Quality Attribute and Customer Satisfaction: Using Kano's Model to Prioritize What Matters Most to Customers

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ABSTRACT

Continuous innovations of smartphone attributes and increasing product usage call for better understanding of the attributes that matter most to customers. This study employs Kano's model for classifying smartphone attributes into various categories and examines the influence of those attributes on the satisfaction of smartphone users. Based on consumer evaluation of the latest and general smartphone attributes, the analysis in this study indicates various levels of satisfaction and dissatisfaction with each attribute. Specifically, our findings reveal merely three categories of Kano's classification, and 'one-dimensional' or performance attributes have higher influence on customer satisfaction as compared with 'attractive' ones. These findings provide implications for further product improvement efforts to consider not only technological capabilities but also to prioritize the attributes that are highly expected by customers. The majority of the respondents in this study include the younger consumer segment and heavy smartphone users, thus limiting generalization of the results to other contexts. Further research should consider respondents across segments and/or in a specific market, and extend the focus beyond product attributes so as to include user experiences and explicit product benefits.

JEL classification: M31, M15, L96

Keywords: quality attribute, customer satisfaction, Kano's model, convergent product

1. INTRODUCTION

The convergent computer, communications and internet technologies lead to boundless innovations of consumer electronic products. A notable example is the continuous innovation of product and service attributes of smartphones. Smartphone evolved from merely a voice communication tool, known as 'mobile phone' in the early 1990s, into a multipurpose personal communications device. Convergent technologies have increased not only the functionalities of smartphone but also users' dependence on the device in their daily lives. With rapid adoption of smartphone across the world, many companies now understand that providing various

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attributes or functionalities in a single product can guarantee its market success. However, do the continuously introduced smartphone attributes and its functionalities meet customer expectations or even are they desirable by most customers? Berthon et al. (2005) argue that innovators view technology as an enabler for the development of new products while marketing tends to view technology as 'a means to an end'. Both views reflect the importance of technology for product development; however, understanding customers remains a central focus of marketing activities. For a technology-oriented product, it is reasonable for new product development to be 'feasible' at the outset, and with the right 'insights' of customer requirements, the product is further developed to be more desirable, i.e. by enhancing its attributes and functionalities. In other words, the success of a product is viewed as a function of technological capabilities and a deeper understanding of customer requirements and expectations. From the marketing perspective, meeting customers' requirements and exceeding their expectations are prerequisites for high customer satisfaction and loyalty.

As the smartphone market has become increasingly saturated, it is becoming more critical for companies to meet customer expectations in product development efforts and identify what attribute matters most to customers. Understanding customers, who they are and what they want is part of the studies known as the voice of customers (VOC). VOC is normally conducted at the start of a new product, process or service design and typically includes identifying a set of detailed customer requirements and summarizing them into a hierarchy where each requirement is prioritized according to its importance to customers (see Griffin and Hauser, 1993). Customer requirements often include product attributes that satisfy various needs; a product or service is likely to be more desirable when it fulfills more than one requirement or 'need'. Customer requirement is dynamic and context-dependent; for example, new attributes that excite customers today will eventually shift to being merely an expected requirement of the product or service, and the importance of each attribute also tends to vary across customers. Thus, it is important for companies to update their understanding of customer expectations to ensure continuous success of any new and/or enhanced product attribute.

The main purpose of this study is to explore the relationship between the quality attribute and customer satisfaction. It employs Kano method for classifying smartphone attributes into various categories and further examines the influence of those attributes on the satisfaction of smartphone users. Kano's method is commonly used for defining new product attributes; however, an analysis of the recently introduced attributes is also valuable for further product enhancement, i.e. to prioritize the importance of each attribute from the customer's perspective. This analysis would allow future technological capabilities to consider attributes that are highly expected by customers. Although the importance of various smartphone attributes may vary across its users, there is increasing customers' dependence on smartphone in their daily lives. This necessitates a deeper understanding of what attributes matter most to customers. The remaining parts of this paper are as follows; section two reviews existing literature on Kano's model; section three discusses data collection and descriptions of Kano's classification method; section four provides discussions of our findings; and finally, section five discusses conclusions of the study and provides directions for further research.

