Integrating Kano's Model into Quality Function Deployment to Facilitate Decision Analysis for Service Quality

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Abstract: - The service quality is critical issue for production and operation organizations. Quality function development has been successfully applied in a number of fields. However, little study has been done in the integrated approach involving Kano's model and quality function development of evaluating service quality for the mobile phones of various brands. This study attempts to evaluate service quality using an integrated approach involving Kano's model and quality function development. This approach aims to help organizations to evaluate service quality, to guide improvement efforts in strengthening their weak technical characteristics, and to expedite the development of innovative services through the identification of technical characteristics for customers' attributes and needs. A case study is presented to evaluate the service quality of mobile phone for various brands in Taiwan. Several important and unimportant technical characteristics and customer attributes were identified and analyzed for organizational strategies. The results of this study can provide an effective procedure for evaluating service quality, facilitating priority analysis, and enhancing customer satisfaction in the marketplace.

Key-Words: - Service quality; Customer satisfaction; Kano's model; Quality function development

1 Introduction

Customers have an expectation about the service quality. If their actually experience 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 service quality, and it is widely used and is also an approval measure index [1].

In Taiwan, the penetration rate of mobile phones was the highest in the world [2]. Mobile phone is a high value-added product, so the service quality is critical issue for the manufacturers of mobile phone. In order to fulfill high service quality, the service quality should be identified and analyzed. Service quality of a mobile phone is always considered as one of very necessary steps in the mobile phone development and marketing procedure.

In related service quality studies, most literature on service quality is based upon the traditional one-dimension quality model. That is, the result is restricted that if a service provider delivers what consumers expected well, the consumers are satisfied. If not, the consumers are not satisfied. This traditional one-dimension quality model is not enough [1, 3]. On the other hand, the Kano's two-dimension quality model (Kano's model) argues that quality element's sufficiency may not enough to satisfy the customer's quality expectation. Sometimes it may be result in unsatisfied or no feeling for the customer. This is the core concept of the Kano's model. Focused on the service quality, Vasilash [4], Matzler [5], Tan [6], Jane [7], Chen and Lee [1] agree that the Kano's model has more profits.

In addition, quality function development (QFD) has been successfully applied in many fields. However, little research has also been applied to evaluate service quality for the mobile phone of various brands using the integrated approach involving Kano's model and QFD. The penetration rates of mobile phones for Nokia, Motorola and Samsung were the top three in Taiwan, so this paper proposes an integrated approach involving Kano's model and QFD to evaluate service quality of three brands. This study applied an integrated approach, using questionnarie data, to evaluate service quality for the mobile phone of various brands. By applying the proposed approach, service quality can be found from questionnarie to enhance their competitiveness in the mobile phone marketplace in Taiwan.

2 Kano's model and QFD

2.1 Kano's model

Kano et al. (1984) established a model to categorize the customer attributes of a product or service based on how well they are able to satisfy customer needs [6, 8, 10]. The Kano's categories of perceived quality are as follow.

(1) Attractive quality element

Attractive quality elements can be described as surprise and delight attributes; they provide satisfaction when achieved fully, but do not cause dissatisfaction when not fulfilled [9, 10].

(2) One-dimensional quality element

For these customer needs, customer satisfaction is a linear function of the performance of the product / service attribute. High attribute performance leads to high customer satisfaction [6].

(3) Indifferent quality element

Indifferent quality element refers to asoects that are neither good nor bad. The attribute performance do not result in either customer satisfaction or customer dissatisfaction [9].

(4) Must-be quality element

For these customer needs, customers become dissatisfied when performance of the product / service attribute is low. However, customer satisfaction does not rise above neutral even with a high performance of the product / service attribute [6].

(5) Reverse quality element

For these needs, customers become dissatisfied when performance of the product / service attribute is high. It refers to a low degree of achievement resulting in satisfaction.

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The following diagram is the popularly named Kano's categories as Figure 1.

