



UNIVERSITI TEKNIKAL MALAYSIA MELAKA

A STUDY AND ANALYSIS OF CONSUMER PRODUCT DESIGN USING THE INTEGRATION OF KANO MODEL AND QUALITY FUNCTION DEPLOYMENT: CASE STUDY

**This report submitted in accordance with requirement of the University Teknikal
Malaysia Melaka (UTeM) for the Bachelor Degree of Manufacturing Engineering
(Manufacturing Management) with Honours.**

by

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ABSTRAK

Tujuan kajian ini adalah untuk mengenal pasti kualiti produk dan ciri-ciri produk utama berdasarkan kepuasan pelanggan melalui Kejuruteraan Kansei (KE) dan Model Kano (KM) dengan Quality Function Deployment (QFD). Dalam kajian ini, 3 aspek reka bentuk telah dipertimbangkan untuk pembangunan produk, seperti perasaan emosi, ciri-ciri, dan keperluan teknikal. Terdapat 2 kaedah yang digunakan dalam kajian ini, iaitu temu bual dan soal selidik. Dalam kajian ini, terdapat 509 responden terlibat untuk menjawab soal selidik yang mengandungi 8 botol reka bentuk syampu, 6 kata-kata yang mewakili kualiti emosi berdasarkan Kansei Words, dan 6 soalan kategori Kano berdasarkan keadaan “Functional” dan “Dysfunctional”. Hasil kajian ini, menunjukkan bahawa kebanyakan responden menyuarakan reka bentuk syampu botol sebagai "AC" (janggal vs selesa). Manakala reka bentuk yang paling digemari adalah reka bentuk no.4, dipilih oleh 239 responden (14%). Reka bentuk ini dinilai oleh responden sebagai cenderung kearah selesa, dengan skor purata 4.79. Di samping itu, dengan mengintegrasikan Model Kano ke Kualiti Fungsi Pertukaran produk, ciri-ciri produk dan dimensi kualiti yang boleh ditentukan untuk penambahbaikan. Hasil kajian menunjukkan bahawa "K2" (mekanisme keluar ke arah cecair di dalam botol syampu) adalah yang paling utama untuk penambahbaikan. Ini mempunyai hubungan yang signifikan dengan ukuran ketinggian produk. Manakala berdasarkan latar belakang responden, kajian ini mendapati pilihan responden terhadap syampu botol berdasarkan keamatan menggunakan syampu (yang adalah 2 hingga 5 kali sehari), isipadu (iaitu 250 hingga 500 mm), tebal (iaitu 40 hingga 60 mm), ketinggian (iaitu 160 hingga 200 mm) dan lebar (iaitu 60 hingga 80 mm). Menariknya, responden juga memilih untuk penutup botol dengan mekanisme “press pump” bukannya reka bentuk “flip top”.

ABSTRACT

The purpose of this study is to identify the quality of the product and the key product features based on customer satisfaction through the Kansei Engineering (KE) and Kano Model (KM) with Quality Function Deployment (QFD). In this study, 3 design aspects were considered for the product development, such as emotional feeling, characteristic attributes, and technical requirement. There were 2 surveys method used in this study, which are interviews and questionnaires. In this study, there were 509 respondent were involved to answer the questionnaires developed contains of 8 shampoo bottle design, 6 words representing emotional quality based on Kansei Words, and 6 Kano category questions towards Functional and Dysfunctional condition. The survey results show that mostly of respondents articulated the proposed of shampoo bottle designs as “AC” (Awkward vs. Comfortable). While to the most preferable design was on design no.4, which is 239 respondents (14%). This design is valuing by the respondents as tend to the comfortable, with average score is 4.79. In addition, by integrating the Kano Model into Quality Function Deployment product, the product features and quality dimensions can be determined for the improvement taken. The result shows that the “K2” (in-out mechanism toward liquid inside the shampoo bottle) is the most priority attributes. This is having significant correlation to the height dimension of products. Towards to the respondents’ background, this study found the preferences of respondents to the shampoo bottle is based on the intensity of using the shampoo (which is 2 to 5 times per day), the volume (that is 250 to 500 mm), the thickness (that is 40 to 60 mm), the height (that is 160 to 200 mm), and the width (that is 60 to 80 mm). Interestingly, the respondents were also preferred to the bottle with cap by the “press pump” mechanism rather than “flip top” design.

