UNIVERSITI TEKNIKAL MALAYSIA MELAKA

CUSTOMER-PRODUCT ATTRIBUTE IDENTIFICATION USING CORRELATION RELATIONSHIP FOR EFFICIENT PRODUCT CUSTOMIZATION DEVELOPMENT

This report submitted in accordance with requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor Degree of Manufacturing Engineering

(Manufacturing Design) (Hons.)

by

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2015

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

BORANG PENGESAHAN STATUS LAPORAN PROJEK SARJANA MUDA

TAJUK: **Customer-Product Attribute Identification Using Correlation Relationship for Efficient Product Customization Development**

SESI PENGAJIAN: **2014/2015 Semester 2**

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This report is submitted to the Faculty of Manufacturing Engineering of UTeM as a partial fulfillment of the requirements for the degree of Bachelor of Manufacturing Engineering (Manufacturing Design) (Hons.). The member of the supervisory committee is as follow:

…….

ABSTRAK

Permintaan pelanggan terhadap sifat-sifat produk sentiasa fleksibel. Keadaan ini membawa kepada peningkatan kos pengeluaran disebabkan oleh pelarasan yang perlu dilakukan selepas pengeluaran dan ketidakpuasan pelanggan. Keseluruhan projek ini adalah bertujuan untuk mengenalpasti permintaan pelanggan terhadap produk dan sifat-sifat produk yang boleh digunakan dalam membina produk. Kurang kajian yang dijalankan dalam mengenalpasti sifat-sifat dengan tepat untuk membina produk. Projek ini bertujuan untuk mengisi jurang ini dengan mencadangkan kaedah mengenalpasti sifat produk pelanggan menggunakan hubungan kolerasi. Ia melibatkan beberapa peringkat; menyenaraikan senarai peralatan elektrik rumah, mengumpul sifat-sifat produk, menjalankan kaji selidik kepada 200 responden dan akhir sekali penilaian berangka dan statistic dijalankan. Setelah data daripada responden diperolehi, analisis kolerasi antara pelanggan dan sifat produk dinilai menggunakan Statistical SPSS 15.0 Evaluation version software. Analisis Pearson digunakan untuk mengukur kekuatan yang wujud di antara pelanggan dan sifat produk. Melalui analisis ini, semakin tinggi nilai korelasi pada sifat-sifat produk, semakin besar kesesuaian sifat tersebut dalam membina produk. Berdasarkan analisis dapatan kajian, terdapat beberapa korelasi positif antara pelanggan dan sifat-sifat produk. Jantina dan jenis penggering pakaian menunjukkan nilai kolerasi r yang paling tinggi dengan nilai 0.225, kedua, jantina dan jenis periuk nasi dengan nilai kolerasi r 0.185 dan 0.170 bagi nilai kolerasi r antara jantina dan warna mesin basuh. Namun, hubungan ini masih tidak menunjukkan nilai optimum yang diperlukan. Hal ini kerana halangan budaya dan faktor-faktor lain yang mempengaruhi nilai yang diperoleh.

ABSTRACT

The demand of customers on the attributes of product is always flexible. This situation lead to increasing of mass production cost due to subsequent adjustments or even customer dissatisfaction. This entire project is about to identify the customer demand on product and the product attributes that can be used in developing customized product. In previous research, there is limited research on identifying the exactly attributes that suit with customers' preferences for customization development. This project attempts to fill this gap by proposing a customer-product attribute identification using correlation relationship. It involves several stages; from extracting the list of home electric appliances, collecting product attributes, conducting survey to 200 respondents and lastly numerical and statistical evaluation. Once the data from respondent is obtained, the correlation analysis between customer and product attributes is measured using Statistical SPSS 15.0 Evaluation version software. Here, the Pearson's analysis is used to measure the strength that exists between the customer and product attributes. The higher the value of correlation on certain product attributes, the greater the emphasis of customization and product service system place on them. Based on the analysis, there are some positive correlations between customer and product attributes. Gender and type of dryer shows the highest correlation r value with 0.225, secondly gender and type of rice cooker with correlation r value 0.185 and 0.170 for the correlation r value between gender and color of washing machine. However, these correlations still did not show an optimal value needed. This is due to cultural barrier and other factors that associated to the value obtained.

