THE IMPROVISED DESIGN OF HEADPHONE USING INTEGRATED KANO AND IMPORTANCE-PERFORMANCE ANALYSIS FOR ENHANCING CUSTOMER SATISFACTION

S. Akmal[1,2], N. Hashim[1], A. Norizan[1] and S. H. Yahaya

[1]Faculty of Manufacturing Engineering,
[2] Innovative Software System and Services Group,
Universiti Teknikal Malaysia Melaka, Hang Tuah Jaya,
76100 Durian Tunggal, Melaka, Malaysia.

Email: [*1] suriatiakmal@utem.edu.my

ABSTRACT: Customer satisfaction is the best indicator for designers to stay competitive in today's global market. Traditionally, survey was commonly used by designers to elicit customer satisfaction. However, survey has a limitation on identifying the design attributes that can increase customer satisfaction. Therefore, to overcome that limitation, this study proposed Kano model which was integrated into Importance-Performance Analysis (IPA) method through the calculation of customer satisfaction and customer dissatisfaction index. Kano-based questionnaires on headphone design were distributed to 400 respondents of young generations. The results of integrated approach interestingly showed that the design attributes that are related to technology such as Wi-Fi USB connector of headphone are perceived as important attributes and could effectively enhance the young generation satisfaction.

KEYWORDS: *Customer satisfaction, customer expectation, kano model, importance-performance analysis.*

1.0 INTRODUCTION

Due to rapid technological innovation, today's product development has faced significant challenges in customer expectations and satisfaction. Customer satisfaction is defined as the positive customer perceptions [1]. Enhancing and satisfying the customer perceptions become crucial strategies for success in the market [2]. Furthermore, in the history of product development process, brand, aesthetic, safety, ergonomic and customer's feedback has been determined as the key factor of customer satisfaction[2,3,4,5].

However, designers lack of understanding and eliciting the intended attributes that are derived from determinants in a product design that influence customer satisfaction. Therefore, determining suitable product attributes is crucial in achieving the higher level of customer satisfaction.

Customer satisfaction is related to the customers' feeling resulting from product usage that is related to their expectations [6]. In addition, customer satisfaction is defined as an expression that is associated with delight, happiness and feelings of acceptance [7]. Furthermore, customer satisfaction varies from one to another as customer expectation is abstract and the degree of satisfaction is related to desired product attributes that are always ambiguous [8].

Product attribute is represented in the form of product appearance [9]. The aesthetics of products such as color, shape, surface and size give product properties that can be described. For example, a headphone is a semi-circle headband and has a long black cable. Attributes provide customers with the overall description which is more informative for a designer to use in the evaluation phase. In addition, a study [10] showed that aesthetic is related to customer perception of the form of a product and customer behavior.

Recently, a study [11] showed that an improvement of science and technology has made an impact towards the interaction among the young generation in Malaysian society specifically. A survey conducted by Suruhanjaya Komunikasi dan Multimedia Malaysia showed that the dominated group of handphone usage in Malaysia with 18.8% is from the age group of 20-24 years old followed by the age of 25-29 with 16.3% (Suruhanjaya Komunikasi dan Multimedia Malaysia, 2014). They also found that about two-third (63.3%) of the respondents agree that they access the internet through their hand phones. These data show that Malaysian communication industry has undergone beyond its basic functions of conveying the voice of two individuals resulting from the changing needs of mobile phone users. Furthermore, manufacturers should be able to produce a product that has

significant attributes to attract the young generation to succeed in the current market. For example, the young generation today needs a large touch screen hand phone to ease their access to the internet.

Similarly, the attributes of headphone are changing as technology and customer behavior change. Initially, it has been used as a medium of communication in the telephone and radio industries and now, airplane pilots use headphones on the job, in the music production in the studio, in leisure time, listening to music without disturbing others. Therefore, investigating attributes for a headphone becomes a continuous concern within these industries for a headphone to stay relevant. This study proposed the integrated approach of Kano model and Importance-Performance Analysis (IPA) to discuss and analyze the headphone design attributes that can increase the young generation satisfaction. It aimed to identify the basic attributes of young generation of headphone users which increase their satisfaction and reduce dissatisfactions.