2. LITERATURE REVIEW

Different terminologies of 'needs', 'wants', 'features', 'requirements', 'benefits' or 'attributes' are sometimes used interchangeably across marketing, engineering and industrial design literatures (see Bayus, 2008). Krishnan and Ulrich (2001) indicate that a useful representation of a product is a vector of attributes which also include customer needs, requirements, product specifications and technical performance metrics. Sanders and Dandavate (1999) indicate that

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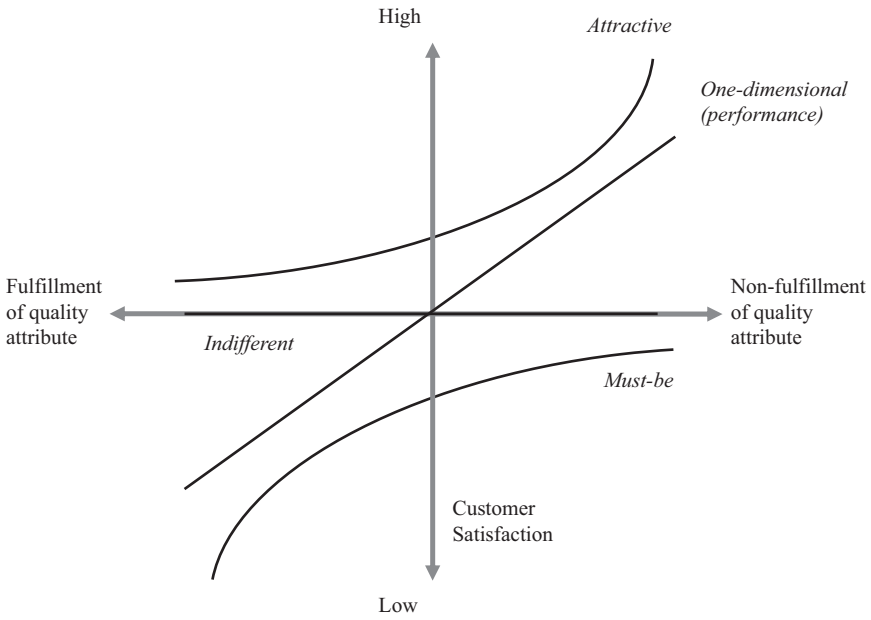
a thorough understanding of customer requirements and expectations requires researchers to learn about customers' memories as well as their current and ideal usage experiences. In this regard, development of new or enhanced product attributes requires efforts to listen to what customers say, interpret what they express and make inferences about what they think, observe how they use a product or service and 'uncover' what they know. These efforts form the basis of VOC studies and information is normally gathered from observations, interviews, focus groups, surveys and questionnaires. Griffin and Hauser (1993) argue that customer needs or requirements are a description of the benefits desired by customers. From a company's perspective, the focus is often on new and enhanced product attributes; however, from a customer's perspective, the main concentration is on the explicit benefits or the functionalities of those attributes. Thus, new development of smartphone attributes should consider 'what technology can do' as well as 'what matters to customers'. Kano's model focuses on addressing quality attributes in the perception of customers; thus, it provides insights for the developments of new or enhanced product attributes.

Kano's model is widely cited in the analysis of the relationship between product attributes (or quality) and customer satisfaction, e.g. Yang (2005), Nilsson-Witell and Fundin (2005), Shahin and Zairi (2009), among others. Figure 1 illustrates Kano's model; on the horizontal axis, the model shows the degree to which a particular product or service meets quality attributes as expected by customers, ranging from complete fulfillment to non-fulfillment of an attribute. The vertical axis indicates the level of customer satisfaction ranging from low to high; it reflects customer satisfaction levels regarding a specific product attribute that meet his or her requirements. Within the two dimensions, Kano proposes four different categories of attribute – *must-be*, *one-dimensional, attractive* and *indifferent*.

Figure 1
Kano's Model of the Relationships between Fulfillment of Product Attribute and Customer Satisfaction (adapted from Berger et.al, 1993)



The first category (bottom curve) is called *must-be* or basic attributes; these product attributes must be satisfied and must be of high quality as demanded by customers. Complete fulfillment of these requirements cannot increase customer satisfaction but if they are not fulfilled, the product or service will be rejected. The second category (middle curve) is known as *one-dimensional* or performance attributes and represents requirements which have a linear relationship with customer satisfaction. These requirements are normally addressed by considering inputs or requests from customers for product improvement purposes. The third category (upper curve) is

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called *attractive* or exciting attributes, and represents requirements that customers do not expect to be satisfied. However, if these attributes are addressed, customers are delighted, thus a higher level of satisfaction; if not, it will not cause dissatisfaction. There are also attributes the presence or absence of which does not make a real difference to customer satisfaction. These attributes fall along the middle of satisfaction level (where the horizontal axis intersects it) and are referred to as *indifferent* attributes. A '*reverse*' attribute is considered as the opposite of '*one-dimensional*' attribute; it decreases satisfaction if fulfilled, and increases satisfaction if not fulfilled, thus it is not considered in our analysis.

