Cost and pricing principles for service configurators

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Abstract

Mass customization has been introduced as a fast and cost effective way to offer personalized products to customers. Mass customization requires three capabilities; a stable solution space, a robust process design, and choice navigation support. Our interest lies in the last one, choice navigation support and in a special case of services. The aim of the paper is to study how pricing and cost information can be combined into conceptual model for mass customizable services. To do this we have picked one model, Four-Words Model, as an example to show how the model could be extended. The results show that pricing model has to be combined with sales configuration model. Moreover, cost model is combined with technical configuration model. Because the service object affects the service process both price and cost information has to be presented as a conditional attribute, simple addition of prices or costs is not adequate..

Keywords: Mass customization, service, configuration, pricing model, cost model

Introduction

Many customers are no longer content with standard offerings. Instead, they demand solutions that are customized to their needs. On the other hand, they are not willing to wait long for delivery. In addition to this customization-responsiveness squeeze (McCutcheon, Raturi, & Meredith, 1994), customers tend to require affordable prices. Thus, companies are squeezed between demand for customization and the pressures it puts on the efficiency and profitability of the operation.

Mass customization has been proposed as an approach to address the squeeze. Successful mass customization requires three capabilities (Salvador, de Holan, & Piller, 2009). First, a stable solution space consisting of modules or components that can be mixed and matched in response to individual customer requests. Second, a robust process design capable of delivering the customized solutions efficiently. Finally, choice navigation support for customers to enable them to identify the most suitable combination of modules to their needs while minimizing complexity and the burden of choosing from potentially numerous options.

To improve the choice navigation capabilities of companies, dedicated IT system support -*configurators* -have been researched, developed, and applied, (see e.g. Sabin & Weigel, 1998). Configurators help in the definition of a sales specification that can be produced, and subsequently translated into the required parts and production information. For configurator support, any required information has to be modeled and entered into the configurator. Usually, the modeling utilizes a *conceptual model* describing the concepts and their relationships that are deemed necessary to capture the phenomena of interest. There are several such configuration conceptual models for goods but they rarely consider pricing or cost information. Yet, customers want to know the price of the customized solution and providers want to know whether the price exceeds the costs related to producing the solution (Becker, Beverungen, Knackstedt, & Müller, 2008).

Our interest lies in services because of their growing economic importance. Differences between services and goods (Bowen & Ford, 2002; Grönroos, 2000, p. 47) imply that research results from goods do not necessarily hold for services. Moreover, a research gap on mass customization of services has been noted (Da Silveira, Borenstein, & Fogliatto, 2001; Heiskala, Paloheimo, & Tiihonen, 2007). More specifically, there seems to be little research on configuration conceptual models for services, and particularly on models that would support capturing pricing and cost information. We address this research gap.

In this paper, we discuss how pricing and cost information can be taken into account in conceptual models for mass customizable, configurable services. We aim to identify requirements for extending current configuration conceptual models with new concepts to capture cost and pricing information. To meet this aim we study literature on conceptual models for mass customizable services, and pricing and cost models of mass customizable services supported by our experience working with service mass customization companies. Our contribution comprises identifying requirements for extending current conceptual models of configurable services and an analysis of the relationships between sales and technical configuration models and pricing and cost models. Our analysis could be used to improve configurator support for mass customizable services. We have chosen one service configuration conceptual model, Four-Worlds Model (Heiskala, Tiihonen, Anderson, & Soininen, 2006), in which the requirements of pricing and cost models are introduced.

The rest of the paper is structured as follows. First, we discuss services and how they may differ from goods. We continue by presenting configurators in more detail, the role of conceptual models in them and follow with describing a generic, publicly available service configuration conceptual model, the Four-Worlds Model. After that, we discuss pricing and cost models for services and how they relate to configuration models and to each other. Next, we present the requirements for extending service configuration models to capture cost and pricing information. Finally, discussion and conclusions end our paper.

Services

There is no single and consistently used definition of services (Shafti, Van Der Meer, & Williams, 2007); this may be due to the vast diversity of services (Cook, Goh, & Chung, 1999). Grönroos (2000, p. 46) "reluctantly" proposes the following definition: "A service is a process consisting of a series of more or less intangible activities that normally, but not necessarily always, take place in interactions between the customer and service employees and/or physical resources or goods and/or systems of the service provider, which are provided as solutions to customer problems."

