Influence of Degree of Customers' Co-Participation on Their Assessment of Product Design and Functionality

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Summary:

The present paper presents the results of an empirical study conducted among Bulgarian customers of furniture sector on the influence of the degree of customers' participation (according to the position of Customer Order Decoupling Point) on their opinion concerning product design and functionality, which are analyzed and discussed.

Key words: survey, customer order decoupling point (CODP), level of customization, product design and functionality, furniture sector

JEL Classification: C40, C83, C93, M11.

1. Introduction

The processes of market globalization and product customization significantly affect the environment and conditions in which modern companies operate and develop (Puig et al., 2009). They experience serious difficulties with regard to how to respond to the ever increasing customers' demands in order to achieve an increasing and sustainable customer satisfaction while minimizing costs (Andreev, 2009, 2013; Daskalova, 2009; Piller & Kumar, 2006; Tseng & Piller, 2003). To make things worse, customers become increasingly demanding and choosey – not only in terms of delivery time, price etc., but with regard to products/services diversity and customization as well (Andreev, 2009, 2013; Daskalova, 2011; Koleva & Andreev, 2013; Gershenfeld, 2005; van Doorn et al., 2010).

This calls for recosnidering company operations strategy and applying new production/operations paradigms in order to ensure a proper transition from striving to produce monotonous standard products to implementing production of customized ones.

One of the biggest challenges faced by producers in the process of this transition is related to the formation and maintenance of such a product mix that meets customer expectations (Andreev, 2009; 2013; Prahalad & Ramaswamy, 2004). This is not an easy task, given that individual requirements for products/services could hardly be predicted and determined – in terms of both product structure and design and functionality.

This task is particularly of important practical significance, since this is the only way companies could build a true

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picture of the degree of variety demanded by customers and their corresponding requirements/expectations for prices, quality, delivery times and so on, as well as for the resulting requirements and/or constraints concerning company operations system, and as a result – to provide good opportunities for building a sustainable and adequately responsive one to ever changing market situations. These and other features of contemporary market conditions make it necessary to optimize the manufacturer-customer interface and create conditions for launching new concepts/approaches allowing the customer to be involved in the process of product creation and/or manufacturing.

One of the main instruments/concepts for defining the degree of customer participation in the manufacturing process is so cold "Customer Order Decoupling Point" (CODP), which offers a combination of the economies of scale from the one hand, with those of greater product mix diversity (economies of scope) from another – as specified by the customer himself/herself by his/her order (Andreev & Koleva, 2014).

The purpose of this publication is to examine how customers' satisfaction and assessment of product design and functionality is affected by the extent to which they are allowed (by the position of CODP) to penetrate into manufacturing processes.

The study was conducted with the kind support of Bulgarian Furniture Cluster and Bulgarian Branch Chamber of Woodworking.

2. Survey Methodology

The empirical study was conducted according to the sequence shown on figure 1, based on the theory and methodology for scientific surveys performance (Aleksandrova, 2012; Zhelev, 1999; Zikmund, 2002 etc.).

3. The Survey

1) *Defining the Research topic*

The **Object of Study** are the customers of a Bulgarian furniture company, hereby called Alpha Ltd. (for confidentiality reasons, the name of the company has been changed).

Directly related to the object, is the **Subject of Study** – the issues associated with determining customers' attitude to the main parameters characterizing end product and its components, namely: functionality and design.

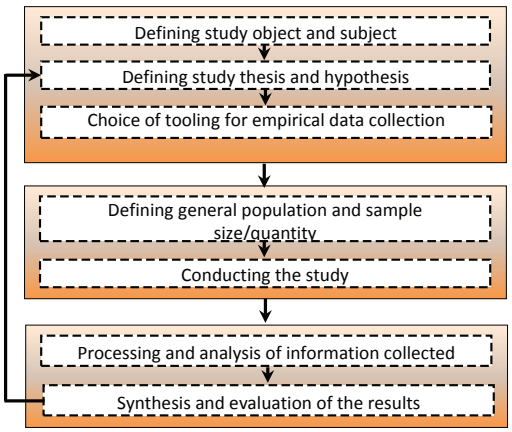

Fig.1 Common structure of methodology of the study

2) *Defining Study Thesis and Hypothesis*

The formulation of **Authors' Thesis** is as follows: In order to maintain the balance between company operations system characteristics and those of the dynamically changing market demand, as well as to assure a strong competitive advantage, manufacturers must direct their efforts to an efficient integration of customers in the process of creating and producing the product.

