APPLICATION OF QUALITY FUNCTION DEPLOYMENT IN MULTIMEDIA INTEGRATED TELEPHONE KIOSK DESIGN

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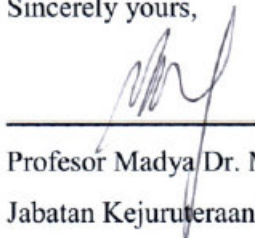
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To my beloved husband, daughter, son, mother, father, siblings.

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ABSTRACT

To develop customer-oriented and higher-quality kiosk is vital due to its demand in the market. The Quality Function Deployment (QFD) has been applied in designing and developing of Multimedia Integrated Telephone Kiosk (MiTeK). This thesis outlines the QFD technique of the MiTeK planning which was carried out in completing the research. The survey of customer demands, requirements and needs had been conducted in establishing the Voice of Customers (VOC). The study also establishes the House of Quality (HOQ), which stipulates several customers' requirements of MiTeK, consisting of 'MiTeK design', 'ergonomic design', 'product appearance', 'endurance material', 'ease of use', 'waterproof material', and 'attractive image'. MiTeK product design planning matrix of QFD was developed based on the captured Coice of Customers (VOC). The requirements were translated and recommended as generic design requirements for kiosk design dedicated for Malaysian users. HOQ results and design validations were conducted accordingly, by gathering experts opinion and conducting three (3) dimensional simulation test. Further work of study was proposed for further task enhancement of the whole phases of QFD and data accuracy.

ABSTRAK

Bagi menghasilkan kiosk yang bersifat 'customer-oriented' dan mempunyai kualiti produk yang tinggi adalah mustahak berdasarkan kepada permintaan yang tinggi di pasaran . *Quality Function Deployment* (QFD) merupakan proses utama yang digunakan dalam applikasi rekabentuk dan pembangunan *Multimedia Integrated Payphone Kiosk* (MiTeK) . Tesis ini membawa garis panduan teknik QFD dalam perancangan MiTeK yang dilakukan bagi melengkapkan kajian ini. Pengukuran tahap permintaan pengguna, kehendak-kehendak dan juga keperluan-keperluan para pengguna telah dijalankan dalam mengukuhkan '*Voice of Customer*' (VOC). Kajian ini juga diperkukuhkan dengan memperkenalkan dan meletakkan syarat yang memenuhi kehendak pengguna yang meliputi 'rekabentuk MiTeK', 'rekabentuk ergonomik', 'penampilan produk', 'ketahanan produk', 'mudah dipakai', 'bahan kalis air' dan juga mempunyai 'imej yang menarik'. Seterusnya, matrik perancangan produk MiTeK telah diwujudkan berdasarkan VOC yang telah diperolehi. Keperluan-keperluan ini turut ditafsirkan dan dianjurkan sebagai satu panduan yang '*generic*' bagi rekabentuk kiosk khusus untuk rakyat Malaysia. Hasil keputusan *House of Quality* (HOQ) dan rekabentuk telah disahkan dengan mendapatkan pandangan-pandangan pakar dan dengan menjalankan ujian simulasi secara tiga (3) dimensi. Kerja-kerja selanjutnya telah dicadangkan untuk menambah perincian terhadap kesemua peringkat proses QFD dan ketepatan data.

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LIST OF SYMBOLS

AS$	-	Australia Dollar
£	-	Pound Sterling (British Pound)
¥	-	Yen
US$	-	United States Dollar
RM	-	Ringgit Malaysia
mm	-	millimeter

LISTS OF ABBREVIATION

3D	3 Dimensional
ADSL	Asymmetric Digital Subscriber Line
BT	British Telecom
CAD	Computer Aided Design
DOE	Design of Experiment
FMEA	Failure Mode Effects Analysis
HOQ	House of Quality
ICT	Information, Communication and Technology
ID	Industrial Design
IT	Information Technology
ITU-T	International Telecommunication Union
KDD	Kokusai Denshin Denwa Corporation
LAN	Local Area Connection
LCD	Liquid Crystal Display
MiTeK	Multimedia Integrated Telephone Kiosk
MMS	Multimedia Messaging Services
NTT	Nippon Telegraph and Telephone
PC	Personal Computer
HOQ	House of Quality
FMEA	Failure Mode Effects Analysis
DOE	Design of Experiments
PDA	Personal Digital Assistant
ADSL	Asymmetric Digital Subscriber Line
EQIP	Engineering Quality Improvements Program

