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A Numerical Kano Model for Compliance Customer Needs with Product Development

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Abstract. Functional form and dysfunctional form of Kano model are considered as customer need regarding attribute of product. Both functional and dysfunctional forms are: Like, Must-be Neutral, Live-with and Dislike. The answers of customer regarding a product of functional and dysfunctional forms have been applied for selection of customer needs regarding product attribute (Kano evaluation). Filling–up and returning the Questionnaires by the individuals are essential for determining Kano evaluation. But many Questionnaires have not been returned in that case. Moreover, many possible consumers could not get opportunity to fill-up questionnaire. These uncertain or unknown consumers' opinions are also essential for product development. The choices of Kano evaluations have been outlined by: Attractive, One-dimensional, Must-be, Indifferent and Reverse. In this study, choices of evaluation of unknown customer are considered uniform cumulative vector probability (scenario 1). This study is based on the Monte Carlo simulation method, concept of probability and Kano model. This model has also been tested for its soundness and found fairly consistent including existing Kano model (scenario 2) and case survey for headlight of bicycle (scenario 3).

Keywords: Kano Model, Probability, Product Attributes, Customer Satisfaction and Dissatisfaction

1. INTRODUCTION

This study is an endeavor for quantitative approach to further develop the well-known Kano Model. It is useful for the research in capturing and quantifying the customer requirements in new product development process as well as consequent quality assurance (Rashid, 2010 and Rashid *et al*., 2010). The authors investigate into the effects of customer needs, regarded as the important attribute in product development. The study examines these needs by relating them to identifying both functional and dysfunctional forms of Kano Model. The paper contributes to the development of a proposed numerical Kano model, incorporating the compliance customer needs and evaluation of uncertain or unknown customers' opinions for product development. It also provides some empirical testing results on validating the efficacy of the proposed model and comparing it with existing Kano model.

The paper addresses the technical aspects in terms of three scenarios, as advocated in the Abstract. Monte Carlo Simulation method coupling with probability concepts is used to expand the existing Kano model to the numerical model.

The testing of the proposed model is illustrated with the setting of simulation scenarios, expressed in equations and figures. The technical correctness of the paper is objectively demonstrated with numerical results. For this purpose, section 2 is illustrated for literature review, section 3 for a numerical method of using Monte Carlo simulation method, section 4 for a study on Kano model, section 5 for inputs of the model events, probability vector and cumulative probability, section 6 for result and discussions.

2. LITERATURE REVIEW

The most appropriate leveraging strategy is essential for product development with respect to the target

