A Study on Kansei Engineering on Product Development Using AHP Method

Submitted in accordance with the requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor of Manufacturing Engineering Technology (Product Design) (Hons.)

by

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2019

DECLARATION

I hereby, declared this report entitled “A Study on Kansei Engineering on Product Development Using AHP Method” is the results of my own research excepts as cited in the reference.

APPROVAL

This report is submitted to the Faculty of Technology Engineering of Universiti Teknikal Malaysia Melaka as partial fulfilment of the requirements for the degree of Bachelor of Manufacturing Engineering Technology (Product Design) (Suhanthan a/l Ravintheran) (Hons.).

The members of the supervisory committee are as follow:

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TS. DR OMAR BIN BAPOKUTTY

ABSTRAK

Mewujudkan produk yang memenuhi permintaan dan menjamin kepuasan pelanggan seringkali rumit dan mengelirukan. Kepuasan pelanggan datang dari perasaan mereka sendiri terhadap sesuatu produk. Perasaan ini berbeza di antara setiap orang. Hal ini demikian kerana setiap orang mempunyai permintaan atau kriteria mereka tersendiri untuk berasa puas hati terhadap sesuatu produk. Pada masa ini, perasaan permintaan tidak dapat dikenalpasti melalui pendekatan saintifik yang menyeluruh. Kertas kerja ini adalah mengenai reka bentuk dan membangunkan suatu produk yang dapat memenuhi permintaan pelanggan dengan menggunakan pendekatan Kansei Engineering. Kansei Engineering adalah satu kaedah yang menggunakan pendekatan statistik untuk menganalisis perasaan kepuasan pelanggan dan memindahkan data untuk dianalisis ke domain reka bentuk. Kansei Engineering telah dibangunkan oleh Mitsuo Nagamachi di Hiroshima sekitar tahun 1970 oleh Jiao et al, (2009). Kaedah ini membolehkan tindak balas emosi pelanggan dikaitkan dengan produk atau perkhidmatan dengan sifat dan ciri mereka. Dalam kajian ini, pelajar dikehendaki mengenal pasti unsur-unsur bagi atribut / keperluan perkhidmatan. Salah satu elemen penting yang perlu dipertimbangkan ialah sifat / kehendak kepercayaan. Untuk tujuan ini, soal selidik diedarkan kepada para pelajar dan kakitangan untuk mendapatkan sifat / keperluan reka bentuk, emosi terhadap produk, dan sifat teknikal yang berkaitan dengan pembangunan produk dan kualiti. Proses Hierarki Analitik (AHP) digunakan untuk menentukan dimensi pembangunan produk dan kualiti.

ABSTRACT

Creating a product that highly fulfils the demand for customer satisfaction is often complicated and confusing. Customer satisfaction came from their feelings toward the product. Customer satisfaction came from their feelings towards the product. Also, this feeling of satisfaction is different between each person. This is because each person has their own demand in order to feel satisfied. Currently, those feeling of demand isn't possible to be recognizing a thoroughly scientific approach. This paper is about designing and developing a product that can fulfil customer demand by using Kansei Engineering approach. Kansei Engineering is a method that uses a statistical approach to analyse the customer feeling satisfied and to transfer the analysed data to the design domain. Kansei Engineering has been developed by Mitsuo Nagamachi in Hiroshima in around 1970s by Jiao et al., (2006). This method allows the customer's emotional response to being linked to a product or service with their properties and characteristics. In this study, a student is required to identify the elements for service attributes/requirements. One of the essential elements that should be taken into consideration is the trust attributes/requirements. For this purpose, the questionnaire is distributing to the students and staffs in order to elicit the design attributes/requirements, emotional toward the product, and technical attributes related to product development and quality. The Analytical Hierarchy Process (AHP) is used to determine the dimension of product development and quality.

DEDICATION

To the Almighty God, to my beloved parents, family, to all the fantastic people I've met along this journey. Thank you so much for your endless support.

ACKNOWLEDGEMENT

First of all, I would like to thank my parents for being very supportive. Their supports give me the strength to complete my project successfully.

I also would like to thank my beloved supervisor, Ts Dr.Omar bin Bapokutty. Without his support, I will never get through this project by myself. I appreciate his time for every consultations and progress.