KDD	Kokusai Denshi Denwa
ICL	International Computer Limited
MMS	Multimedia Messaging Service
BT	British Telecom
NTT	Nippon telegraph and telephone
PDPC	Process Decision Program Chart
QFD	Quality Function Deployment
SMS	Short Messaging Services
SQC	Substitute Quality Characteristics
TFT	Thin Film Transistor
VOC	Voice of Customer
WI-FI	Wireless Fidelity
Wireless LAN	Wireless Local Area Connection

LIST OF TERMINOLOGIES

Affinity Diagram (KJ Method) - Affinity Diagram is a tool that gathers large amounts of language data (ideas, opinions, issues) and organizes them into groupings based on their natural relationships.

Interrelation Diagram - The interrelation diagram shows cause-and-effect relationships between different aspects of a complex situation in order to find an appropriate solution.

Tree Diagram - Tree diagram breaks down broad categories into finer and finer levels of detail, helping move thinking step by step from generalities to specifics.

Matrix Diagram - Matrix Diagram method clarifies problematic spots through multidimensional thinking.

Planning Matrix - Planning Matrix illustrates customer perceptions observed in market surveys. Includes relative importance of customer requirements, company and competitor performance in meeting the requirement.

Performance Benchmarking - Performance benchmarking was defined as

Set Target - Target is the goal for the Substitute Quality Characteristics

LIST OF APPENDICES

CHAPTER 1

INTRODUCTION

1.1   Background

The demand for public kiosks usage in the market is growing fairly rapidly and well accepted by users alike due to their functionality and ability to fulfill various tasks especially in various self-service business purposes.   Information kiosks, online kiosks or public access kiosks predate the recent growing interest in e-commerce (Rowley, 1995). For example, the small size of many self-service kiosks offer space-constrained organizations commonly used in disposal of products such as foods, car park tickets, car park ticketing payments, cash and so forth.   Such evolution enables flexible sales strategies that provide self-service terminals. Critically, in a highly competitive and difficult trading environment, the self-service model fundamentally changes the total cost of sale. Also, new generation of self-service technology is by far more usable and reliable. Early kiosks, such as those reviewed by Rowley (1995) were typically uninteresting boxes with relatively simple interfaces, designed specifically to allow customers to conduct simple transactions, such as placing an order, or locating a specific item of information. Online kiosks are seen to offer significant potential as alternative to mobile technologies in retailing,

information provision service delivery (Rowley and Slack, 2003). Current lifestyle of today, public kiosks are the alternative to mobile technologies for the consumer away from fixed technology in homes or workplaces such as the fixed line phone, desktop and internet (Rowley and Slack, 2003).

Quality design of a telecommunication kiosk would be a strong keyword to explain the satisfaction because a quality telecommunication kiosk could meet a defined customer needs and demands, satisfy the customer's expectations and provide value for money (Urban and Hauser, 1980). Experienced of companies' failure are commonly occurred due to neglect to understand the customer's wants and needs. At this point, users' wants and needs are important goal to achieve. Otherwise, customer's dissatisfaction could be very high. A research by Hepworth (1997) showed that 8.5 percent of revenue was at risk from customer dissatisfaction. This situation in fact, could be worse because many customers seldom complain when a product's quality is not up to their expectations. As a result, it could encourage customers to simply switch to a competitor's or alternative product to fulfill their needs at the next purchase explained Hepworth. Therefore, producing a quality telecommunication kiosk is necessary to avoid dissatisfaction and customer switch to competitor's product or alternative product.

In this study, Quality Function Deployment (QFD) has been identified as a method to understand those needs and wants of the users of telecommunication kiosk. QFD is a tool to translate the voice of the customer (which the customer needs and wants expressed in their own words) into a set of technical requirements that can be used to guide in determining the design guideline. Even though the application of QFD is timely but and become a necessity as it provides the planning process that can help organization plan for the effective used of other technical tools to support and complement each other.

Information, Communication and Technology (ICT) industry is a fast growing industry business that can be observed with the growing and the rapid communication by internet industry worldwide (Reding, 2006). The introduction of internet has resulted instant access to online information, email, instant messaging and other communications services available over the internet. For business, it means communicating more quickly and more reliably with customers and suppliers (Reding, 2006). Dependency to one working place is no more practical to today's lifestyle but mobility is indeed because the 'in thing' of today is people started to find solutions to be connected at anytime, anywhere.