In the light of CODP positioning, two hypotheses could be considered:

Hypothesis 1: *Correlation exists between the degree of customers' penetration into manufacturing process (defined by CODP) and their assessment of product functionality;*

Hypothesis 2: *Correlation exists between the degree of customers' penetration into manufacturing process (defined by CODP) and their assessment of product design.*

The above hypotheses express the widespread view that greater customers' involvement in the process of formation of the final product contributes to a greater degree of satisfaction on their part in the perception of the product – in terms of functionality and design.

The verification of these two hypotheses is done by using the statistical software package SPSS 20.

3) *Choosing the tool for empirical data collection*

Data collection has been accomplished through interviews. It must be pointed out that for the purposes of this study, a particular end item (product) was selected – "Wardrobe". Among its models, four

Fig. 2. Wardrobe – model ETO

Fig. 3. Wardrobe – model MTO

configurations were selected, which are characterized by different degrees of customization, and this way four typical positions of CODP were covered, namely:

- Engineer-To-Order (ETO)

The wardrobe model presented on Figure 2 is **designed and manufactured** wholly under customer requirements, and features an innovative design.

Two colors of MDF (Medium-Density Fiberboard) are used with glossy finish, expressly indicated by the customer. As distinct functional features of the model which are a result of the customer selection, there could be mentioned:

- mechanisms for smooth door closing;
- built-in drawers with "push" opening.

- Make-To-Order (MTO)

The wardrobe model presented on Figure 3 is **manufactured** wholly under customer requirements. Here, several variants of the final product have been presented to the customer, among which s/he has been able to choose – for example: among 5 design variants of the cabinet, and 4 options for materials the wardrobe to be produced of. For the model under consideration, two types of material are used – chipboard for the cabinet and MDF with matte finish on the wardrobe doors and drawer fronts. Here, as distinct functional features of the model which are a result of the customer selection, there could be mentioned:

- mechanisms for smooth door closing;
- mechanisms for smooth opening and closing of drawers.

- Assemble-To-Order (ATO)

In the wardrobe model presented on Figure 4, the **intervention of customer is limited** to the selection of the type of cabinet (among 10 options: five types of cabinet design and two choices of veneer).

In this case two types of veneer are used – for the cabinet, and for the wardrobe doors and drawer fronts. Here, as distinct functional features of the model which are a result of the customer selection, there could be mentioned:

- mechanisms for smooth door closing;
- a standard solution is applied about drawers opening and closing.

Fig. 4. Wardrobe – model ATO

- Make-To-Stock (MTS)

In the model presented on Figure 5, the **intervention of customer is highly limited** only to the selection of a finished end item among several offered variants available in the showroom at the moment. The design and functional characteristics in this case are standard solutions, available in the product catalogue.

As a consequence of above presented four wardrobe models, and concerning the collection of empirical data for this study, four questionnaires were developed, each of which was accompanied by a show-card representing the picture and characteristics of the corresponding wardrobe model.

Fig. 5. Wardrobe – model MTS

Note: Questionnaires were coordinated and tested in advance, using marketing experts' opinions and advice.

4) *Defining general population and sample size*

In this section, the approach to deciding what quantity of customers (so called Sample size) to be interviewed is clarified, so that the results are representative and conclusions of the analysis could be valid for the aims of this study.

During sample size determining, the following restrictive conditions (constraints) have been taken into account:

- The study was conducted in the showroom of Alpha Ltd;
- A time period of 7 days was provided for the study;
- According to the company representatives, an average number of 38 visitors per day attend the showroom.

This way, for the total volume of the population we come to a quantity of **N = 266** individuals. The recommended volume of the population (*n'*) is defined according to Bartlett, Kotrlik & Higgins (2001) – allowing a preliminary permissible relative error (*p*) of 0.05 (5%), i.e. the confidence probability is 95%, and a confidence coefficient (γ) of 1.96, for the recommended sample size we come to a value of ***n'* = 85**.

