An Application of Kano Method in the Elicitation of Stakeholder Satisfying Requirements for an e-Ebola Awareness System

Azham Hussain and Emmanuel O.C. Mkpojiogu

Abstract—Several software requirements elicitation techniques exist and are used in the elicitation of software requirements. However, most of the techniques are limited in that they are only effective in capturing the voice of the customer/user. They are not effective in capturing their mind. There are some kinds of requirements that stakeholders take for granted, not expecting or are not apt to voice out. Such requirements need special requirements elicitation approaches that will probe the psychology of the respondents so as to succinctly collect the needed requirements from them were necessary. Kano model provides a framework that enables the elicitation of these kinds of requirements. More so, it allows appropriate requirements to be elicited that will lead to the satisfaction of stakeholders if the requirements are met or to their dissatisfaction if they are unmet. It categorizes software requirements based on some quality attributes that describes the kind of requirements elicited. The Kano approach also, helps to obtain the perceived quality of the proposed product from the customer/users' point of view. This method helps to filter out requirements that do not lead to the satisfaction of stakeholders and thus the quality of elicited requirements and the proposed software solution. Kano method, though popular in the interdisciplinary field of quality management, is seldom applied in the field of software engineering, especially in requirements elicitation. In this study, the Kano method was applied in the elicitation of requirements for a proposed e-Ebola Awareness System. The result of the Kano analysis indicated that the elicitation of stakeholders' satisfying requirements leads to increase in the satisfaction level of potential users/customers of the would-be product. It also indicated improvement in the perceived quality of such product from the viewpoint of the potential users/customers as shown from the customer satisfaction coefficients and the self-stated importance ratings.

Keywords—e-Ebola Awareness System, Kano Model, Requirements Elicitation, User/Customer Satisfaction

I. INTRODUCTION

DESPITE advances in the requirements elicitation research, software engineers do not still comprehend what exactly a software system/product should offer to succinctly meet the needs and expectations of users/ customers. There is a relationship between quality and user satisfaction [13][51]. Eliciting user/stakeholder satisfying requirements contribute to the quality and competitiveness of the product [51].

Requirements, met or unmet, can influence the extent of user/customer satisfaction or dissatisfaction for a product, because in the eyes of users/customers, products with the right functionality that satisfy them implies that such products are quality ones. This aspect of quality consideration is often neglected by researchers and practitioners. Kano Model and its extensions and improvements explore an approach that clearly explains how software product requirements/features can influence the level of satisfaction derived from such product as well as the level of dissatisfaction the absence of such requirements/feature in the product could cause in users/customers.

This paper explores and applies this model in eliciting requirements for a proposed e-Ebola awareness system. The result reveals that eliciting user/customer satisfying requirement increases the satisfaction level of potential users/customers of the proposed product and also improves the perceived quality of such product in the eyes of the potential users/customers as evidenced from their satisfaction scores and self-stated importance ratings

Considering software quality late in the software development life cycle is responsible for the poor quality of software products today [20][24]. In considering software quality assurance, researchers gross over and do not look closely at the impact of the elicitation of user satisfying requirements at the elicitation phase on software quality. There is a dearth of recent literature of on this subject of great significance. The influence of the neglect of these problems increases with subsequent phases of the software development as defects introduced in previous phases are carried over to the current software development phase, thus causing the omission of important functionalities, inclusion of irrelevant features, bad designs, costly reworks and even, the outright rejection of the system by the clients and the intended users as their needs are not met or satisfied [21]. All these can be eliminated, avoided and/ or reduced, if an early attention and commitment are given to the investigation and concerns about software quality from the start of a software development project [20][23]-[24][51].

One of the ways of looking into the concerns of software quality early in the software development lifecycle is to begin with the elicitation of requirements that delight and satisfy potential users and customers of the system. Early focus on

A. Hussain is with the Universiti Utara Malaysia, Sintok, Malaysia (e-mail: azham.h@uum.edu.my).

E. O. C. Mkpojiogu is with the Universiti Utara Malaysia, Sintok, Malaysia (e-mail: emelnuel@hotmail.com).

building quality products drives the need to ensure that from the very beginning of the software development lifecycle, requirements with right functionalities and features are elicited with a focus on how and to what extent such requirements satisfy the intended users and potential customers of the product.

Customer Satisfaction is a great concern and a condition for a competitive product in today's market environment. The excitement and satisfaction of users/customers is very vital because of its place in generating competitive advantage for a given product[14]. Users/customers who are satisfied with the features of a software product are loyal to the product, remain users/customers for a longer time and contribute to advertising and promoting the product, thus increasing the chances of patronage, usage, sales and competitive advantage. The reverse is the case when users/customers are disenchanted and dissatisfied with the requirements/features of a software package [33].

Product quality is associated with user/customer satisfaction [13] and in the eyes of users/customers, products that delight or satisfy them are seen by them as quality products, but this relationship is often times overlooked when designing and developing software solutions [31]. Despite the advancements in the requirements elicitation research, software engineers do not still understand clearly what a software system/product should provide to satisfyingly meet the needs and expectations of stakeholders [22][51].