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LIST OF ABBREVIATIONS

UTeM	-	Universiti Teknikal Malaysia Melaka
AHP	-	Analytical Hierarchy Process
WHO	-	World Health Organization
KE	-	Kansei Engineering
MCDM	-	Multi-Criteria Decision Making
WSM	-	Weighted Sum Model
WPM	-	Weighted Product Model
GDP	-	Gross Domestic Product
PFI	-	Priorities for Improvement
SD	-	Semantic Scale
KES	-	Kansei Engineering System
CPU	-	Central Processing Unit
MCDA	-	Multiple-Criteria Decision Analysis
PSM I	-	Projek Sarjana Muda 1
PSM II	-	Projek Sarjana Muda 2
SPSS	-	Statistical Package for the Social Science

CHAPTER 1

INTRODUCTION

1.1 Background

Years ago, the customer will only have the chances to choose products in the market which are already fully designed and produced by manufactures. The customers did not have the absolute authority to expressing their exact desire and requirement needed for a specific product as the former production strategy differs from current production strategy. The former production strategy means a strategy in which manufactures devise a new product manufacturing plan with their own decision and industrial designers' idea (Sun et al, 1999). The concept is a customer-orientated production strategy in which manufactures investigate customers psychological needs and desire positively and reflect the information in their production plan to catch up with "time to market" and fulfil customer satisfaction.

In order to satisfy customer preference and grab their attention towards product manufactured, a concept was founded thirty years ago at Hiroshima university named as Kansei engineering or Kansei ergonomic (Nagamichi,2002). It aims at the implementation of the customer's feelings and demands into product function and design. Nagamichi (1997) has demonstrated Kansei engineering on how ergonomic technology can be vital to produce new goods in tomorrow's world. It is a consumer-orientated technology that precedes product development. This is in direct contrast to the role ergonomics currently plays in improving poorly designed systems.

For this project, the Kansei Engineering methodology will be applied to the water bottle design. The study is conducted in order to define the most desired water bottle design among students and staffs considering parameters such as size, shape, colour, material and grip. The evaluation of the data will involve one type of Kansei Engineering method, which is a method of category classification to determine the most satisfying water bottle design among students and staffs in UTeM.

1.2 Problem Statement

On average, water consumption is 210 litres per capita per day, which is 27% higher than 165 litres per capita per day as recommended by World Health Organization (WHO), but Malaysians refuse to practice this habit hence it's proven according to New Vision, Dehydration is a leading cause of disease. Statistics show that at least 65% of Malaysians who work and frequently go out such as labours, students and travellers do not carry a water bottle due to few factors such as weight, laziness and etc. Basically, Nagamachi (1991) cited Kansei Engineering focuses on customers' feelings and needs, viz. Kansei, about a product and converts these ambiguous expressions of the product into detailed design, through a collection of techniques such as psychological assessment, statistical analysis or artificial intelligence, and graphics.

While, Zhai et al. (2007) mentioned that Kansei Engineering had been widely regarded as a useful tool for customer-orientated product development, which is able to translate the human Kansei into the product design elements. The first phase of product development and a base of product design is customer needs analysis. Research on the analysis of the needs of drinking bottles has been done by Solihin et al. (2017). In their study, it was found that the design of drinking bottle products should pay attention to the safety and price of the bottle. However, in their research, there is no user characteristics and design of the drinking bottles. The purpose of this research is to complete the previous research which is to find the characteristics of the users of drinking bottles

and how to design the drinking water bottle in accordance with the needs of the customer.

1.3 Objective

The purpose of this study is to identify the suitable water bottle design based on customer requirements to fulfil customer's satisfactory. The objectives of this study are as follow:

i. To identify the characteristics and attributes of water bottle design based on Kansei Engineering.
ii. To design a conceptual design of a water bottle that increases customer satisfaction by using the Analytic Hierarchy Process (AHP)

1.4 Scope

This project covers the water bottle design as a case study to be evaluated. The subjects involved in this study are randomly picked 100 UTeM students and staffs who will be as the respondents to answer the questionnaire prepared. Ten types of water bottle design from various brands will be studied and compared for the most desired bottle design and specification, which suits the requirements. Kansei words will be selected from various sources such as magazines and books and lastly evaluated in the questionnaire to be rated by 5-point scales for all the water bottle designs. Once the data is collected and classified into specific parameters, then the data will be analysed using the AHP method. Various parameters and methods of Kansei Engineering can be evaluated to be applied in this case study. However, the Analytic Hierarchy Process (AHP) will be used to obtain the customer's preference for the water bottle design. Finally, a new design for water bottle will be designed based on the analysis conducted as the final output of this project.

