

PROPOSITION OF MASS CUSTOMIZATION TYPES BASED ON MULTIPLE CASE ANALYSES

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Abstract: *A wide variety of products across industry sectors have been successfully adapted to a mass customization model. However, mass customization of electronic consumer goods remains in its infancy and its parameters are not well understood. This paper presents the results of research into mass customization strategies and their commercial application. Case studies representing different levels of mass customization, different product sectors and different strategies are comparatively reviewed and discussed through the literature. Subsequently, a categorization is made for each group of cases (electronic, non-electronic) according to literature-derived identifiers. Six 'customization types' are defined for each group. They will be explained in this paper.*

Key Words: *Mass customization, customization types, case studies, consumer electronics*

1. INTRODUCTION

Customization is being used widely as a differentiation tool in worldwide companies. A long list of companies integrating mass customization can be found in [1]'s study. [4] states that customers expect different alternatives of a product when they sharply differ in their preferences for certain attributes of a product. Adidas, Dell and Shimano are some leading examples from different sectors integrating mass customization successfully into their product development process.

However there are some limitations for mass customization that may affect different sectors at different levels. The limitations can be stated as below ([3], [4]):

- requirement of a highly flexible production technology
- requirement of an elaborate system for eliciting customers' wants and needs
- requirement of a strong direct-to-customer logistics system

To understand integration of mass customization at different sectors, cases from these industries integrating different levels of customization into their product

development strategy are listed and their customization strategies are reviewed.

[5] in their recent book on mass customization have categorized mass customizing companies into 11 groups of sectors. In addition to their categorization, depending on different sources on mass-customization (milkorsugar.com, configurator-database.com, egoo-journal.com), research on cases from the literature and cases from the internet a final categorization is made for this research:

1. Printed products
2. Personalized Fashion & Textiles
3. Food, drinks & nutrition
4. Made to measure apparel
5. Jewelry& bag & accessories
6. House & garden
7. Sports equipment
8. Footwear
9. Vehicles
10. Electronic consumer goods

For each defined sector at least one case study is selected to be reviewed. Totally 28 cases are reviewed, 14 from each group (consumer electronics and others). According to the analysis of the cases, both groups are divided into six parallel customization types. These types are defined according to three hierarchical criteria (1. CD - customization degree, 2. CT - customer type, 3. T - timing) that will be explained in detail in the next section.

2. CASE STUDIES

Cases that have been reviewed are divided and discussed in two separate groups:

- cases from electronic consumer goods sector
- cases from other product sectors

Cases from electronic consumer goods sector is reviewed to get information on customization studies in consumer electronics. Review of cases from other sectors is reviewed to see the possible other ways and strategies of customization and used to make comparison. The outputs of the analysis on these two groups' customization strategies are discussed comparatively in Discussion part.

For reflecting different perspectives of pioneers and to benefit from the existing assessment of cases, the comparison matrix of [6] is used as a base for the analysis. Comparison matrix (Table 1) consists of different cases from different sectors. The companies they have reviewed cover NBIC, Motorola, European Bicycle Manufacturer, Computer Manufacturer and Commercial Vehicle Manufacturer. This comparison matrix is extended by the authors to see different customization experiences in different sectors at different levels by adding more cases both from electronic consumer goods sector (Apple, Dell, IBM, Lutron Electronics, Loewe, Philips, and Vestel) and other sectors (Adidas, 121 Time, Cupboardyourway, Custom Foot, Custom Jeans, Planters, Indi, M&M's, New Era, Paris Miki, Raleigh Industries, Smilers.).

Characterizing the level of customization is an important issue. In this study it is made according to the analysis of the cases. Three main criteria are determined for defining the overall level of customization that is possible for a product-company combination. The three criteria are shown in Figure 1 (1. Degree of customization offered; 2.Customer type; 3.Timing of customization activity).

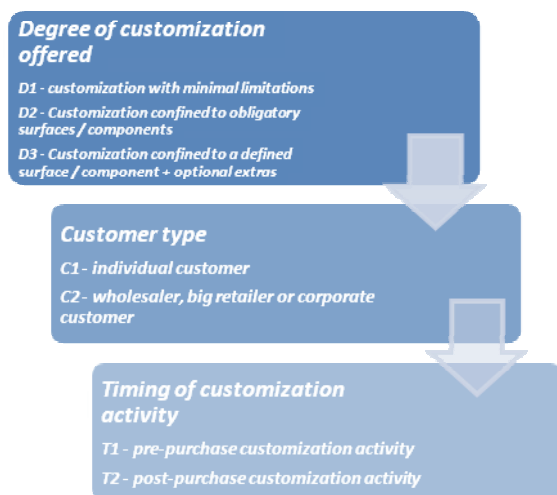


Figure 1. Criteria for defining level of customization

2.1. Criterion 1: Degree of Customization Offered

In this study level of customization is defined according to the level of limitations for customization. Features and attributes that are available for customization in each product have different level of limitations for customization which consequently defines the level of customization.