Requirements elicitation is the process of capturing and determining customers/users' (stakeholders') requirements for a system to be built, that result in high probability of satisfying the stakeholders and end-users' needs [38]. Requirements elicitation involves the convergence of the mental model of stakeholders; this convergence poses a great challenge to the requirements elicitation process [43].

Actually, requirements elicitation is a complex, rigorous and critical process which can make or mar the entire system development process and thus, is key to a successful and quality oriented software engineering project [38][43][48]. Its goal is to understand and collect users' and stakeholders' needs, constraints, and expectations that will be analyzed, specified and modeled as requirements [42] and such requirements captured must be clear, correct and complete [49].

Sharma and Pandey [40] categorized elicitation methods into the following: conversational, collaborative, contextual (observational) and cognitive methods. The traditional elicitation methods include: interviews, surveys, background reading/ document analysis, workshop, focus group, brainstorming etc [41] (these traditional methods are also called conversation method because most of them support vocal communication) [41]. Li et al [42] argued that the traditional elicitation techniques are primarily driven by the requirements analysts with a limited stakeholder involvement [42][50].

Interviews have three basic types, namely: Structured, semi-structured and un-structured. In requirements definition, the most valuable is the unstructured interview type. However, this unstructured interview should be conducted by experienced requirements engineers to be able to maximize its use [46]. The use of structured interview do lead to some important requirements being missed if the set of questions is not well prepared and structured [46].

The brainstorming technique is a useful technique. It is a very useful addition to the semi-structured interview [46]. In the situation where there is more than one stakeholder, with the use of brainstorming, the whole group can be questioned and requirements collected from them [46]. Also, the laddering approach is one which is employed as part of the brainstorming. With it, the brainstorming session can be moderated. Thus, it allows stakeholders answers to be hierarchically structured [46].

Survey or the questionnaire method is perhaps the most used method. It is probably the most important impersonal method of requirements elicitation. It is useful especially in preliminary requirement collection. However, this method is limited in that it is not very effective in discovering new facts or dimensions for a proposed software system. Hence, it has to be prepared by experienced requirements engineer who have good knowledge of the problem domain [46][51].

Another technique is the observation technique. This method allows users/ stakeholders to be observed in their natural setting (that is, in their own environment). This method is valid in human centric system design. However, this method is limited because of privacy concerns and the fact that users can decide to change their behavior when they are aware or informed that they are being observed [46].

In addition, there are many collaborative methods identified, among them are: Cooperative requirements capture, joint application design, quality function deployment. These techniques foster communication between the stakeholders and the analysts and facilitate group collaboration [42]. Some methods are a combination of collaboration and communication methods like group storytelling, narrative network modeling and dialogue game [39].

Some elicitation techniques are useful in exploring the diverse background, motivations and emotions of users like the use of personas and scenario-based techniques. The above methods are good, but are limited in probing the mind of the user/customer and they are not explicitly designed to capture the satisfaction customers/users will derive from the meeting of requirements. To both capture the customers/users' voice and mind and also their satisfaction on elicited requirements, Kano method is more appropriate and it is thus proposed to be used in this study.

The Kano model probes both the customers' voice and the customers' mind; it explores the potential users'/customers' psychology. Its use helps to filter out those requirements that will not satisfy the users' needs or that have no value to the users, thus, enhancing the quality of the requirements; it provides a way of optimally deciding on which feature/ requirement to retain and which to discard in the software development process.

Kano model helps to extract from users what they really expect from a product. Using this model, proposed features that most stimulate users are captured; hence, enabling the

building of a unique and lean product that contains the necessary features that pleases and at the same time amazes the users [22].

Kano model of quality and customer satisfaction captures and categorizes requirements on the grounds of how satisfied and excited the potential users are about the requirements, so as to know the requirements that delight users more, remove the ones that are irrelevant to them and thus improve the quality of the intended system. Eliciting requirements is not enough, how satisfied are the stakeholders about each of the elicited requirements? This should be put into consideration.

In this study, Kano Model is applied in the gathering of users' requirements through survey technique and in the modeling of users' requirements' satisfaction. Kano model is popular in the interdisciplinary field of quality management, but rarely applied in software engineering research. The main objective of this study is to elicit quality and satisfying user requirements/features for the proposed system employing Kano Model. The remaining part of this paper is divided into five sections: section 2: background; section 3: methodology; section 4: results; section 5: discussion and section 6: conclusions.

II. BACKGROUND

This section begins with the need for e-Ebola awareness system (solution).

A. Why an e-Ebola Awareness System?

Health is a hot surfing topic on the Internet today. According to a survey study conducted by the Pew Internet and American Life Project, there is an increasing rise in the popularity of the Internet as a source and resource for obtaining information on health related issues [3][6]. Back in 2005, 8 in 10 (80%) of Internet users surfed the Internet for health related topics [6].

