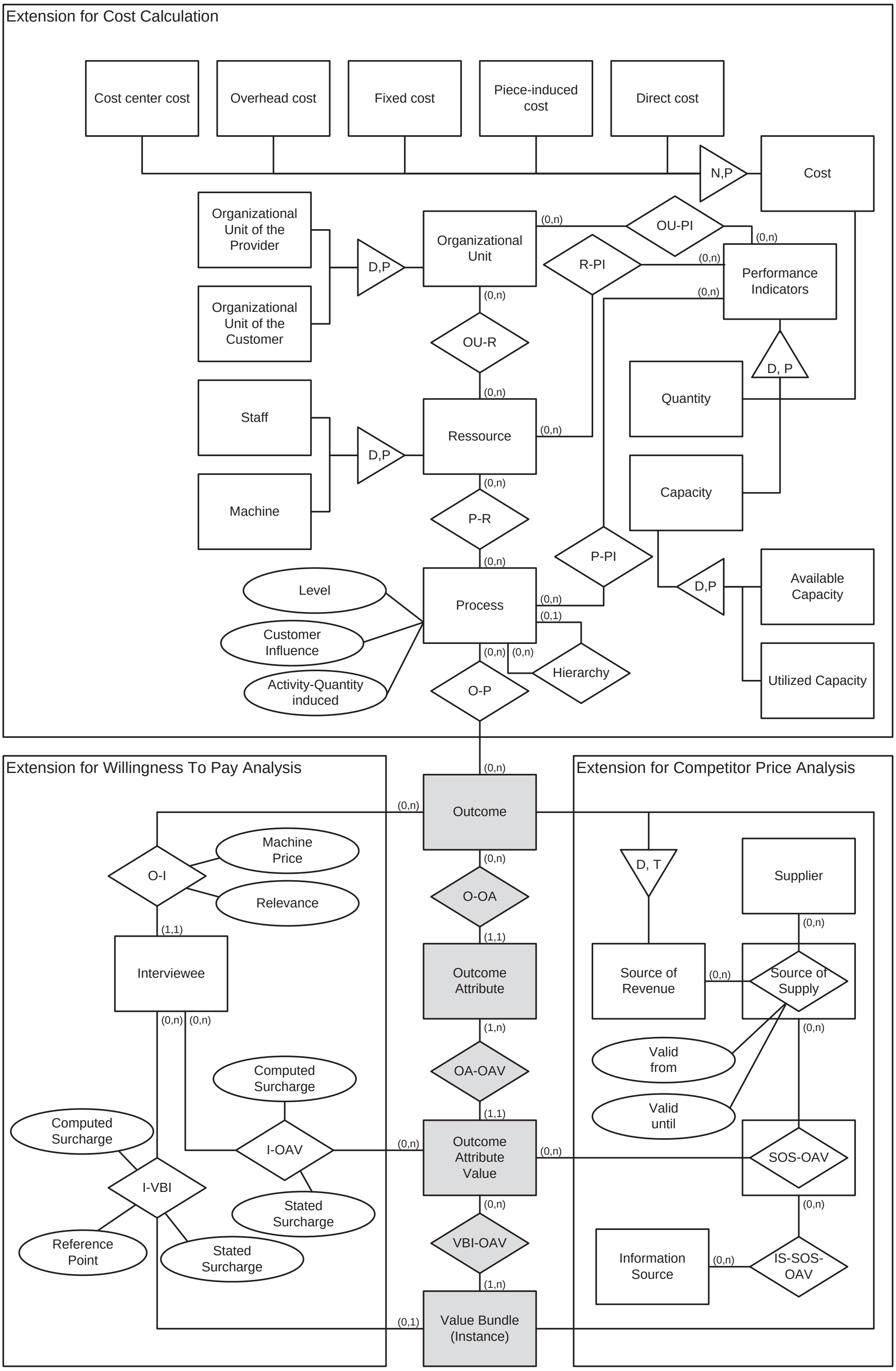

Figure 4: Model extensions for pricing value bundles

cards with respect to the perceived value of the items described on the cards. Third, estimation procedures are applied to the evaluations of the conjoint cards to derive the customer's utility function (i.e., preferences or willingness to pay) regarding the selected item attributes.

Variants of conjoint analysis can be subdivided into compositional, decompositional and hybrid methods.