Kano's model is adopted and modified by researchers in a wide range of industries, for example the applications of the model in the airlines sector by Shahin and Zairi (2009), web-community service attribute by Kuo (2004), teaching attribute by Chien (2007), among others. In the most recent research, Song (2016) focuses on Kano's wording and its impact on smartphone attributes classification. Advantages of classifying smartphone attributes based on Kano's model include better understanding of these attributes, i.e. attributes that have the greatest influence on customer satisfaction can be identified. Classifications of product attributes into *must-be*, *one-dimensional*, *attractive* and *indifferent* categories are useful for new product development and/or further enhancement of these attributes based on their influence on customer satisfaction. *Indifferent* and *must-be* attributes do not lead to high customer satisfaction and are more critical during the outset development of a new product as compared with the improvement of its attributes. Lee et al. (2013) note that *must-be* attributes are basic customer expectations and are often taken for granted in evaluating product performance. *Must-be* attributes are the minimum product requirements; a product or service that merely satisfies basic requirements and/or meets standard performance criteria is often perceived as mediocre and cannot lead to high customer satisfaction and loyalty. Given a saturated smartphone market, companies tend to compete by introducing the most advanced attributes enabled by the latest technologies to attract customers and increase product usage. However, not all of new attributes are expected or desirable by customers. As this study focuses on the general and most recent smartphone attributes, we expect the following:

Hypothesis 1: Consumer evaluation of smartphone quality attributes will merely reflect the three categories of Kano's classifications, i.e. one-dimensional, attractive and indifferent.

One of the commendable features of Kano's model is that it provides valuable benefits in trade-off situations during the product improvement stage. For example, if *one-dimensional* or *attractive* attributes cannot be met simultaneously due to technological constraints or financial reasons, the attribute which has the greatest influence on customer satisfaction can be identified and prioritized (see Shahin et al., 2012). Moreover, Kano's model has no technical limitations regarding the number of attributes to be included in any study. This is particularly useful for a technology-oriented product such as smartphone that is used as a multi-purpose communication device and subject to boundless innovations of its attributes. At the maturity stage of a product life cycle, discovering and fulfilling customer requirements for *one-dimensional* and *attractive* attributes of a product or service will create a wide range of possibilities for differentiation strategies. In a highly saturated smartphone market, it is more crucial to focus on *one-dimensional* and *attractive* categories as they have greater influences on customer satisfaction. Although the importance of smartphone attributes may vary across users, identifying *one-dimensional* and *attractive* categories reveals specific attributes that guarantee the optimal level of satisfactions. In this study, the quality attributes reflect the general and latest smartphone attributes which are made possible by technological capabilities such as convergent technology; therefore, we expect the following:

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Hypothesis 2: Customer evaluation of smartphone attributes will equally reflect one-dimensional and attractive attributes.

Kano's model directly deals with customer requirements and acknowledges that customer needs and expectations evolve; an *attractive* attribute today will eventually shift to being a *one-dimensional* attribute and over time will become a *must-be* or basic requirement. For example, short messaging service (SMS) was perceived as an *attractive* service attribute in the 1990s; in the 'convergent era', text message is now considered as merely a basic requirement for many people. Apart from providing useful insights on the evolutionary aspect of customer requirements for a product, Kano's model also serves as a useful tool for classifying and prioritizing attributes that have greater influence on customer satisfaction. It basically stipulates that *one-dimensional* and *attractive* categories have greater influence on customer satisfaction; it is worth identifying which category has greater influence on satisfaction as well as the extent of their influence on customer satisfaction. Despite various new smartphone attributes enabled by the latest technologies such as 3D functions and multi-tasking, we presume that attributes that are associated with enhancing user's productivity and usage experience such as processing speed and internet speed have higher influence on customer satisfaction. Thus, we expect the following:

Hypothesis 3: One-dimensional or performance attributes have higher influence on customer satisfaction than the attractive smartphone attributes.

To sum up, evolution of technologies and customer needs or product requirements calls for dynamic frameworks such as Kano's model in order to capture the importance of VOC with regard to product innovations. Specific quality attributes and the extent of their influence on customer satisfaction can be analyzed through various research methods such as implementing Kano's survey. To enhance the effectiveness of Kano's survey, it is important for the respondents to be familiar with the method before the survey is conducted. This is because the questionnaires in the survey normally consist of two sections of functional and dysfunctional forms, i.e. *how do you feel if a certain attribute is present in a product or service*, and *how do you feel if the attribute is not present in a product or service?* These two sections concern customer response about including (functional question) or omitting (dysfunctional question) an attribute, and this might be confusing for respondents who have never heard of Kano's method. In addition, the wording of the questionnaires should be crystal clear and reflect a specific attribute of the product under study. Thus, a brief introduction to Kano's model and the methodical design of the questionnaires is critical to facilitate more reliable responses. Some researchers such as Nilsson-Witell and Fundin (2005), Mikulic and Prebazac, (2011) and Song (2016) modified the questionnaire design to reduce the interference between functional and dysfunctional questions. This paper employs Kano's approach for classifications of product or quality attributes; our questionnaires are designed to reflect the general and latest smartphone attributes and customer satisfaction.

