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Customisation Design

Levels of Customisation

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Abstract. To implement *Mass Customisation (MC)* is often a non-reversible decision. Consequently, many issues have to be considered when companies want to move to such a future position. In order to support this decision making, a *model for customisation* has been developed. This model arranges customisation in four different *levels of customisation,* ranging from the *structure level* at the bottom, through the *performance level* and the *experience level* to the *learning level* at the top. The model has a dual view with a customer side and product side and it is important that a balance between these two sides are created and maintained.

Keywords. Mass customisation, customisation, product configuration, product family model, product configurator, personalisation, experience.

Introduction

Mass Customisation (MC) was introduced by Davis (Davis, 1989) and Pine (Pine, 1993), (Pine et al., 1993). Since its introduction, MC has called for a change of paradigm in manufacturing and several companies have recognised the need for mass customisation and much effort has been put into identifying, which success factors are critical for an MC implementation and how different types of companies may benefit from it (Lampel and Mintzberg, 1996), (Gilmore and Pine, 1997), (Sabin, 1998), (Silveira et al., 2001), (Berman, 2002).

For obvious reasons, there are different strategies on how to implement MC most appropriately and it varies naturally also between different companies, markets and products. Because there is not a single generic strategy, it is important to look at the issue from different viewpoints. The fact that products must be easily customisable in order to achieve MC has been described comprehensively in the literature and, more general, (Berman, 2002) and (Pine,

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1993) have discussed the issues related to readiness of the value chain. Newer research underlines that MC is a strategic non-reversible development and suggests that the change process is considered as a strategic mechanism. Consequently, in order to benefit fro MC, the mangers must tailor the development process to the existing business, rather than vice versa.

Mass Customisation and Product Configuration

An often used approach for implementation of MC is *product configuration*, in which a series of products is defined by one single model – a *product family model* (see figure 1) (Jørgensen, 2003). Hence, a *product family* can be viewed as the set end products, which can be formed by using a predefined product family model. The result of each configuration will be a model of the configured product, *configured product model,* and from this model, the *physical product* can be produced.
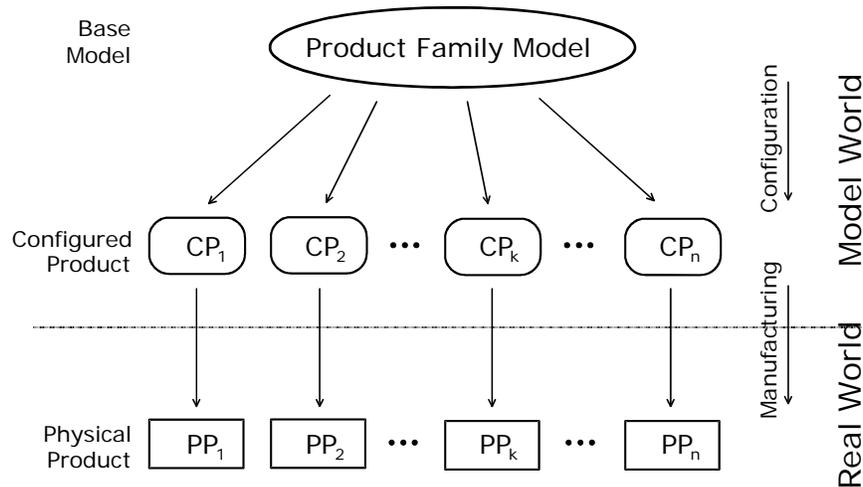

Figure 1 – Product family model as basis for configuration

Mass Customisation and product configuration is relevant for many enterprises and great benefits are normally found, where customisation is common and where the idea is introduced gradually. In general, however, the benefits depend very much on the product and the market. In the relationship between the manufacturer and the market or more precisely the product and the customer, the product configurator plays a major role.

A major distinction regarding markets/customers is between business-to-business (B2B) and business-to-consumers (B2C) and an important dimension here is the *degree of personalisation*. Personalisation is most relevant in relationship with B2C and a high degree of personalisation towards individual customers or small groups of customers generates special requirements to product configurators but, on the other hand, this also raises new opportunities for increased volume.