When measuring preferences with the help of compositional methods, preferences for attribute values are directly queried from the interviewee. The perceived total value and the resulting preferences or willingness to pay are subsequently accumulated according to a predefined function. Compositional methods have been criticised because of their separate evaluation of single product or service attributes. This does not necessarily reflect the actual decision behaviour of customers, especially in the context of integrated value bundles.

Therefore, for the preference measurement of integrated value bundles, decompositional methods are preferable. The interviewee here assesses the perceived value of a complete offering. From the resulting preference judgments preferences or willingness to pay for individual attribute values – incl. the attribute price – can be derived. In the *Limit Conjoint-Analysis* (LCA) the interviewee is asked to make preference judgements with regard to various offerings by sorting them according to their perceived value. Using a limit card, the interviewee additionally marks offerings as 'worth buying' or 'not worth buying'. This procedure causes the test person to make a (simulated) choice. By adding the distinction between offerings worth buying and offerings not worth buying LCA goes beyond simple preference measurement.

Hybrid methods combine compositional and decompositional interview methods. A hybrid method widely used in commercial market research is the computer-assisted *Adaptive Conjoint-Analysis* (ACA). In a first compositional interview attributes and attribute values that are inacceptable for the interviewee as well as those that are particularly important are identified. Based on this information, subsequently each interviewee is asked to rate customised offerings in a decompositional evaluation task. The hybrid *Hierarchical Individualised Limit Conjoint-Analysis* (HILCA) enhances the LCA by introducing a first compositional step, similar to ACA, in which the interviewee can make a selection of particularly important attributes. Based on this selection, individual offerings are generated and rated holistically. The aim of the HILCA is to cover a greater number of product or service attributes without overtaxing the interviewee cognitively.

The *ServPay Conjoint-Analysis* (SPCA) is an enhancement to HILCA, especially designed to carry out price queries for value bundles (Backhaus et al. 2010). Consequently, we extended the core modelling language (Fig. 3) with core concepts of the SPCA (Fig. 4).

The survey design of the SPCA is focused on the constructs *outcome, outcome attribute value*, and *value bundle (instance)*. It comprises five steps:

1. As a warm-up task the interviewee is asked to fix a *machine price* for a given physical core product that is to be bundled with a set of value-added services. In the subsequent steps, this price anchor is used to translate percentaged price mark-ups for value-added services into absolute surcharges.
2. Next, the interviewee is asked to eliminate irrelevant services from the complete list of services offered. According to the answers, the value 0 (irrelevant) or 1 (relevant) is stored in the attribute *relevance* to include or exclude services, i.e., outcomes, from the consecutive steps of the SPCA.
3. In the following query for individual price mark-ups, the interviewee states acceptable surcharges for each *outcome attribute value* added to the physical core product. These values are filed under *stated surcharge* for each

outcome attribute value. For instance, referring to the outcome attribute value ‘warranty extension for 12 month’, an interviewee can state to be willing to pay an additional 1.19% of the physical product’s price.

4. In the next step, price enquiries for complete value bundles are carried out in a compositional evaluation task. Customised *value bundle instances* are shown to the interviewee in the form of one conjoint card each. This means that one conjoint card represents an entire set of outcome attribute values to be evaluated by the interviewee with one price surcharge only. Since during the interviews different offerings are generated for each interviewee, the answers for each value bundle instance must be stored with reference to the interviewee. To avoid overstraining the interviewees’ cognitive capacity, it is advisable not to put more than four outcome attribute values on each conjoint card (Backhaus et al. 2010), although the SPCA approach per se permits to account for an unlimited number of attributes. In order to reduce the cognitive workload for the interviewee, the compositional evaluation task is carried out in two steps: First, only three conjoint cards are rated. These cards are designed to represent a (presumed) ‘low’, ‘middle’, and ‘high’ value for the interviewee. The interviewee’s ratings of these bundles, therefore, can act as a point of reference for rating the other value bundles. In case a conjoint card shall be treated as such a *reference point*, the attribute reference point is set to ‘high’, ‘middle’, or ‘low’ depending on its position, ‘null’ otherwise. The interviewee’s additional willingness to pay with reference to the price of the physical good is stored in the attribute *stated surcharge* of the relationship-type I-VBI.
5. Based on the data from steps three and four, a customer’s willingness to pay can be predicted for any bundle composed out of the predefined outcome attribute values or value bundle instances. Since a willingness to pay is subject to an individual customer, it will be filed under *computed surcharge* with reference to a value bundle or an outcome attribute value. It is, of course, also possible to aggregate (e.g., mean, max, min) individual willingness to pay values to derive prices for whole groups of customers. This can be done by clustering customers according to a set of pre-defined customer characteristics, such that an additional customer’s willingness to pay for a value bundle instance can be predicted based on asking a set of demographic questions (this procedure has been described in detail in Backhaus et al. 2010).