Services are often characterized by their IHIP attributes (Grönroos, 2000, p. 47): inseparability, perishability, heterogeneity and intangibility. Not all services have the IHIP characteristics, but typically, these features can be found. IHIP characteristics are also considered to differentiate services from goods. Production and consumption of services are *inseparable,* taking place simultaneously, and significant parts of the production cannot begin or proceed until some customer inputs are provided or the customer is present. *Perishability* refers to the time-sensitivity of service provider's capacity to produce a service – for example, the production capacity of a maintenance engineer's time or the fact that an airline seat is lost if there is no customer to receive the service. *Heterogeneity* refers to the (non-desirable) variability and lack of consistency in the service process caused by variations in worker or customer performance. Another source of heterogeneity is that customers differ and they do not necessarily know what to expect from the service. In sum, customer participation creates unpredictability and variation in the service process (Sampson & Froehle, 2006). *Intangibility* is often attributed to services, and can be divided to physical intangibility, i.e. incapable of being perceived by senses or mental intangibility, i.e. difficult to be grasped mentally (Lovelock & Gummesson, 2004). Differences stemming from the IHIP characteristics seem to indicate that operations in services differ from goods (Bowen & Ford, 2002).

Configurators

Product configuration systems (configurators for short) are IT systems that improve the choice navigation capabilities of a company by supporting the *configuration process* of configurable products (Forza & Salvador, 2008; Tiihonen, Soininen, Mannisto, & Sulonen, 1998). The configuration process is often divided into two stages: sales and technical configuration process.

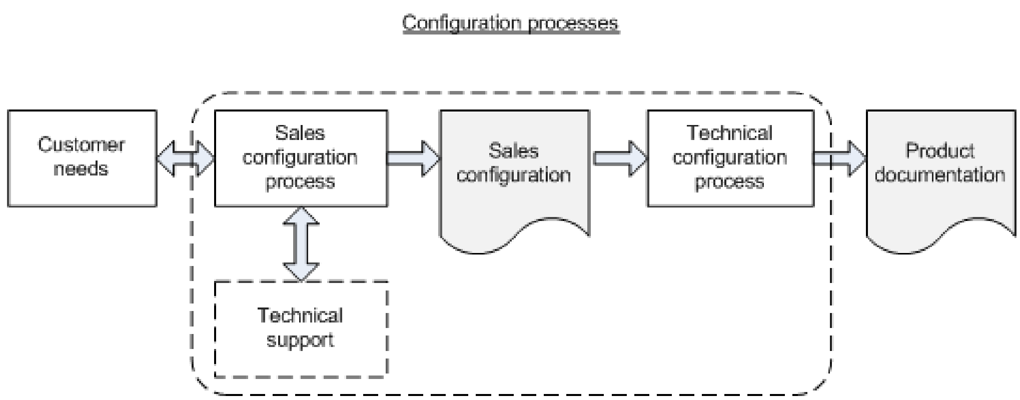

Figure 1. A generic two-stage configuration process (Forza & Salvador, 2008).

In the *sales configuration process*, the customer requirements and needs are collected and possible product options that would satisfy them are explored. This exploration can be very difficult and error-prone without configurator support, as the number of adaptation possibilities to choose from can be numerous and their interdependencies complex. Sales configuration process results in a sales specification. It defines the product individual that the customer wants to buy and the company agrees to provide. Configurators ensure that the solution defined in the sales specification is correct and complete, which guarantees that it can be produced and delivered. Configurators that intelligently and in a personalized way support customers in choice navigation, e.g. via the application of recommendation technologies, are emerging (Blecker, Abdelkafi, Kreuter, & Friedrich, 2004; Zanker & Tiihonen, 2008). Configurators can also help providers translate the sales specifications into what parts need to be included in the final product and how it should be produced.

The *technical configuration process* translates the sales specifications into production instructions. These can include partial listings (bill-of-materials), process steps (routings), and drawings required to make and assemble the customer-specific product.