1.5 Significant / Importance of Study

The findings of this study will benefit the water bottle manufacturers to study customers emotions towards water bottle design. This experiment will provide the desired Kansei attributes for the water bottle design. Next, it is beneficial for future researchers to improve this study by selecting more Kansei attributes to indicate the best criterion preferred by customers when buying a water bottle. Thus, this will help the manufacturers to manufacture water bottle according to customers preference and able to increase the productivity of the company.

1.6 Project Report

The report is divided as follows into five chapters:

Chapter 1: This chapter introduces the project which includes this project's background, statement of problems, objective and scope.

Chapter 2: This chapter describes the review and theory of literature related to this project and any previous research that may assist in supporting this research.

Chapter 3: This chapter explains how this investigation was conducted by method, process and step.

Chapter 4: This chapter explains the outcome and discusses the result obtained.

Chapter 5: This chapter concludes the test result and provides recommendations for future study.

CHAPTER 2

LITERATURE REVIEW

This chapter will explain the literature review with respect to this study. All the findings and collection of information regarding the topics which include the product development and quality will explain in this chapter. A literature review is a phase of finding previous research and related technical papers that are related to the project. It defines the process of searching related study, collects the information, analyzes the information to the detailed scope and determines the conclusion. In addition to that, the literature review evaluates other people studies to find related works and methodology with the current study.

For this chapter, in the study that was made on several related topics. Past studies were made for product development and quality evaluation using Kansei Engineering by applying MCDM methods. Most of the studies were made by using a different approach of MCDM such as SERVQUAL, weighted sum model (WSM), weighted product model (WPM) and Analytic Hierarchy Process (AHP).

2.1 Kansei Engineering

There is a decrease in the gap between the information system and the feelings of human according to an approach that is referred to in Kansei engineering. Initially, Kansei engineering was referred to as an ergonomic technology to capture consumers perception of product design. Kansei

engineering was defined as a translating technology of a user's feeling of the product based on design elements, according to Nagamachi(1995). The word 'KANSEI' means the experience of people in their mind or a psychological feeling in Japanese, according to Nakada (1997). As shown in Figure 2.1, Kansei can be defined as human subjective perception which is generated by interactions between impression and cellular functions.it is the impression someone gets from the environment, situation using all the human senses such as smelling, hearing, eyesight, feeling, taste Nagamachi (2001). Kansei engineering is and ergonomic method and design strategies for affective design to satisfy the consumers feel. By using this method, the product produced will be able to fulfil all the needs of their customer and to simplify it, Kansei engineering can be said as a technology that translates human feeling into a product.

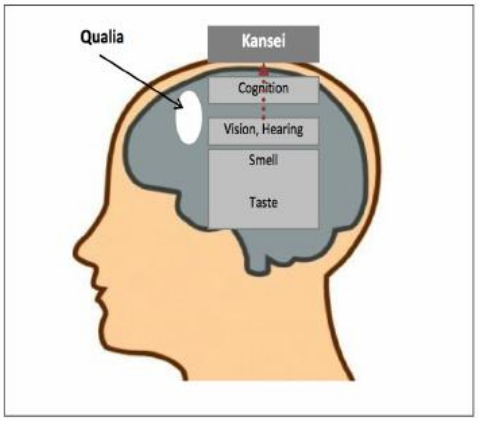

Figure 2.1 The Process of Kansei (Lokman & Nagamachi,2009)

2.1.1 Pioneer/ History

The concept of Kansei Engineering was first founded and proposed by Nagamachi in the year 1974.He was the one who predicted there would be a change from mass production to the generation of merchandise, satisfying an individual customer in the market (Choi and Jun, 2007).The terminology of "Kansei Engineering" is an idea of Yamamoto in the year 1986 at Mada

Motors. He used some systematic process in designing automobiles that satisfies the needs and taste of customers, and it was also called emotion engineering. The term was first declared by Nagamachi in 1988 as a unique science sphere which includes all the technique including desirable features of a product through the eyes of customers.