A product family model is often the basis for development of a product configurator. A *product configurator* can be defined as a tool, computer software, which can support users in the configuration process (Faltings, 1998), for instance by selecting modules to compose products. Hence, with a product configurator, it is possible to configure multiple individual solutions – perhaps a large set of products. Hence, product configurators are important tools, which can provide a range of opportunities for adding new dimensions to the subject and configuration may also *add more value to customers*. Therefore, when a configurator is designed, a large number of design parameters must be considered and balanced decisions must be made. Many of the parameters are related to development of software systems, e.g. usability, reliability, flexibility and security.

Customisation Levels

Most of the methods, which exist for product family modelling, focus on modelling of the solution space of a configuration process. This means that they describe the attributes of the products and the product structure. Hence they do typically not focus on additional information which goes beyond what must be used to perform the configuration itself. This kind of information, which could include e.g. customer, market, logistics and manufacturing information, is according to (Reichwald et al., 2000) similarly important, since a successful implementation of MC must integrate all information flows in the so called "Information Cycle of Mass Customisation".

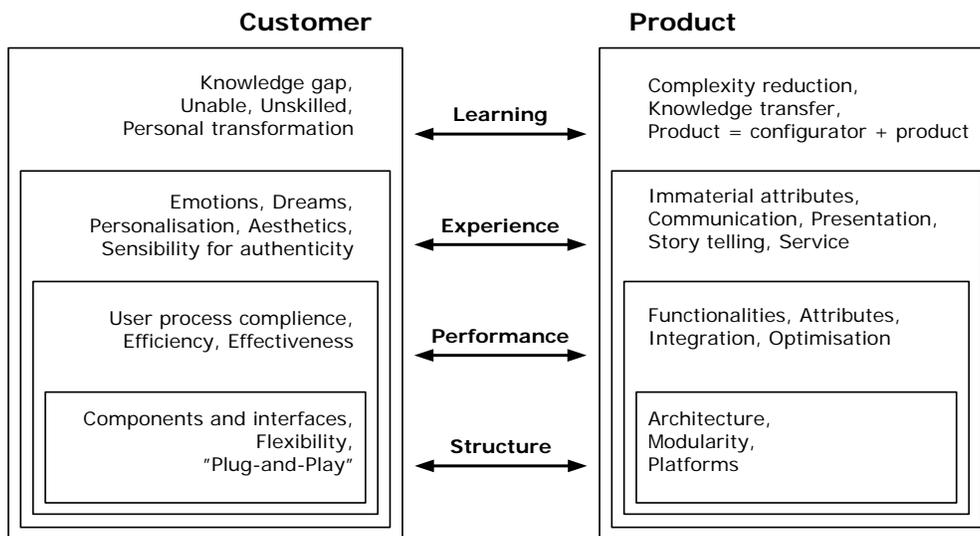| Customer		Product
Knowledge gap, Unable, Unskilled, Personal transformation	**Learning**	Complexity reduction, Knowledge transfer, Product = configurator + product
Emotions, Dreams, Personalisation, Aesthetics, Sensibility for authenticity	**Experience**	Immaterial attributes, Communication, Presentation, Story telling, Service
User process complience, Efficiency, Effectiveness	**Performance**	Functionalities, Attributes, Integration, Optimisation
Components and interfaces, Flexibility, "Plug-and-Play"	**Structure**	Architecture, Modularity, Platforms

Figure 2 – Customisation on four different levels

In order to support the decision making regarding customisation of products, a *model for customisation* has been developed (see figure 2). This model arranges

customisation in four different *levels of customisation,* ranging from the *structure level* at the bottom, through the *performance level* and the *experience level* to the *learning level* at to top. The model has a dual view with customers at one side and products at the other side and it is developed so that it can be generally applies and, typically, it must be decided how far up in levels the development should aim.