3. METHODOLOGY

Kano et al. (1984) classify various product attributes into *'must be', 'one-dimensional', 'attractive', 'questionable', 'reverse'* and *'indifferent'* categories. Figure 2 shows Kano's method using a structured questionnaire consisting of pairs of questions for product or service attributes. The example of functional and dysfunctional questions (top left side of the figure) reflects one of the questionnaires used in our survey on smartphone attributes. Following Kano's method, one question in the pair asks about the customer's feelings in the case of fulfillment of an attribute, or a "functional question", and the other question asks about customer's feelings for non-fulfillment

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of a smartphone attribute, or "dysfunctional question". For example, if a respondent answers "I like it that way" as regards the functional question of "If the call connections of your smartphone are good, how do you feel?"; and "I dislike it that way" as regards the dysfunctional question of "If the call connections of your smartphone are bad, how do you feel?", the combination of his or her response will be categorized as '**O** = One-dimensional or performance' attribute based on Kano's evaluation table at the bottom of Figure 2. This indicates that call connectivity is a one-dimensional attribute, i.e. more improvement of this attribute performance will lead to higher level of the respondent's satisfaction. A similar process is repeated for all answers of the respondents. The next step is calculations of frequencies for every response in order to provide the final classification or category of all smartphone attributes. The classification results are discussed in the findings section.

Figure 2
Kano's method, adapted from Berger et al. (1993)

Functional form of the question	If the call connections of your smartphone are good, how do you feel?	1. I like it that way 2. I expect it that way 3. I am neutral 4. I can tolerate it that way 5. I dislike it that way
Dysfunctional form of the question	If the call connections of your smartphone are bad, how do you feel?	1. I like it that way 2. I expect it that way 3. I am neutral 4. I can tolerate it that way 5. I dislike it that way

Customer requirement, i.e. smartphone attributes		Answer to dysfunctional (negative) question				
		Like	Expect	Neutral	Tolerate	Dislike
Answer to functional (positive) question	Like	Q	A	A	A	O
	Expect	R	I	I	I	M
	Neutral	R	I	I	I	M
	Tolerate	R	I	I	I	M
	Dislike	R	R	R	R	Q

Kano's Evaluation Table:

Smartphone attributes	M	O	A	Q	R	I	Total	Category of Kano's model
1.		1					1	O
2.								
3.								
…								

(Note: **M** = Must be; **O** = One-dimensional or performance; **A** = Attractive; **Q** = Questionable; **R** = Reverse; **I** = Indifferent)

As mentioned in the previous section, one of the major challenges of implementing Kano's method is to ensure that target respondents understand the nature of Kano's survey which includes the functional and dysfunctional parts of questionnaires. In this regard, it is important to provide a brief introduction of Kano's method to the respondents. As indicated in Ahmad (2014), the young segment of consumers is the heaviest users of mobile communication; they use smartphone for various purposes and are very familiar with its latest attributes. This segment of users is

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regarded as 'lead users'; they are normally customers who are ahead of market trends and have communication needs that go far beyond those of the average users. To enhance reliability of the responses, this study ensures that first, target respondents are among the heaviest smartphone users and second, they are briefly informed about the functional and dysfunctional questions prior to the survey.

The questionnaires of this survey include the latest and general attributes of smartphone derived from product specifications of leading smartphone manufacturers and recent articles on smartphone features and convergent products, such as Song (2016), Ganesan and Sridhar (2014) and Lee et al. (2012). Our selected product attributes reflect the quality attributes commonly used in smartphone research such as in Song (2016); they include memory, battery usage time, screen size, display resolution, depth, weight, camera solution, build, sound quality, crash resistance, water resistance, voice recognition, fingerprint sensors, processing speed, wireless charger, battery charging time, multitasking, 3D function, accidental damage warranty, internet speed and call connectivity. Although internet speed used to be regarded as an online related service, and call connectivity as a basic function, they are included as 'general attributes' to reflect the current nature of smartphone as a convergent product (see Lee et al., 2012).

This survey employs the purposive sampling technique in which the author identifies three graduate students who have experienced or are familiar with Kano's questionnaires. These students serve as research assistants (RAs) for the data collection purpose and their primary task is to brief target respondents about the nature of Kano's survey particularly, on the functional and dysfunctional aspects of Kano's questionnaires prior to participation of the respondents. These RAs were requested to distribute the questionnaires to smartphone users in the university campus as well as outside the campus within the period of six weeks, from October 10th until November 21st, 2016. The reason behind the chosen sampling technique and data collection was to gather a sample of appropriate size within a time constraint and to ensure that respondents had a brief understanding of the unique nature of Kano's questionnaires before participating in the survey. Table 1 shows the profiles of the respondents in this survey. As shown in the table, about 86% of the respondents are the young segment of smartphone users. Although this survey was conducted in Japan; the respondents included both local and international students or residents from 29 countries; about 74% from Asia, and the remaining 26% included the respondents from Europe, North America and Africa.