2.0 RESEARCH METHODOLOGY

The aim of this study was to identify the attributes of headphone that can satisfy the young generation using Kano model and Importance-Performance Analysis (IPA). Therefore, this study focused on college students around Melaka.

There are few main activities involved; Kano-based questionnaire development; data analysis, and finally the development of headphone using 3D-model.

2.1 Kano-based questionnaire

The questionnaire had three sections which were 'Demographic', 'Kano-based Question', and 'Important Analysis Questions'. The Demographic section was necessary to ensure the respondents are from the young generation. This is because age of customers might influence the customer purchasing pattern in which the young generation's opinion differs from the old generation. For example,

the older generation prefers the functional value rather than aesthetics because they use headphone traditionally in terms of listening to music while working at the office. On the other hand, the young generation uses headphone beyond the traditional functions such as voice communication during driving, listening to music while jogging or riding in the public transport.

The second part was 'Kano-based method', which was used to catch the attributes that would influence the decision of a customer's purchasing. In the Kano-based questionnaire, the first and second part are concerned with the functional and dysfunctional questions towards the product's features respectively. While the functional questions were asked in a positive way, dysfunctional questions were asked in a negative way. A pair of Kano questions is shown in Figure 1.

How do you feel…	Functionality	
	If your smartphone has cover for the camera?	o I like it that way o It must be that way o I am neutral o I can live with it that way o I dislike it that way
	Dysfunctionality	
	If your smartphone does not have cover for the camera?	o I like it that way o It must be that way o I am neutral o I can live with it that way o I dislike it that way

Figure 1: Kano-based questionnaire

2.2 Data Analysis

In order to identify the headphone attributes that can highly satisfy the customer, the customer satisfaction coefficient is calculated. Prior to that, all the respondents' feedback were categorized according to Kano attributes categories as shown in Table 1.

Table 1: Kano's attributes categories

		Dysfunctional				
		Like	Must-be	Neutral	Live with it	Dislike
Functional	Like	Q	A	A	A	O
	Must-be	R	I	I	I	M
	Neutral	R	I	I	I	M
	Live with it	R	I	I	I	M
	Dislike	R	R	R	R	O

Where, O is one-dimensional requirements, A is attractive requirements, M is must-be requirements, I is indifferent requirements, Q is questionable requirements and R is reverse requirements. Furthermore, the relationship between customer satisfaction and degree of fulfilment of quality attributes are represented in the two-dimensional diagram as shown in Figure 2.

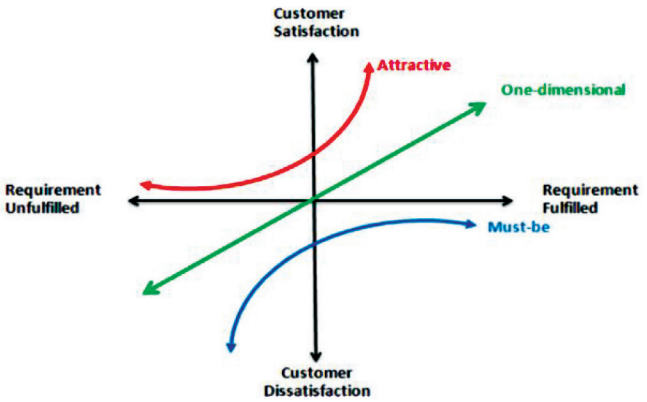

Figure 2: Kano model with quality attributes

This study calculated the strength and weaknesses of each headphone attributes using IPA. The IPA is a framework for understanding customer satisfaction that is related to the importance of the attributes and the performance of the product function [2, 13]. The relationship between importance and performance analysis is represented in the two-dimensional grids to produce a four-quadrant matrix that identifies areas which need to be improved as well as areas of effective performance as shown in Figure 3.