There are three levels defined D1 representing the highest degree and D3 representing the lowest. All levels, including the highest level D1, have a structure of a non-customizable core that customization is built on.

D1 - Customization with minimal limitations: The customization that could be required by the customer is nearly unlimited. Customization area on the product and type of the customization options for this area can be defined by the customer. These customization options can be designed according to special expectations of the customer. Engineering studies can be carried out for

these special needs if needed (i.e. Vestel fashion TV case, illuminated logo study).

D2 - Customization confined to obligatory surfaces / components: In this level, customizable areas are given by the company. Customer can make customization in this defined area (i.e. Philips photo frame serves a kind of customization on its back cover. Customer can demand any message to be laser engraved on this surface). Pre-defined customization area is the limitation in this case. He/she cannot exceed from its limits but he/she is free within the limits of this area.

D3 - Customization confined to a defined surface/component + optional extras: At this level, both customization area and customization options are pre-defined by the production company. The customization alternatives for the defined area are designed and offered by the production company to the customer as ready-made options. Customer is also limited with these options (i.e. in Loewe case TV stand is given as one of the customization areas and different stand options are offered to the customer readily).

2.2. Criterion 2: Customer Type

Type of customer whether it is an individual, wholesaler or retailer may also affect the level of customization. Expectation of customization may come from individual customer which makes the level higher or it may come from a wholesaler deciding on behalf of a group of customers which makes the level lower.

C1 - individual customer: If the expectation on customization comes from individual customer there occurs a closer fit between expectations of the customer and offered product. Customization forms individual fit to the expectations of the customer.

C2 - wholesaler, big retailer or corporate customer: If the customer is a wholesaler or a corporate customer the expectations on the customization idea is decided by the customer company instead of individual customers (as end users). The wholesaler makes decision on a group of its customers' expectations. A direct individual fit cannot be created.

2.2. Criterion 3: Timing of Customization Activity

Timing of customization activity whether it happens before purchase during production or after purchase also affects the level of customization activity.

T1 - pre-purchase customization activity: At this level customization activity occurs before purchase of the product. During the production process expectation of the customer on customization is collected and product is produced accordingly by the production company. The power of mass production can be used as an advantage for increasing level of customization. There is a disadvantage for this level. Since the customization work is done as a pre-purchase activity it is fixed and cannot be changed with the changing needs or expectations.

T2 - post-purchase customization activity: Customization activity takes place after purchase. Customization options on different attributes are offered by the production company. These options may reach to the customers with different channels (i.e. online purchasing). Customer may customize the product

according to his/her changing needs and expectations by himself or by assistance of a technical service. Post-

customization level is higher than the post-purchase activity.

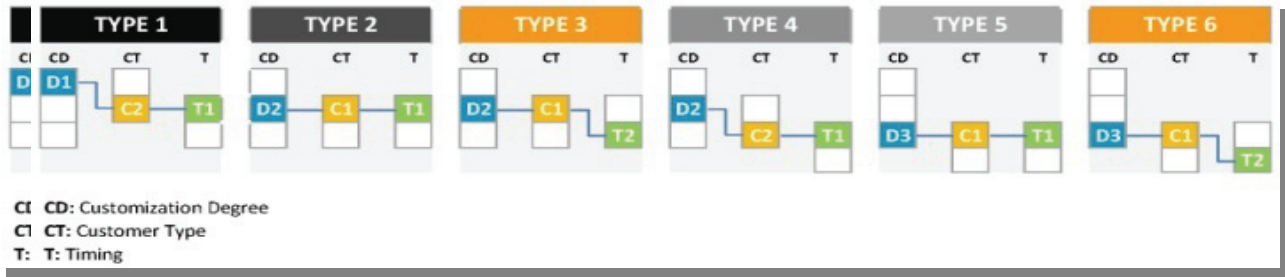


Figure 2. Definition of six customization types according to three hierarchical criteria (CD, CT, T)

purchase structure of the customization activity allows repeat customization over extended periods of time. This gives flexibility to the customer. However customization level is lower when compared to pre-purchase customization activity since the customer is limited with the options offered by the producer company.