For this kind of support to be possible in configurators, the adaptation possibilities of the solution and the knowledge about the required production resources and activities need to be formalized and modeled. This is done by utilizing conceptual models that define the necessary concepts and their relationships for formally capturing the relevant knowledge. Usually the information needed for sales and technical configuration processes is modeled separately. For sales configuration, the models include concepts for capturing the adaptation possibilities. The technical model ties the sales specification into how the individual product should actually be made.

A Service Configuration Conceptualization: Four-Worlds Model

Configuration conceptual models have been developed mostly for goods. Only a few publicly available service-configuration conceptual models exist. In this paper, we use one such model, the Four-Worlds Model (FWM), as the basis of our analysis. It is presented in more detail in Heiskala et al. (2006).

The objects-of-service world describes the recipient(s) of service (like persons or physical systems) and the environment relevant to the recipient(s), and would typically include the identification and characterization of the customer. The objects-of-service world aims to specify what the company needs to know about the service recipient(s) and the environment to be able to configure the service in the sales phase successfully and later on deliver the service accordingly. The recipient of the service and other relevant stakeholders can affect service specification, the service delivery process, the availability of service elements, and pricing.

The needs world captures the requirements to be satisfied: goals or benefits sought from the service, the required quality attributes, preferences, and other factors. The needs world enables the description of requirements on a more customer-oriented or higher level of abstraction than the actual service solution. The needs world together with objects-of-service world helps to determine a fitting service specification for a particular customer.

The service solutions world describes the specifications to which the service is to be delivered. It describes the configurability of the offering, i.e. the adaptation possibilities. The service solutions world is the core of the model. In many services, the solutions world would correspond to the service agreement terms.

The process world depicts the service delivery process and resources required to carry it out. From the sales perspective, it is intended for communicating relevant aspects of the configured process for the customer. The process world describes how and with what the service is put into practice. Communicating the process to customers, and especially their role, potentially helps to better manage customers' participation in the process and keep customers' expectations realistic.

There can be relationships between the worlds, see Figure 2. Certain service objects, or ones with specific characteristics, may indicate specific needs, causally or as correlations. Similarly, some service objects or their specific characteristics may be incompatible with specific service elements or their characteristics. Needs are satisfied by specific service elements or their characteristics. Specific service solution elements with given properties are delivered by certain process modules. Service objects can be required as resources for process modules.

Needs, service objects, service elements, process modules, and resources can all be organized in both generalization (is-a) and part hierarchies (whole-part) and also be characterized with attributes. Process modules further define the sequence in which they will be performed.

Attributes have certain possible values. Complex relationships between different modeling concepts can be defined with constraints.

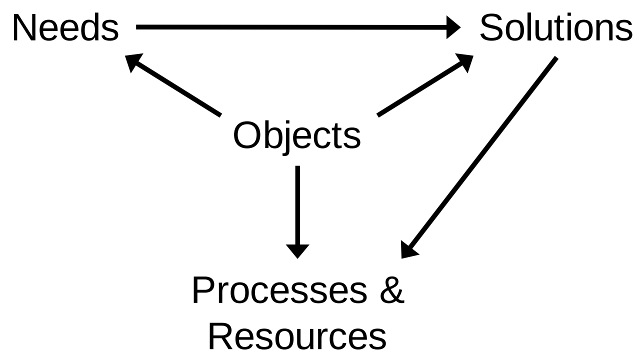

Figure 2. Four-Worlds Model

Pricing models for services

Even though the pricing of services has been the stepchild of the pricing profession, there are many possible ways to set a price for services (de Miranda, Baida, & Gordijn, 2006; Simkovich, 1998). One quite common method is to base the price on the usage of resources, typically an hourly rate. When service is seen as doing something on behalf of someone, the rationale behind usage-based pricing is obvious. In addition, the heterogeneity of services justifies the use of usage-based pricing, because it is hard to know in advance the resource consumption of the service delivery process. However, it is good to keep in mind that an hourly rate is almost risk-free for the service provider. Charging by the hour means that the customer carries the risk. Moreover, the hourly rate should be comparable to the productivity of the resource; the higher the productivity, the higher the rate.