Also, according to Freudenheim [3]-[4], a more recent survey results indicate that 4 in 5 (80%) of Internet users seek healthcare related information on the Internet [4]. As Samuel et al [3] observed, online health sites provide a great range of topics on health, ranging from general topics, to specialized ones. They opined that from statistics gotten from a survey, 51% of health sites focus on general topics. These resources are provided via an owner generated content that accounts for 46% of the online sites surveyed. In addition, they also showed that 56% of health content among the surveyed websites is for broadcast-to-any, that is, content delivered to any user [3].

In 2012, a study was conducted that revealed that users who need self-help are increasingly having access to care on the Internet [5]. On the Internet, there is a large content on health related information that can be accessed free of charge by patients [1].

However, this scenario is not evident in the case of Ebola Virus Disease as there is a dearth of online systems devoted to providing real time information and creating awareness of the disease, hence, the need for an Ebola Awareness System to provide general and specialized content on Ebola online at real time to potential users. Information technology can enhance the quality, affordability and efficiency of providing health care to a teaming number of users when harnessed and used as in this case [2].

E-Ebola Awareness System, an online (Web-based) e-Health awareness system, will be built with quality in mind, right early from the elicitation of requirements. The requirement elicitation process takes the end-user into account such that the requirements gathered are those that satisfy and delight them. This application is proposed for the purpose of creating awareness on Ebola in response to the recent Ebola outbreak in some parts of the world. Ebola is a hot global issue at the moment because it is a highly infectious, deadly disease with a 90% fatality rate [25]. According to the World Health Organization "The current outbreak in West Africa, (first cases notified in March 2014), is the largest and most complex Ebola outbreak since the Ebola virus was first discovered in 1976" [25].

At the moment, not enough public awareness has been created about the disease. The public awareness of Ebola is still low and inadequate and the channel of public awareness being used so far, are mostly through some other media other than online medium [27]-[30].

Also, this application is proposed to be dynamic and will use web services (APIs) to gather data from different resources on the Internet. It will also serve/provide content in some international and local languages. The system when developed aims to contribute to the United Nations Millennium Development Goals Number 6 which is, "COMBAT HIV/AIDS, MALARIA AND OTHER DISEASES" [26].

B. Kano Model

Kano et al [13] proposed the Kano Model based on Herzberg's "Motivation-Hygiene" Two Factor Theory. The model measures users/customers' feeling and the impact of product quality on their perceived satisfaction. It defines the different classifications of product quality attributes/features that have influence on customer satisfaction. It is a two-dimensional model that views the relationship between product quality and customer satisfaction as non-linear [9][13]. The model is however, qualitative in nature. Berger et al [32] proposed the customer satisfaction coefficient (CS-Coefficient) to compute the proportion of customers who are satisfied when a requirement is met (when a feature is present) in a product and the extent to which they are satisfied as well as the proportion that are dissatisfied when the reverse is the case and the extent to which they are dissatisfied [32].

Matzler and Hinterhuber [14] also proposed an approach based on the Kano Model that explores customer requirements and integrates it with quality function deployment (QFD) [14]. Moreover, Matzler and Sauerwein [36] and Garver [35] made use of inferred and stated importance to group attributes in key (performance), basic, amplifier (excitement) and secondary attributes/ qualities. Attributes having high importance are reckoned as key attributes while those that have low importance are reckoned as secondary [37].

Also, Tan and Shen [10] proposed an approximate transformation function to adjust the improvement ratio of customer requirement [10]. Tan and Pawitra [11] in their

work, proposed the integration of Kano model and SERVQUAL into QFD by first obtaining the Kano classification for each requirement followed by the assignment of 4, 2, and 1 as multiplier values to the attractive, one-dimensional and must-be categories respectively [11].

Kaivan and Hines [17] integrated Kano Model into QFD in a similar way to Tan and Pawitra [11], the only difference is that the weights are 4, 1, 0.5, but their weight selection was highly subjective and the association between customer satisfaction and product quality is still handled as linear even after the assigning of weights to the various corresponding categories of the Kano Model. The only distinction is that the slopes are different, which may be smaller or larger than one in following the various Kano classifications [15][17].

Tontini [12] proposed an adjustment factor that is, the max (|SI|, |DI|) based on the CS Coefficient of Berger et al. [32]. In his proposal, SI and DI are the satisfaction and dissatisfaction indexes. He took the adjustment factor as the importance of customer requirement [12]. The proposed adjustment factor is the higher absolute value of SI or DI that measures satisfaction or dissatisfaction when a requirement is met or unmet, as the case may be. However, he still handled the association between customer satisfaction and product quality as linear with different groupings of requirements given the same importance [16]. Chaudha et al. [16] proposed a function to adjust the traditional improvement ratio based on the adjustment factor proposed by Tontini [12][15].