DEDICATION

*This thesis is dedicated to my parents,
Abd Rahim B Yahya and Buziah Bt Alias
For their endless love, support and encouragement*

And

*For my families and friends
Thanks for their loves and caring.*

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LIST OF ABBREVIATION

A	-	Attractive
AHP	-	Analytical Hierarchy Process
CR	-	Customer Requirement
CS	-	Satisfaction
DS	-	Dissatisfaction
FA	-	Factor Analysis
GRA	-	Grey Relational Analysis
HOQ	-	House of Quality
I	-	Indifferent
KE	-	Kansei Engineering
KES	-	Kansei Engineering System
KW	-	Kansei Word
M	-	Must-be
O	-	One Dimensional
Q	-	Questionable
QFD	-	Quality Function Development
R	-	Reverse
SD	-	Semantic Differential
VOC	-	Voice of Customer

CHAPTER 1

INTRODUCTION

1.1 Project Background

Today's, more companies are using satisfaction as an indicator of performance evaluation towards products and services as well as an indicator of the company's future. According to Nassezadeh *et al.*, (2008:151), this is due to customer satisfaction has been becoming the most important factor in today's highly competitive business world where the customer is one of the most important elements of the company's intangible assets. This means that since the customer satisfaction is common interest of many leading companies around the world (where the customer satisfaction is seen as a key differentiator and be a key element of business strategy), customer satisfaction is therefore as one of the key factors in modern marketing and customers' behavior analysis. For instance, by the growing competition, increased customer awareness, as well as legislation to protect consumers, stated that the providers of goods and services should have to ensure customer satisfaction and pay prompt attention to any dissatisfaction. If the customers dissatisfy, they will most probably switch to a different brand which will then lead to negative advertising (Nassezadeh *et al.*, 2008:151).

In facts, the way to satisfy today's customers are much more difficult task than previously due to the customers by now, however, has lots of various kinds of options (Vazifehdoust *et al.*, 2012:130). Although numerous definitions and methodologies have been created with many different techniques and concepts evolved to improve product or service quality, there are three common quality-related functions within a business. First, related to satisfaction that become more

depends on several variables, both psychological and physical satisfaction behavior, such as return and recommend rate. Second, the levels of satisfaction that varies and depends on other options to customers can have about the products. Third, satisfaction that varies from person to person and product or service to a product or service since customer satisfaction is the articulation and the manifestation of the abstract expectation of customers. Therefore, if we believe that the most strategic part of business strategy is the plans and activities made for attracting, retaining and promoting customers to make them loyal, according to Vazifehdoust *et al.*, (2012:130) την της κερ χονχεπτιονσ οφ πλαννινγ, οργανιζινγ, σεγμεντατιον, ταργετινγ, ποσιτιονινγ σηουλδ βε χονσιδεδ ασ α μεανσ οφ μεετινγ της χυστο ομερσ εξπεχτατιονσ; ιφ τηρε ισν τ ανψ χυστομερ, τηρε ωουλδν τ βε ανψ βυσινεσσ . Χονσιδερινγ ον της ωιεω, αχχορδινγ το Μχθουιτψ *ετ αλ.*, (2000:1), α χυστομερ ωιλλ λεαρν φρομ εξπεριενχε ιν ωηιχη της δεχρεασινγ λεω ελσ οφ εξπεχτατιονσ–δισινφορματιον αγαινστ γοοδσ ανδ σερπιχεσ σηουλδ α φφεχτ χυστομερ σατισφαχτιον.