Table 1
Profiles of Respondents

Gender		
	Total	**Percentage**
Male	53	44.92%
Female	65	55.08%
Age Group		
20–29	101	86%
30–39	13	11%
40–49	4	3%
Total	118	100%
Region		
Asia	87	73.7%
Europe	11	9.3%
North America	10	8.5%
Africa	10	8.5%
Total	118	100%

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4. FINDINGS

Table 2 shows classification results of smartphone attributes ranging from call connectivity to accidental damage warranty. Description of each smartphone attribute employed in this study is included in the appendix. As shown on the right side of Table 2, call connectivity, internet speed, memory, battery usage time, camera resolution, sound quality, crash resistance, finger print sensors, processing speed are categorized as performance or '*one-dimensional*' in Kano's method of classification. These attributes have a linear relationship with customer satisfaction in which better performance of each attribute will lead to a higher level of customer satisfaction. Display resolution, water resistance, wireless charger, battery charging time, accidental damage warranty are categorized as '*attractive*' attributes. Attractive or exciting attributes reflect the requirements that customers do not expect to be satisfied, but if they are addressed, the customers will have a high level of satisfaction, and if not satisfied, it will not cause their dissatisfaction.

Table 2
Classification of Smartphone Attributes Based on Kano's Method

Smartphone Attributes	M	O	A	Q	R	I	Total	Category of Kano's model
1. Call connectivity	41	43	15	18	0	1	118	One-dimensional
2. Internet speed	17	75	17	7	0	2	118	One-dimensional
3. Memory	12	50	31	24	1	0	118	One-dimensional
4. Battery usage time	12	49	33	20	0	4	118	One-dimensional
5. Screen size	10	13	32	37	1	25	118	Indifferent
6. Display resolution	12	22	41	41	1	1	118	Attractive
7. Depth	1	3	8	63	0	43	118	Indifferent
8. Weight	1	73	4	40	0	0	118	One-dimensional
9. Camera resolution	14	45	37	21	0	1	118	One-dimensional
10. Build	16	25	33	41	0	3	118	Indifferent
11. Sound quality	18	41	28	29	0	2	118	One-dimensional
12. Crash resistance	10	51	30	25	1	1	118	One-dimensional
13. Water resistance	2	29	55	32	0	0	118	Attractive
14. Voice recognition	4	27	19	66	1	1	118	Indifferent
15. Fingerprint sensors	22	38	22	34	0	2	118	One-dimensional
16. Processing speed	16	63	24	14	1	0	118	One-dimensional
17. Wireless charger	2	20	58	35	0	3	118	Attractive
18. Battery charging time	6	38	42	30	1	1	118	Attractive
19. Multitasking	10	24	29	52	1	2	118	Indifferent
20. 3D function	1	11	42	58	0	6	118	Indifferent
21. Accidental damage warranty	13	31	45	28	0	1	118	Attractive

(Note: **M** = Must be; **O** = One-dimensional or performance; **A** = Attractive; **Q** = Questionable; **R** = Reverse; **I** = Indifferent)

Screen size, depth, build, voice recognition, multitasking, 3D function are categorized as '*indifferent*' attributes. This category implies that the presence or absence of those attributes does not make a real difference to the satisfaction of smartphone users included in this survey. As we expected, none of the general attributes are considered as 'must-be' attributes; this supports

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Hypothesis 1, which states that consumer evaluation of the smartphone quality attributes merely reflects the three categories of Kano's classifications, i.e. *one-dimensional, attractive* and *indifferent*. The findings also reflect customer's expectation for better performance, even for an attribute that is considered as a basic function or requirement (i.e. call connectivity) in other studies such as in Lee et al. (2012). It should be noted that as the respondents in this survey include smartphone users from various countries, their evaluation of the performance of call connectivity may also be influenced by the development of network technologies in their home countries.

Table 3
A summary of classification results for each category

Classification	Attributes	Number of Attributes
One-dimensional (performance)	Call connectivity, Internet speed, Memory, Battery usage time, Weight, Camera resolution, Sound quality, Crash resistance, Fingerprint sensors, Processing speed	10
Attractive	Display resolution, Water resistance, Wireless charger, Battery charging time, Accidental damage warranty	5
Indifferent	Screen size, Depth, Build, Voice recognition, Multitasking, 3D function	6

Table 3 summarizes the findings of customer evaluation of smartphone attributes; almost half (10 out of 21 attributes, or 47.6%) of the attributes selected in this study are categorized as the *one-dimensional* or performance category, while merely five attributes are categorized as *attractive* ones. These findings do not support Hypothesis 2, which predicts that consumer evaluation of smartphone attributes will equally reflect *one-dimensional* and *attractive* attributes. A significant implication of the findings is that as *one-dimensional* or performance attributes have a linear relationship with customer satisfaction, it is critical for companies to prioritize the necessary actions or improvements on *one-dimensional* over the *attractive* attributes. Moreover, improvements of the latter attributes are not expected by smartphone users, thus will not cause customer dissatisfaction if they are not fulfilled.