Another way to price services is to use a flat rate, for example a monthly fee. The user pays a fixed price regardless of the usage. The rationale of this pricing is that ability to provide services causes costs that are sunk (fixed) whether or not the service is used. This can be seen as insurance for user; regardless of how much service is needed, the user always pays the same amount, and the risk is carried by the service provider. A third way of pricing is to use a two-part tariff combining the two previous ones, both fixed and usage based rates. The user pays certain fixed fees and additional usage-based fees.

The usage-based pricing model can be linear on non-linear. In a linear model, the marginal unit price is always the same. However, the unit price might vary depending if there is a fixed base rate or not. If the marginal unit price is a function of amount, then the pricing model is non-linear. An example of this is the n-block tariff where the price is fixed up to certain quantity, q_n. When q_n is exceeded, the unit price will change for all units greater than $q_{n.}$ Both the two-part tariff and the n-block tariff are similar to the typical company's cost structure. Quite often, setting up service costs a certain amount and increasing the volume does not increase costs linearly.

The above-mentioned pricing models present a cost-plus pricing framework. Basing pricing on the use of resources gives fairness in pricing. However, there is also a completely different way to set a price – basing the price on the value that the service provides to the customer (Hinterhuber, 2004). However, building a value-based pricing model is challenging because value is always subjective and consists of several components, like use, utilitarian, exchange, intrinsic, and personal value (Woodall, 2003). Moreover, the value of the service or product can vary dramatically over time. Similar to value-based pricing is performance-based pricing where the price is set based on the measurable outcome, such as an increase in productivity in the case of management consultancy. Both value-based and performance-based models have been presented for use in a professional service context (Homburg & Stebel, 2009; Wardell, Wynter, & Helander, 2008). Even though these models provide advantages to both parties, provider and client, the opportunistic behaviors of both parties can weaken the outcome, and thus the value (Homburg & Stebel, 2009).

Cost models for services

The first rationale of cost models is to define the cost of objects, which are normally outputs like products or services but can be resources or activities as well. Moreover, cost models can be used in managing the company and especially in managing the resources of the company. In general, cost systems give a monetary value for the use of resources. First costs are allocated to cost centers or cost pools and then these are allocated to resources. There can be reallocations between resources and especially supportive (indirect) resources are allocated to direct resources, which are allocated to final cost objects, outputs. In activity-based costing (ABC), there is one more level, an activity, between resources and outputs (Kaplan & Cooper, 1998). Actually, it is an oversimplification to talk about one new level, because in practice, as with resources, there are many supportive activities that are not directly allocated to cost objects. Moreover, activities can be combined into processes or macro-activities, which are finally assigned to cost objects (Lawson, 1994; Sievänen & Tornberg, 2002; Turney & Stratton, 1992).

When the validity and relevancy of cost calculations are discussed, the cost model has to fulfill a few conditions (see, e.g., Mévellec, 2009). Maybe the most important is causality, the ability to link causes and consequences. Causality has been one of the main reasons for promoting ABC (Kaplan & Cooper, 1998). Traceability is also mentioned as a requirement for internal relevancy. Traceability, the system’s ability to track resources and costs from entry to exit, is not a problem for almost any cost model design. There are also requirements for external relevancy but they are not discussed in this paper.

In general, it has been said that companies have difficulty knowing the cost of services (Anderson & Narus, 1995). This might result from the cost structures in services, with more fixed than variable costs (Mathieu, 2001). However, Brignall (1997) observed that cost traceability decreases when moving from professional services to a service shop and further to mass services. This might be a result comparable to the low number of customers and service products in professional services, thus making it possible to use project-costing methods. Furthermore, the customer has an effect on productivity of services, affecting the use of resources and that way to costs (Gummesson, 1998). Thus, the cost of the service may vary depending on a customer. It has been indicated that a customer, rather than the product or service, would be a suitable cost object (Carú & Cugini, 1999). This supports the use of ABC since it allows for multilevel cost drivers. For costing purposes, this means that the service has one cost and the customer has another cost. Furthermore, costs can be calculated in terms of market segment or geographic area. The total cost of providing the service is the sum of these costs.

