Faculty of Manufacturing Engineering

STRUCTURAL MODEL OF CUSTOMER SATISFACTION USING THE INTEGRATION OF KANSEI ENGINEERING AND KANO METHOD

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Master of Science in Manufacturing Engineering

2014

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A thesis submitted
in fulfillment of the requirements for the degree of Master of Science
in Manufacturing Engineering

Faculty of Manufacturing Engineering

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

2014

DECLARATION

I declare that this thesis entitled "Structural Model of Customer Satisfaction Using the Integration of Kansei Engineering and Kano Method" is the result of my own research except as cited in the references. The thesis has not been accepted for any degree and is not concurrently submitted in candidature of any other degree.

Signature : …….....

Name : Fevilia Nurnadia Binti Adria Syaifoel

Date : 29th August 2014

APPROVAL

I hereby declare that I have read this thesis and in my opinion this thesis is sufficient in terms of scope and quality for the award of Master of Science in Manufacturing Engineering .

Signature : ……..

Name : Saifudin Hafiz Yahya

Date : 29th August 2014

DEDICATION

For my beloved parents who are always supported me:

Adria Syaifoel Bin Malin Sutan

Ida Elisma Binti Hasan

And

***For my Supervisor**,*

Mr Saifuddin Hafiz Yahaya

Mr Hasoloan Haery Ian Pieter

For my Lovely Partner of life journey,

Kamal Izzet Abd Latif

For my Families and my Friends

Thanks for their loves and caring.

ABSTRACT

This research has been carried out based on the Kansei Engineering (KE) and Kano Method. The Kansei Engineering is used to identify and investigate the customer requirement based on the emotional feeling articulated in Semantic Differential word, while Kano Method (KM) is employed to identify the quality attributes of products based on the functional and dysfunctional attributes. Both approaches are integrated to address what the customer requirements of the products characteristics related to the design elements. All of these processes are combined together as the Structural Model of Customer Satisfaction. The first implication of this study offered a structural models of customer satisfaction in the product development that is not limited to the functionality of products only. The model is a new method in the product development where the perception (KE) and stage of satisfaction (KM) is being taken as one on how to measure the customer satisfaction against the products. Also, this a new model propose the conception on how to develop the product based on Kano requirements and Kansei Engineering . In order to know what the customers perceptions and satisfaction levels of the products, this research involved 220 respondents (college students) in Melaka. Through the questionnaires developed using Kano Method and Kansei Engineering towards the pen products as a case study, the results showed that the final design preference is the design no.4 (grip, clip and click elements). This pen represent the best design selected by respondent since the emotion feeling of comfortable value is 4.63. This design also has the significant correlation to the Kano quality attribute no. 5 (0.303, $p<0.01$) where the clip element is a highest priority in the design development refers to the structural model. Both of the results in Kano model represent as the 'Indifferent'. This study also found that there is a relationship existed between the KE and KM. The result shows us that the perceived attributes or qualities is impacted or influenced against the emotional design or Kansei responses.

ABSTRAK

Kajian ini telah dijalankan berdasarkan pembangunan model pelanggan didalam pembangunan produk. KE digunakan untuk mengenalpasti apakah keperluan sebenar pelanggan berdasarkan perasaan emosi mereka yang dikenalpasti yang telah dinyatakan didalam perkataan Semantic Differential. Sementara itu, pendekatan KM telah dijalankan untuk mengenalpasti sifat-sifat kualiti yang berhubung dengan kewujudan atau tidak wujudnya suatu sifat ciri-ciri rekabentuk produk. Kedua-dua pendekatan ini meggariskan keperluan pelanggan berhubung terhadap unsur rekabentuk dimana ia telah digabungkan bersama sebagai satu proses didalam Structural Model of Customer Satisfaction. Implikasi pertama kajian ini ialah, ia memberi gambaran model berstruktur kepuasan pelanggan didalam pembangunan produk yang mana ia bukan sahaja tentang pengistilahan fungsi sesuatu produk. Kemudian, model ini telah direka untuk memberi petunjuk atau cara didalam pembangunan produk berdasarkan persepsi (KE) dan peringkat kepuasan(KM) sebagai satu cara untuk mengukur kepuasan pelanggan. Disamping itu, ini adalah pendekatan baru didalam pembangunan produk berdasarkan keperluan Kano dan Kansei Engineering.Sebagai langkah untuk mengetahui persepsi dan tingkat kepuasan terhadap produk, kajian ini telah disiasat dikalangan 220 responden (pelajar) di Melaka. Menerusi soalan yang dibentuk menggunakan KM dan KE terhadap pen produk, hasil mendapati pilihan muktamad adalah terhadap rekabenuk no.4(unsur pencengkam, klip dan klik) dimana ia rekabentuk terbaik yang dipilih atau dibeli dikalangan pengguna, ia memberi emosi keselesaan (4.63) ketika digunakan. Rekabentuk ini mempunyai korelasi terhadap Kano-5(0.303, $p<0.01$) dengan unsur klip, pilihan utama didalam pembangunan produk berdasarkan struktur model. dan unsur klik meraih keputusan tertinggi didalam tingkat Kano. Kedua-dua keputusan didalam Kano memberi tingkat kepuasan Indiffrent. Kajian ini mendapati terdapat hubungan korelasi yang wujud diantara KE dan KM. Ia menunjukan sifat-sifat atau ciri-ciri yang dilihat adalah kesan atau dipengaruhi terhadap reka bentuk emosi atau respon Kansei.