DEDICATION

Dedicated to my father, Junaidi bin Bustami and my mother, Noor Ridza binti Hasan. To my supervisor, lecturers and friends for their help and motivation in completing this thesis.

ACKNOWLEDGEMENTS

“In the name of Allah, the most gracious, the most compassionate”

Alhamdulillah, thanks to Allah S.W.T., finally after facing a lot of challenges during my final year project, I manage to complete it. I would like to thank for those people who helped me throughout this project by giving me support, encouragement and ideas.

A billion of thanks dedicated to my supervisor, Dr Suriati binti Akmal and lecturer, Hasoloan Haery Ian Pieter for their passionate guidance throughout the whole process of completing this project besides teach me the proper techniques of writing reports.

Also special thanks to my family and friends for giving motivation and advice. Thank you.

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LIST OF ABBREVIATIONS, SYMBOLS AND NOMENCLATURE

AHP	-	Analytic Hierarchy Process Method
CS	-	Customer Satisfaction Evaluation Method
HOQ	-	House of Quality
PSS	-	Product Service System
QFD	-	Quality Function Deployment

CHAPTER 1
INTRODUCTION

This chapter presents an overview of research study which consists of the background of the project, problem statements which drives to the objective and scope of this project.

1.1 Background

Currently, requirement for a product which determines a business strategy is frequently influenced by customers desires (Cao et al., 2011). However, they do not know what exactly they want until they see it and the ideas in their minds are always dynamic (Zhou et al., 2008). Subsequently, they are always unsatisfied with the existing products.

Although the intention of a customer is a very subjective issue, many people often have similar preferences for the same type of products. This conflict in demands often leads to increase the cost–efficiency of mass production that is caused by subsequent adjustments or even customer dissatisfaction. Therefore, manufacturing companies are continually facing challenges and difficulties in producing product varieties that fulfilled the dynamic customer's desire on product offering. Most of customer prefer product that are specifically tailored to their requirements, but are no costly than common products (Smith, 1997). Here, it is important for manufacturing company play their role as a customer satisfying process instead of a goods producing process only and reviewed the

failures of many other manufacturing company to their being excessively product oriented rather than customer oriented.

Pine (1993) stated that mass customization seems to be a manufacturing strategy that attempts to address this concern by clarifying variety and individual customization at prices comparable to standard products and services. He also introduces mass customization in production management and proposed that it can fulfill individual customers' requirements with high quality, low cost and efficient production. Approach used in mass customization allows manufacturing company to offer more distinction in products while meeting production processes and cost expectations (Bare & Cox 2008). Besides that, this approach also becomes acceptable due to the positive response from customer where they willing to pay more for products that suit to their preferences, requirements and characteristics. In this approach, the satisfaction of customer level is one of the most challenging areas that must be considered when offering a variety of customized product and service.

1.2 Problem Statement

In past decades, the use of information technology and flexible process reengineering, allows products or services variations at reasonable prices to the customer (Yadav & Goel, 2008). However, it is insufficient to measure customization without knowing the exact attributes that match with customers' preferences. Sometimes, even after the determination of product attributes, there might be unclear indicator on which ones determine preferences and purchases of product (Li et al., 2014). There is still limited research on the suitability evaluation model, quantitative and reasonable criteria methods for development of customized product. This project attempts to fill gaps in the literature by proposing a methodology of attributes evaluation for customizing product, which focuses on the quantitative methods for each category of attributes.