2.1.2 What is Kansei?

The Japanese articulation Kansei is hard to decipher. It implies roughly "complete feelings", however, that does not entirely clarify it is significance in truth, not more than most. Kansei is the impression someone gets from specific antiquity, condition or circumstance utilizing the majority of their faculties of sight, hearing, feeling, smell, taste just as their acknowledgement (Schutte and Eklund, 2003). To investigate the thinking behind why Kansei Engineering is turning into an undeniably vital instrument to use in Product Design, the examination is made of the rate with which new items entering the commercial centre are getting to be adult, due to a shorter lifecycle and expanded challenge (Schutte and Eklund, 2003).

Organizations currently need to take a gander at elective answers for improving turnover, as fast model changes, specialized updates or value decrease are never again satisfying client prerequisites. Numerous clients, in these high-decision commercial centres, settle on their official choice unwittingly and dependent on rather emotional components. They buy the item, which "feels" better, and are regularly unfit to clarify why. Taking this "feeling" into the record as of now in the plan procedure can give considerable selling advantage. Kansei Engineering is an approach for methodically investigating people groups "sentiments" about an item and making an interpretation of them into plan parameters (Schutte and Eklund, 2003).

Kansei Engineering is versatile to a broad scope of item applications depicts how Professor Nagamachi clarifies the two bearings of 'stream' (Jordan, 2002). One of which is 'from

plan to finding'. This includes controlling individual parts of an item's formal properties so as to test the impact of the change on clients' general reaction to the item. This method has been utilized to aid the structure of a different scope of items. Kansei is regularly utilized as a component of different strategies and practices. This is frequently performed in the Define Phase of a Lean Six Sigma Project and progressively regular in Design of Six Sigma and even TRIZ ventures. The other is from 'setting to plan' which includes taking a gander at the situations and settings in which the item is utilized and after that reaching determination about the ramifications of this for the structure (Steven, 2008). This second heading of the stream includes the get-together of personal information by means of field perceptions. For this situation, the information is utilized to help set up the connection between the formal properties of a plan and the advantages related to the item. In this examination, the essential centre is the 'structure to determination's course of Kansei Engineering.

2.1.3 Stages of Kansei

The decision of Domain is the place the item/administration is characterized, including the detail of the item and components, for example, the objective market or gathering. Related items, tests, potential ideas and thoughts are likewise gathered. The area is characterized as generally as conceivable considering existing procedures just as ideas, which have not yet been created or made. Traversing the Semantic Space is a three-advance procedure, which characterizes the Kansei words to be utilized later in the model. Stage one is accumulation of words depicting the item type picked, stage two determination of the words with the most elevated effect on the clients mind, stage three, choice of the Kansei words relying upon vital contemplations spreading over the Space of Properties is gathering a rundown of physical properties, for example, weight, shading and size. Significant properties are featured, and tests for each of these are accumulated.

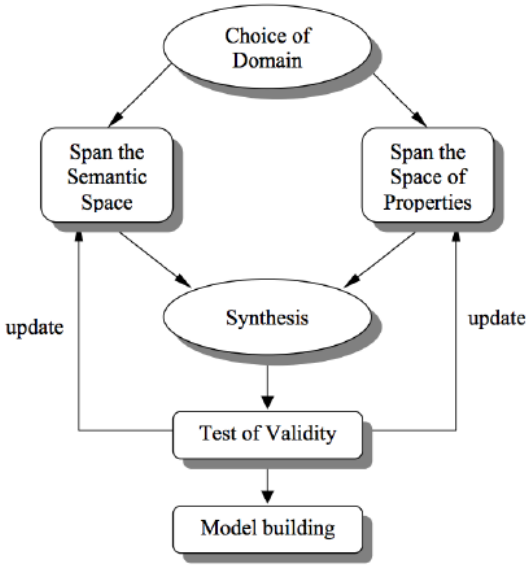

Figure 2.2 Model of Kansei Engineering (Schütte et al. 2008)

2.1.4 Procedures of Kansei Engineering

There are three main styles of Kansei Engineering system; Type I, II and III as shown in Figure 2.2. Type I Kansei Engineering implies Category Classification from zero-to nth-classification. Type II utilizes the computer framework and Type III uses a numerical model to reason the fitting ergonomic plan (Nagamachi, M. 1995).