Ιν αδδρεσινγ ον της ισσυε, της δεγρεε οφ σατισφαχτιον περτινεντ το θυαλιτ ψ ιν ωηιχη α προδυχτ ορ σερπιχε χονφορμσ το α σετ οφ πρεδετερμινεδ σταנד αρδσ, ρεφερσ το Αδαμ *ετ αλ.*, (1981), της χηαραχτεριστιχσ ρελατεδ τηατ δετε ρμινε ιτσ ωαλυε ιν της μαρκετπλαχε ανδ ιτσ περφορμανχε οφ της φυνχτιον φ ορ ωηιχη ιτ ωασ δεσιγνεδ σηουλδ βε δεφινεδ ανδ φυστιφιεδ. Ον της, Ηαρρη *ετ αλ.*, (2010:5) στατεδ αβουτ θυαλιτψ ισ ασ α περχεπτουαλ, χονδιτιοναλ ανδ σομεωιατ συβφεχτιωε αττριβυτε. Σπεχιφιχαλλψ, Μειροπιχη *ετ αλ.*, (2007:242–243) στατεδ τηατ της δεσιγν θυαλιτψ ισ της δεγρεε το ωηιχη α προδυχτ ορ σερπιχε δεσιγν (σπεχιφιχατιον) φιτσ χυστομερ νεεδσ ανδ εξπεχτατιονσ, ωηιλ ε χονφορμανχε θυαλιτψ ισ της δεγρεε οφ ματχη βετωεεν της φεατυρεσ οφ α σ πεχιφιχ προδυχτ (σερπιχε) and its specification. This is the customers' expectation that is focused on the specification quality of a product or service, or how it compares to competitors in the marketplace. So, the company might measure the conformance quality, or degree to which the product or service was produced correctly meets the specification. Hsu and Cai (2009:5) said that when customer satisfaction is modeled as a function of disconfirmation arising from discrepancies

between prior expectations and actual performance, then the expectations as a critical antecedent of satisfaction becomes a determinant of attitude.

From the product development perspectives, the subject to process development, underline about the design information transformed and accumulated is as very important in the developing a good product that has a stronger market competence. By doing in effectively manner which led to a deeper understanding of how to gather and use information about the customer in the design, testing, launch, and management of new products (Dahan & Hauser, 2001:179), the development process can be optimized and the design information can be accumulated well, beside the improvement of the concurrent degree, product quality and cut development cost and time. This means that companies must bring products/services to market in a timely manner with adequate levels of quality in all dimensions of interest to the customer. Since feelings and impressions of a product are important for the purchasing decision, designing attractive products requires knowledge about the feelings and impressions of the products evoke on the customer and the user.

On this issue, meet the individual needs of each customer through the customization of products is a problem for the designer to optimize the design of the product. Therefore, to face the market challenges, the customer product design must cover a larger scope and highlight the added value to customers. By this new paradigm, according to Jiao and Tseng (2004:745), enables the company to the higher profit margins, better and improved customer satisfaction, as well as high-value added business opportunities due to a maximum of customer-perceived value while exploiting the potential of design that generate a huge amount of variety. On this, according to Du *et al.*, (2006: 396), *“customer value analysis not only empowers customers to express their preferences for various product features explicitly, but it also facilitates the company’s justification of different customization solutions.”*

1.2 Problem statement

Customers have an expectation about the product quality. If they are actually more experienced than their expectations, then they will feel satisfy. If not, then they will

feel not satisfy. Therefore, satisfaction is a tool to measure in each field of people's feelings of product quality where the product emotion has been recognized as the primary aspect of consumer's satisfaction and market success (Nagamachi, 2002). This is shown as where for many years, Japan has always been ahead of other country in developing new and innovative product. Their successes heavily rely on their sensitiveness to the demand of the consumers' implicit needs, *i.e.* the Kansei, via the implementation of technology KE.

Therefore, to determine the essence of product development as the process of creation, utilization, and exploitation of design knowledge that has become an increasingly important in translating voice of customer (customer expectation) into design parameters (which is to guide the product design by extracting quality criteria for evaluating through quantitative values are actually mimic a non-linear relationship between

περφορμανχε οφ θυαλιτψ αττριβυτεσ ανδ οπεραλλ χυστομερ σατισφαχτιον), αχχορδινγ το Ελλιοτ ανδ Σμιτη (2010), ιτ σηουλδ αδδρεσσ τηε λαχκ οφ υνδε ρστανδινγ τοωαρδσ τηε χηαραχτεριστιχσ φυνχτιον ασ α σεμαντιχ γαπ. Τηε ψ σηουλδ βε χαρριεδ ουτ ωηεν εξπλορινγ χυστομερ ρεθυιρεμεντσ τηατ ρεθυι ρε α μινιμιζινγ ανψ βαρριερσ το προδυχτ δεσιγν υνδερστανδινγ βασειδ ον χυ στομερ εμοτιοναλ / feelings. This is due to how determine linguistic variables or linguistic preference relations rather than numerical ones into the quantitative expressions may sometimes vague the preference degree of one alternative over another, and they cannot estimate preferences with exact numerical values.