Table 1 shows an exemplary extract from an analysis of willingness to pay for value-added services associated with a machine tool. The data of n=428 potential machine tool buyers has been collected via web-supported telephone interviews. The subsequent data analysis has been conducted with a software tool based on the constructs of the modelling language presented in Fig. 4. The calculated willingness to pay is represented as a percentaged surcharge on the price of a new machine. The results show that the customer group under investigation is, for example, willing to pay an extra 0.72% for individual software training. There is, however, practically no willingness to pay for a basic machine training (0.03%), and even a negative willingness to pay (-0.13%) for a guaranteed return at the end of the lifecycle.

3.2.2 Lower price limit: Cost calculation

To determine an appropriate price for a value bundle, not only the customer’s willingness to pay, but also the supplier’s cost of providing the complete solution need to be calculated. The supplier’s costs result from engineering, marketing, and delivering the value bundle and therefore accrue throughout the value bundle’s whole lifecycle. Depending on the type of bundled outcomes, this lifecycle may extend to several decades. This particularly applies to industrial investment goods, such as machine tools.

Table 1: Additional willingness to pay for industrial services in the investment goods industry, as determined with the SPCA (n=428) (Backhaus et al. 2010)

Value-Added Service	**Willingness to Pay Mark-Up**
Provision of CAD-data of the machine	+ 2.24%
Proof-of-concept by producing parts on test systems	+ 1.82%
Fixed prices of spare parts for 2 years	+ 1.60%
Spare parts are stored at a consignment stock at the customer's plant	+ 1.30%
Warranty extension for 12 month	+ 1.19%
Process optimisation	+ 1.15%
Spare parts available within 24 hours	+ 1.15%
Assembly and initial support in a 2-days start-up phase	+ 1.02%
Individual software training	+ 0.72%
Basic training	+ 0.03%
Guaranteed return at the end of the machine's lifecycle	- 0.13%

Due to the characteristics of the included services the allocation of costs to individual value bundle instances or single outcomes is challenging (Möller and Cassack 2008; Reckenfelderbäumer 1995). The distinctive characteristics of services are consequences of the direct reciprocal influence, or interaction, between service provider and service consumer (Sampson and Froehle 2006). The customer acts as a co-producer of value by providing inputs into the service process. This interaction implies that services, unlike physical goods, are not storable and that services are subject to different forms of customer induced variability (Frei 2006). One consequence is, that services incur a large proportion of standby costs, which have to be regarded as fixed costs and therefore arise regardless of the amount of actual transactions (Corsten 1997; Reckenfelderbäumer 1995).

To be able – despite these problems – to make meaningful analyses of costs arising from the provisioning of value bundles, activity-based costing seems to be a promising option. Reckenfelderbäumer (1995) has adapted the general activity-based costing method to the characteristics of services.

Below we will explain how the modelling language depicted in Fig. 3 has to be extended (see Fig. 4) in order to support an activity-based costing as proposed by Reckenfelderbäumer. Outcomes, i.e., products and services, are the result of the execution of *processes*. Processes can be arranged in process *hierarchies* to form business processes, primary processes, and sub-processes. Different *levels* of processes in regard to the outcome can be distinguished: first-degree processes, e.g., production and logistic processes, comprise all activities that are directly connected to the delivery of an outcome. Second-degree processes, e.g., marketing processes, only have an indirect relation to the actual outcome. Finally, third-degree processes, e.g., management processes, cannot be linked to any specific outcome at all. Furthermore, different degrees of *customer influence* can be distinguished: Integrative processes require a high degree of customer integration. This could, for instance, include all frontstage activities within a service system, which are immediately perceivable for customers and therefore susceptible to their influence. Autonomous processes, in contrast, comprise processes that are not influenced by the customer. This could, for instance, include processes in the supplier's service system backstage. For value bundles, backstage activities might involve all activities necessary to manufacture rather product-like outcomes, since this often does not require direct customer input. Processes are further divided into *activity-quantity induced* and activity-quantity neutral processes. The costs caused by the former type of processes can be directly linked to the delivery of a single outcome or value bundle instance and hence will be allocated directly to the respective outcome or value bundle instance. The costs caused by the latter type of processes cannot be traced back to single instances. These costs have to be allocated by using compensation keys.