Table 4 shows analysis results of customer evaluation of the impact of smartphone attributes on customer satisfaction. The customer satisfaction (CS) coefficient indicates how strongly each attribute influences customer satisfaction (or the fulfillment of quality) and dissatisfaction (or the non-fulfillment of each quality). The implication of the CS coefficient is whether satisfaction can be increased by improving the quality of product attributes or whether fulfilling this requirement of quality merely prevents the customer from being dissatisfied. This study adopted Berger et al. (1993)'s calculations of the average impact of each attribute on satisfaction and dissatisfaction. The extent of satisfaction or satisfaction index (SI) is calculated by adding the 'attractive' and 'one-dimensional' column and dividing the sum by the total of 'attractive', 'one-dimensional', 'must-be' and 'indifferent' responses, or (A+O)/(A+O+M+I). The positive CS coefficient ranges from 0 to 1; the closer the value is to 1, the higher the influence on CS; a positive CS coefficient that is close to 0 indicates merely low influence on CS. For example, internet speed and battery usage time have a high influence on customer satisfaction, 0.79 and 0.72 respectively. The results indicate that better performance of these attributes lead to a higher level of customer satisfaction.

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Table 4
Impact of Fulfillment of Smartphone Attributes on Customer Satisfaction

Smartphone Attributes	Total	Category of Kano's Model	Extent of Satisfaction (SI)	Extent of Dissatisfaction (DI)
1. Call connectivity	118	One-dimensional	0.50	–0.72
2. Internet speed	118	One-dimensional	0.79	–0.79
3. Memory	118	One-dimensional	0.69	–0.53
4. Battery usage time	118	One-dimensional	0.72	–0.54
5. Screen size	118	Indifferent	0.49	–0.25
6. Display resolution	118	Attractive	0.54	–0.29
7. Depth	118	Indifferent	0.15	–0.05
8. Weight	118	One-dimensional	0.65	–0.63
9. Camera resolution	118	One-dimensional	0.70	–0.50
10. Build	118	Indifferent	0.50	–0.36
11. Sound quality	118	One-dimensional	0.59	–0.51
12. Crash resistance	118	One-dimensional	0.70	–0.53
13. Water resistance	118	Attractive	0.71	–0.26
14. Voice recognition	118	Indifferent	0.40	–0.27
15. Fingerprint sensors	118	One-dimensional	0.52	–0.52
16. Processing speed	118	One-dimensional	0.74	–0.68
17. Wireless charger	118	Attractive	0.68	–0.19
18. Battery charging time	118	Attractive	0.69	–0.38
19. Multitasking	118	Indifferent	0.46	–0.30
20. 3D function	118	Indifferent	0.47	–0.11
21. Accidental damage warranty	118	Attractive	0.65	–0.38

The extent of dissatisfaction or dissatisfaction index (DI) is calculated by adding 'must-be' and 'one-dimensional' column and divide them by the same normalizing factor, i.e. the total of 'attractive', 'one-dimensional', 'must-be' and 'indifferent' responses or $-1(M + O)/(A + O + M + I)$. Note that a minus sign is placed in front of the CS coefficient of customer dissatisfaction to emphasize its negative influence on CS when a particular attribute quality is not fulfilled. The negative CS coefficient ranges from 0 to –1; if the value is close to –1, it indicates that the influence on customer dissatisfaction is especially high if the attribute is not fulfilled. A value close to 0 signifies that the attribute does not cause dissatisfaction if it is not fulfilled. Using earlier examples of an internet speed and battery usage time, dissatisfaction results are –0.79 and –0.54 respectively; internet speed has a higher level of dissatisfaction among the users as compared with battery usage time. This implies that the users expect the companies to address or improve the performance of these attributes if their dissatisfaction levels are to be reduced. Furthermore, as one-dimensional attributes have a linear relationship with customer satisfaction, their continuous improvement is critical and requires constant inputs regarding customer requirements and expectations.