Interconnections between configuration, pricing, and cost models

In this section, we discuss the relationships between the different models presented earlier. First, we look at how configuration and pricing models, and then how configuration and cost models are interconnected. Last, the dependencies between pricing and cost models are discussed. The relationships between the models are summarized in Figure 3.

Combining configuration models and pricing models

Price is an exchange value of service. If the exchange value is lower than the total value for a customer then a customer is willing to pay the price and buy the service. Thus, price is needed for selling the service. Price also has other functions; it signals estimated quality, and it makes all saleable items comparable in monetary terms. Moreover, pricing models should be somehow connected to either the estimated customers' value or to production costs to make prices justified and acceptable.

Service sales configurators aim to make services easy to sell and buy, thus they have to provide prices immediately. This implies that a customer has to know both the price of his/her configuration and how much certain choices affect price. When configurable (mass customized) services are bundles of service modules, it is obvious that modules have to have a set price. However, the price of combining two modules might not be the sum of the prices. Therefore, the price of service module is conditional and depends on a specific bundle. Typically, it is estimated that offering more services simultaneously is cheaper because of set-up costs, but it can be also higher because of complicated combinations. The price change can be shown in separate parts (services) or in the bundle.

Because the characteristics of the service object(s) affect the service productivity significantly, they must be taken into account also in the pricing model. For example, the price of a service contract for an elevator varies depending on the age and the usage of the elevator. A service contract for a new elevator in a residential building is most likely cheaper that one for an old high-rise elevator in a commercial building. In practice, this means that simple summing of pricing models is inadequate for the pricing of configurable services in the general case. Pricing models have to be conditional, and logical operators are required for determining the price. However, an accurate pricing model may easily become too complicated. Therefore, it may be necessary to apply a somewhat simplified pricing model. Thus, some risk premiums have to be added to prices to ensure the profitability of the service provider.

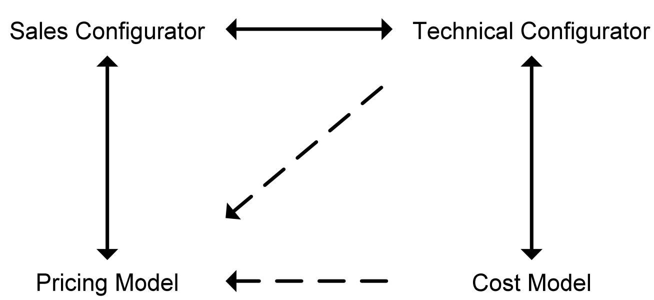

Figure 3. Relationships between models.

Configuration model and cost model

The idea behind cost models is first to allocate costs to resources and finally to outputs, typically to products and services. For this purpose, a cost model needs to identify resources and how much they are used to produce a product or service an individual. Typically, bills of material (BOM) and routings convey this information. In configurable services, these specify the service modules – activities and/or processes – needed to produce the service individual.

In a two-stage configuration process, the first stage produces the sales specification and the second stage the technical specification. The technical specification is detailed and usually includes the BOM and routing. This is practically the same information as required by the cost model. In FWM, the process world depicts the service delivery process and the resources required to carry it out. If the process world is modeled in detail, technical specifications can be generated. However, objects-of-service affect service processes, i.e. the processes required for delivering similar service solutions will vary depending on service object (customer). For example, duration of activities may vary, extra activities or sub-processes may be needed, or even a completely different process may be used to implement the service solution. The configuration model should capture relevant process variations. Moreover, sophisticated configuration models have intelligence (rules) to ensure that the service individual can be delivered in the context of the object-of-service at hand. A simple example is that in a maintenance contract a 1-hour response time is not available in remote locations.

When combining configuration and cost models we have to ask: It is worth the effort to maintain detailed technical information (BOM and routing) in both models when the number of possible variations (combinations) will easily rise up to thousands or more? If not, there are two practical solutions and both require a close integration between the models. Either detailed technical specifications of each service individual have to be imported from the technical configuration model into the cost model case by case. The actual cost calculations are performed only in the cost model. Alternatively, detailed information is only stored in the configuration model and cost is a conditional attribute of service modules (activities, processes, and resources) given by the cost model. Moreover, because the object-of-service (the customer) affects the processes and thus the costs, it would also be justified to have object-specific cost drivers.