Table 2.3 Types of Kansei Engineering

Kansei Types	Methods
Type I	Category Classification
Type II	Kansei Engineering System (Computer-aided system)
Type III	Kansei Engineering Modelling (Mathematical framework)
Type IV	Hybrid Kansei Engineering (forward and backward reasoning)
Type V	Virtual Kansei Engineering (Combination of Virtual Reality and Kansei Engineering)
Type VI	Collaborative Kansei Engineering System

2.1.4.1 Type I: A Category Classification

The Category Classification is a strategy in which a Kansei classification of an item is separated in the tree structure to get the plan subtleties. Following is a genuine case of the use of Kansei Engineering Type I. A Japanese car maker, Mazda has built up another games vehicle named "Miyata" which was gotten from Kansei Engineering. Nagamachi educated Kansei Engineering to Mazda. The director, Mr Kenichi Yamamoto, has much enthusiasm for this new ergonomic innovation (Yamamoto, 1986).

From that point forward, in Mazda, Kansei Engineering has turned into a significant innovation for new item improvement. Mr Hirai, an administrator for a spic and span vehicle, chose to execute Kansei Engineering in "Miyata" advancement and settled the zero-level classification of the new vehicle "Human-Machine Unity (Jinba-Ittai in Japanese)" after discourses with his venture group. This idea infers that a driver feels a unification between oneself and the vehicle when driving. The driver feels that his or her body may be the vehicle and controls the machine with his or her very own expectation unreservedly (Nagamachi, M. 1995).

Human-Machine Unity is only the idea of another vehicle and informs nothing regarding the vehicle structure, for example, motor qualities, vehicle estimate, etc. In Kansei Engineering Type I, the zero-dimension idea ought to be separated into obviously critical subconcepts to get the structure subtleties. The individuals from the task group began to arrange the zero-dimension idea to the subconcepts, that is, first, second . . what's more, nth subconcept until they acquired the vehicle structure particulars. The methodology of Type I has appeared in Table 2.3. With respect to", "the zero Kansei level was grouped into four subconcepts in the first dimension; "Tight-feeling", "Direct-feeling", "Quick inclination" and "Correspondence". "Tight-feeling" suggests "fitting near the machine" and "not expansive nor little". With this subconcept, the group

chose that the vehicle length would associate with 4 meters. It wound up 3.98 m in the wake of examining its suspension length. When they mounted four sheets inside the vehicle, the shopper's inclination was "thin" and this subconcept did not coordinate "Tightfeeling" (Nagamachi, M. 1995)

In this way, the group planned the vehicle-mounted with two sheets. This clarifies how the Type I methodology of exchanging the subconcepts to the plan subtleties, as appeared in shows a piece of a stream as to "Tight-feeling". In the event that the group couldn't get the plan subtleties, it should proceed with the arrangement to second, third... nth dimension. At the point when the group realized the bits of the vehicle plan, it analyzed the structure subtleties minutely as far as the car building. In this stage, the group made a lot of new licenses. Through the technique of Kansei Engineering Type I, Mazda has prevailed with regards to building up the new game's vehicle, "Miyata", which is classified "Eunos Roadster" in Japan and has been a decent merchant in the U.S. just as in Japan. After this achievement, Mazda and its subcontractors have been using Kansei Engineering Type I as the central innovation for vehicle improvement (Nagamachi, M. 1995) as ahown in figure 2.4 and 2.5.

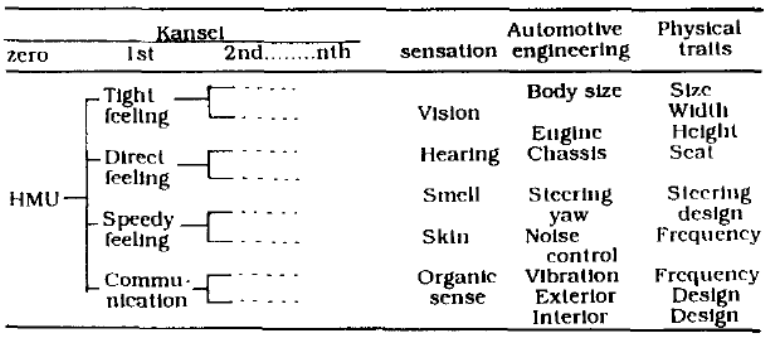

Figure 2.4 The translation of Kansei into car physical traits in the case of "Miyata" (Schütte et al. 2008)