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market segments considering the customer trends (Weck *et al*., 2005). Product development is an integrated result of design, manufacturing, research and development, and compliance with Voice of Customers (VOC). Product development is considered main challenge to comply among satisfaction, affordability of customer, production rate, technical ability, human error, production cost, shorter reaction time, selling price, organizational complexity and bureaucracy, value chain and competitor of manufacturer in various customer segments (Browing, 2003; Prasad, 2000; Burlikowska and Szewieczek, 2009; Willcox and Wekayama, 2003; Matt, 2009).Various challenges are raised from different customer segments according to their individual customer needs. In this respect, manufacturers are following laws of consumer needs, customer pain points (Handfield and Steininger, 2005), and attention of changing customer needs by adapting design requirements (Hintersteiner, 2000). Another challenge of product development is to an unstable and diversified market behavior (Cochran *et al*., 2000) and the demographic and psychographic factors of customers. Thus, VOC, organizational aspects, peripheral aspects, methods and tools are considered appropriately for product development, (Fujita and Matsuo, 2006). Systems development society is working for integrating VOC into product development. For instance, Transitional Business Model (TBM) is developed to incorporate the customer needs into the concept generation processes for aerospace product development (Guenov *et al*., 2006). Data mining techniques are identified for product development by the researchers Jiao *et al*., 2007. A knowledge management model is developed by Fagerström and Olsson, 2002 for using Soft System Methodology (SSM) and emphasized the need for effective collaboration between main supplier and customers for adding value to a product development process. Identified factors are explained or significantly contributed to successful launch of product development of an innovation by another research group Haapaniemi and Seppanen, 2008. Integrated design knowledge is applied for reuse framework, bringing together elements of best practice reuse, design rationale capture and knowledge-based support in a single coherent framework by Baxter *et al*., 2007. A formal basis for the creation of an automated reasoning system is also supported for creative engineering design by Sushkov *et al*., 1995. Mannion and Kaindle, 2008 developed a formal logic-based approach to deal with the VOC in term of product requirement. Sivaloganathan *et al*., 2000 carried out a study for the effectiveness of systematic and conventional approaches to design. A stepwise procedure based on quantitative life cycle assessment is integrated of environment aspects in product development by Nielsen and Wenzel, 2002. A model is developed for coexisting product and process design. There are various design concepts to evaluate in order to identify the ‘Best’ concept with application of fuzzy logic for design evaluation and proposes an integrated decision-making model for design evaluation at developing a computer tool for evaluation process to aid decision-making (Green and Mamtami, 2004). A design structure matrix (DSM) is provided by Browing, 2003 a simple, compact, and visual representation of a complex system that supports innovative solution to decomposition and integration problems for product development. The rapid change of technology has been led to shorter product life cycles for many products most particularly in consumer electronics. A product definition and customization system (PDCS) is established to meet rapid change of competitive and globalised business climate (Minderhond and Fraser, 2005; Chen *et al*., 2005). Moreover, an information technology (IT) framework is solved the product development problem through automatic generation of information (Dean *et al*., 2008). Other than information cannot be summed for decoupled designs and overcome the problem was applied joint probability density function and uniformly distributed design parameters (Frey *et al*., 2000). A deliberate business process is involved hundreds of decisions and supported by knowledge and tools for product development, where a new composition of fuzzy relations which is defined by using the drastic product development (Krishnan and Ulrich, 2001). The products model is developed for technical and marketing purpose (Meyer, 1992). Reused design is applied by Ong *et al*., 2008 for product development modeling and analysis and optimization. Integrated design of products and their underlying design processes are provided for a systematic fashion, motivating the extension of product life cycle management (PLM) (Panchal *et al*., 2004). ‘Validation Square’ is validated by testing its internal consistency based on logic in addition to testing its external relevance based on its usefulness with respect to a purpose (Pedersen *et al*., 2000). The concept of Lean has influenced the research of VOC and its implementation. The focuses of all activities are turned to customer needs rather than job-at-hand (Oppenheim, 2004). Browning, 2003 recommend that removing one activity or changing its focus as because it is a non-value adding activity does not help improve overall value of a product. Sireli *et al*., 2007 developed a method to integrate Kano model with QFD. Chen and Chuang, 2008 integrated Kano model with the concept of robust design. Li *et al*., 2009 integrated Kano model to make AHP (Analytical Hierarchy Process) and rough-set based calculations. Xu *et al*., 2009 developed a variant of Kano model called “analytical Kano model”. As a result, the Kano model has been appeared into one of the most popular quality models now a day since its introduction in 1984. Kano’s model of attractive quality (Kano *et al*., 1984) has been taken the researchers of industries for quality product development (Berger *et al*., 1993; Matzler and Hinterhuber, 1998; Kai, 2007; Fuchs and Weiermair, 2004). Based on the information from Kano questionnaire, it provides a quantitative approach to observe and follow the change over time (Raharjo *et al*., 2009). An investigation is done for 3G mobile services perceive on the market (Baek *et al*., 2009). The major difference in contrast to other wide spread quality models, such as the technical and functional quality model (Gronroos, 1984) or the Gap model (Parasuraman *et al*., 1985), is that Kano's model is based on the assumption of existence of nonlinear and asymmetric relationships between attribute-level performance of products/services and overall customer satisfaction (OCS). Nevertheless, the empirical studies (Chen and Chuang, 2008; Li *et al*., 2009; Xu *et al*., 2009; Sireli *et al*., 2007) of Kano model are in a sense helpful in materializing the issues that have been emphasized by the holistic frameworks of product development (Fagerström and Olsson, 2002; Browning, 2003; Oppenheim, 2004; Guenov *et al*., 2006). Kano model is able to identify a set of product attributes satisfying a set of customer needs (Kano *et al*., 1984; Berger *et al*., 1993; Matzler and Hinterhuber, 1998; Kai, 2007). The above review guides to develop a numerical Kano model for unknown customer need analysis. Moreover, Ullah and Tamaki, 2009 have developed a method of 25 individuals; only 14 of them submitted a Kano questionnaire with their answers on time. 11 individuals, *i.e.* 44% of the answers were unknown or technically uncertain. Their study was constrained in this specific area to know the 11 unknown people's answer. According to above previous researchers' discussion it is found that generic unknown customers' evaluation is not studied. For this reason in this regard Ullah and Tamaki made a proposition in their next work (Ullah and Tamaki, 2010), that unknown customers are considered uniform cumulative vector probability. According to this proposition, the proposed model is developed for unknown or uncertain customer evaluation regarding product attribute to follow above guideline. Regarding Kano model based numerical simulation model is crucial for unknown customer need analysis with product attribute i.e. Kano evaluation or customer evaluation.