Connections between pricing and cost models

In this paper, we do not discuss whether a price should be set based on costs or be market driven. However, it has been shown that costs are usually used in pricing decisions (Govindarajan & Anthony, 1983). Moreover, the price has to be set so that customers are willing to pay it, so pricing is always partially market driven. It has been said that costs set the minimum price but that is not true in all cases because a market price can be below cost. There is still a connection between cost and price; both are needed to calculate profit, which is price minus cost.

The detailed specifications from the technical configurator are needed to calculate the final costs of a service individual. This may leave the connection between pricing and cost models vague because a direct link between cost and pricing models may be missing. However, service modules have to have set costs in the cost model. These service module costs can be used to estimate the final costs and profitability of a service individual. The service module costs can be linked to the pricing model to give cost information for pricing decisions. The logic of the pricing model can be similar to the cost structure; for example, the use of a flat rate when there are set-up costs.

Often the ability to offer service causes costs rather than service delivery. In such cases, the variable marginal cost of service is low. This knowledge can be used when pricing services. An example of this is a time-based price customization, such as low-season pricing. Customers are used to this type of pricing and expect to get lower prices during the low-season, and similarly they are willing to pay higher prices during the high-season (Simkovich, 1998).

Requirements for extending configuration conceptual models

In this section, we discuss how configuration conceptual models should be extended to take price and cost information into account in sales and technical configuration. In addition to the issues discussed earlier, we review previous work on how price and cost has been captured in service configuration modeling. We divide the analysis to sales and technical configuration and begin each of these subsections by discussing previous work. The discussion is summarized in Figure 4.

Sales configuration

Becker et al. (2008) present a metamodel for modeling language for configuration of value bundles, i.e. solutions that can contain both physical products and services. In their metamodel, they introduce price as an attribute of outcomes offered to customers. In FWM, this would correspond to introducing a dedicated attribute for the price of service elements. Becker et al. (2008) apply if-then rules for determining the value of an attribute. In other words, price is not a constant but rather conditional. De Miranda et al. (2006) note that the price of a service may change depending whether it is sold as a standalone or as part of a bigger bundle of services. In de Miranda et al. (2006), the model of Akkermans et al. (2004) is extended to include pricing. The price of a service element is determined by a condition or formula called a *pricing model*. A service element may offer several pricing models from which the customer may choose. The total price of a customer-specific service is the sum of all the service elements included in it minus a discount or discounts applied to the whole service or some of its elements.

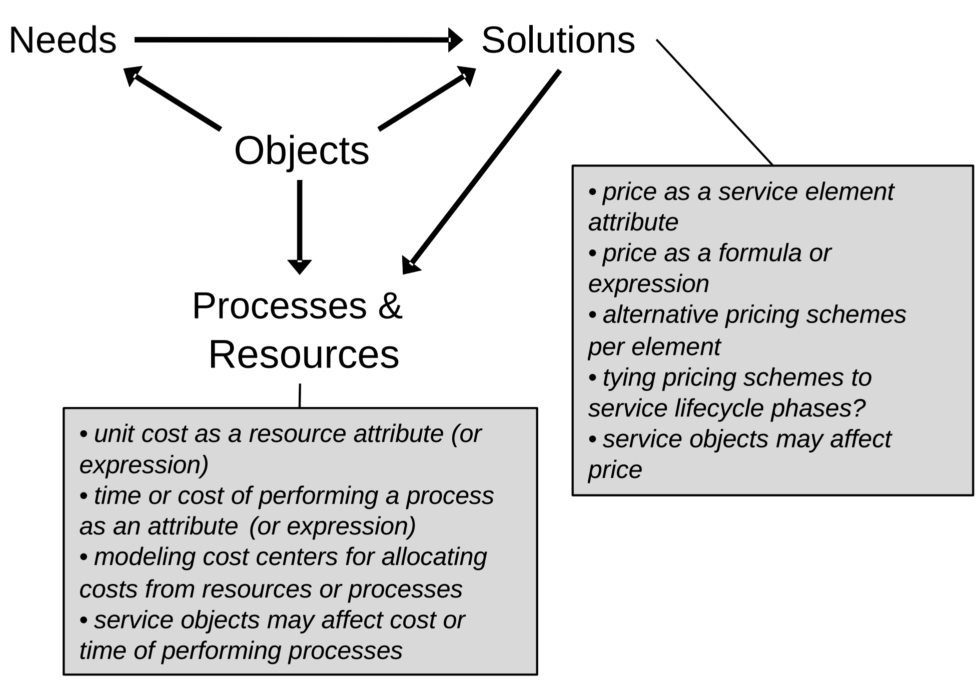

Figure 4. Extension of the Four-Worlds Model.