1.3 Objectives

To overcome the issues of identification of product attributes, this project would like to fill that gap by achieving the following objectives:

1. To determine the customer demand for a product.
2. To identify the product attributes that can be used in developing customized product.

1.4 Scope

This project is focusing on daily consumption products which are home electric appliances. The survey is carried out among 200 respondents to investigate the customer demand under mass customization criteria of home electric appliances. The statistical analysis which is SPSS 15.0 Evaluation version software and mathematic approach (Correlation analysis) are used in this project used to analyze the relationship between the customer and product attributes.

CHAPTER 2
LITERATURE REVIEW

2.1 Demand identification

Recently, management in many business markets was concern on delivering the best value to their customers. Many researches have been conducted on the concept of customer value among business managers and academia. Slater (1997) has discovered that the 'existence and success of the firm mostly depend on the creation of customer value'. The customer value is a marketing tool for identifying customer's requirement instead of just a pricing technique or market research approach (Ulaga, 2001). In order to accomplish a great achievement in new product development that give customer value, (Shieh et al., 2008) stated that multicultural factors are the critical issues for obtaining and conducting customer requirements. A customer's demands for a certain product mostly depend on their attitude and cultural influenced. A customer analysis model that has been developed by Ha (2007) able to tracks customer attitude and predicts customer attitude patterns.

In last decades, the voice of customers has been broadly obtained as a main source of input for taking design metrics and specifications for product concept generation (Chen et al., 2002). Traditional approach for concept generation has been conducted in order to obtained customer requirements in certain products. For examples, house of quality (HOQ) and quality function deployment (QFD) which mainly focused on certain group and product survey. Quality function deployment is viewed as a suitable explanation by

using the house of quality (Nordin 2002). Besides that, Scott and Antonsson (1998) stated that by using product characteristic and functionality it is easy to plan QFD based on customer preferences.

Kano et al. (1984) develop a model which is two-dimensional model that generally used to identify attributes of a product or even services based on the performance of these attributes in satisfying customer requirement. There are three classification of product criteria involved in Kano model which are attractive, one-dimensional and attribute. Some researchers showed the advantages of this model in classifying customer demands. For example, Yadav and Goel (2008) used an integrative method involving the quality function deployment (QFD) and Kano model or Florez-Lopez and Ramon-Jeronimo (2012) used integrative approach of Kano model and Fuzzy method to identify the customer demand. However, sometimes it is not easy to determine a criterion for the attractive attribute or one-dimensional attribute besides difficulty in giving explicit formulation to quantify these two classifications.

Li et al. (2014) tried to fill this gap by proposing customer satisfaction evaluation method (CS) which focused on quantitative methods of each classification criteria. Mathematical model is formulated and weights of criteria are obtained by integrating Entropy weight and Analytic Hierarchy Process (AHP) method.

2.2 Mass customization

Mass customization can be described as the capability to fulfill requirements of individually patterned products besides considering the services to customers (Silveira et al., 2001). Versatile, and constantly improved are the element that should be considered in order to make a successful mass customization. Moreover, mass customization requires quick product development and innovation abilities due to short life cycles introduced by mass customization. Sharing knowledge can simplify the changing

strategy and depends on the capability on converting new customer requirements into new services. Hence, design for mass customization as mentioned by Tseng and Du (1998) needs developing the reusability and commonality in order to satisfy the requirements of customers.

In the scope of mass customization, economies of scale plays important rule where the efficiencies mainly correlate with demand-side changes of various type of products, may be one of the primarily reasons for potential market strategy. According to Dong et al. (2011), by using some components frequently in various types of products or services, the economies of scope can be accomplish. Considering companies to accumulate economy of scale through repetitions, mass customization is then capable of reducing lead-time and cost. Thus, mass customization can accomplish higher margins and become more advantageous. With the growing flexibility built into modern manufacturing systems and also programmability in computing, companies that produce low production volumes can gain an added value compare to competitors by implementing mass customization.