ACKNOWLEDGEMENT

Thousand of thanks to my supervisor, Mr Saifuddin Hafiz Yahaya and Mr Hasoloan Haery Ian Peter, for giving me a chance to do my research under their supervise. Unforgettable too to Mr Yuhazri as my research advisor. Thank you for inspiring discussions and your enthusiasm for my research. I would like to show my highest gratitude for their invaluable support, patience, assistance, and especially their encouragement to this research. I truly have learnt a lot and all this would not be without their guidance.

I would like to extend my thankful to Universiti Teknikal Malaysia Melaka, Politeknik Merlimau and Kolej Komuniti for giving opportunities to do my research, willing to help for distributing the questionnaires to students and completed the questionnaires by achieving the target.

My deep gratitude to my old friend Bahari Azhar for correcting my English and for your support the editing of this thesis. Special thanks to my "surrogate-family" here in Melaka. Thank you Fariz, Kisha, Nad, Sharafine, Anis and Meklin that you let me be part of your life.

Kamal Izzet thank you for being my steady power source, and soul mate. You are really the "universal genius" and lovely funny spirit I need.

Finally, I would like to thank my parents, Syaifoel and Ida, my siblings, for their love, care, support, understanding and encouraged me on my own way to carry out this thesis to the best of my ability.

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LIST of ABBREVIATIONS

KE	-	Kansei Engineering
KM	-	Kano Method
AHP	-	Analythical Hierachy Process
SPSS	-	Software Package for Statistical Analysis
METI	-	Ministry of Economy, Trade and Industry (METI)
SD	-	Semantic Differential
KW	-	Kansei Words
MC	-	Miserable and Comfortable
SF	-	Slippery and Firm
UB	-	Ugly and Beautiful
SS	-	Simple and Stylish
BA	-	Boring and Attractive
IC	-	Irritating and Convenience
AVER.	-	Average
*	-	Correlation is significant at the 0.05 level (2-tailed)
**	-	Correlation is significant at the 0.01 level (2-tailed).
F	-	Functional
Df	-	Dysfunctional
MAX	-	Maximum
MIN	-	Minimum
K	-	Kano

LIST OF PUBLICATIONS

1) **Syaifoelida, F**., Sihombing, H., Yahaya, S.H., Yuhazri, M.Y. and Izzet, K. (2013): The Design Preferences Decision Using the Analytical Hierarchy Process towards Kansei Engineering Approach: Spectacles Design, International Journal of Application or Innovation in Engineering & Management, Vol.2, No.2, pp.2319 – 4847.

2) **Syaifoelida, F.,** Sihombing, H., Yahaya, S.H., and Yuhazri, M.Y. (2013): The Correlation Of Cognitive Alert Style In Education Towards The Spectacles Design Preferences By The AHP Decision Process, Proceeding of the Creative Technology Entrepreneur Conference (CrTEC), pp. 281-291, 17-18 June 2013, Johor.

3) **Syaifoelida, F.,** Yahaya, S.H., Sihombing, H., and Yuhazri, M.Y. (2013): Kansei Engineering: KE's Package Review, Journal of Global Engineers & Technologist Review, Vol.3, No.5, pp. 8-20.

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5) **Syaifoelida, F.,** Yahaya, S.H., Sihombing, H., and Yuhazri, M.Y. (2014): The Integration Framework of Kansei Engineering (KE) and Kano Method (KM) for Product Development, Proceeding of the International Conference on Advances in Civil, Structural and Mechanical Engineering (ACSME), pp.30-34, 4-5 January 2014, Bangkok, Thailand.