On this issue, first, although QFD is a unique tool that allows a company to plan and design products to meet customers' needs (Rawabdech *et al.*, 2011), brings various advantages to companies due to reduced product development cycle time, fewer start-up problems, and customer satisfaction and probably the most important management tool developed to assure quality in new or improved product (Han *et al.*, 2010) which stresses on cross-functional integration based on their structured approach to seek out customers, understand their needs and ensure that their needs are met, QFD is, in fact, a complex and time-consuming process requiring a lot of detail (Brodie, 1994; Shen, 1994; Zairi & Youssef, 1995), due to this method seems

tends to create huge matrices where to perform QFD manually within a large matrix can be prone to errors (Han *et al.*, 2010:800) and difficulties in practice.

Second, in the traditional importance adjustment technique, the relationship between customer satisfaction improvement and importance increment ratio is treated as linear. It is assumed that a certain percentage of customer satisfaction improvement can be achieved by increasing the importance of the product in the production process. In fact, it may not be true under real circumstances. It is correct that a certain percentage of customer satisfaction improvement can be achieved by increasing the importance of the product in the production process, but the relationship is not a simple linear one. For some customer attributes, customer satisfaction can be greatly improved; while for some other customer attributes, customer satisfaction can only be slightly improved when the importance of the product in the production process is increased.

Third, since QFD has been an important tool to translate the voice of the customer (VOX) into product specifications and quality improvement around the World (Akao, 1990; Clausing, 1994; Cohen, 1995), basically, in the QFD, the main objectives and targets are on how and what customer needs translated into design attributes. The facts, although QFD is a customer-oriented approach by supporting design teams in developing new products based on an assessment of customer needs where the design attributes are then deployed in process and quality requirements, it is obviously seen that most of the traditional techniques that aimed to find the relative importance between requirements, including QFD, assume that customers have previous knowledge about the product and its attributes (Deszca *et al.*, 1999). This condition could be hindering the introduction of innovations. Especially, when customers may not be able to express their opinion of whether a particular product or a particular feature of a product fulfils their needs (Shen *et al.*, 2000:92).

As for Kano Methods, the current applications of the Kano model are mostly qualitative in nature (Berger, 1993). Most of them are focused on the benefits of using this method and the managerial implications from the model. An important issue in Kano analysis is the evaluation of Kano categories with nearly equal number of occurrences (Berger, 1993). The most frequent observation approach works well when one response dominates the sample, that is, when the frequency of the mode is much greater than any other characterization. However, as the difference between the frequencies of two classifications gets narrower, proper classification of the requirement becomes less clear. As a result, it becomes difficult to label that CR with a definite Kano category.

First, this is due to, according to Chen (2012), Kano Method is too complex and difficult to implement in real world situations. Therefore, the regression methods are required to provide a more analytical view to their non-linear relationships. Second, the ignoring of moderating effect on fulfillment the relationship between attribute performance and customer satisfaction in variable regression that could fail to produce

αχχυρατε χλασσιφιχατιονσ. Ηερε. Ξυ ετ αλ., (2007) στατεδ τηατ (τραδιτιονα λ) Κανο μετηοδ ισ ιναδεθυατε ιν θυαντιτατιππε επβαλυατιον ανδ ιτ λαχκσ πρ οπερ χριτερια φορ ρεθυιρεμεντ χλασσιφιχατιον. Αχχορδινγ το Χαρριλλατ ετ αλ., (2009:157), σινχε τηε ρεσπονδεντσ αρε αλλοωεδ το χηοοσε ανψ χομβινα τιον οφ τηε ανσωερσ φορομ τηε φυνχτιοναλ ανδ δψσφυνχτιοναλ σιδεσ, τηερεφ ορε τηε ανσωερσ μαψ παρψ α λοτ βεχαυσε τηε ρεσπονδεντσ αρε δριπεν βψ δεμογραπηιχ φαχτορσ. Ιν αδδιτιον, ιν τερμσ οφ Κανο σ μοδελ οφ χυστομερ σατισφαχτιον, τηε ωορδ ισ ον τηεψ δελιγητ τηε χυστομερ . Τηισ επολωδεσ ιντο μυστ βε ρεθυιρεμεντσ ωηιχη μεανσ τηατ οργανιζατιονσ ορ χομπανιε σ νεεδ το βε χοντινυαλλψ αλερτ το νεω οππορτυνιτιεσ “to delight” (Leece & Muldoon, 2009). Third, there is also a possibility that the users of Kano model are usually cannot find attractive or one-dimensional quality due to ill-designed questionnaire, ill-defined quality attributes or lifecycle of quality attributes. This condition will, in many ways, affect the result from the questionnaire and this would