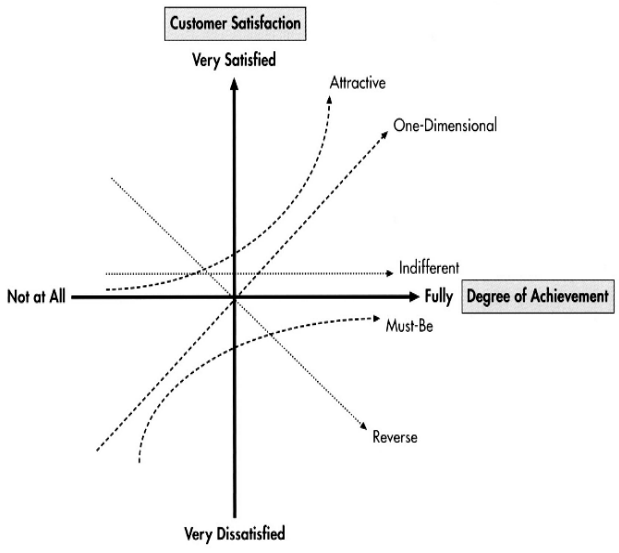

Figure 1 Kano's categories [9]

Usually, one sees how it may not be enough to merely satisfy customers by meeting only their must-be quality element and one-dimensional quality element. In a extremely competitive marketplace, organizations need to adopt strategies and to make product / service attributes targeted specifically at over-satisfying customers [6]. Matzler and Hinterhuber (1998) summarized its following benefits of Kano's model [5, 6]:

(1) The use of Kano's model can lead to develop a wide range of product/service differentiation by examining the attractive quality elements. The attractive quality elements are the key to beat the competition in the marketplace.

(2) Kano's model promotes realization of product/service requirements for customers. The attributes that have the greatest importance on customer satisfaction can be determined.

(3) Kano's model provides valuable guidance in the following trade-off situation. If two product attributes cannot be promoted simultaneously due to economic or technical causes, the attribute that has greater importance on customer satisfaction, can be identified.

Kano's model can identify various quality elements for customer attributes. The data needed in classifying customer attributes are obtained through a questionnaire survey that consists of a pair of questions. For more information on the design and analysis of Kano questionnaire, see for example, Kano et al. [10] and Tan [11].

2.2 Quality Function Development

QFD is a Japanese development and design technology. QFD was first introduced by Akao in 1972 at Mitsubishi's Kobe shipyard site, and then Toyota and its suppliers developed it further for a rust prevention study [12]. After the concept of QFD was introduced in the US through auto manufacturers and parts suppliers [13], many US firms, such as AT&T, Digital Equipment, Ford, GM, Hewlett-Packard, Procter & Gamble, and Raychem, applied QFD to improve product development and communication [14, 15].

QFD has been widely applied to achieve customer needs and improve customer satisfaction in many fields. Some researchers defined QFD as follows: "This technology focuses and coordinates skills within an organization, first to design, then to manufacture and market products that customers want to purchase and will continue to purchase [16].

Some companies have claimed great success with QFD. Proponents assert that QFD has helped them reduce production costs and design time; increase customer satisfaction and product quality [15, 17].

QFD is a cross-functional planning tool which is used to ensure that the voice of the customer is deployed throughout the product planning and design stages. QFD is used to encourage breakthrough thinking of new concepts and technology. Its use facilitates the process of concurrent engineering and encourages teamwork to work towards a common goal of ensuring customer satisfaction. Because the voice of the customer is essential, the house of quality (HOQ) converts each customer need into one or more technical characteristics in the first phase of QFD. The main goal of HOQ is to identify customer needs and weights for the product (WHATs) and then to convert these needs into technical characteristics (HOWs).

3 Integrating Kano's Model into QFD Procedure

The integrated approach involving Kano's model and QFD involves a series of activities, from classifying customer attributes to evaluate the priority analysis of technical characteristics. The previous steps can be served as the baseline reference for the next step, and the steps for evaluating service quality are described below.

To simplify the space, each customer attribute is denoted as CA.

Table 1. Definitions of customer attributes

	Customer attributes
CA1	Modeling
CA2	Call quality
CA3	Protection
CA4	Storage function
CA5	Screen and key
CA6	Diversions
CA7	Simpleoperation
CA8	Brand value
CA9	Service
CA10	Accessory

3.1 Classifying customer attributes into Kano's categories

The penetration rates of mobile phones for Nokia, Motorola and Samsung were the top three in Taiwan, so this paper proposes an integrated approach involving Kano's model and QFD to evaluate service quality of three brands. In this study, a case example is presented to illustrate how the Kano's model can be integrated into QFD by adjusting the raw importance of each customer attribute. The integrated approach is applied to this case study for the evaluation of service quality and the design of mobile phone.

