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MASS CUSTOMIZATION STRATEGY IN SMALL AND MEDIUM ENTERPRISES

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Abstract: In this time of intense competition, a relatively new strategy of manufacturers and retailers is mass customization (MC), or the indvidualizing of standard products and services to meet the specific needs of each customer. Mass Customization is the result of a more self-aware type of customer who demands more choice and more involvment. Small and medium enterprices, through their flexibility advantages and closeness to customers, potentially can increase their sales volume in economic downtourns. Smaller firms and those producing made-to-order products were most likely to have realized increased sales volume. Small and medium enterprises competitiveness is based more on working closely with customer to produce fully customized products.

Key Words: *Mass Customization, Customized Products, Customer Preferences.*

1. INTRODUCTION

While mass producers stand behind products and services at prices low enough, that nearly everyone can afford them, mass customizers advocate producing goods services with enough variety and customization so that everyone finds what they want. Companies operating in a demanding environment may need to react by providing flexible manufacturing systems, but these systems exclusively are not enough to offer variety without compromising on profitability [1]. The transformation process necessary to become a mass customizer is still not fully developed, and research on practical implementations is needed to gain experience on how to proceed.

Customer co-design and integration are the key to mass customization [2]. This is the core element that differentiates mass customization from other strategies like lean management or agile manufacturing [3]. With today's information technology, MC customers can be included into the value creation chain by defining, configuring or modifying an individual order. Though an interactive website customers can configure specifications of the product or service, packaging and even delivery options.

Including the customer in the product design also establishes an individual contact between the manufacturer and customer, which offers possibilities for building up a lasting relationship. If the customer is satisfied with an individual purchased item, it awards the manufacturer with an increased chance for customer loyalty as reorders become simplified [4].

It is important to note that in mass customization, where customers are presented with a variety of choice, they are not involved in the specification of that variety [5]. Customers must first interact with the manufacturer, the retailer, or the product itself in order to configure the end solution. In order words, depending on the situation, customers can be involved in specifying features of the product during phases of design, fabrication, assembly, or use [6,7].

Small and medium enterprises comprise most of the world's manufacturing sector. In addition to feeling intense pressure from low-cost international competitors, these organizations have to dial with rising raw material cost, customers demanding high quality service, support, and product variety.

In this paper we give an overview of the mass customization concept, look at the advantages and disadvantages, and also explains the implementation of mass customization strategy in small and medium enterprises.

2. MASS CUSTOMIZATION STRATEGY

The mass customization strategy in management, a process of integrating mass production and standardization principles with customization, seems to be gaining momentum all over the world. Major companies like Dell, Motorola, Hewlett-Packard, General Motors, Ford, Chrysler, Toyota, Proctor and Gamble, and others are experimenting and also successfully implementing this process in their production and operations facilities. Mass production and customization have traditionally been at the two opposite extremes of the production continuum. However, integrating these together as mass customization seems to be the practice of the present with the strong likelihood that it would[17].

The decision makers are the customers. The task that must be fulfilled by the customers is the selection of the optimal product variant from the solution space of the mass customizer. Two main categories of information emerge: the objective information about individual needs that the customers would require to select the optimal product variant and the subjective information about individual needs that the customers actually use to select a product variant. We call the first category of information the objective customers needs and the second category the subjective customers needs. The information supply relates to the information that the customers receive from the mass customizer in order to carry out product selection. This information refers to the achievement potential and is called offered variety.

Mass customization is a reality because it is an attractive strategy for both manufacturers and customers. Producers are able to reduce their inventories and manufacturing overhead costs, eliminate waste in their supply chains, and obtain more accurate information about demand [14]. Customers, on the other hand, get reasonably priced, tailor-made products according to their personal preferences of style, features, colors, and functions.

The high product variety of a mass customization strategy induces a high level of complexity both from the mass-customizer's perspective as well as from the customers viewpoint. Mass customization is the interaction of customer, provider and product. The product adapts to the needs of the customer, and the customization is an outcome of customer-productf interaction. A customized product is a special product designed for individual customers to meet their needs. Figure 1 presents the differences between traditional product and mass customized product.



Fig. 1. Traditional and Mass customized product

Some of the major factors that have contributed to the strong growth and popularity of mass customization include the emergence of the internet and the phenomenal success of hightech companies. The growth of the internet has given the manufacturers a platform for taking orders online from a mass market audience for customized products such as cosmetics, shoes, bicycles, clothes, vitamins, computers and computer related accessories, at very minimal costs[17]. The internet allows companies to provide high customization at low cost and has displaced to a large extent the traditional and more expensive method of highly skilled and trained salespeople interacting with customers. It also allows

smaller businesses with flexible manufacturing systems to compete more effectively with much larger companies.

