A modular product data structuring model improves the product life cycle management of service products in the telecommunication industry

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Abstract

We have developed and implemented an object-oriented model that covers a holistic product view of physical and service products. The introduction of the object view for all parts of a product deviates significantly from the popular material based description of product structure which is embodied in ERP systems realised by the method of part lists in particular. Using the functional view all product parts need to be allocated to five distinctive function groups. This grouping already defines specific aspects for the product construction sequences.

In this newly developed product structure model we have linked significant elements of the well-known modular system with the function orientated methodology of the value engineering. The first defines modules, which consist of clearly defined relations. The latter is based on a functional model. Combining both methodologies we can define functional modules, which integrates the relationships as well as the values of the functional model.

The advantage becomes particularly clear with more complex products. With this model, the product term could be extended also to services and thus cover even non-physical components. The implementation in a telecommunication company proved that the automation of customer centric processes can be achieved if the product design includes the coding of human knowledge.

Introduction

Mass Customization is one of the core parts of the competition strategy of successful enterprises. Apart from the positive aspect of designing long-term relationship with individual customers the implementation of Mass Customization has fundamental effects on the methodology of the product construction as well as the operational processes to produce and deliver these products.

A practical transformation towards Mass Customization must limit the arbitrarily individualisation of products and in parallel must assure a perceived flexibility by the customer without any customizing the product-life-cycle of core parts of the product. The given creativity of customers needs to be canalised by appropriate marketing and sales measures to guarantee the design of products and processes along the whole life-cycle. The customer is allowed to arrange his product, if the overall design framework is already pre-defined by the necessary product modularity concept within the product construction processes [1].

The design framework thereby grows on the one hand with the increase from manual performing activities to the production of these products. These activities are characterized by human-intelligent situative reactions and thus cannot be replaced in their flexibility. In particular activities relating to crafts apply.

Secondly, the manufacturing depth of the products is of importance. The further the offered product flexibility penetrates into the operational activities, the higher the process complexity will become [2]. As a result the

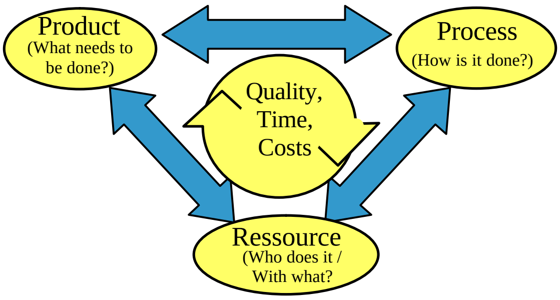

Fig. 1: Interaction of product, processes and resources

transition from arranged co-ordination to chaotic and abrading improvising will accelerate. The latter will normally result in White-Paper-Reorganization.

Another aspect of Mass Customization is the time to deliver. It will not be acceptable for the customer to have to wait for his order much longer than for a standard product. For a successful implementation it is therefore not sufficient enough to introduce a product configuration to collect the characteristics of the customer order. The integration with a homogeneous information chain towards the value creation processes is a must. Dealing with multi-site companies and a heterogeneous IT-landscape it is inevitable to rely on a Corporate Identity on products, processes and resources (refer to Fig. 1) [3].
Only by an equal integration of these three perspectives within the design of business models it will be realistic to be innovative and successful.

Modular product data structuring

Therefore we propose to introduce an advanced modular product structure as a substantial basis for the construction of customised products. It must:
- align with all requirements of a holistic view onto the product,
- apply independently of applicable IT systems,
- defines different views for all processes concerned,
- embodies all responsibilities for product and processes,
- permits a detailed reporting/statistics,
- permits external product variety,
- make possible internal standardisation.

In several industrial projects a model was developed and implemented that covers all these requirements mentioned above. As a significant advantages a holistic product view can be generated by an object-oriented as well as function based product structure. The introduction of the object view for all parts of a product deviates significantly from the popular material based description of product structure which is embodied in ERP systems realised by the method of part lists in particular. Using the functional view all product parts need to be allocated to max. five distinctive function groups. This grouping already defines specific aspects for the product construction sequences.

In this newly developed product structure model we have linked significant elements of the well-known modular system (mainly used for mechanical engineering products) with the function orientated methodology of the value engineering. The first defines modules, which consist of clearly defined relations [4]. The latter is based on a functional model [5].
Combining both methodologies we can define functional modules, which integrates the relationships as well as the values of the functional model.

The advantage becomes particularly clear with more complex products. With this product structuring model, the product term could be extended also to services and thus cover even non-physical components.
Additionally, we include aspects of the product that go far beyond the concentration on the (mostly technical) "product core". E.g. the service for product problems offered by the supplier as well as the pricing (even if it depends on the selected business process) becomes integral parts of the product. At the same time in all stages of the structuring of the product, associated processes and responsibilities are defined.