Customisation: Structure Level

Configuration on the structure level is a rather common view of configuration and is characterised as a matter of acquiring components, which can be used as building blocks, comparable with using the well known LEGO bricks. Typical commercial product examples are computers, automobiles and bicycles. Important issues are modularity, interfaces of modules and product platforms. Modules are defined as assemblies of components and end products are composed of modules (see figure 3). Very often, modularity is recommended as a precondition for implementation of product configuration and modules are most preferably identified with clear separation of functionalities, i.e. modularity is in contrast to integration. Further, different architectures of modularity are worth considering.
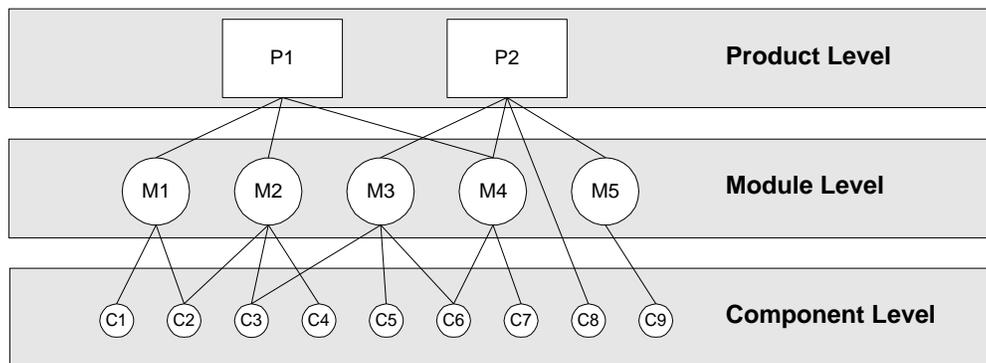

Figure 3 – Model of the structure with the three levels.

Customisation: Performance Level

On the next level, the performance of products is essential. When products are installed in their user environment, they perform their functions – hopefully in the expected way. Therefore, considerations about the ability to perform the functions, which are required by the customer, are very important and should be a significant subject of configuration. Hence, the focus of product configuration is shifted to identification and definition of product attributes instead of modules and components. This is particularly important when the performance of the product is essential and a careful balance between integration and modularisation must be established. Extreme product examples are automobile engines and computer

processors. The performance level is also important in companies, where order horizons are long and where many changes often have to be managed. Focus on requirements regarding the product functions in the early stages may reduce the need for making expensive changes in later phases.

Figure 4 illustrates how underlying modules/components of an end-product in a product family can be determined on the basis of decisions regarding attributes.
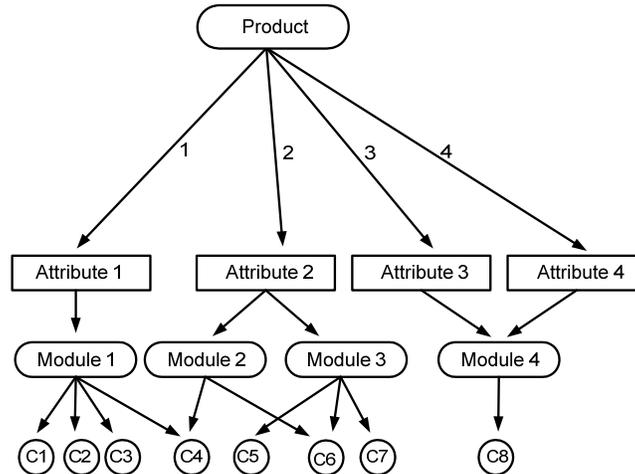

Figure 4 – Specification of modules directly or indirectly through functionalities.

Attribute 1 corresponds to one module whereas attribute 2 determines two modules. Further, the figure shows that module 4 is determined by two attributes.

In special situations, configuration is not a matter of module selection. Products may be composed of multiple modules but are rather parametric products, where the end-product is defined by adjusting a set of parameters.

Mapping of functional requirements to specific modules is considered in (Jiao et al., 1998), (Du et al., 2000) and (Männistö, 2001). Jiao proposes to use a triple-view representation scheme. The three views are the functional, the technical and structural view. The functional view is used to describe, typically, the customer's functional requirements and the technical view is used to describe the design parameters in the physical domain. The structural view, which corresponds to the structural level described above, includes the mapping between the functional and technical view as well as the rules of how a product may be configured. The description of this modelling approach is however rather conceptual, and is not easily implemented in industrial applications.

The two lower levels of customisation, the structure level and the performance level, are rather common and widely used with many products and on all types of markets. Further levels of customisation will primarily relate to customers and products with higher degree of personalisation.