Mass customization can be achieved through product line rationalization, modularity and part standardization, using internet catalogs and order entry, supply chain design, even lean manufacturing can be an entry in mass customization.

2.1 Mass Customization-advantages

Many researchers found a lot of positive benefits in the companies. These include increased customer satisfaction, increased market share, increased customer knowledge, reduced order response time, reduced manufacturing cost and increased profit. It appears that the benefits companies experienced with mass customization were related more to the customers and market impact than profit and cost factors[17].

Management at many companies are using mass customization to successfully create greater value for their customers and competitive advantage for their companies. The modern consumer is more demanding than ever in the past and due to the increasingly easy access to a global marketplace the industry dynamics are continuously changing [8]. Companies operating in a demanding environment may need to react by providing flexible manufacturing systems, but these systems exclusively are not enough to offer variety without compromising on profitability [1].

It is these pressures that mass customization attempts to address, by providing an option to answer new market realities while maintaining high levels of efficiency [9]. Mass customization technologies make it possible for companies to create a cost efficient value chain, while increasing flexibility towards answering customers needs from heterogeneous market demands. In this relatively new concept of industrial value creation, companies listen to their consumers [10] pay higher attention in delivering services and, instead of solely acquiring new customers, they concentrate on building lasting relationships with the existing clientele. Introducing consumer participation into the company's value creation process, increases customers' sense of involvement in the end product and brings real first hand consumer knowledge back into consumer product manufacturing [11].

2.2 Mass Customization-disadvantages

Some disadvantages also reported by companies that used mass customization include increased material cost, increased manufacturing cost, lower on-time deliveries, supplier delivery performance, increased order response time, reduction in product quality. Apparently most of these disadvantages were cost related. This is mainly due to the premium cost that the production system incurs for including the flexibility of customization, and sacrificing some degree of cost efficiency that usually is associated with standardization. Further, the production process at most companies may not have fully evolved into a masscustomizing one, but continues to produce batches of standardized products[17].

The layover time is one of the biggest problems of Mass Customization. Since it is a custom product it will take longer to reach the consumer. When you order something that isn't custom it will reach you in a decent amount of time. When you customize it, it will take three to four weeks longer than a non-customize product because they have to build it up for you. The time depends of the complexity of the customized product. Another disadvantage would be that you can not return a custom product if you are not satisfied because it was created specifically for you. It is not a rule but most of the managers applied this as a condition in their companies[14].

3. IMPLEMENTING MASS CUSTOMIZATION TO SMALL AND MEDIUM ENTERPRISES

In today's world of business where the customer is most important, and business products and services are more likely to be customized to fit the needs of the customers, it is highly critical that even small businesses learn to adapt and include customization in their offerings. Small and medium enterprises, are already adopting variations of the mass customization concept. For example, in the Customers get the basic standardized product but may choose from a variety of attributes according to their preferences and likes.

Also, in today's highly competitive business environment, customization is almost a mandatory option that companies have to offer to keep their customers happy and coming back for more. Due to the highly competitive marketplace, small businesses may need to develop a niche strategy such as customization, which may become even more important in small and medium businesses than larger ones. Also, in many cases, the smaller businesses can more easily adapt and make changes to effectively implement the customization concept. Small and medium businesses including software developers and solutions providers using the PC

and internet technology can offer affordable and customized solutions for their clients. The strategy of customization seems to offer small businesses a niche and a competitive edge in the marketplace. Even some larger companies are repositioning themselves as small business units so as to effectively benefit from the implementation of customization in their companies[17].

In today's markets, small companies are better suited and more quickly able to implement customization to meet their many fickle-minded customers who possess increasing control and are looking for endless options.

It is easier for the small and medium enterprises to contact with their customers and build a good relationship with them. Because of that, these enterprises can produce customized products including their customers as codesigners. Using some of the mass customization strategies like using internet catalogs and order entry, small and medium enterprises are competitive manufacturers on the market. Their main goal is satisfying customer needs and increasing their profit.