Owing to the unknown weights of raw importance for customer attributes, a large questionnaire survey was created. Customers are asked to prioritize their needs. After cautious data gathering, several main customer attributes and their corresponding raw importances were identified. The raw importances had been identified by using a 1-5 scale as shown in Table 2. Furthermore, two brands of mobile phones are chosen to make a competitive analysis, i.e. Motorola and Samsung. Customers are asked to rate their satisfaction degree for both Nokia and two competitors' brands using a 1-5 scale for each customer attribute. Through this way, customer attributes, raw importances and competitive analysis are collected. To implement the proposed integrative approach, customers are also asked to group properly their needs into Kano's categories. The results can also be shown in Table 2.

Table 2. The raw importances, competitive analysis and Kano's quality elements

Customer attribute	Raw important	Competitive analysis			Quality element
		Nokia	Motorola	Samsung	
CA1	3.9	3.9	3.7	3.9	O
CA2	3.9	4.1	3.8	3.9	O
CA3	3.8	3.9	3.5	3.8	M
CA4	3.7	3.8	3.6	3.7	M
CA5	3.8	3.9	3.5	3.8	M
CA6	3.8	3.7	3.3	3.8	M
CA7	3.8	4.1	3.5	3.8	O
CA8	3.9	4.1	3.6	3.9	O
CA9	3.8	3.9	3.6	3.8	O
CA10	3.7	3.8	3.5	3.7	O

M, must-be; O, one-dimensional.

According to Table 2, this study analyze the whole customer attributes of three brands by using Kano's categories. By categorizing 10 customer attributes, this study find that no one can be sorted as "attractive quality element". There are four essential customer attributes be classified as "must-be quality

element" included " protection ", "storage function", "screen and key" and "diversions". Six customer attributes are classified as "one-dimensional quality element" included "modeling", "call quality", "simpleoperation", "brand value", "service" and "accessory".

3.2 Adjustment of improvement ratio by using Kano's model

To achieve the desired customer satisfaction level. The final adjusted importance may provide such useful information by using Kano's model. Kano's model can be integrated to adjust the raw importance. Based on Nokia current position in regard to its competitors, along with other factors (i.e. rate of importance, strategic goals, etc.), determine and record in the matrix where the customer satisfaction targets to be. In competitive analysis, this study set the highest level as the targets.

After setting the customer satisfaction targets, the traditional improvement ratio (IR) can be calculated by dividing where the customer satisfaction targets to be by where the Nokia is now as follow.

IR = (Target) / (The current customer satisfaction value of Nokia).

After grouping customer attributes into proper Kano's categories and choosing the appropriate transformation function (k values), the adjusted improvement ratio can be calculated as [11]:

$$AIR = IR^{\frac{1}{k}}$$

AIR: Adjusted improvement ratio
IR: Improvement ratio

k: k values (transformation function)
M, must-be ($k=0.5$);
O, one-dimensional ($k=1$);
A, attractive ($k=2$).

The adjusted improvement ratio represents the desired increment of the customer satisfaction degree, while it represents what we should do more to achieve the desired customer satisfaction degree. Finally, multiplied by the adjusted improvement ratio, the raw importance for each customer attribute can be adjusted into the final importance. Taking CA6 (diversions) as an example, the adjusted importance is gained as follow: 3.8 (the raw importance) × 1.06 (Adjusted improvement ratio)= 4.0. The results can also be shown in Table 3.

Table 3. The adjusted improvement ratio and adjusted importance by using Kano's model

Customer attribute	Raw importance	Competitive analysis			Quality element	Target	Improvement ratio	k value	Adjusted improvement ratio	Adjusted importance
		Nokia	Motorola	Samsung						
CA1	3.9	3.9	3.7	3.9	O	3.9	1.00	1	1.00	4.1
CA2	3.9	4.1	3.8	3.9	O	4.1	1.00	1	1.00	4.6
CA3	3.8	3.9	3.5	3.8	M	3.9	1.00	0.5	1.00	3.8
CA4	3.7	3.8	3.6	3.7	M	3.8	1.00	0.5	1.00	4.0
CA5	3.8	3.9	3.5	3.8	M	3.9	1.00	0.5	1.00	3.9
CA6	3.8	3.7	3.3	3.8	M	3.8	1.03	0.5	1.06	4.0
CA7	3.8	4.1	3.5	3.8	O	4.1	1.00	1	1.00	4.0
CA8	3.9	4.1	3.6	3.9	O	4.1	1.00	1	1.00	3.9
CA9	3.8	3.9	3.6	3.8	O	3.9	1.00	1	1.00	4.4
CA10	3.7	3.8	3.5	3.7	O	3.8	1.00	1	1.00	4.1

3.3 The priority analysis of technical characteristics

Determining the correlation between each customer attribute (WHATs) and each technical characteristic (HOWs) at the intersection of these whats and hows, record the correlation.