From the above literatures, attempts have been made by researchers to improve on the Kano Model because of the qualitative nature of its requirements categorization which is subjective. The various authors proposed various quantitative methods to quantify the Kano Model. Kano et al. [13] along with Berger et al. [32] and Matzler and Hinterhuber [14], all applied the functional and dysfunctional approach. Matzler and Hinterhuber [14] revealed that one way to quantify the Kano Model is to assess how customers/users' are satisfied or dissatisfied with regards to the influence of the presence or absence of a products feature, quality or requirement. In the light of the foregoing, this paper applied the Berger et al. [32] improvement on the Kano Model [34]. The Kano Model provides answers to the question of which feature or requirement has a greater influence or impact on users/customers' satisfaction or that affects the quality of a proposed software product [8].

C. Kano Model Categories

Survey method is the most widely used traditional methods in eliciting user/customer's requirements. The underlying reason is that the survey method can be carried out at scale. This scale is a Likert type of 5 or 7 points that ranges from lest to most important. However, the use of this method of survey has shown that users/customers often say that every requirement is either very important or important, which indicates obvious survey bias.

Another demerit is that this method leaves no clue as to how many requirements are to be met without failure [7]. Also, customer focus group interviews do not suffice when investigating potentially new and latent software products. This method cannot extract attractive requirements from users since users do not expect such features [8].

However, Kano et al [13] showed that not all requirements are at equal level of importance from the viewpoint of the user/customer. According to them, in the eye of the customer, the importance of requirements can range from must-be, to one-dimensional, to attractive (in the order of high to low). They opined that customer/user requirements can be classified into three key groups, namely: 1. "Must-Be" requirement: A basic requirement, of which its absence leads to user/customer extreme dissatisfaction, the user/customer takes this requirement for granted, thus, their being met does not increase the satisfaction level of users/customers. Meeting this requirement leads to a state of "not dissatisfied" 2. "One-Dimensional" requirement, which is a linear kind of requirement, when met, the satisfaction of the user/customer is increased, but when unmet satisfaction level of the user/customer is decreased, that is, their dissatisfaction increases. This requirement/feature is what the user/customers expect from the proposed product. It is a performance requirement, which improves the quality of the product in the eye of the user/customer. These requirements are usually demanded by users/customers 3. "Attractive" requirement is a kind of nice to have requirement. Without it, there is actually no problem (there is no feeling of dissatisfaction), but having it will maximize the level of satisfaction (that is, it leads to more than proportional satisfaction if met). These requirements are the features that have the greatest impact on the level of user/customer satisfaction.

In addition to these three categories, Kano et al also indicated that the requirements can fall into any of the following categories depending on how the questionnaire was filled: 1. "Indifference" requirement, a no preference requirement, implying that the user/customer is indifferent to the requirement/feature. He does not care if the feature is present or not. 2. "Reverse" requirement, an inverse requirement (can be either way), here, the user/customer expectation about the feature is in a reverse order 3. "Questionable" indicates a wrong answer from the user/customer filling the questionnaire which renders the response invalid [7][18]. Fig.1 shows the Kano Model.

In addition, Guizzi et al. [44] describes that requirements can be classified based on the relationship between customer satisfaction and degree of fulfillment. On that basis, they classified requirements following Kano classification into: Basic or implied requirements, explicit or performance requirements and exciting requirements. Kano model qualities can be summarized into two categories, namely: Spoken quality and unspoken quality. Spoken quality coincides with performance or express requirements while unspoken quality is the basic or implicit requirements. Customers either do not speak of such quality or they may not even be aware of it or they considered them implied in the product Guizzi et al. [44].

Simonette et al. [45] in their work used the following Kano classification for requirements categorization: Normal requirements, expected requirements and exciting requirements. Normal requirements are the requirements that are explicitly required. Expected requirements are the basic

requirements. They are so basic that sometimes stakeholders forget to mention them as part of their requirements, because they feel it is somewhat unnecessary to request for them explicitly. Any systems that do not have or include these requirements is very dissatisfying to users, however, when these requirements are met, they are often unnoticed by customers/users. The exciting requirements are those requirements that if not present in the software system, their absence will not be perceived and their absence will not dissatisfy the stakeholder. Customers/users or other stakeholders do not voice out these requirements [45].

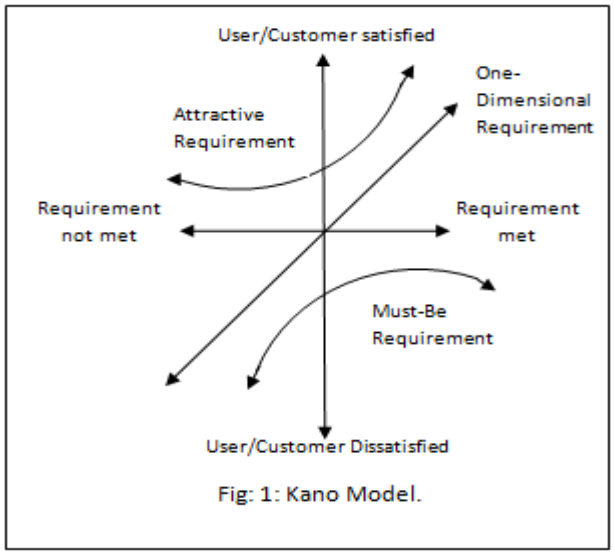

Fig: 1: Kano Model.