The execution of processes requires *resources*, which may include *machines, staff* or other resources. Resources are provided by different *organisational units* (e.g., by the providers and customers involved in the delivery of the value bundle).

On the basis of the above systematisation, processes, resources, and organisational units are evaluated according to various performance indicators. These are: *costs, capacities,* and *quantities.*

Direct costs are directly accountable to a specific outcome. In the context of value bundles direct costs occur, e.g., for spare parts used in maintenance processes. *Activity-quantity induced costs* can be directly linked to the execution of a single process instance. Examples are costs for temporary staff. *Activity-quantity neutral costs*, in contrast, cannot be accounted to a single process instance; e.g., costs for instruments and tools that are used for different processes. *Overhead costs* can not even be allocated to specific outcomes. Typical overhead costs are costs for a factory canteen. For reporting reasons, costs cannot only be allocated to processes, but also to organisational units. These costs are called *cost centre costs.*

An analysis of costs induced by the delivery of value bundle generally reveals varying cost behaviour patterns of single outcomes over the value bundle's lifecycle (Blinn et al. 2008). For a selection of value-added services from Tab. 1, the corresponding cost graphs are exemplarily represented in Fig. 5. By implementing the resources necessary for the design and engineering of all outcomes included in a bundle, the provider incurs costs in advance of selling the value bundle (for instance, for an initial proof-of-concept). Next, a particular customer demands a value bundle. For the supplier, this is reflected in the costs related to each outcome (such as for assembling a machine). For integrated value bundles including long living investment goods (e.g., machine tools), a bundle's lifecycle frequently exceeds the marketing phase of the physical goods, which means that even after the completion of the product sale, services – as for instance, maintenance or repair of the physical goods – will still be required.

3.2.3 Upper price limit: Estimating competitors' prices

To estimate competitor prices a provider must first verify whether a specific value bundle is, or could be, offered by its competitors. The *source of supply* documents which *sources of revenue* (i.e., outcomes or value bundle instances) are offered by which other *suppliers.* The entity-type *supplier* here comprises both the company which is performing the price analysis and the company's competitors. If a competitor offers the same or a similar value bundle, the prices of whole *value bundle instances* can be compared. If, however, a competitor is currently not offering a comparable value bundle, but is assumed to be able to do so in the future, single *outcomes* can be regarded as sources of revenue. To determine the competitor price the *outcome attribute value* of the outcome attribute 'price' will be assigned to combinations of sources of revenue and suppliers (relationship-types *SOS-OAV* and *Source of Supply*). These values are subject to *validity periods.*

Competitor prices can be identified via a variety of methods. *Information sources* document the various procedures for identification, which may display different degrees of reliability. Among the most important procedures are the following (Diller 2007):