According to the above described identifiers a rank ordering is made for all cases. First the degree of limitations on the customization activity should be investigated for each case. Where the degree of

The above framework is formed by analysis and discussion of customization level offered in each case study. And finally defined customization types are illustrated in Figure 2. All cases are analyzed according to the defined ordering method. Cases carrying the same levels of customization are labeled consecutively from Type 1 (most customization) to Type 6 (least customization) and grouped by color coding in the Table 2.

Here in this study “level of customization” deals with the degree to which a product can be differentiated to

Table 2. Categorization of cases according to six customization types

| | TYPE 1 | TYPE 2 | TYPE 3 | TYPE 4 | TYPE 5 | TYPE 6 |
|----------------------------------|------------------------------------|-----------------------------|------------------------|-------------------------------|-----------------------|-----------------|
| Electronic Consumer Goods Sector | Commercial vehicle manufacturer | NBIC | New Era Cap Box Set | Planters Company | Raleigh Industries | Adidas Adicolor |
| | | Paris Miki | | European Bicycle | | |
| | | Custom Foot | | | | |
| | | Smilers Personalized Stamps | | | | |
| | | Cupboardyourway | | | | |
| | | 121 Time | | | | |
| | | Indi Custom Jeans | | | | |
| | | M&M's | | | | |
| | | | | | | |
| | | | | | | |
| Other Sectors | Vestel(special customization work- | Philips Photo Frame | Lutron Electronics | Vestel(catalog customization) | Apple Macbook Pro | Philips Flavors |
| | | Apple Ipod touch | Apple Iphone (software | Apple Iphone (hardware | Loewe | |
| | | | | | Dell | |
| | | | | | IBM | |
| | | | | | Motorola | |
| | | | | | Computer Manufacturer | |

customization offered is higher, a high customization level is allocated. If the degree of limitations on the customization activity is the same as for other cases, then the second identifier (customer type) is taken into consideration for ranking.

If the customer is an individual customer the customization level is higher than the other options like wholesaler, big retailer or corporate customer. If the customer is also the same such as an individual customer or a wholesaler, then the timing of the customization activity is taken into consideration.

If the customization is a pre-purchase activity the company can differentiate the product more and offer more closely fitting products to the customer since it can still be changed in the production facilities. Accordingly

achieve a desired level of customization. Because this is related with how closer can the customized product fit with the expectation of the customer. If the customization studies on the product supplies close fit with the expectation of the customer the level of customization is regarded as higher; if the customization study on the product doesn't supply close fit with the expectation of the customer the level of customization is regarded as lower. Investigation on the level of customization is important for this study since this is interrelated with how much the product needs to be differentiated from the existing version, how much differentiation is possible, and how much effort is needed for realizing this differentiation. Analysis of this information may help build associations between product

groups, product attributes, company strategies, level of customization required by the customer and level of available customization in terms of company or sector capabilities.

3. RESULTS OF CASE STUDY CROSS-COMPARISONS AND ANALYSIS

Companies that are reviewed in this study are Apple, Dell, IBM, Loewe, Lutron Electronics, Motorola, Philips and Vestel for electronic consumer goods and Adidas, 121 Time, Commercial Vehicle Manufacturer, Cupboardyourway, Custom Foot, European Bicycle Manufacturer, Indi Custom Jeans, M&M's, NBIC, New Era, Paris Miki, Planters, Raleigh Industries and Smilers for other sectors. The products reviewed in the cases from electronic consumer goods sector can be listed as Philips photo frame, Apple Ipad touch, Lutron lighting controllers, Apple Iphone (software customization), Philips Flavors, Vestel TV (catalog customization), Apple Iphone (hardware applications by Colorware), Apple Macbook Pro, Loewe TV and sound systems, Dell computers, IBM computers, Motorola pagers and Vestel special customization work for Fashion TV.

All the cases are analyzed according to their customization strategies on one product group excluding Vestel, Philips and Apple that are analyzed with their different approaches to mass customization based on their different product groups. By the analysis of this group of cases, it is intended to reveal how customization strategy differs on different product groups of the same company.

4. DISCUSSION

Both groups (electronic consumer goods and other sectors) consequently are divided into 6 customization types. It is seen that same types of each group (i.e. Type 1 of electronic consumer goods and Type 1 of other sectors) had same levels in terms of customization degree (CD), customer type (CT) and timing (T) which makes it easy to compare them. However it is also seen that there are differences on the strategies and levels based on differentiation of the sector which are explained below comparatively for each customization type.