However not only singular, but also dependent products can be worked out with this product structured model. This constellation exists rather rarely with material products, but is of importance for products of the telecommunication industry. With books, textiles, shoes, CD, even machine tools etc. we have to deal with products, which can be ordered, compiled, and supplied. After the delivery the product design is finished. But, with dependent products a product presupposes another. This constellation requires defining the interrelations between both products within the product design process, even if these products will be supplied by different suppliers.

A generic product structure must be able to fulfil even this constraint to assure an accurate product composition as well as to deliver the sales tool with the relevant knowledge about inter product relationships. The platforms, which are needed for the order configuration, are still not part of the product content.

Specifics of telecommunication products

The current discussion of Mass Customization ignores in particular the existence of non-physical products [6]. In view of the fact that nearly 90% of all households in the western industrial nations operate at least one telephone connection in the fixed net and millions of people use mobile phones, we can claim that there is a high demand for individualisation. In addition such saturation of the market rates always bears greediness to attract customers from the competitor and to establish long-term relationships with the customers.

The speciality of telecommunication industry is the fact that the supplier has a long-term mandate to supply the customers. In detail the products can be used by the customer but the core technology remains within the domain of the provider.

The individualisation of physical products normally results in a one time impact on processes and resources. The on-going customer relationship management normally does not have any impact on the realisation process.

The following example illustrates these differences:

If a customer in Germany buys a similar telephone connection, he will receive his number as well as the connection including various technical features. Automatically a long-term customer relationship is initiated, because as long as the customer does not quit or changes something with the contract, the infrastructure of the telephone company must be working and features are not allowed to change. It is neither a physical product, nor does the customer contact to the manufacturing unit is terminated.

This contact is valid during run time, including also monthly accounting and repair services. In addition technical improvements must be accomplished, which may lead only in completely few cases to interruptions. Furthermore the customer can select several tens of additional technical features, tariffs and service level agreements as well as configure its individual connection. These articles are mainly dependent products, because the change of tariff does not have any impact on the technical connection. But he is only allowed to do it if a technical connection exists and the selected tariff fits to it.

In this case because of the character of non-physical products the individualisation by the customer can be produced either by combining several products or by demanding variable products.

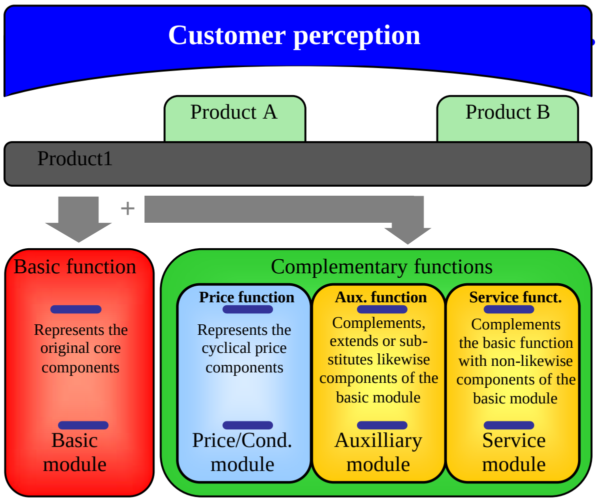

Fig. 2: Relationship between customer perception, dependent products and overall structural model

Figure 2 demonstrates that the customer benefit is realised by three products, whereas products a and b substitute adequate parts of product 1. At the same time product 1 is prerequisite for the selection of products a and b.

The individualisation of physical dominated products can be seen immediately so that the customer is able to compare the result with his requirements. In respect to telecommunication products the customer is satisfied if the desired result is working and the administration effort reduces to a minimum (e.g. a single bill). Here, mass customization offers huge potential.

Product design processes

With the product structuring model developed by us both products in their dependence are specified to each other as well as product components with their relations to each other and to processes and resources. The product flexibility is already specified in the product development stage on the basis of individual parts. According to different market requirements and business strategies we propose to differentiate three different product types. Two of these three product types are defined for the general market, which covers both mass markets and individual segments. The third is necessary for one piece production and does not have any relevance for mass customization.

The *rigid product* for the mass-market is finally defined within the construction process and cannot be changed by the customer. Even for non-physical products the effect can be realised by product combinations. Thus we modelled the typical product for the mass production.

The flexible product (standard solution) fulfils the demands of high flexibility. A framework can be set within a multiplicity of alterable or selectable characteristics can be defined. The extent and the quality of these variables should be arranged in the long run in the sense of the mass customization by purposeful Learning Relationships [3]. It is clear that the desire of the customer is addressed to use it for a channelled on-going development. Tops or flops characteristics have to be identified to improve the products. The flexible product covers variant as well as individual products. If variants are products, which are already produced and selected by customers, then we can go on to individual products just by moving the customer-driven point of impact on the design process. The advantage of this principle can be shared by the customer and producer. On the one hand the customers' illusion of total individualisation can be realised. On the other hand the producer can pre-define variants to optimise his planning and processes. The product model supports both effects.