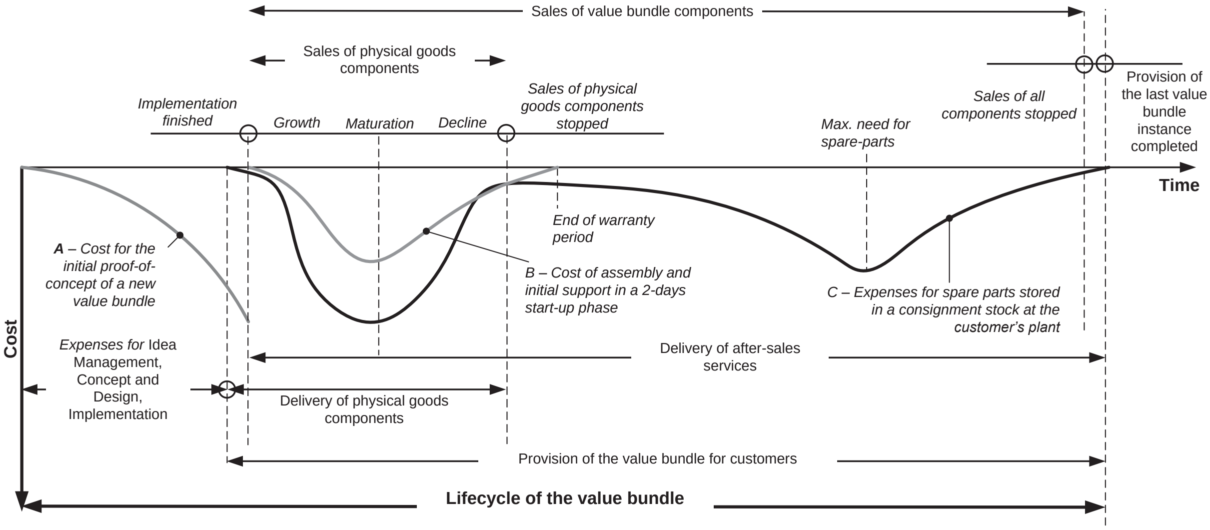

Figure 5: Lifecycle costs of a value bundle

- *Price observations* are non-reactive measurement processes generally carried out through test requests and test purchases, internet research, or panel surveys repeated at regular intervals. As a general rule, specialised market research institutes are commissioned to conduct these surveys. However, for complex and unique value bundles, the only suitable way to find out about competitors' prices might still be to send out requests for proposals and compare the incoming offers and prices.
- *Official statistics*, e.g., from public authorities or consumer organisations are usually published in the form of price comparison lists – tables comparing the levels and statistical distributions of prices that apply to specific physical goods or services. They are either based on hedonistic price functions (Diller 2007) or on mathematical models that factor in the market prices for specific outcome attributes (cf. conjoint analysis in Sect. 3.1). In the investment goods industry, official statistics regarding the market prices of machines and value-added services are still quite uncommon. Reasons for this comprise the complexity of bundles, their highly individual design, and the reluctance of firms to post fixed prices on web-based marketplaces. For instance, the German Engineering Federation (VDMA) is hosting a marketplace[1] on which their members can offer their goods and services. However, this market seems to be strongly focused on physical goods, and seems not to provide information on prices of related services or even complete value bundles.
- Another way to compare competitor prices is *online marketplaces*, on which services and physical goods are traded. One example is represented by an online marketplace for advertising and trading unutilised machine capacity for machine tool manufacturing. The machine tool supplier GILDEMEISTER offers such a platform to their own customers[2]. Other examples are represented by bidding platforms for easy to outsource services such as logistics services. In Fig. 6 such a bidding platform for logistics services is displayed[3].

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[1] VDMA e-Market, available at `http://www.vdma-e-market.com`

[2] available at `https://www.dmgmarketplace.com/portal/login.jsp?kblang=en`

[3] available at `http://www.shiply.com/transport/Jcb-814-Super-Excavator/248486/`

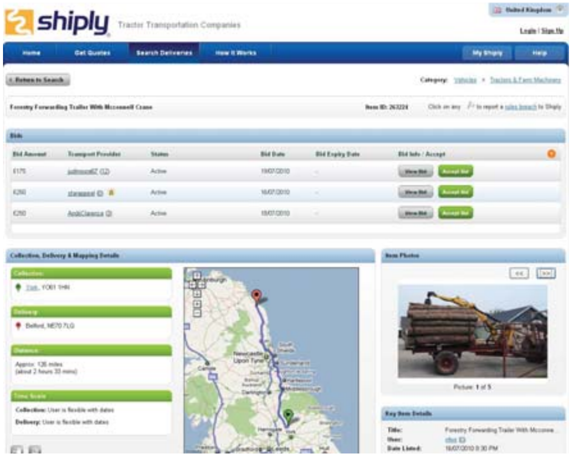

Figure 6: Example of a web-based bidding platform

4 Software support for pricing value bundles

The presented multi-perspective modelling language is the basis for a comprehensive tool support, namely the Pricing Workbench. The perspective-specific price margin analyses are made available to marketing and controlling managers via an integrated graphical user interface (see Fig. 7):

1. *Value Bundle Modelling:* In a first step, the product manager designs structural models of value bundles. The result of this process is a solution space that specifies all possible configurations of the available outcomes. The models are saved to a database and can subsequently be accessed by a set of analytical tools.
2. Willingness to Pay Analysis: The survey design for the SPCA can be defined by selecting desired outcomes from the model database. Complete value bundles will be generated by the permutation of the selected outcomes. Next, the actual SPCA is performed with a set of selected customers as interviewees. The resulting willingness to pay information will be stored in the database and gets linked to the analysed outcomes and value bundles as well as to the interviewed customers. In addition, aggregated willingness to pay information for whole customer groups can be derived.
3. Cost Calculation: Next, based on an activity-based costing approach, financial controlling can calculate costs for engineering, marketing, and delivering value bundles. The resulting data complements the value bundle models and represents the basis for lifecycle-oriented cost analyses.
4. *Competitor Price Analysis:* The competitor price analysis is supported by various market research methods. Gathered market research data will be analysed to identify the lowest competitive price for a single outcome or for a complete, functionally comparable, value bundle. Again, the resulting cost data is added to the model database.
5. *Value Bundle Recommendation and Configuration:* The final customer-specific decision making process is supported by a recommendation and configuration system. The recommender makes individualised suggestions of possible outcomes of interests based on the willingness to pay data collected beforehand (Backhaus et al. 2010). The configurator assists in the configuration of complete value bundle instances by interpreting the structural value bundle model (Becker et al. 2009a). Due to the analysis of the available price corridor (steps 2 to 4), the system only recommends profitable value bundle configurations and can even apply dynamic pricing methods to fully exploit a customer's willingness to pay.