For each customer attribute / technical characteristic where a correlation was determined to exist, this study computed the weight of that correlation by multiplying the demanded weight by the correlation factor. Taking CA9 (service) as an example, each technical characteristic is gained as follow:

Good public praise
3 × 4.4(adjusted importance) = 14.4

Fitting personal style
3 × 4.4(adjusted importance) = 14.4

Assured period
5 × 4.4(adjusted importance) = 22

Maintainable assurance
5 × 4.4(adjusted importance) = 22

Complimentary battery
3 × 4.4(adjusted importance) = 14.4

Furthermore, the score for each technical characteristic column was totaled. Taking fashion (technical characteristic 3) as an example, the score of fashion is gained as follow:

3(CA1) × 4.1(adjusted importance) +
1(CA5) × 3.9(adjusted importance) +
1(CA7) × 4.0(adjusted importance) = 20.2 ≒ 20

Listing the priority was recorded for each technical characteristic as shown in Figure 2.

According to the priority of each technical characteristic, "complimentary battery", "photo function", "movie and music" and "game" should be closely noticed since they have high priority and could become the most important technical characteristics to satisfy customer attributes and needs. On the other hand, "fashion", "large phone directory" and "easy to access" should be closely unnoticed since they have low priority and could become the most unimportant technical characteristics. Different technical characteristic should be considered differently for satisfying customer attributes and needs. These technical characteristics of mobile phone were identified and analyzed. For the manufacturers of mobile phone, this results can facilitate their important technical characteristicss, and to expedite the development of innovative services through the identification of technical characteristics.

4 Conclusion

QFD has been successfully applied in many fields. However, little study has been done in the integrated Kano's model and QFD of evaluating service quality for the mobile phones of various brands. This study attempts to evaluate service quality for helping organizations to guide improvement efforts in strengthening their important technical characteristics, and to facilitate decision analysis, and enhance customer catisfaction through the identification of technical characteristics by using an integrated approach. The results of this study can provide an effective procedure of evaluate service quality in the marketplace.

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Technical characteristic (HOWs) / Customer attribute (WHATs)	Raw importance	Quality element	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	Competitive analysis			Target	Improvement ratio	Adjusted improvement ratio	Adjusted importance
			Turn or cover style	Flimsy design	Fashion	Good signal	Clear communication	Call display	Waterproof design	Secret code	Key lock	Large phone directory	Easy to access	Proper size	Luminous light	Large typeface	Photo function	Movie and music	Game	Internet	Editorial ring	Easy to use	Good public praise	Fitting personal style	Assured period	Maintainable assurance	Complimentary battery	Nokia	Motorola	Samsung				
CA1	4.1	O	5	5	3			1	1	1	1				1	1	1					1		1				3.9	3.7	3.9	3.9	1.00	1.00	4.1
CA2	4.6	O				5	5		1					1				1							1	1		4.1	3.8	3.9	4.1	1.00	1.00	4.6
CA3	3.8	M							5	5	5																	3.9	3.5	3.8	3.9	1.00	1.00	3.8
CA4	4.0	M										5	5				1	1	1									3.8	3.6	3.7	3.8	1.00	1.00	4.0
CA5	3.9	M			1			5	3	3	3			5	5	5	3	3	3	3	3	3						3.9	3.5	3.8	3.9	1.00	1.00	3.9
CA6	3.8	M															5	5	5	5	5	1						3.7	3.3	3.8	3.8	1.03	1.06	4.0
CA7	4.0	O	1		1					1	1					3	1	1	1	1	1	5						4.1	3.5	3.8	4.1	1.00	1.00	4.0
CA8	3.9	O																					5	3	3	3	3	4.1	3.6	3.9	4.1	1.00	1.00	3.9
CA9	4.4	O																					3	3	5	5	3	3.9	3.6	3.8	3.9	1.00	1.00	4.4
CA10	4.1	O																									5	3.8	3.5	3.7	3.8	1.00	1.00	4.1
Score			25	21	20	23	23	24	39	39	39	20	20	24	24	36	44	44	40	36	36	35	33	25	34	34	46	5 = strong relationship 3 = medium relationship 1 = weak relationship						
Priority			9	12	13	11	11	10	4	4	4	13	13	10	10	5	2	2	3	5	5	6	8	9	7	7	1							

Figure 2. The QFD with Kano's Model