Fig.1: Kano Model

Kano method helps in promoting quality which invariably can lead to an improved competitive potential for a product in the market. A competitive product ought to meet the basic requirements, maximize performance requirements and include as many exciting requirements as possible at the cost which the market can afford [47].

There are several nomenclatures describing the same Kano quality attributes. For the purpose of this study, the following Kano classification naming will be used: Attractive (i.e. exciting) requirements, One-dimensional (i.e. performance/ Linear) requirements, Must-be (i.e. basic) requirements, Indifferent requirements and Reverse requirements.

D. Kano Questionnaire

The Kano Model incorporates a survey instrument that overcomes the bias arising from the traditional requirement elicitation survey instrument. To remove the inconsistency and bias, (that is, that every requirement is equally important), two questions are asked for each requirement. The first question is functional (a positive question) and the second is dysfunctional (a negative question). The first question is asked to find out how the users/customers feel if the proposed feature is in place or requirement is met while the second question is to find out how they feel if the intended feature is not in place or requirement is not met. Each of the questions (whether functional or dysfunctional), has a list of five options, namely: 1. "I like it that way" (like), 2. "It must be that way" (must-be), 3. "I am neutral" (neutral), 4. "I can live with it that way" (live with), 5. "I dislike it that way" (dislike).

After the survey, the result is tallied and totaled to show how the majority of users/customers expressed their requirements, and this is categorized into M "Must-Be", O "One-Dimensional", A "Attractive", I "Indifferent", R "Reverse" and Q "Questionable" categories. The highest tally/count among the totals of each of these categories for a given requirement is picked as the category for the requirement. The rule for evaluation is: "M>O>A>I". This rule guides decisions when making decisions on which feature/requirement has more influence on the perceived quality of the proposed software product [7][18].

E. Coefficient of Customer Satisfaction

The coefficient of satisfaction indicates whether if by meeting a requirement, the level of customer/user satisfaction can be increased or whether meeting the requirement just hinders the user/customer from being dissatisfied [32]. This coefficient shows the degree or the extent to which the presence of a software product feature may impact customer satisfaction and its absence can influence customer dissatisfaction. The coefficient of satisfaction (CS) is calculated thus [32]:

$$SI = \frac{A + O}{A + O + M + I} \quad (1)$$

$$DI = -\frac{O + M}{A + O + M + I} \quad (2)$$

Where SI is the extent of Satisfaction, DI is the extent of Dissatisfaction, A is Attractive, O is One-Dimensional, M is Must-Be and I is Indifferent. The minus sign in the DI equation is to place emphasis on the negative influence on user/customer satisfaction that will result if the requirement is not met or if the feature is not incorporated into the design of the product.

A positive CS-Coefficient runs from 0 to 1 while a negative CS-Coefficient ranges from 0 to -1. Zero (0) implies no influence on satisfaction if the requirement is met (as in SI) or on dissatisfaction if the requirement is not met (as in DI). The closer the value is to 1, the greater the impact of meeting the requirement is on user/customer satisfaction (that is, for SI) and the closer the value is to -1, the greater the influence of not meeting the requirement is on user/customer dissatisfaction (that is, for DI).The closer the value is to zero, the lesser the influence [8]. This implies that the requirement /feature have lesser impact or influence on user/ customer satisfaction and on the proposed product quality.

III. METHODOLOGY

In this paper, Kano Model was used for data collection and analysis as well as in the categorization of requirements. Berger et al. [32] extension of Kano Model [13] was applied in determining the coefficient of customer satisfaction. A Kano questionnaire was

constructed and administered to fifty (50) respondents during the Kano survey and survey ethics were duly observed. The participants were staff and students of Universiti Utara Malaysia, Malaysia.

All participants are potential users of the proposed e-Ebola Awareness System (E-Easy) and all had pre-knowledge of the Ebola Virus Disease. With the sample size of fifty (50) the expected margin of error will be 13%. During the administration, a screening question was asked to screen out those who are not eligible to respond to the questionnaire. The screening question was: "Have you heard of Ebola in the past?" Only respondents that responded "Yes" were eligible to respond to the Kano questions.

After the survey, the responses were collated and analyzed using a semi-automated Kano Analysis Excel tool. Further analysis was done with SPSS version 17 package. In addition, the requirements were categorized following Kano's approach [13] and the Coefficient of User/Customer Satisfaction was computed using Berger et al [32] method.

Also, a self-stated importance of requirements was elicited from participants using a 7-point Likert-type importance rating scale that ranges from totally unimportant to very important. The entire survey instrument was checked and examined for reliability using Cronbach Alpha and the result was 0.79, indicating a good internal consistency of the questionnaire items. The Cronbach Alpha coefficient is usually used in computing the reliability of a survey instrument. A Cronbach Alpha of 0.7 and above is accepted as an acceptable reliability coefficient [19].