Becker et al. (2008) are interested in services around physical products, like maintenance and repair. Required services may differ based on the condition of the product, i.e. in what lifecycle phase the product individual is. To support capturing this phenomenon and corresponding pricing, Becker at al. (2008) include a way to model the length of a service contract and to divide it to different lifecycle phases. Prices of different services may be affected by the lifecycle.

We suggest that extending FWM to include pricing information should take into account at least the following requirements: The model should support defining the possible price of a single service element with attributes. It should also support defining the price of a service element in ways that capture the possibly complex relationship of the price with other modeling concepts in FWM. Further, how price models behave in generalization and part hierarchies should be determined.

A dedicated price attribute with a default value of zero would support the simplest case of pricing a sales specification: determining the price of a service solution by summing the prices of included elements. However, for many cases this would be too simplistic because the price is often conditional. The price of a service element may depend on the characteristics of certain service objects, other service solution elements, and even the process or resources used in performing the service element. It must be possible to model these relationships even if they are complex. In addition, it must be possible to model pricing options per service element. Definition of a service element price needs to expressive enough to capture these aspects in full.

Possible further requirements for extending FWM could include support for dividing the pricing along different time spans of the length of the service agreement. The service lifecycle concepts Becker et al. (2008) use are worth considering as well to support identifying different pricing methods along the length of a service contract. Further, the price of service elements may change according to the market segment or area – and the price can be expressed in different currencies. Support for market and currency specific prices should be added to the FWM.

Technical configuration

Few configuration conceptual models address the "technical" service production process by including modeling concepts for describing it. Becker et al. (2008) is one exception. Becker et al. (2008) model the service processes with activities related to a certain lifecycle phases. Activities are carried out by a business unit, which itself can be subdivided to jobs. Jobs have their length and hourly rate as attributes. The resources that are required to perform activities can be also defined in Becker et al. (2008). Resources have units and unit cost as attributes. The participation of the customer in the service process can be modeled as customer resources required for activities. Both jobs and resources can be assigned to cost centers. This allows estimating costs of customer-specific configurations and allocating the related costs to different cost centers.

FWM also has modeling concepts for capturing "technical" service production processes and their resources in the process and resources world, although FWM was originally developed to be a sales configuration conceptual model. Applying the FWM modeling concepts for "technical" service delivery process modeling is nevertheless possible. Therefore, cost information could be captured in the FWM similarly as in Becker et al. (2008).

We suggest that extending FWM to include cost information should take into account at least the following requirements: The model should support defining the cost of performing a process module. Further, allocating the costs should support cost system designs, like ABC, with multiple level cost drivers. Moreover, how cost information behaves in generalization and part hierarchies should be defined. The model should be extended to support allocation of costs to different cost centers.

The cost of performing a process module could be captured with an attribute. However, this could be too simple for many cases. Another way could be determining the time performing a process module requires as an attribute and the cost of a resource per unit of time as an attribute. The cost for the process module individual would then be calculated by multiplying these factors. Giving these attributes also to service objects acting as resources in the process might allow calculating the process cost for the customer as well, at least regarding their direct participation in the process. The cost or time of performing a process module may vary according to service object characteristics and modeling this relationship should be supported in FWM.

Ex ante calculation of the costs of a service individual is complicated. Customers' participation in the process and how this affects the provider costs can be unpredictable. Moreover, arriving at the exact cost of a sales specification would require knowledge about how many times a process module is performed during the service contract. In manufacturing, it is possible to identify every activity and resource that is required to produce the end product, enabling fairly accurate cost calculation. In services, this is often not the case. For example in repair and maintenance services, the maintained machinery may break an unpredictable number of times.