4. CUSTOMER PREFERENCES

Mass customization aims at satisfying individual customer needs with the efficiency of mass production [Pine]. To optimize the product variety, a company must assess the level of variety at which customers will still find the company's offerings attractive and the level of complexity that will keep the costs low [12]. Developing product families has been recognized as a natural technique to facilitate increasing complexity and costeffective product development [13]. In this regard, the manufacturing companies put their effort in organizing, developing, and planning product families to balance the tradeoffs between product diversity and engineering costs.

Not all the existing market segments create the same opportunity for the companies in the same industry due to the discrepancy of their targets, strategies, technologies, cultures, etc. Therefore, it is most important for the manufacturing companies to make the decisions which market segment should be targeted and what products should be planned for the target market, namely, product family positioning.

This paper introduces an approach to measure customer preferences within the context of mass customization. We use a methodology for product family positioning, and the results can be analyzed through an example for a company which produce furniture.

4.1 Measuring customer preferences

Measuring customer preferences means identifying a set of product attributes, $A = \{a_k \mid k=1,...,K\}$, which company can produce it. Each attribute has a few levels, $A_k^* = \{a_{kl} \mid l=1,...,L_k\}$, the product family is a combination of these attribute levels, $Z = \{\overline{\boldsymbol{x}}_j \mid j=1,...,J\}$. Each product is defined as a vector of specific attribute levels, $\overline{\boldsymbol{x}}_j = [a_{klj}^*]_K$, where any $a_{klj}^* \neq \emptyset$ represents an element of the set of attribute levels that can be assumed by the product, $\{a_{klj}^*\}_K \in \{A_l^* \times A_2^* \times ... \times A_K^*\}$ and any $a_{klj}^* = \emptyset$, represents that the product does not contain some of thr attributes [15].

The product family which is positioned, A, is a set of a few selected product profiles, $A = \{\overline{z}\} \mid j=1,...J'\}, \subseteq Z$. Every product is associated with certain engineering costs, denoted as $\{c_j\}_J$. The company has to make decisions about the price of its offered products, $\{pj\}_J$. The market today has multiple segments, $S = \{si \mid i=1,...,I\}$, each of them contains homogeneous customers. Product demands of the market, $\{Pi \ j\}_{ixj}$, are described by the products which the customers choose, denoted as customer or segment-product pairs, $\{(si, \overline{z}\})\}_{ixj} \in SXZ$.

The modeling of the price is to treat price as a separate attribute that can be chosen from a limited number of values for each product [16]. Adding price as one more attribute, the attribute set becomes $A = \{a_k\}_{k+1}$, where a_{K+l} represents the price possessing a few levels, $A^*_{K+l} = \{a_{(K+l)l} | l = 1..., L_{K+l}\}$.

Measuring customer preferences helps companies to predict customer needs at different market segments. Next, is presented measuring customer preferences with example of a product family with its attributes and attribute levels.

4.2 Case study

The problem , identifying customer needs, we can solve by applying market research which contains all of the offered product combination in a product family. In our case is presented an example for sitting furniture product family. The attributes and attribute levels are presented in Table 1, they are: material, mechanism, armrest and also the price is treated as one of the attributes.

Table	1. List o	f attributes	and	their	levels

attribute (a_{κ})	a _{kl}	code	attribute level	
	а		skin	
	11	A1-1		
	а			
	12	A1-2	eco- skin	
material	а			
	13	A1-3	toile	
	а	A 1 4	11. 21. 11. 2.11	
	14 AI-4		combination skin-tolle	
	a	A1-5	combination eco skin-toile	
	15 A	111.5		
	21	A2-1	sitting	
mechanism	a		C	
	22	A2-2	sitting and sleeping	
	а			
armrest	31	A3-1	whit armrest	
armest	а			
	32	A3-2	without armrest	
	а			
	41	A4-1	30 000-50 000 MKD den	
price	a			
r	42	A4-2	50 000-70 000 MKD den	
	а		70 000 00 000 MKD 1	
	43	A4-3	/0 000-90 000 MKD den	

The first level represents the product family, second level are the key attributes and the third level are the attribute levels. In Figure 2 the generic structure of the sitting furniture product family is presented.



Fig. 2. Generic structure for the selected product

All product attributes and their levels as shown in Table 1, give a total number of 5x2x2x3=60 combinations which may be constructed [15]. To construct a testing profile with the managers in the company, we generate

28 product profiles that company can produce it. For exploring customer preferences we designed a test table, Table 2, where the last column shows customer assessment. Each of the 20 customers selected to act as the respondents, is asked to evaluate all 28 profiles one by one with a preference scale from 1 to 5 (1 means least, 5 means most). Analyzing these data, we find customer segments based on the similarity among customer preferences. Two segments are formed: s_1 , and s_2 . The first one is home users (customer which buy furniture for his home) and the second segment is business users (customer which buy furniture for his business needs).