To be successful in new product design planning for the market is not without challenges. Hence, the product referred to as the telecommunication kiosk is no exception. Urban and Hauser (1980) indicated that between 35 and 44 percent of all products launched could be considered as failures. To avoid repeating such failures, telecommunication kiosk failures, end users' wants and needs are considered essential in establishing the self service concept in delivering telecommunication products or services. In order to fulfill optimum design requirements, the users' wants and needs are to be captured and translated into company language. Akoa (1972) mentioned that users' wants and needs were important in fulfilling their satisfactions because this could be identified as one of the major criteria for the survival and profitability of a new telecommunication kiosk, Akoa (1972).

Prior to the introduction of mobile phone technology, public telecommunication product such as coin and card public phones had very high demand (Yeung and Thurston, 1998). As time changed, the product technology also keeps changing (Stern, 2003). The new demand of mobility has made mobile phone be in the first and high demand (Yeung and Thurston, 1998). The networking applications made the communications easier in the form of email, conferencing, communicating, searching and downloading data (Attewell, 2005). Nowadays, it is important to be connected to the network rather than relying to the desktop or working at one work place (Castel et. al, 2004). Realizing the need of having public

multimedia terminal, Schlumberger Electronic transactions and Absolu Technologies of Canada launched advanced multimedia and Internet-capable payphones in Europe in the year 1997 (Yeung and Thurston, 1998). France Telecom launched its multi-media payphones, called Totem, in time for the World Cup in June 1998 (Yeung and Thurston, 1998). While in United Kingdom (UK), British Telecom (BT) and International Computer Limited (ICL) rolled out 200 units of "Touch Point" multi-media public information kiosks across London in 1996 (Yeung and Thurston, 1998). While Telstra from Australia has developed a multimedia payphone and was intending to trial 100 units at the end of 1998. Hong Kong also has introduced Powerphone to its market by end of 1998 (Yeung and Thurston, 1998).

There is no record that Malaysia has a multimedia kiosk in the market. These findings showed that only several markets or countries are ready for public multimedia telecommunication kiosks. Since Malaysia still lacking in providing the multimedia kiosk for the public users, therefore the initial exertion in Malaysia is needed for Malaysian users.

1.2   Problem Statements

The public payphone and kiosks are problematic lots in term of design flaws with respect to the human-kiosk interactions of tasks involved, crimes, fraud and vandalism (Geason and Paul, 1990). In Malaysia, the existing of public telephones models such as Rotor is an imported payphone in Malaysia. These imported public payphones came with standardized parts and measurements from the origin country. Therefore, the products do not incorporate Malaysian anthropometric data and does not meet Malaysians standard of body sizes. These findings could cost Malaysia

from two perspectives, one jeopardizing Malaysians want , need and comfortability, secondly no local production of the design, therefore extremely hard to find support parts and replacing cost of damaged parts would be very costly.

Fraud and vandalism cases of public telephones and kiosks' were identified as a big problem to be resolved (Geason and Paul, 1990). These cases imposed huge costs to society, not only in terms of money, but through danger to human lives, increased fear of crime, loss of services and a lowering of the quality of life in the communities (Geason and Paul, 1990). Such impression looked bad but these were the realities and had an impact on the existence public telephone and kiosks (Geason and Paul, 1990). The reason was to correlate on the statistical data and how this could contribute to the public telephone and telecommunication kiosk design. The statistics of several countries are as shown in Table 1.1. It described losses costs for public telephones were very high for several recorded countries. It was found that the cost of payphone crime had given a major impact to the operating costs and profitability (Yeung and Thurston, 1998). The record of 1998 revealed that Malaysia was losing about RM2.1 million due to problems such as selling cheap calls, stealing coins, coin-boxes empty over three months period but line active, cables had been cut and were linked by new wiring. While in Australia, up to 1988 Australian Telecom was spending A$18 million annually to repair vandalism to its public telephones, and in Liverpool in the United Kingdom, before an anti-vandalism campaign began to take effect, half that city's public phones were out of commission at any given time (Merseyside Police Public Relation Department, 1988).