Customisation: Experience Level

The next level, termed the experience level, focuses on special attributes of products and also on *immaterial attributes*, which are related to customer's

emotions and *dreams*. Involvement in a configuration process will for many customers result in a higher degree of *satisfaction* and the customer will likely feel a stronger attachment to the solution (Pine and Gilmore, 1999). The experience level of customisation is therefore strongly related to personalisation. Hence, customers are primarily individual persons or relatively small groups. Many fashion and service products, for instance, are highly personalised and aim at giving the customer specific experiences. Examples are entertainment, personal care, wellness and travel. Many examples show that configurators for these types of products aim at special values of the products for the customers. But for many customers, ordinary products may be looked at with extra dimensions of personal valuation. Customer's concern for the environment may for instance give more preference for ecologic products.

Because the experience level focuses primarily on attributes, Figure 4 can also be used as an illustration of this case. In order to create good support for the experience level, it is important that the available options are matched properly with the customer needs and it is important to analyse, what effect different attributes have on customers, whether they are real or imaginary attributes. Many products are presented with images of apparently happy people and admirable locations.

An important aspect of this customisation level is authenticity (Gilmore and Pine, 2007). There is a tendency that customers are becoming more sensitive and expect higher and higher quality of goods and services. Practically all consumers desire authenticity. Every person is unique and he is intimately aware of his own uniqueness and values it. The consumer sensibility for authenticity evidences itself and, whenever informed, individuals independently purchase any item with which they are intensely involved. According to this theory, many companies fail if they act differently than they announce that they do. In such cases, there may be a great risk that configuration will give a negative effect. If a company claims to be very conscientious, it may very fast loose great respect, if it is disclosed that some products for instance are produced by children and perhaps under poor circumstances.

Means for good configurator support on the experience customisation level are to present the perhaps unseen values of products and to provide good and reliable guidance to the user, to display consequences of choices. If the options are limited, it is important to be selective regarding customer segments. However, some customers may be intimidated by getting a wrong message. In many cases it is like balancing on a knife edge; if you fall, you may cut yourself.

Customisation: Learning Level

At the top level of customisation, the learning level, special services must be offered that may result in further impact on the involved customer. At this level, *the transformation of the customer* is the primary aim. A product in traditional sense is available but special aspects of the product should lead to a learning process for the customer. Consequently, a further amount of services are added and such services may include a range of subjects that represent a gap between the

customer's knowledge and what the product can offer. The lower customisation levels may be identified, i.e. a modular or otherwise configurable product may be offered and appealing attributes may be presented, but the addition of the learning level should create further attraction from the customer towards the underlying product.

The customer's knowledge gap may be related to different areas and the product may be complex and difficult to understand. Perhaps the product must fit into complex processes at the customer's site and it may be difficult for the customer to estimate, how the product can fulfil the requirements. Maybe the customer is a first time buyer so many issues are new for the customer. Therefore, it should be possible for the customer to find answers to questions about issues, which the customer finds complex. If customers are unable or unskilled to make decisions about such issues, trustworthy guidance must be included, perhaps along with the configurator. In this way, the configurator is integrated with the product or it can be seen as a part of the product.

Like for the previously presented customisation levels, adding such additional features also requires a good segmentation of customers in order not to give a negative effect. Well skilled customers may find this kind of support as a barrier, so it is important that the configurator is able to adjust itself to different customers.

Conclusion

Mass Customisation (MC) combined by product configuration implies that each individual product is specified by a configuration process, where customers make decisions about the solution based on a set of available options. It is thereby possible to configure multiple individual solutions. Customers will be able to select a variety of configurations and thereby to some degree participate in individual product design.

Product configuration can be applied to many products and many markets or customers and the development of configurators will depend on these application areas. A major distinction regarding markets/customers is between business-to-business (B2B) and business-to-consumers (B2C). An important dimension here is the degree of personalisation because a high degree of personalisation towards individual customers or small groups of customers generates special requirements to product configuration. Implementation of such requirements, however, may also raise new opportunities for increased volume.

In order to support this decision making, a model for customisation has been developed and presented. The model arranges customisation in four different levels of customisation, ranging from the structure level at the bottom, through the performance level and the experience level to the learning level at the top. The model underlines the importance of seeing customisation from both a customer side and a product side. Designers must decide how far up in levels the customisation should be developed.

Development of configurators, which can offer a good support for configuration processes and produce well specified individual product models, is a great challenge and, when a configurator is designed, a large number of design parameters must be considered and balanced decisions must be made.

Many applications of configuration and use of computer based configurators provides a range of opportunities for adding new dimensions and it is argued that the presented model for customisation on different levels can add more value to a product and make it more attractive for customers to select.

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