Discussion and conclusions

In this paper, we studied interconnections between configuration models, pricing, and cost models in the context of configurable services. Configurators are needed to assist a customer in choice navigation and to ensure that the service individual with agreed-upon sales specifications can be delivered. Two-stage, sales and technical, configuration is a common way to conduct the process (Forza & Salvador, 2008). Sales configuration defines the product/service individual the customer wants to buy and the company agrees to deliver. The detailed item-specific information can be found in technical configuration models. A pricing model should be integrated with a sales configurator to be able to give a price for service individual at the point of sale. Similarly, the cost model and technical configuration models have to be integrated, thus avoiding storing specific technical data in two separate systems. We assert that configuration models play a central role when defining the price and the cost of a service individual.

When extending FWM we have shown that price information has to be added to service-solution world. However, simply adding a price as a dedicated attribute of a service module and determining the total price of a service bundle as the sum of service module prices would be an inadequate solution in most cases. The price may change depending on the final combination of service modules in the bundle. Performing more modules simultaneously may raise or lower the price. Similarly, the service object will affect the productivity of the service and consequently the price. Therefore, the price attribute has to be conditional and calculation of the price of the service bundle can be more complicated than simple summing up of the prices of modules.

Including the cost view to FWM affects the process world in a similar manner as adding price information in the service-solution world. The process world defines the service delivery process and resources required to carry it out. Therefore, cost calculations can be performed in a configuration model if the cost information can be imported from the cost model. Similarly, as with the price attribute, the cost attribute has to be conditional for the same reasons. Moreover, because the object of service may affect productivity and costs, there also has to be an object-level cost attributes (drivers). This supports the use of a cost system design where there are multilevel cost drivers, like ABC. However, *ex ante* calculations for services are problematic, even with a stable solution space and robust processes. Especially in a case of long service contracts, it is hard to estimate precisely how often and what resources and processes are needed. Moreover, *ex post* calculations have to be based on collected service data, which, based on our experience, is often documented insufficiently.

In this paper, we did not aim to identify which pricing model would be the most appropriate for configurable services. In our view, there is no optimum solution suitable for everyone. Practically all pricing models can be included in a sales configurator. However, value-based pricing models are complicated because the value for customers can change over time. Furthermore, total value is always subjective (Woodall, 2003) and we do not support using value-based pricing models in sales configurators.

Dynamic pricing models were not discussed in detail. Designing an advanced dynamic pricing model that includes several factors is always challenging, even as a stand-alone model. Combining that with a sales configurator in a service context is even more challenging. Based on current theory and our experience we cannot give any advice. Similarly, we did not address lifecycle pricing and costing, although we have recognized the issue. A lifecycle view might open new possibilities for pricing, because a single sale can result in cash flow for a long period. Such a sale can be unprofitable in the short run but a long customer relationship can make it profitable.

We have shown that prizing and cost information can be included in one conceptual service configuration model. In FWM, the price and cost attributes should be conditional. However, the ample use of conditional attributes may result in the model being too complex and making its maintenance overly complicated. We cannot answer whether there is an optimum number of conditional attributes. The answer might be some kind of balance between accuracy and practicality.

The connection between pricing and cost models and configurators is not widely studied and we hardly scratched the surface in this paper. Thus, there is significant potential for future work. Maybe the most rewarding topic to start would be to apply the ideas of the conceptual model into a real word case and to build operating service configurators that have price and/or cost information included. Maybe, an easier way to start would be integrating pricing and cost models to product configurators for goods. At least in assembly manufacturing, the degree of difficulty could be less challenging because of a more stable solution space. In addition, the expansion to dynamic pricing and cost models would be an interesting topic.

Volumes in many service sales contexts are too low to justify the investment in building and maintaining an intelligent configurator, at least if the service offering is heterogeneous. If the service offerings are relatively standard and volumes are large, like in telecommunication services, then the use of an IT-based configurator may be rewarding. However, we assert that the conceptual thinking required to define configurable service offerings will be valuable, even if the final configuration will be performed manually. Similarly, we present that price information has to be included as a conditional attribute in the sales configuration model. The cost information can be a part of the technical configuration model and it is important to understand cost effects of process and resource choices.

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