5) *Conducting the study*

The study was conducted from April 7th to April 13th, 2014. Empirical data were collected through interviews, and covered a total of 200 respondents.

6) Processing and analyzing the collected information

In the present section, an analysis is done on the correlation between the degree of customers' penetration into manufacturing process defined by the position of CODP and their assessment of product functionality and design.

First, the following variables are presented:

X – *Degree of Customer Penetration into Manufacturing Process"* (values: MTS, ATO, MTO and ETO);

Y – *Product Functionality* (with a score on a scale from 1 Very Low to 7 Very High).

The variable **X** is a category (qualitative) variable and **Y** is a quantitative one. That is why Manov (2001) and Zhelev (1999) think that in this case a dispersion analysis (ANOVA test) has to be performed to investigate the correlation between above variables.

The following hypotheses are assumed:

H_0: *There is no statistically significant difference between mean values of customer assessment for product functionality through different degrees of customer penetration*, i.e. $H_0: \overline{Y}_{MTS} = \overline{Y}_{ATO} = \overline{Y}_{MTO} = \overline{Y}_{ETO}$;

H_1: *There is a statistically significant difference between mean values of customer assessment for product functionality through different degrees of customer penetration,* i.e. $H_1: \overline{Y}_{MTS} \neq \overline{Y}_{ATO} \neq \overline{Y}_{MTO} \neq \overline{Y}_{ETO}$.

Similarly, the hypotheses are formulated about *Customer Assessment for Product Design* adopted for the dependent variable.

For a significance level of α = 0.05 (probability of 0.95) the results shown in Table 1 have been obtained. It is obvious that the mean values of variable **Y** *Customer Assessment for Product Functionality* increase as the degree of customer penetration increases:

In summary, the results of the present study show: the higher the participation provided to customers in the end item/ product formation, the higher the rate of their satisfaction concerning the Product Functionality and Product Design characteristics.

It is also evident that customers' approval of above two characteristics significantly

Table 1. Statistics for Customer Assessment for Product Functionality and Customer Assessment for Product Design in correlation with different Customer Penetration Degrees

Descriptives									
		N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
						Lower Bound	Upper Bound		
Product Functionality	MTS	50	3,72	1,196	,169	3,38	4,06	2	7
	ATO	50	4,48	,814	,115	4,25	4,71	3	6
	MTO	50	4,92	1,047	,148	4,62	5,22	3	7
	ETO	50	5,94	,793	,112	5,71	6,17	4	7
	Total	200	4,77	1,260	,089	4,59	4,94	2	7
Product Design	MTS	50	3,64	1,045	,148	3,34	3,94	2	5
	ATO	50	3,98	,958	,135	3,71	4,25	2	6
	MTO	50	5,04	1,068	,151	4,74	5,34	3	7
	ETO	50	6,02	,769	,109	5,80	6,24	4	7
	Total	200	4,67	1,342	,095	4,48	4,86	2	7

Table 2. Results from the ANOVA test for Customer Assessment for Product Functionality and Customer Assessment for Product Design

ANOVA						
		Sum of Squares	df	Mean Square	F	Sig.
Product Functionality	Between Groups	128,895	3	42,965	45,018	,000
	Within Groups	187,060	196	,954		
	Total	315,955	199			
Product Design	Between Groups	174,820	3	58,273	62,277	,000
	Within Groups	183,400	196	,936		
	Total	358,220	199			

improved in the case where CODP is positioned in Engineer-To-Order.

It could be seen from Table 2 that for the variable **Y** *Customer Assessment for Product Functionality*

Sig. F = 0,000 < α = ***0,05***

That is, the Hypothesis H_1, could be accepted, i.e. a correlation exists between variables under consideration – **X** *Degree of Customer Penetration* and **Y** *Customer Assessment for Product Functionality*:

Table 2 Results from the ANOVA test for *Customer Assessment for Product Functionality* and *Customer Assessment for Product Design*

As an integral part of dispersion analysis, the condition for equality of variances in samples of different levels of explored factor is checked. The following two hypotheses are tested:

- $H_0: \sigma_1^2 = \sigma_2^2 = \sigma_3^2 = \sigma_4^2$ and
- $H_1: \sigma_1^2 \neq \sigma_2^2 \neq \sigma_3^2 \neq \sigma_4^2$.