More so, five requirements/features were elicited and evaluated in this study. They include:

R1: Locally generated content on Ebola
R2: Ebola Tweets from Twitter
R3: Ebola News via Google News
R4: Content translation through Google Translate
R5: Security of Content

These five requirements are the main requirements/features expected to be incorporated in the design of the first release of the proposed software product.

IV. RESULTS

The survey results as well as Kano model analysis is given in this section.

A. Demographic Characteristics

The result of the survey shows that of the 50 respondents, 58% were male and 42% were female. Their age ranges are as follows: below 20 (4%), 20-29 (64%), 30-39 (26%), 40-49 (2%), above 49 (4%). The marital status of respondents is: single (70%), married (30%). The participants' highest educational qualification is: Secondary School Certificate (22%), Diploma (6%), Bachelor (50%), Masters (18%), Doctorate (4%); and the distribution of their monthly income in Malaysian Ringgit is as follows: Below 3000 (86%), 3000-7000 (12%), 7001-10000 (2%).

These demographic data underscore the spread of respondents and the coverage of their background. In terms of gender, both males and females were well represented. The age distribution shows that most of the participants were within the ages of 20-29 (64%) and 30-39 (26%). Also, a larger proportion of respondents were singles (70%), the married were just 30%. More so, the percent of the highest educational qualification of respondents is more for Bachelor degree holders (50%), followed by secondary school certificate holders (22%). With regards to monthly income, most of the participants claimed that their monthly income is below RM3000 (86%), this category is followed by those in the RM3000-RM7000 range of monthly income (12%). The peculiarity and characteristics of the demographics is as a result of the setting of the survey.

Generally speaking, the spread of respondents was comfortably okay for the study of this nature as they cover a considerable spectrum or segment of potential users of the proposed software system (in terms of gender, marital status, education among others). The distribution of the countries of origin of respondents is given below: Nigeria (18%), Yemen (10%), Somalia (6%), Iraq (10%), China (4%), Malaysia (32%), and Oman (6%). Others comprise 14%, which include: Pakistan, Zimbabwe, Libya, Jordan, Algeria, Indonesia and Thailand with 2% each. The respondent countries of origin were mainly from Africa (30%), Asia (42%) and the Middle East (28%), cutting across the continents of Africa (30%) and Asia (70%).

These demographics are particularly important as the respondents fall within areas where information concerning the Ebola Virus Disease is likely to be sought for. It is interesting to know that past incident of the Ebola Virus Disease was prominent in one the continent captured in this survey (i.e. Africa). Also, the effect of the recent Ebola crises in some parts of the world was felt virtually everywhere in almost every continent, so, the respondents must have responded to the Kano survey with a strong knowledge of the impact of the Ebola Epidemic.

B. Kano Analysis

Kano analysis (Table I) indicates that almost all the requirements are "One-Dimensional" (80%) with only one as "Attractive" (20%). None of the requirements are a "Must-Be" or "Indifferent" requirement. R1 (28%) (Provision of locally generated content on Ebola by the system owners) is an attractive requirement. This implies that the absence of this feature or quality in the proposed product will not cause users dissatisfaction, but its presence makes users happy and excited and improves their satisfaction for the software product. R2 (30%) (Provision of Ebola Tweets via Twitter), R3 (44%) (Provision of Ebola news collated from major international news media via Google News), R4 (44%) (Translation and provision of content in some international and local languages via Google Translate) and R5 (36%) (Provision of security for Ebola content in the system) are all one-dimensional requirements.

Table I: Kano Requirements Categorization Table

Req	M	O	A	I	R	Q	T	Cat.
R1	11	14	16	06	03	-	50	A
R2	5	15	13	14	03	-	50	O
R3	07	22	11	07	02	01	50	O
R4	07	22	12	06	03	-	50	O
R5	04	18	06	18	04	-	50	O
Req	M%	O%	A%	I%	R%	Q%	T%	Cat.
R1	22	28	32	12	06	-	100	A
R2	10	30	26	28	06	-	100	O
R3	14	44	22	14	04	02	100	O
R4	14	44	24	12	06	-	100	O
R5	08	36	12	36	08	-	100	O

A (Attractive); O (One-Dimensional); M (Must-Be); I (Indifference); R (Reverse); Q (Questionable); T (Total); Cat (Category); Req, R1-R5 (Requirements)

The implication of these one-dimensional requirements in the product is that they make the product to achieve quality in the eyes of users as these are the requirements/features they are expecting. When not fulfilled, that is, when these requirements are not met the users will be dissatisfied, but when met, they will be satisfied. The requirements have a linear characteristic. Their being met is proportional to users' satisfaction and their not being met is proportional to users' dissatisfaction.