Type 1 (D1+C2+T1). Customization Type 1 that represents the highest level of customization for the two groups seems similar in both groups in terms of the strategies, CD, CT and T of customization activity. However these aspects differ considerably in two representatives of two product groups. The case company of Customization Type 1 for Electronic Consumer Goods is Vestel Fashion TV, and Commercial Vehicle Manufacturer for other sectors. For customization work done in both cases, shared strategy is pure customization [2] since engineering work is also included. However when Vestel Special Customization work is compared to Commercial Vehicle Manufacturer's customization work, the level of customization for Commercial Vehicle Manufacturer is higher. Although they seem similar in terms of identifiers, the customer for Vestel case is wholesaler while it can also be individual customer for the Commercial vehicle manufacturer. Working for wholesalers instead of individual users

brings higher limitation in terms of good fit to individual expectations. It is seen that this level of customization for individual customer cannot be affordable for Electronic Consumer Goods case. However it is possible for Type 1 Customization of other sectors.

Type 2 (D2+C1+T1). When Type 2 Customization of the two groups is compared it is observed that both groups have same customization strategy for the highest level as tailored customization [2]. However the customization area is limited to only visual application in consumer electronics sector whereas it comprises a wider area of visual applications and also functional customization works for Type 2 of other sectors. For instance for Philips Photo frame, tailored customization is made by engraving intended message of the customer at the back cover of the product. The customer is free to write any message. However the customization is made on a small visual attribute. For Paris Miki, a customized spectacle producer, the customization is made on both visual and also functional attributes. The spectacles are customized according to visual selection of the customer. Additionally for catching bodily fit, the size of the customer's nose and face are taken and the spectacles are designed according to these special dimensions. This also originates from the ergonomics needs of this product group which is also necessary for NBIC, Custom Foot, Cupboardyourway, 121 Time and Indi Custom Jeans of Type 2 Customization cases for other sectors.

Type 3 (D2+C1+T2). Type 3 Customization has a different structure for both groups since it is carried out as a post-purchase customization activity. It differs from Type 2 Customization of both groups only for its timing as a post-purchase activity. Highest level customization strategy is tailored customization [2] for both groups. Their customization level is lower than the previous types because product is tailored for predefined needs of group of customers. The individual customer makes it tailor to his/her expectations by making selection or making configuration according to his/her needs between the offered options after purchase. The advantage in this type of customization is that although being limited with the offered options, customer can make changes on his/her customization selections according to changing needs and expectations.

Type 4 (D2+C2+T1). Customization Type 4 of both groups, cases from electronic consumer goods and cases from other sectors are similar in terms of their highest level customization strategy and other identifiers (CD, CT, T). The result customization activity is also similar. Highest level customization strategy for Type 4 customization is tailored customization [2] for both groups.

Type 5 (D3+C1+T1). Type 5 Customization of electronic consumer goods sector and other sectors fit with each other. Type 5 carries the lowest customization level for both groups among the pre-purchase customization activities. They all have customized standardization (Lampel and Mintzberg, 1996) as a customization strategy.

Type 6 (D3+C1+T2). Type 6 Customization of both groups again fit with each other in terms of their strategies and level of identifiers. The main thing in Type 6 is its post-purchase activity. This Type differs from

Type 3 (the only other customization type that has a post-purchase customization activity) in terms of the customization degree.

5. CONCLUSION

It is revealed that obtaining same level of customization is harder for product groups of electronic consumer goods when compared to the product groups of other sectors. Also within the cases from both groups, although having same customization strategies and although being categorized as in the same level of customization, it is observed that customization options and final customization work is much more limited in electronic consumer goods cases. In electronic consumer goods sector highest level customization strategy, pure customization occurs only for the wholesaler customers. In some other sectors such as vehicle manufacturing it can also occur in individual level. For electronic consumer goods sector this becomes unaffordable for just making this level of customization for individual customer since it brings engineering work and complexity in production and increase in cost.

There are also production related limitations for customization in consumer electronics sector. In complex sectors such as consumer electronics, since there exist too many components for each product a good forecast is a must to not fail with faulty big stocks. In such sectors also the production with different combination of components brings time and cost increase and extra workload. The components are all interrelated not just mechanically but also electronically and before the production, the combination of components desired should be checked in terms of reliability, compatibility, safety and other necessary factors.

Consequently, it is apparent that there is a need for different kind of strategies for successful integration of mass customization into electronic consumer goods design. Further observations as a result of the analysis of the study are listed below and they will be explained in depth in further studies.

Observation 1: Bringing out same level of customization is harder for the electronic consumer goods sector.

Observation 2: The majority of cases from other sectors tend towards the highest degree of customization whereas it is the reverse for electronic consumer goods

Observation 3: Customization occurs on visual attributes more than functional in electronic consumer goods cases.

Observation 4: Different types of customization can be carried out on a single product offering from a single company.

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