make the result to be inaccurate and unusable for the analysis later (Chen *et al.*, 2008).

In addition, since the assumption that there is a linear relationship between attribute performance and customer satisfaction, what may lead to wrong decisions about which attributes should be improved or offered to increase customer satisfaction (Huiskonen & Pirttila, 1998; Tontini & Silveira, 2005), there are some requirements should be considered and articulated through the measurement that bring more satisfaction than others.

Τηρεφορε, ιτ ισ περψ ιμφορταντ το δετερμινε ωηιχη ρεθυιρεμεντς οφ α προδ υχτ βρινγ μορε σατισφαχτιον τηαν οτηερς. Ηοωεπερ, υνδερστανδινγ χυστομ ερς πνεεδσ μαψ βε α χηαλλενγε φορ ΘΦΔ δυε το προβλεμς συχη ασ ιν χαπτυ ρινγ, υνδερστανδινγ, ανδ οργανιζινγ τηεσε ινπυτς. Το ιμφορτε ιτς αβιλιτυ το ρεχογιζε χυστομερς εξπεχτατιονς, βψ ασσοχιατινγ Κανοπς μοδελ το ΘΦ Δ γιπε α υνιθυε ωαψ οφ ιδεντιφινγ χυστομερ ρεθυιρεμεντς ιν μορε δετ αιλ β ψ ασσιγνινγ διφφερεντ χατεγοριες το διφφερεντ ρεθυιρεμεντς, ανδ χουλδ προ ωιδε μορε αχχυρατε ςΟΧ ασ αν ινπυτ το ΘΦΔ αναλψσις. Ηερε, τηε πρινχιπλ ες οφ Κανσει Ενγινεερινγ ινωολπε τηε θυαλιτυ φεελινγς αρε ρεθυιρεδ το συ ππορτ βοτη οφ θυαλιτατιπε ανδ θυαντιτατιπε αππροαχη το χυστομερ σατισ φαχτιον ασ ωοιχε οφ χυστομερ βασειδ ον χηαραχτεριστιχς ανδ αττριβυτες ο φ προδυχτς δελιωερεδ, ωηερε αν εξτενδεδ μοδελ οφ υσινγ ΘΦΔ ιν δετερμινινγ τηε φυλφιλλμεντ λεωελς οφ χυστομερ σατισφαχτιον ιν τηε σταγε οφ προδυχτ δεσιγν ρεθυιρες τηε χονχεπτ οφ φυζζψ σετς το αδδρεσσ τηε ιμπρεχισενεσσ ο φ εωαλυατινγ τηε ρελατιονσηιπς βετωεεν χυστομερ ρεθυιρεμεντ ανδ δεσιγν ρεθυιρεμεντς. Φορ αν εξαμπλε, ιν τηε εωαλυατιον οφ αεστηετιχς διμενσιον τηατ ις συβφεχτιπε ανδ ηιγηλψ ινδιωιδυαλιστιχ ωηερε τηε εωαλυατιον τηα τ αρε βασειδ σολελψ ον μεαν σχαλε ρατινγς, ωιτηουτ χονσιδερινγ ωαριατιον ιν χυστομερ εωαλυατιονς, ις νοτ αππροπριατε (Χηεν, 2008:668).

By using Kansei Engineering, some condition attributes are defined on preference-ordered scales and the decision classes are preference-ordered (Zhai *et al.*,