In a nutshell, these requirements contribute to enhancing the quality of the proposed product and will improve the competitiveness and the odds of the use of the product on the Web. However, the high percentages of "Indifferent" category for all requirements are a cause of concern. In addition, the proportion of requirements in some of the "Must-Be" and "Attractive" categories beg for close attention. Even though, these requirements categories do not constitute the majority, interestingly, their percentages show that there are user segments that are likely to fall into these categories, though they are not in the majority.

C. Coefficient of Satisfaction

Table II and Fig. 2 below clearly reveal the extent of users' satisfaction and dissatisfaction with regards to when the requirements are met and unmet respectively. The degree of satisfaction when the requirements are met for almost all the requirements is above 60%, while on the other hand the degree of dissatisfaction when the requirements are not met is barely above 60% in only two of the requirements and below 60% for most of the requirements.

Table II: Table of CS Coefficients

Coefficient of Satisfaction(CS)		
Req.	SI	DI
R1	.64	-.53
R2	.60	-.43
R3	.70	-.62
R4	.72	-.62
R5	.52	-.48

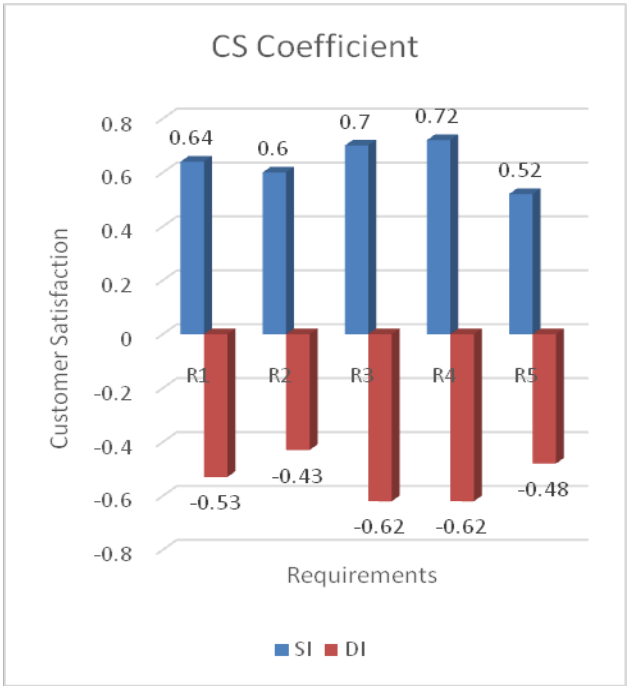

Fig.2: CS Coefficient with SI and DI indexes

R3 (70%) and R4 (72%) tops the list of requirements that increases that satisfaction of users when met and at the same time also top the list of requirements that will dissatisfy users when unmet (R3 (62%); R4 (62%)). This underscores their level of importance to the potential users of the software product. This result corroborates with the self-stated importance rating of users' perceived importance of the requirements as the two requirements also tops the list of the most important requirements.

Also, R2 (60%) and R5 (52%) are the least of the requirements that satisfies users when met and incidentally, are also the least of the requirements that dissatisfies users when unmet, R2 (43%), R5 (48%). This result also confirms the result of the self-stated importance rating of the requirements as the two requirements are the least important as perceived by the respondents.

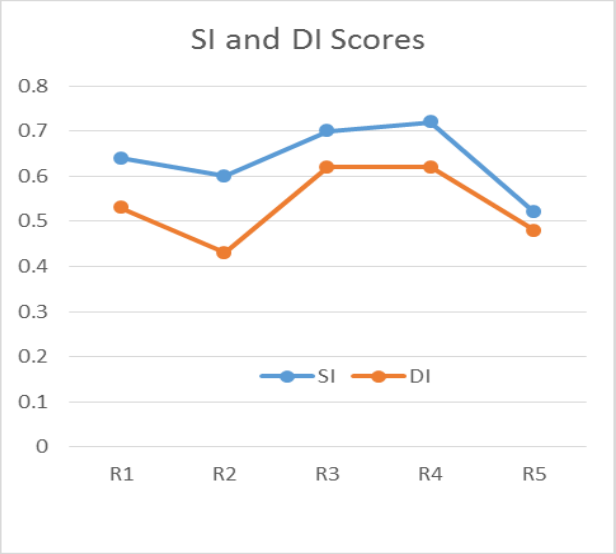

Fig.3: Comparison of SI and DI

As can be seen from the above graph (Fig.3) (the minus sign in DI was removed to closely see the relationship between SI and DI), the level and extent of user/ customer satisfaction when the requirements are met (SI) is higher than their degree of dissatisfaction when such requirements are not met (DI). This observation cuts across all the five requirements. The gap is widest for R2 (The provision of Ebola Tweets via Twitter) and narrowest for R5 (The provision of security for the Ebola content in the system). For both SI and DI in R5, there is a fall in satisfaction and dissatisfaction respectively. The satisfaction and dissatisfaction levels for R3 (Provision of Ebola news from major international news media via Google News) and R4 (The translation and presentation of content in local and international languages via Google Translate) are almost running parallel with the dissatisfaction levels.