In 1997, BT suffered 150,000 incidents of theft and vandalism costing over £16.5 million (US$27 million) or five (5) percent of its total revenue. In the same year BT's payphone division made a loss of £4 million (US$6.6 million). In Japan, International Operator Kokusai Denshin Denwa Corporation (KDD) experienced a ¥ 22 billion drop in revenue, representing 50 percent of revenue from payphone calls,

as an indirect result of card forgery when Nippon Telegraph and Telephone (NTT) limited the use of phone cards for international calls from payphones. These vandalisms and theft attacks are points that revealed the weaknesses of the existing public telephone. Thus, it is valid to be considered during the new design of telecommunication kiosk. A new telecommunication kiosk design presents a challenge to designers to be used effectively, safely and comfortably for Malaysian users.

Table 1.1: The Cost of Public Telephone Crimes (Yeung and Thurston, 1998)

British Telecom (Britain)	1997 (Vandalism and thefts attacks)	
	Cost of Crime	Incidents
Total Crime Related Costs	£16.5 million	NA
Vandalism	£3.5 million	129,000
Theft Attacks	£6.5 milliom	26,000
Telekom Malaysia (Malaysia)	1998 (first 6 months)	
Vandalism	RM 2.1 million	NA
Nippon Telegraph and Telephone (Japan)	1995 (Magnetic strip phone cards were being re-activated and re-sold at a tenth of their face value)	
	Cost	Incidents
Card Forgery	¥ 14 billion	261,000
Telstra (Australia)	1997 (Theft and vandalism, stealing coin-boxes)	
Forgery	AS$ 2million	

Current kiosks were not able to address a kiosk that able to serve users as one stop centre for multimedia access of network connection, telephone, online transaction and WIFI point. These existing kiosks design came with different forms, purposes, usages, applications and strategic locations. The screen of each kiosk was seen as a compulsory component, required for displaying the text, graphics, and video of multimedia application purposes. This kiosk is able to offer the potential information and service provision in an environment where many people were on the move. This, in turn, strengthened the role for kiosks as an alternative to mobile

technologies for public mobile users. Even though the existing kiosks available in the market are of varieties, carried product identity, looked tough and reliable as public facility, but these kiosks were designed and developed as single application. The available kiosks were providing single application such as multimedia access application or information kiosk only. These product designs come with specific design intent, by concerning the product functionality, features, target users, and specific target human factors, and these are the revealed of the output.

The existing of patented kiosk designs shows that no information of multimedia telephone kiosk design in Malaysia was available. Local public telecommunication product segmentation needs changes parallel with the change of the ICT industry. Otherwise, it has limited the communication activities to users who could ill-afford to have mobile gadget or mobile services. These situations are justify the need to introduce a new public kiosk, catering affairs of accessing network without depending too much on desktop equipment. Thus, in establishing Malaysians requirements, their expectations need to be catered. New effective multimedia telephone kiosk design presents a challenge to designer because it is expected to be accessed by general public included people with very different skill, experience and confidence levels.

1.3   The Research Objectives

The main purpose of the study is to develop a telephone kiosk with function of multimedia features using House of Quality (HOQ) based on Quality Function Deployment (QFD) technique. It can be broken down into several key objectives;

    a) To capture customer wants and needs by establishing Voice of Customers (VOC)

    b) To develop product design planning matrix (HOQ) based on VOC

    c) To develop and apply a telephone kiosk design based on HOQ results

1.4   The Research Area

The research area is the design and development of Multimedia Integrated Telephone Kiosk using QFD and anthropometry measurement. The study also involved the capturing of Voice of Customer (VOC) and translating them into technical characteristics or language comprehensible to designers. Part deployment matrix, process planning matrix and production planning matrix would not be included in this study.

1.5   Structure of the Thesis

Chapter one (1) provided the introduction chapter of the study. It discusses about the introduction, problem statement, research objectives and also the research scope of studies. Chapter two (2) provided the payphone background, literature review of past and recent researches of design methodology, relevant design tools and techniques, design processes and technologies, review of patented kiosks and literature on ergonomics. Chapter three (3) provided the methodology for the study so that it can be carried out systematically. While in Chapter four (4) provided the results and analyses based on the implementation of selected methodology. Chapter five (5) provided the development and validation of design. Chapter six (6) provided the conclusion of the research and suggestion of the future works.

1.6   Conclusion

This chapter described current issues of payphone telephone, emergence and the implication of mobile technology, problem statements, the research objectives

and research areas. Design problems and the objectives of thesis were established. Further review of the design needs, the ICT technology, current and past researches are found in the next chapter.