The test is made automatically by SPSS package through so called Test of Levene:

The results of Levene test show that the zero hypothesis is rejected, because

Sig. F = 0.000 < ***α = 0.05***

Thus, the conclusion of the analysis of variance proved uncertain. That is why, according to Zhelev (1999) it is necessary to use an additional, non-parametric test (NPar Test – "Kruskal-Wallis test"), by which conclusively to confirm or reject the conclusions of the variance analysis (Table 4).

Kruskal-Wallis test shows that ***Asymp. Sig. = 0.000*** < α = ***0.05***. This confirms the results of the NOVA test.

Hence, Hypothesis 1 is confirmed: *Correlation exists between the degree of customers' penetration into manufacturing process (defined by CODP) and their assessment of product functionality!*

With respect to the variable **Y** *Product Design*, it is obvious from Table 1 that mean values of customer assessment increase as the *degree of customer penetration into manufacturing process* increases:

$\bar{Y}_{MTS} = 3{,}64; \quad \bar{Y}_{ATO} = 3{,}98; \; \bar{Y}_{MTO} = 5{,}04$ и $\bar{Y}_{ETO} = 6{,}02$

Table 3. Results of Levene test

Test of Homogeneity of Variances				
	Levene Statistic	df1	df2	Sig.
Product Functionality	5,835	3	196	,001
Product Design	4,702	3	196	,003

Table 4 Results of non-parametric test of Kruskal-Wallis

Ranks			
	CODP Position	**N**	**Mean Rank**
Product Functionality	**MTS**	50	56,03
	ATO	50	85,44
	MTO	50	106,34
	ETO	50	154,19
	Total	200	
Product Design	**MTS**	50	57,62
	ATO	50	69,98
	MTO	50	116,43
	ETO	50	157,97
	Total	200	
	Product Functionality		**Product Design**
Chi-Square	80,858		98,754
df	3		3
Asymp. Sig.	,000		,000
a. Kruskal Wallis Test			
b. Grouping Variable (MTS / ATO / MTO / ETO)			

Consequently, Table 2 shows that ***Sig. F = 0.000*** < α ***= 0.05***, which gives grounds to assume hypothesis H_1 confirmed also in respect to variable **Y** *Product Design*, i.e. *Correlation exists between the degree of customers' penetration into manufacturing process (defined by CODP) and their assessment of product design!*

Kruskal-Wallis test (Table 4) confirms this conclusion.

6) *Summary and evaluation of results*

It can be concluded from the survey results that increasing the level of customers' participation in creating their customized products leads to an increase in their satisfaction and approval to the products with regard to product functionality and design. It is also evident that customers' persuasion and assessment is drastically increased in cases where CODP is in 'Make-To-Order' and 'Engineer-To-Order' positions. This is an indication that in terms of product under consideration (Wardrobe) the company will have to focus its efforts mostly to establish and keep conditions for customers to be allowed to penetrate to the levels defined by these two positions of CODP.

Conclusion

Nowadays the main trends in the developments of market demand and competition show that the market success of enterprises is largely determined by their ability to offer products that satisfy specific customer requirements. In this respect, manufacturers are trying to offer an increasing range of varieties of products, but frequently later many of them prove to be unnecessary, since customers are not interested in them. Instead, they should seek a competitive advantage by focusing on achieving diversity, which corresponds to the customers' attitude and their individual needs. However, to achieve this, it is necessary to seek customers' advice and assistance in the process of forming/'creating' the end products in the company product mix. The benefits of involving customers also in product design and development, after-sales maintenance

and other similar and/or related activities are becoming more and more apparent and are materialized through increasing competitive advantages for the companies applying this concept, such as:

- Market offer in a full compliance with customer needs and/or requirements;
- Decreasing the risk for rejecting products, as well as opportunities to achieve long-lasting customer satisfaction;
- Reducing the amount of inefficient investments in product R&D.

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