CHAPTER 1

INTRODUCTION

In enhancing global competitiveness, a product development and manufacturing are two important factors for the industry to rethink of what is the best approach to the development of their products. The new products produced are sometimes not as successful as expected, even though they might be perfectly functional, reliable, and suit to what customers' desire. So, in order to remain competitive, companies should expand their designs by producing a product for all users (generalization) since some of them are not being able to adequately satisfy the need of customers towards what is produced or provided. In positioning of the generalization and individualization (customization), they are considering their position to market segmentation and customer analysis (Juran, 1992). This consideration is to define the most effective set of consumers' classes so that companies can concentrate on customers' requirement in order to serve them better. Also, to discover on how the consumer experience, how to evaluate product performance as the challenges faced by companies to undertake the design as well as the function and documentation of a product offering.

In addition, through quality focused on consumer satisfaction, towards the product offered in the market is an ambiguous and abstract concept of the manifestation of "the state of satisfaction" is varies individually, customers' experience and expectations. This is as what the companies faced against the challenges and competitions in the market, especially on how to identify the consumer's satisfaction and requirement. Depends how they can develop their market with an improvement made to their business. To ensure the highest of quality and demanding of consumers, since consumer satisfaction is a major outcome of marketing activities and serves to link the processes culminating in purchasing and consumption with post purchase phenomena, such as attitude change, repeat purchase, and brand loyalty. Then every effort made by companies should certainly be met and exceeds to the customers needs and expectations in order to maintain the loyalty of clients.

Hence, all elements aforementioned must be considered to satisfy the customer in order to gain their satisfaction and exceeds their expectations. Norman (2004) said, "the attractive things work better to influence the way human minds to solve the problem because the aesthetic value will influence the emotion". To optimize the success in developing the product, therefore the functional and emotional considerations should be collaborated to ensure an overall good design (Jordan, 2000; Norman, 2004).

1.1 Problems Statements

The structural model to design consumer product that are able to achieve customer satisfaction, require the emotional aspects generated from semantic attributes to what the product features. Since customer satisfaction can be achieved through the product sold, customer satisfaction should be studied and explored through the study of the product image.

The relationship factors between product and person itself and how this correlation can be matched in customer satisfaction context is considered as the first problem. In the current socioeconomic context, since the customer satisfaction as a mantra of all effort for business is an ambiguous and abstract concept, then the manifestation of "the state of satisfaction" varies individually, against the product. This is what companies faced the challenges and competitions in the market, especially on how to identify what the customer satisfaction and requirement and how they can develop the market with an improvement made to their business in order to ensure the highest quality service offered. In this context, the satisfaction is the consumer's response to the evaluation of the perceived discrepancy between prior expectations and the actual performance of the product as perceived after its consumption (Tse and Wilton, 1988).

Moreover, since the users have different emotions and belong to various social classes, the psychosocial act is then as the emotional in nature and consequences can be different for different users. As consequences, Schenkman & Johnson, 2000 discussed about the emotional aspect of product related to the emotional dimension and how to measure this emotion to the structure of emotional response towards a product. Zhang *et al.,* 1999 claimed about how people respond emotionally to products and what aspects of a design trigger an emotional reaction. There are two emotions that will influence the thought process, the positive emotions

broaden thought processes and are critical to learn (go to curiosity) while the negative emotions occur is going to the narrow thought process (Norman, 2004). The functional and emotional considerations, according to Jordan (2000), considerations should be collaborated, therefore to ensure the excellent product design happens to the optimal success in product development.

The development factor of product considered as the final problem. The demand that triggers the introduction of a new research field which dealing with the collection of customers' hidden subjective needs and their translation into concrete products. Since people want to use products that should be functional at a physical level, a psychological level should therefore be attractive at a subjective; emotional level. A market-driven product development process is a process in which a formulated business and marketing strategy that decided by the company. By understanding consumer's preferences and needs within the target market, Srinivisan *et al*., (1997) stated about product concept according to consumer's needs and selecting the best concept for detail specification and commercialization. A new product in the early phase of concept development, by understanding the key factors that affect consumer's evaluation, it is possible to improve the changes of making the right decision in the next phase of product design and development (Veryzer, 1998). Totality, the consumer satisfaction is being the ultimate goal of any industries; the consumer wants and need is the primary driving functions of product development (Karbhari *et al.,* 1994).

Based on these problems, the Kansei Engineering (KE) approach will be used as a guidance to interpret the design aspects related to satisfaction, while Kano method is used to explore the quality attributes of the product. The integration of Kansei Engineering (KE) and Kano Method (KM) is employed to evaluate the emotional appeal of products and scales of response towards the quality and appearance of products during the development stage. Here, the consumer satisfaction about the product appearance and quality used will be evaluated and calculated using the Kano Method and Kansei Engineering, specifically, the affective meaning to present uncertainty in real life and as the main benchmarking of the correlation between product's criteria. Analytical Hierarchy Process (AHP) is used to assist the multi-criteria decision making that represent the decisions that people make every day and affect their lives in the present in the future. According to Simon (1987), though human behavior is intended to be rational, decisions are rational only in a restricted sense because it depends on a decision

maker's capacity to collect and analyze information. The modeling of customer satisfaction at this point can be formed as the process shown in next methodology.