In general, the participants seem to be more satisfied with having these features in the proposed system than being dissatisfied with not having them in the design of the system, but the difference is not substantial. There seem to be some proportionality in the degrees of satisfaction and dissatisfaction levels for almost all requirements as they seem to run in parallel. The requirements appear to have similar behavior and quality and seem to drive similar levels of influence in terms of their impact on user's satisfaction and dissatisfaction, that is, as satisfaction goes up so do dissatisfaction and vice versa. This result also reveals how valuable these features are to the potential users of the proposed software solution. For all features, there is parallel rise and fall in users' satisfaction and dissatisfaction when the features are present or absent respectively.

D. Self-Stated Importance

The result of the perceived importance ratings of the requirements as stated by the respondents is as follows (shown in Table III):

Table III: Respondents' Self-Stated Importance

Self-Stated Importance Rating			
Req.	Mean	Std	Rank
R3	5.74	1.34	1
R4	5.32	1.71	2
R1	5.32	1.48	3
R2	5.28	1.47	4
R5	5.04	1.59	5

From this result as shown in Table III, the requirement of top most importance to the surveyed participants is R3 (Ebola News from major international news channels and media via Google News). This is followed by R4 (The translation and provision of content in other languages other than English). Next is R1 (The provision of Ebola content locally generated by the owners of the system). The fourth in the order of importance in the eyes of the participants is R2 (Ebola Tweets send from Twitter). The least important feature as stated by respondents is R5 (The security of the Ebola content in the system). The importance level of R4, R1, and R2 are almost similar while there is a big margin of difference in the perceived importance of requirements R3 and R5. Obviously, the participants seem to value Ebola news content more than the security of the content as there is nothing so crucial in the content to secure. The result of the self-stated importance ranking agrees with the result in Table II, Fig. 2 and Fig. 3 on SI and SI.

V. DISCUSSION

As can be seen from the analysis offered in the study, the kind of requirements elicited during the elicitation phase of the software development lifecycle matters. This study shows that for the design and development of an e-health awareness system, most of the requirements should be one-dimensional in order to maximize the quality, value, patronage and use of such product. For an e-health awareness solution, users/customers are interested in the content that the product provides or offers and they place value on them than the security of such content. Securing the content, even though it satisfies the user/customer, is of less importance to them (that is, within the health awareness domain).

Among the content that increases the satisfaction of users, the top two are: first, provision of current news on Ebola. The next is the provision of content in some local and other international languages; these top two requirements are incidentally also the top two features that are most important to the potential users, thus, the evidence from the coefficient of satisfaction is substantiated by the outcome of the self-stated importance rating scores. Also, the least feature that satisfies users is the provision of security for the Ebola content in the system; this also upholds the results obtained from the self-stated importance rating of the features/ requirements. Users see less need in securing the content as there is nothing at risk if they are not secured.

VI. Conclusion

Kano analysis is used as a quality tool to identify which user/customer needs are important, as well as to capture which requirements are satisfied or that leads to satisfaction when included in the design of the proposed product [47]. The Kano method helps to provide a glimpse of the perceived quality of the intended product.

This paper reveals that 80% of requirements for the proposed design are one-dimensional. This indicates that these requirements are quality enhancer and they can proportionately increase the satisfaction of users when incorporated into the design of the proposed software solution. Their absence in the future product will greatly dissatisfy users. This conspicuously shows the level of influence these requirements/features have on the perceived quality of the proposed system. Even the 20% of the requirements that is "Attractive" also shows that though its absence in the future product may not cause dissatisfaction, its presence on the other hand will delight users.

This notwithstanding, a careful look at the Kano analysis shows that many of the respondents indicated indifference to the requirements, implying that they do not care whether the requirements are met or unmet. The presence of these features does not trill them and neither does their absence dissatisfy them. They are nonchalant about the proposed software design and product. This indicates a segment of users that will be indifferent to the features and qualities of the proposed solution. The issue here is that the proportion of this segment of users is high and should be a cause of worry and concern.

The study is however limited in the sense that the sample size was small and the participants were made up of staff and students of Universiti Utara Malaysia and mainly African and Asians by descent. There was no participant from Europe or the Americas. Future confirmatory studies may leverage on these limitations. Also, future studies should utilize these requirements in the design of e-health awareness systems as they are mostly performance requirements and good contributors to the quality promotion and competitiveness of such systems especially in today's competitive global market.

From the results gotten from this study, it is clear and obvious that Kano method has an important role to play in the elicitation of software requirements, in categorizing them on the basis of quality attributes and in capturing the level of stakeholder satisfaction or dissatisfaction if the requirements are met or unmet. The method is thenceforth appropriate for use and applicable in the elicitation of requirements within the software engineering domain. The Kano method can be adopted, especially when the focus of the requirements elicitation is on capturing both the voice and the mind of the customers/stakeholders and in situations where their satisfaction is a prime objective and where it is necessary to predict the perceived quality of proposed software products from the point of view of the potential user/ customer.

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