 Table 2. Product Profiles evaluation

profile number	material	mechanisam
1	skin	sitting
2	skin	sitting and sleeping
3	skin	sitting
4	skin	sitting and sleeping
5	eco -skin	sitting
6	eco -skin	sitting and sleeping
7	eco -skin	sitting
8	eco -skin	sitting and sleeping
9	toile	sitting
10	toile	sitting and sleeping
11	toile	sitting
12	toile	sitting and sleeping
13	skin-toile	sitting
14	skin-toile	sitting and sleeping
15	skin-toile	sitting
16	skin-toile	sitting and sleeping
17	skin-toile	sitting
18	skin-toile	sitting and sleeping
19	skin-toile	sitting
20	skin-toile	sitting and sleeping
21	eco skin-toile	sitting
22	eco skin-toile	sitting and sleeping
23	eco skin-toile	sitting
24	eco skin-toile	sitting and sleeping
25	eco skin-toile	sitting
26	eco skin-toile	sitting and sleeping
27	eco skin-toile	sitting
28	eco skin-toile	sitting and sleeping

nrofile		price (MKD	preference scale
number	armrest	den)	(least 1 -illost 5)
Hamber		70,000-90	
1	with armrest	000	3.6
-		70 000-90	5,5
2	with armrest	000	3 3
		70 000-90	5,5
3	without armrest	000	2.7
		70 000-90	
4	without armrest	000	1.95
		50 000-70	2,00
5	with armrest	000	3
	With drifficst	50 000-70	
6	with armrest	000-70	3.1
0	With drifficst	50 000 70	5,1
7	without armrest	000-70	2.5
,	without anniest	50.000-70	2,5
8	without armrest	000-70	2 35
0	without anniest	30.000-50	2,33
0	with armrost	000-50	2
9	with anniest	20,000,50	5
10	with armrost	50 000-50	2.0
10	with driftest	20,000 E0	2,9
11	without armrost	30 000-50	2.25
11	without anniest	20,000,50	2,33
10	without armrost	50 000-50	1 0
12	without anniest	E0 000 70	1,0
12	with armrost	000-70	2.25
13	with anniest	E0 000 70	3,33
14	with armrost	50 000-70	2.1
14	with anniest	E0 000 70	3,1
15	without armrest	000-70	2.45
15	without anniest	50 000 70	2,43
16	without armrest	000-70	2 35
10	without unitest	70 000-90	2,33
17	with armrest	000	2.5
	With unit est	70 000-90	2,5
18	with armrest	000	3.05
		70 000-90	5,00
19	without armrest	000	1.8
-		70 000-90	7-
20	without armrest	000	2,6
		30 000-50	,
21	with armrest	000	3,5
		30 000-50	
22	with armrest	000	2,75
		30 000-50	
23	without armrest	000	2,8
		30 000-50	
24	without armrest	000	2,2
		50 000-70	
25	with armrest	000	3,6
		50 000-70	
26	with armrest	000	2,95
		50 000-70	
27	without armrest	000	2,75
		50 000-70	
28	without armrest	000	2,5

4.3 Results

Product family positioning optimizes both a mix of products and the configurations of individual products in terms of specific attributes. This research allows products to be constructed directly from attribute levels and the analysis is used to quantify the customer preference. Figure 3, presents customer preferences for all of the 28 product profiles and Figure 4 shows customer preferences for the both market segments.







Analyzing this reasrch and the results in the diagrams, we conclude which products the company should produce it often. This is clearly present in the charts, Figure 3 and 4. Ddefining customer needs is the first step for implementing mass customization strategy in small and medium enterprises.

5. CONCLUSION

today's In highly competitive business environment, is very difficult to get a place on the market. Mass customization as a future strategy is almost a feature that companies have to offer to keep their customers and coming back for more. Due to the highly competitive marketplace, small and medium enterprises may need to develop a strategy such as mass customization, which may become even more important in small and medium enterprises than in larger ones. In many cases, the smaller enterprises can more easily adapt and make changes to effectively implement this strategy because they have good relationship with all of their customers.

Measuring customer preferences is one of the stages for implementing a strategy such as mass customization. Through this analyze companies get a vision about the needs of its customer and they can plan the production.

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