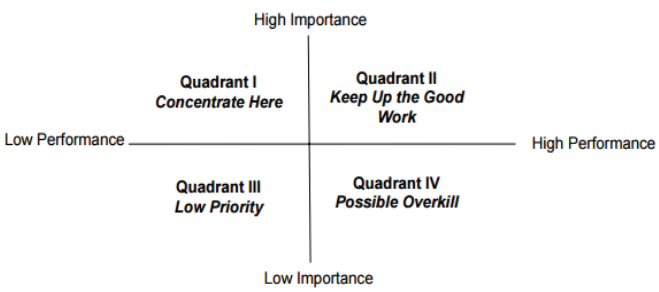

Figure 3: Importance Performance Analysis [12]

Figure 3 shows that attributes in Quadrant I are required to be improved with top priority. Quadrant II are viewed as the potential attributes to gain the competitive advantage in the market. Any attributes to gain the competitive advantage in the market. Any attributes that fall into Quadrant III and IV are perceived as not important and do not pose a threat to the manufacturers or companies.

In general, the results were evaluated and interpreted according to the answer frequency. However, if the questions were in-depth or detailed, the results might be distributed. Hence, it is suggested that if the value (O + A + M) is larger than the value (I + R + Q), the maximum value of (O, A, M) should be adopted. While, the maximum value of (I, R, Q) should be used [14]. Moreover. When the results have the same two frequency requirements, the classification that would have the greatest impact on the product or service should be chosen. Thus, the priority order is M > O > A > I.

The next step was customer satisfaction index calculation. A positive customer satisfaction coefficient ranged in value from 0 to 1 which was closer to 1, it indicated a greater influence on customer satisfaction. If the index value is closer to -1, it represents customer dissatisfaction. The following are the computation formula for extent of satisfaction, CS and extent of dissatisfaction, DS as defined by [15]:

$$CS = (A+O)/(A+O+M+I) \quad (1)$$

$$DS = (-1)(A+O)/(A+O+M+I) \quad (2)$$

3.0 RESULTS AND DISCUSSION

400 questionnaires were distributed to 400 respondents who were UTeM's students. The statistical analyses of the collected questionnaires were computed based on the 400 responses which were effective regarding the headphone's features. The statistical software of SPSS 15.0 is used in order to conduct the analysis.

Cronbach's alpha was used to check the reliability and measure the relation of an asset of the item as a group. The analysis from SPSS has

showed that Cronbach's alpha values for Kano's functional, Kano's dysfunctional, and overall importance question were 0.72. The Cronbach's alpha value of the overall questionnaire is 0.92. The demographic information from the survey is shown in Table 2.

Table 2: The demographic data

Item	Classification	Number of times	Percentage
Gender	Male	171	42.8
	Female	229	57.3
Age	18-20	106	26.5
	21-23	110	27.5
	24-26	90	22.5
	27-30	94	23.5
Activity	Study	114	28.5
	Relaxing	161	40.3
	Travelling	64	16.0
	Sport	61	15.3
Handphone usage (year)	< 1 year	166	41.5
	1-2 years	160	40.0
	> 2 years	74	18.5
Price (RM)	20-50	215	53.8
	51-100	142	35.5
	101-250	43	10.8

In order to identify the attributes that can give high satisfaction, the functional and dysfunctional questions in questionnaires represented customer requirements. These requirements were categorized according to headphone's attributes such as a button, cord, headband, earpad and accessory. In total, there are 14 attributes identified. Each requirement was evaluated using the number of attributes that had been frequently selected by respondents. Table 3 shows the requirement that has the highest frequency obtained and analyzed according to Kano quality attributes. The most important attributes are Must-be (M), one-dimensional (O) and attractive (A)

The results of this Kano analysis indicated that there were three attributes of Must-be requirements which are necessary to satisfy the basic needs of headphone customers. Those attributes were volume button, detachable cord, and adjustable headband. This requirement is compulsory to deliver to customers, but the presence of the requirement does not increase the customer satisfaction. However, its absence will cause great dissatisfaction to users. For example, in the absence of volume button that is generally known to control the sound

coming from the speaker may cause the user to bring other devices or may cause great danger to their ears. The adjustable headband is another Must-be element as the head circumference differs from one person to another.