Based on the results of CS coefficient from Table 4, Figure 3 illustrates selected smartphone attributes of each category and the extent of their influence on customer satisfaction and dissatisfaction. Findings from Table 4 and Figure 3 indicate that attributes associated with

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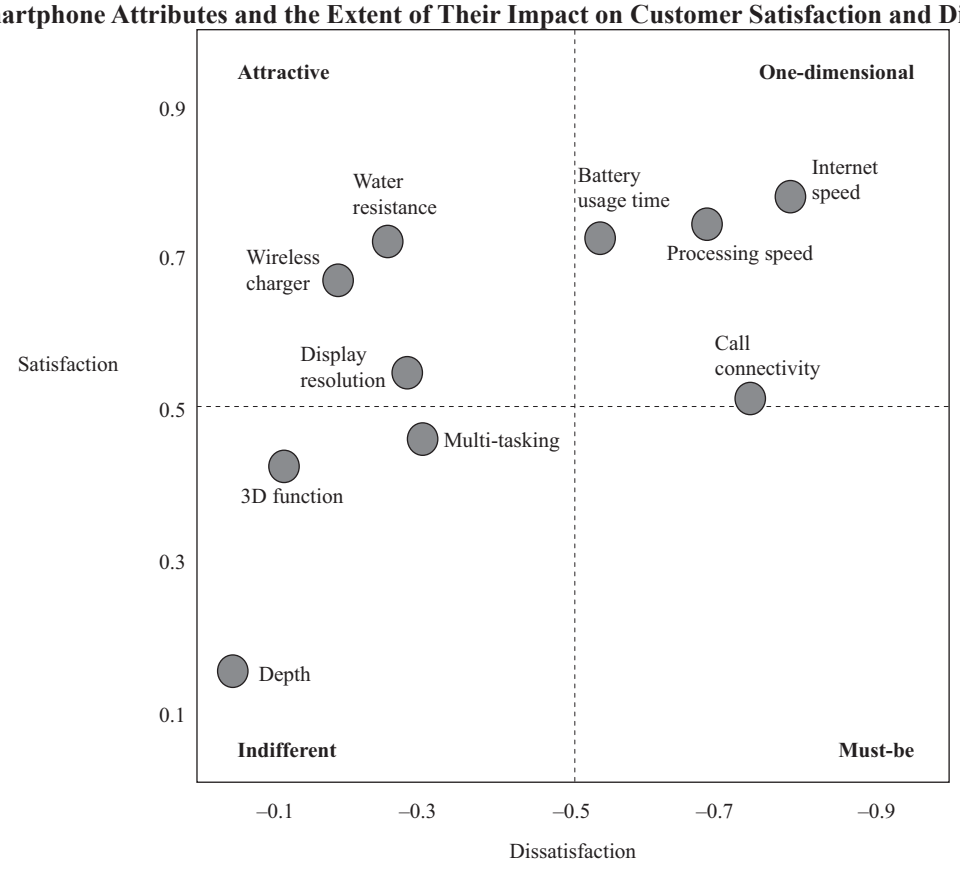
enhancing user's productivity and usage experience such as processing speed and internet speed have higher influence on customer satisfaction, SI of 0.79 and 0.74 respectively, while attributes that are associated with the latest convergent technologies such as 3D functions and multi-tasking are 0.47 and 0.46. The findings support Hypothesis 3, which presumes that *one-dimensional* or performance attributes have higher influence on customer satisfaction than the *attractive* attributes. Notably, attributes of *attractive* category such as display resolution and wireless charger also have a relatively lower impact of customer satisfaction when compared with battery usage time, internet speed and the processing speed of applications in a smartphone.

Figure 3 also illustrates that '*one-dimensiona*l' attributes have a greater impact on customer satisfaction and dissatisfaction as compared with '*attractive*' and '*indifferen*t' attributes; this is parallel to the general prioritization rule of thumb for the importance of attributes, i.e. Must-be > One-dimensional > Attractive > Indifferent. Thus, improvement of *one-dimensional* attributes such as internet and processing speed will not only lead to a higher level of customer satisfaction but also reduce dissatisfaction. Further enhancements of '*attractive*' attributes such as a wireless charger, water resistance and display resolution will lead to a higher level of customer satisfaction than the current satisfaction level. Although these attributes are not expected by the customers, their improvements will delight the smartphone users. '*Indifferent'* attributes such as depth (thickness or thinness of the device), 3D function and multi-tasking reflect a low influence on customer satisfaction and dissatisfaction, thus, should be the last to be considered for future product enhancement efforts.

Figure 3

Selected Smartphone Attributes and the Extent of Their Impact on Customer Satisfaction and Dissatisfaction



Kano's model holds that 'one-dimensional' attributes have a significant impact on customer dissatisfaction. Thus, improvement of these attributes should be prioritized to minimize customer dissatisfaction. The results indicate that attributes associated with productivity and usage experience are critical to increase customer satisfaction and decrease dissatisfaction. Different

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consumer segments of smartphone tend to have different product or service requirements and expectations. Note that, in this survey, the majority of the respondents are among the heaviest product users, aged 20–29. As smartphone is characterized as a convergent product, many users use the device beyond personal and social communication needs; they heavily depend on smartphone for work or study-related activities. Interestingly, the result indicates that smartphone depth has the lowest impact on customer satisfaction and dissatisfaction; this reflects indifferent users' feeling toward the attribute. In a saturated smartphone market, distinctive product features or points of difference (POD) of the 'hardware' such as premium design or thickness or thinness of the device among the competing brands are of relatively low importance. Thus, customers tend to expect attributes that are associated with product performance that enhance user's productivity and usage experience such as processing speed of its applications and internet speed.