1.2 Research Objectives and Scope

The study is focused on the consumer product (common product used in daily life such as pen) as part of the customer satisfaction. The design of products in today's markets is often becoming increasingly complex since they contain more functions and they have to meet more demands on user-friendliness, manufacturability, and ecological consideration. In addition, due to reason of existing the shortened product life cycles as a common ground of current consumer products that is likely to increase development costs. Both are, however, having to success in a certain market segment that does not only require knowledge about the competitors and their products' performance, but also about the impressions of the products made with the customer. Considering this reason, Aaker (1995) said the strategic dimension of an organization should therefore includes on how the product becoming more competitive through customer satisfaction/brand loyalty and product/service quality. According to Reichheld (1996), 65 to 85 percent of customers who defect to competitors' brands say they were either satisfied or very satisfied with the product or service they left. Therefore, in order to ensure that the customers do not defect, Bowen and Chen (2001) said that customers must be extremely satisfied with their product.

Based on the aforementioned, the study is carried out through the survey where the questionnaires are required and made in order to explore the consumer expectation and perceptions by using the Kansei Engineering (KE) and Kano Method (KM). KE uses the same individual perspective of the traditional methodologies for product concept development phase and it also links the consumers' need to the engineering characteristic by testing several concept prototypes created according to certain rules. A daily life product will be used as case studies (pen product), as a real situation feature to apply the structural model. While, to analyze the measurement taken with customer expectation which is conducted through survey, observations, and questionnaires in the institution selected only in Malacca area. Several software programs are used, such as Microsoft Excel, Cad Cam and SPSS to analyze the data and to get the best decision from the data collection. The software tools use are to model the

structure of product design and satisfaction configuration, beside the correlation and validation of the study carried out.

The aim of this research is to provide evidence that the integration of both KE and KM can be used as one of the product development techniques. After outlining the issues related to product chosen, the research develops its objective, and they are as follows:

1. To define and investigate customer satisfaction and requirements on KE and KM.
2. To develop a structural model or design integration consists of customer satisfaction and requirements based on KE and KM
3. To apply this model into the real situation (case study: product).

A set of statistical tests are performed on the survey data in order to signify the structural model as the conclusion. The details of the statistical tests and their assumptions are presented later in the related sections.

1.3 Research Questions

The research will begin with finding the answers to research questions in order to achieve the research goals. The research questions are formulated in to achieve the research objectives. The research questions are as follows:

- **Research Question 1:** Can the product emotion be quantified?

  Although the discussion on the importance of the emotional aspect of product development has been increasing, there is no systematic method or the structural model has been established to access this emotional response. This research attempt to provide evidence that subjective product could be quantified and the level of satisfaction can be measured.

- **Research Question 2:** What are the customer satisfactions of design elements in product that compose the external appearance through emotional and quality function attributes?

Conforming to the approach of the research that focuses on users, this research seeks every possible design element towards product that based on the customer needed and how much they perceive this design element as the importance level of their desire.

- **Research Question 3:** Can the structural model be developed based on the level requirement and emotional in customer's satisfaction?

  This question requires and pursues an answer whether the structural model that contains both of emotional and level of satisfaction in customers could be designed. The answers will verify the soundness of the anticipated guideline and the validity of the proposed method of the structural model.

1.4 Structure of the thesis

The research focuses on emotional signature of product existing in the market nowadays. Adopting the methodologies of KE and KM, the research quantifies the user of the product chosen and in the same way, to discover relationships between emotional response and product elements. Chapter 1 introduces the project that contain of objectives, scope, and background. In this chapter, it describes the background of product development how it's growing, the product appearance and its characteristic can meet consumer satisfaction. It provides an overview of the thesis, summaries all chapters and audiences can have a clue to the overall content of the thesis. Chapter 2 describes the literature review on concepts of consumer satisfaction related to the consumer attributes, analyzing the customer needs by using KE and KM to meet consumer expectation and analyzing the survey by using the AHP as the technical decision method. The theoretical of this method applied is also included in this chapter. Chapter 3 represents the flow chart that carried out in the whole process of the methodology and project scheme (Gant Chart) and reviews KE and KM as a potential method in the engineering of emotions in product development. Chapter 4 analyzes the data by using KE and KM methodology and AHP will be used to analyze the consumer satisfaction by evaluating the consumer perception as the decision maker while Chapter 5 concludes the entire research that presents the summary of the research. This chapter will conclude the study objective and give suggestion on the future work.