Besides that, in term of economic perspective, mass customization allow better match between producer's capabilities and customer needs. This can be achieved through development of company's portfolio which include products, equipment, service and skills that market demands. In reality, we can see that if the unique requirements of customers are being satisfied, they usually willing to pay it at premium price, thus giving companies advantage in their profits (Porter, 1996). Moreover, it may possibly develop customer loyalty and increase market share by expanding the product differentiation to support the customer needs.

2.3 Product service system

The factors of competitions are thoroughly changed and in various condition products differentiation competition is giving away to service's differentiation by offering integrated product and services. This situation is related to a new paradigm which is a new base of competitiveness which currently dominants in potential market (Copani et al., 2010). A product service system (PSS) generally is a combination of both products and services which proposed better sustainability of the production and also consumption for products (Akmal et al., 2014). Meanwhile (Baines et al., 2009) define a product service system as a system that comprised of products, services, infrastructure, and supporting networks which able to fulfill customer demands with a competitive and environmentally benefit.

In potential marketing area, Porter (1985) stated that the value of service depends on the understanding perception of customers. This research has been extended by Vargo and Lusch (2004) who has stated that the value is obtained and determined by customer on the basis "value of in use". Tomiyama (2001) in Service Engineering described a service as a process between service provider and service receiver that shifts the state of receiver; hence, the receivers' value is recognized when his or her state shifts to a new desired state. The concept used in product service system also considers the integrated product and service offering which gives value in use (Baines et al., 2009). So, in order to realize PSS, designers need to pay more attention on customers and their requirements instead of following a benchmarking strategy determined by a competitor analysis.

2.4 Type of product service system

As we all know, product service system involve of tangible product and intangible services that are designed and combined together so that they are able to fulfill specific customer requirements. Various types of PSS have been proposed. Below is the

explaination of three main class of PSS which have been mostly accepted by researchers in this field. Most of type classifications make a differences between three main class of PSS.

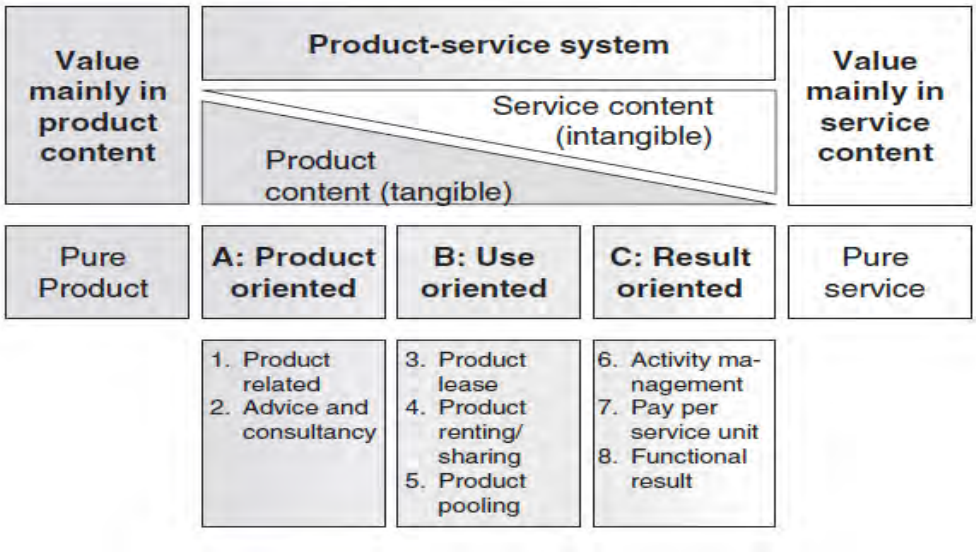

Figure 2.1: Main subclass of PSS (Tukker, 2004)