5. CONCLUSIONS

Continuous developments of smartphone attributes are to be expected as the product is highly influenced by technological advancements and increasing usage among the customers. As smartphone users heavily depend on the product for multi-purpose communication activities, it is critical to examine the impact of each new attribute on customer satisfaction. The analysis of this study reaffirms that development efforts of product attributes should be directed at not only what a product (technology) can do but also on the attributes that matter to customers. This study employs Kano's method in classifying various smartphone attributes into *'one-dimensional'*, *'attractive'*, and *'indifferent'* category and examines the impact of those attributes on customer satisfaction. These classifications are useful to prioritize attributes that matter most to customers, and are particularly crucial for a technology-oriented product such as smartphone in which boundless new product attributes are developed. A significant implication of the analysis is that a deeper understanding of the link between existing smartphone attributes and customer satisfaction may lead to better product improvement efforts, and possibly anticipate future attributes that are highly expected by customers.

The findings of this study indicate various levels of satisfaction and dissatisfaction with the general and latest smartphone attributes in the perception of customers. Further product improvement activities follow the general prioritization rule, i.e. 'Must-be > One-dimensional > Attractive > Indifferent'; our findings provide not only better understanding of customer requirements and satisfaction but also insights on specific smartphone attributes that matter most to customers. To strengthen competitive position and ensure high customer satisfaction (and minimize dissatisfaction), development activities can be directed at improving call connectivity, internet speed, memory, battery usage time, weight camera resolution, sound quality, crash resistance, fingerprint sensors and processing speed. To gain competitive advantage through differentiation strategies, further enhancement efforts are to be channeled at 'attractive' attributes such as display resolution, water resistance, wireless charger, battery charging time and accidental damage warranty. Further investment and improvement of smartphone attributes such as screen size, depth, build, voice recognition, multitasking, and 3D function are to be carefully considered as the results indicate that their presence or absence does not make a real difference to customer satisfaction.

Kano's model is an instrumental and a dynamic tool for efforts to develop new products and to examine customer satisfaction with its exiting attributes at various stages of the product life cycle. It should be noted that Kano's model is inherently customer-driven, i.e. focuses exclusively on addressing concerns of customers (see Sireli et al., 2007). As such, from the product development perspective, it disregards the main concern of companies in terms of their capabilities and/or cost constraints to meet customer requirements. It is worth mentioning that to some extent, the quality

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of the questionnaires, interviewer(s) and target respondents is more crucial for the reliability and validity of research based on Kano's method as compared with other consumer surveys. Thus, a rewarding application of Kano's method requires a thoughtful design of the questionnaires, clarity of the functional and dysfunctional questions and respondents' familiarity with Kano's method. These are the main challenges in conducting a survey based on the method; this study made utmost efforts in dealing with the challenges in order to enhance the effectiveness of our survey. Finally, as the importance of smartphone attributes differs in various contexts and across segments, generalization of the findings should consider the followings: first, the respondents of this survey include mainly young and heavy users of smartphone and second, although the survey was conducted in Japan, the respondents included smartphone users from 29 different countries. Future research should include a larger sample size across segments and/or in a specific market(s) and consider a questionnaire design that focuses on customer benefits instead of product attributes.

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APPENDIX 1: DESCRIPTION OF SMARTPHONE ATTRIBUTES

No.	Attribute	Description
1	Call connectivity	The degree of call connections without fail
2	Internet speed	Network data speed via a smartphone
3	Memory	Internal storage capacity for pictures, videos, and applications
4	Battery usage time	Battery lifetime after a full charge
5	Screen size	The size of smartphone screen
6	Display resolution	The resolution of the smartphone screen; the higher the resolution, the better the definition
7	Depth	Thickness or thinness
8	Weight	Heaviness
9	Camera resolution	The definition of the built-in camera (megapixels)
10	Build	Build quality with aluminum unibody design (premium looking)
11	Sound quality	Sound quality of voices, audios, or videos
12	Crash resistance	The degree of crash or drop resistance
13	Water resistance	he degree of water resistance
14	Voice recognition	A human interface which enables users to perform tasks by voice commands
15	Fingerprint sensors	Touch-based responsive finger print sensors
16	Processing speed	The processing speed of applications in a smartphone
17	Wireless charger	Built-in wireless charging capabilities
18	Battery charging time	Quick charging time after the battery is dead to a reasonable state (more than 50% in less than an hour)
19	Multitasking	Using multiple functions such as running applications, text messaging, and web surfing, simultaneously
20	3D function	A function that enables users to watch a 3D movie, or play a 3D game
21	Accidental damage warranty	Damage warranty during the first year

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