There are two attributes for one-dimensional which is cord compartment and turnable ear pad. Cord compartment of the headphone always comes with the cord. The turnable ear pad acts as cushioning that provides padding to rest comfortably against user ears and noise isolation. The one-dimensional requirement is a requirement that is proportional to customer satisfaction. If turnable ear pad and cord compartment are missing in the headphone design, the customers may be happy or dissatisfied [16].

The next important type of attributes is the one that falls into an attractive requirement. The customer is more pleased when the headphone is better in term of functionality. However, this requirement is neither explicitly expressed nor expected by consumers and the absence of its element brings no effect toward satisfaction level [16]. Based on the survey results, there were three attributes that were classified in attractive requirements such as manage song button, mute button, and shape of earpad.ndicular.

Table 3: The requirements according to Kano analysis

NO	REQUIREMENTS	A	M	O	I	R	Q	CATEGORY
Button								
1	Volume button	104	**110**	84	73	13	16	M
2	Manage song button	**104**	80	82	103	14	17	A
3	Mute button	**103**	97	82	87	19	12	A
Cord								
4	Detachable cord	94	**101**	82	93	18	12	M
5	Cord compartment	89	81	**101**	98	23	8	O
Headband								
6	Adjustable headband	99	**99**	81	98	12	11	M
Earpad								
7	Turnable 360º	78	103	**105**	85	13	16	O
8	Material (Leather)	89	62	85	**126**	22	14	I
9	Cover all ears	96	61	91	**126**	12	14	I
10	Shape is perpendicular	**118**	70	64	115	19	14	A
Accessory								
10	Hanger chop	97	86	98	**100**	9	10	I
11	Wifi USB socket	98	63	94	**120**	15	10	I
12	Light	87	**100**	75	97	20	21	M
13	Headset	72	72	88	**130**	26	12	I

In summary, out of 14 attributes, 5 shows indifferent requirement. However, among 400 respondents, 114 respondents mostly choose must-be requirements (M), 104 respondents select indifferent requirement (I), 98 selects attractive requirement (A), 72 selects one-dimensional requirement (O), 7 selects questionable requirement (Q), and 5 selects reverse requirement (R).

Furthermore, the customer satisfaction index and customer dissatisfaction index for each requirement were calculated using Equation (1) and (2), respectively.

The CS and DS indices started from 0 to 1 value. If the value of the index was closer to 1, the attribute had a higher influence towards the customer satisfaction. In addition, the dissatisfaction index should be taken into consideration. A negative value that was closer to -1 indicated that the absence of that requirement would cause the greatest level of dissatisfaction. For example, a good detachable cord shown in Table 4 with a satisfaction index of +0.527 leads to high satisfaction and a bad detachable cord with -0.495 index can slightly increase dissatisfaction.