5 Outlook

In this paper, we have presented a multi-perspective decision support approach for the pricing of value bundles. The approach includes a core modelling language for representing the structure of value bundles as well as three language extensions supporting the pricing process for value bundles from different perspectives, namely a customer, provider, and competitor perspective.

Besides supporting marketing tasks, such as pricing, the presented modelling language can be

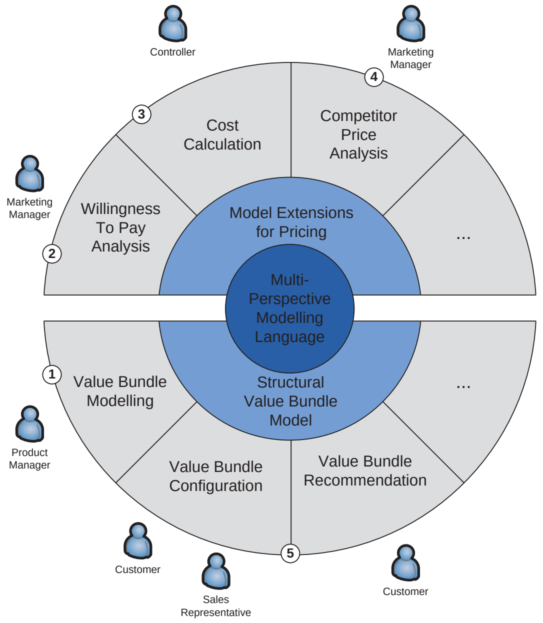

Figure 7: Functions of the Pricing Workbench

extended by further perspectives supporting various other phases of a value bundle's lifecycle:

- Focusing on the early stages of the core processes of value bundle engineering (DIN 2009), the core modelling language can be extended to support *innovation and development* processes. The language can be augmented with constructs that allow for comprehensive descriptions of products and services to be bundled. This may – in a knowledge management fashion – support tasks such as idea generation and discovery of promising bundle compositions (Müller-Wienbergen et al. 2009).
- *Planning and forecasting* processes can be supported by exploiting the representation of the compositional and temporal structure of a value bundle. Using causal forecasting methods the demand for value-added services can be derived from the sales figures of the physical core product. The demand for maintenance services, for instance, can be predicted based on the number of installed products at customer sites (i.e., the installed base) and historical data on failure rates.
- *Productivity measurement* is another possible extension for the presented modelling language. Using Data Envelopment Analysis (DEA), for example, allows for considering non-monetary performance indicators such as customer satisfaction or quality of service in performance measurement. Such an analysis exhibits a complement to the here presented assessment based on financial performance indicators only, i.e., costs and prices.

Any language extension, such as the described examples, should rely on a thorough meta-model based analysis of already existing task-specific modelling languages. To identify promising constructs of modelling languages for product/service modelling, we have compiled a catalogue of relevant modelling languages, along with exemplary models, and (reconstructed) meta-models (Becker et al. 2009b).

6 Acknowledgement

This contribution would not have been possible outside the context of the research projects FlexNet (Flexible information-systems architectures for hybrid value networks, funding number 01FD0629) und ServPay (Willingness to pay for business models for value-added services, funding number 02PG1010), both of which were subsidised by the Federal Ministry of Education and Research (BMBF). The project FlexNet received funds in the context of the subsidy programme 'Innovation through Services' and was supervised by the working area 'Development of Work and Services' of the project management agency within the German Aerospace Centre (PT-DLR). The project ServPay was sponsored within the framework of 'Research for Tomorrow's Production' and supervised by the Project Management Agency Karlsruhe (PTKA-PFT) of the Karlsruhe Institute for Technology (KIT).

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