Process design aspects

As substantial criterion for efficiency and effectiveness of the product model the interaction with a likewise modular developed processing concept can be noted. Each object of the product model is linked directly with the appropriate objects from the process view. The effect is that during composition of the product the dependent processes can be generated automatically, without any conflicts. The modules used in the product model are process proved due to the construction process. As a prerequisite the processes must be modularised accordingly.

The processing concept consists of modular single-sequence operations, which define specific relations to each other. All cases of business can be arranged by the combination of single steps, which are controlled by products. This symbiosis of modular structure of product and modular structure of process makes it possible to react to customer requirements with standardized operations at the same time. Another advantage derives from the accessibility of automated statistics in respect to products, processes and resources. An integrated controlling and the target oriented management of the company can be realised easily. Very important is the systematic collection of human expertise. All objects contain the "knowledge", e.g. knowledge about combination, parameter, and required resources for processing.

Test case

In a common project with one of the biggest telecommunication companies in the world, we have demonstrated the conversion of the product model into the operation of an existing enterprise.
As mentioned above, most of products consist of non-physical components and the "production" of a product is not finished with the delivery to the customer.

The project started with typical requirement analysis. We found out that the customers didn't use the much extended product portfolio, although it required massive investment in technology and infrastructure. In parallel, these offerings didn't rely on standardised processes but on individual activities including a high degree of human interaction. The effect was that variants in the product offerings directly resulted into an increase in internal complexity.

Implementing the product structured model we could demonstrate that an increasing portfolio doesn't accelerate the internal complexity because of the modularised approach. One of the most important hurdles lies in the fact that this model is object oriented as well as function based. The full realisation with typical ERP software applications will fail because they normally does not support object orientation. It is then necessary to realise the model with the method of part lists that will lead to a lot of restrictions.

Another example is the development of individual software for the business customers. Today you can buy standard software with lots of functions you normally do not need (maximum approach). Or you decide to use individual applications (optimal approach).

The first intervenes mostly in very many ranges of the enterprise, consists of many functions, and includes a development environment for advancements. Such program products are mostly very extensive and must be adapted to fits the enterprise requirements. This implemented static becomes critical if the business model needs to be changed and will result in very expensive add-on developments. In addition the many small isolated solutions develop very fast exploding self-dynamics and need to be in integrated with a high effort.

Customised software fits to specific requirement in the best way. Changes in the business model can be done faster, because the application covers only a very narrow scope. Integration between these individual systems requires even a high effort.

In both cases the cooperation of the customer to design a product is restricted to the selection of the product. The customer can buy or leave. A genuine individualizing does not take place.

Conclusion

With the introduction of an object and function oriented product model we have demonstrated that products (consisting of physical and non-physical components) can be fully described with only one methodology. With a systematic linkage of product design and operation it is possible to offer customers a full portfolio without increasing internal complexity.

The implementation in a telecommunication company proved that the automation of customer centric processes can be achieved if the product design includes the coding of human knowledge.

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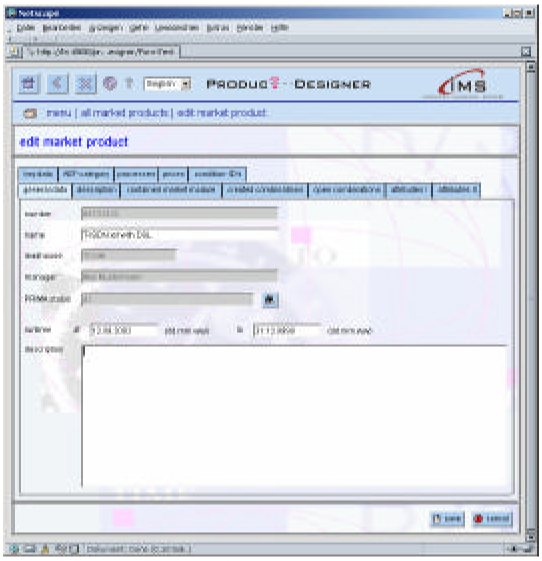

Fig.3: Screen shot of the product designer application

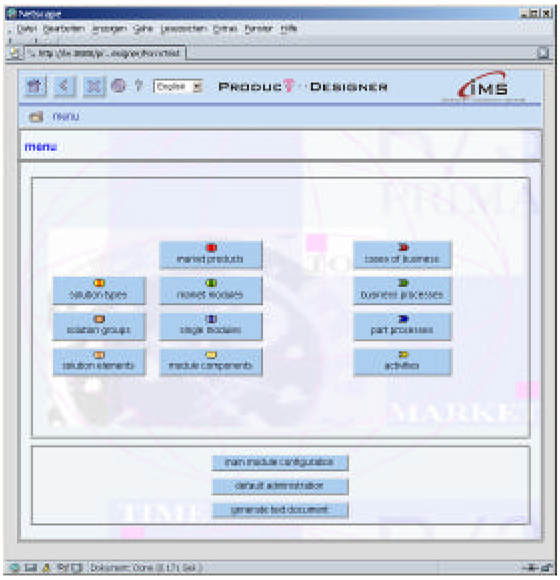

Fig.4: Screen shot of the product designer application