Table 4: The customer satisfaction index and customer dissatisfaction index

NO	DESIGN ATTRIBUTE	CS	DS	KANO
1	Has a knob button for volume adjustment	0.490	**-0.505**	M
2	Has a button to manage the song (replay, change the song, forward and backwards)	**0.504**	-0.439	A
3	Has a mute button	**0.501**	-0.461	A
4	Have a cord that can be detachable from the headphone	**0.527**	-0.495	M
5	Earpad can turn 360º	0.455	-0.471	O
6	The Headphone design with hanger chop	**+0.517**	-0.493	I
7	The Headphone design with Adjustable Headband	+0.477	-0.493	M
8	The material of ear-pad of headphone design is Leather	+0.481	-0.406	I
9	The headphone has Cord Compartment	+0.461	-0.493	O
10	The earpad design of headphone is fully cover of my ear	+0.484	-0.406	I
11	The headphone has a 'Wi-fi' USB connector	+0.492	-0.419	I
12	The earpad design is perpendicular	+0.496	-0.365	A
13	The headphone has light	+0.451	-0.487	M
14	The headphone attaches headset	+0.442	-0.442	I

All the attributes are presented in the two-dimensional diagram as shown in Figure 4. The results indicated that there were three attractive quality attributes and one-dimensional quality

attributes that were possible to increase the level of customer satisfaction more than other requirements. The Must-be requirement and one-dimensional requirement had the lowest value of DS index. The absence of that requirement would cause the greatest level of dissatisfaction.

Figure 4: Position of attributes in two-dimensional diagram

The next crucial step was to measure the most important attributes among the attributes that are listed in Table 4. Hence, the respondents were required to rate each attribute according to five points Likert scale to measure the importance (1 = very unimportant to 5 = very important) and performance (1 = very unsatisfied to 5 = very satisfied) attributed to each benefit. The results were calculated in average value as shown in Table 5.

Table 5: Importance of Elements

No	DESIGN ATTRIBUTE	KANO MODEL	IMPORTANCE (Average)
1	Has a knob button for volume adjustment	M	4.0125
2	Has a button to manage the song (replay, change the song, forward and backward)	A	4.085
3	Has a mute button	A	3.995
4	Have a cord that can be detachable from the headphone	M	4.05
5	Earpad can turn 360º	O	3.8275
6	The Headphone design with Foldable Hinges	I	3.945
7	The Headphone design with Adjustable Headband	M	4.0725
8	The material of ear-pad of headphone design is Leather	I	3.885
9	The headphone has Cord Compartment	O	3.9525
10	The earpad design of headphone is fully cover of my ear	I	4.03
11	The headphone has a 'Wi-fi' USB connector	I	4.0925
12	The earpad design is perpendicular	A	3.875
13	The headphone has light	M	3.845
14	The headphone attaches headset	I	3.9625

These findings enhance the authors' understanding of the customer satisfaction. Table 5 shows that the must-be quality attributes and attractive quality attributes should be taken into consideration in the development process, but the important value is not necessarily high. For example, the knob button volume is identified as must-be quality attributes but the average of importance is only 4.0125. Hence, this results showed that the attributes could increase the customer satisfaction even though that attribute was not important for user.

Similarly, the headphone which had a "Wi-Fi USB connector" showed an indifferent requirement but the importance was quite high, 4.0925. Hence, even though the element will not give satisfaction nor dissatisfaction, users still think it is important because Wi-Fi is necessary for daily life of the young generation nowadays.

4.0 CONCLUSION

This paper presents the use of Kano and IPA as an approach to increase the customer satisfaction toward headphone design. The main distinguishing aspect of this study is the developed questionnaires that focus on the young generation of today.

The findings suggest that to fulfil the customer satisfaction, headphone must have all the must-be requirements such as having volume button, adjustable headband and other accessories like light at a certain spot and cord compartment. If one of this attributes is not fulfilled, the customer will be dissatisfied.

Besides, the attractive requirements are headphone with button and mute button. The button will give the headphone distinctive design with more functions. The fulfilment of these types of needs can make customer more impressed with the product. In addition, the one-dimensional attribute that needs to be fulfilled are detachable cord and foldable hinges. These attributes are not compulsory, but their presence will increase customer satisfaction. The IPA approach shows that any attributes that are related to the internet are highly important

to the Young generation. Thus, the proposed Kano-IPA approach is a relevant approach to simultaneously enhance young generation satisfaction.

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