Figure 2.1 shows first main class which is product-oriented services. In this service, the customers own the product. Here, the manufacturer or service provider will provide service for extended product service. The most clearly examples of this services include maintenance agreements, repairs, warranty and upgrades. Other than that, recycling and take back service are also examples in this class. Second class is use-oriented services. In this class, the ownership belongs to service provider. Service provider will sell the functions instead of products to the customer. Typically examples are sharing, pooling, leasing. The last class is result-oriented services. Here, the customer and service provider agree on a result there is no involvement of pre-determined product. In other word, the product is replacing with information and services by giving customers with a specific result instead of a specific product. For example chemical company which is agreed to provide chemicals, handle their usage, transportation, and waste disposal. The

company also compensated by a handling fee with a shared saving incentive. Other examples within this class include refrigeration, cleaning and energy service.

2.5 Approach used in product service system

Many researchers have developed approach to justify customer demands that correspond to design demands which create value in use for PSS. These approaches mainly extract customer demands in consideration of the internal and external environment of PSS provider. Müller et al. (2010) proposed a checklist of clustered attribute based on a comprehensive literature review of product development, service engineering, and IT systems for internal environment. The checklist facilitates designers to obtain and define PSS demands systematically. Besides that, this checklist also extracted the customer demands from the viewpoints of object-oriented characters and process-oriented characters. The object-oriented character involve of a structure, technical artifact and so on while process-oriented characters involve of behavior, lifecycle activities and many more.

Regarding to external environment perspective, Marilungo et al. (2015) composed a method for demand analysis which considers uncertainties resulted by environmental factor such as social, political and technologies uncertainties. Akasaka et al. (2010) also introduced an approach that considers both perspectives by using SWOT analysis. Customer demands are classified from the viewpoints of their fulfillment level and Kano classification and then allocated in the SWOT matrix.

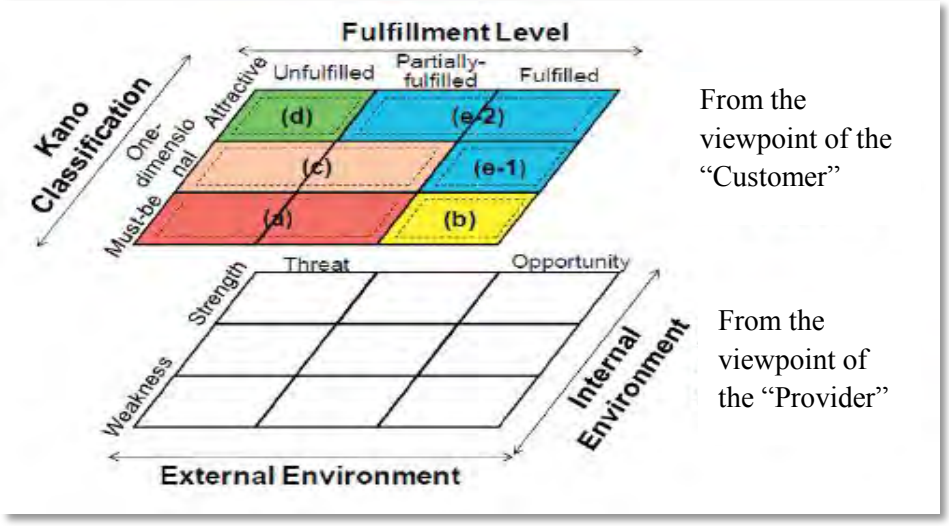

Figure 2.2: Requirement evaluation matrix (Akasaka et al., 2010)

Life cycle oriented approach that was introduced by Aurich et al. (2006) is a useful method for systematic design of technical services based on its modularization and combines it with existing product design process. The technical product-service system is a kind of product service system that highlighted the content of technical services such as maintaining, user training, refurbishing and retrofitting. The potential impact of technical services throughout the product life cycle considering the techniques that should be applied to service design. Aurich et al. (2006) viewed the process definition and standardization are crucial elements to be considered for service design because the quality of technical services influenced by the quality of the underlying service processes.