3. METHODS

This section explains the common settings of the simulation method. Before introducing the general settings, a particular case of simulation (i.e., simulation of three mutually exclusive events from given proabilities) are described for better understanding.

The simulation process of three mutually exclusive events denoted by A, B, and C with known probabilities is schematically illustrated in Fig. 1. The explanation of the simulation process is as follows:

Suppose that A, B, and C are three mutually exclusive events and Pr(A), Pr(B), and Pr(C) are their probabilities, respectively, so that Pr(A) + Pr(B) + Pr(C) = 1. Using these probabilities, the cumulative probabilities (CPr(.)) can be calculated in the following manner: CPr(A) = Pr(A), CPr(B) = Pr(A) + Pr(B), and CPr(C) = Pr(A) + Pr(B) + Pr(C). Three mutually exclusive intervals can be derived using the cumulative probabilities, as follows: [0, CPr (A)), [CPr (A), CPr (B)), and [CPr (B), CPr(C)]. Suppose that r_k, is a random number in the interval [0, 1] for all k = 1, ⋯, N.

Consider the following rule to simulate A: "If $r_i \in$ [0, CPr(A)) Then S_k = A." This rule ensures that if r_i is a

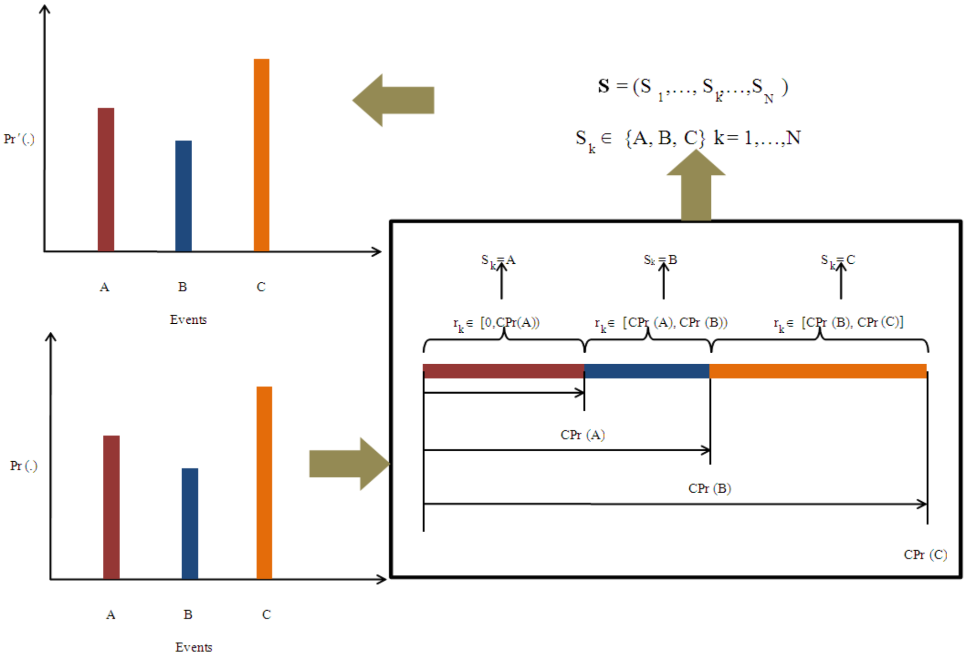

Figure 1. Simulation of three mutually exclusive events.

value in the interval [0, CPr (A)), then S_k becomes A. Similarly, consider two more rules to simulate B and C, as follows: "If $r_i \in$ [CPr (A), CPr (B)) Then S_k = B" and "If $r_i \in$ [CPr (B), CPr(C)] Then S_k = C." Therefore, if these three rules are repeated N times, each time S_k will become A, B, or C depending on the value of r_i. As such, if **S** is the vector of N simulated events **S** = (S_1,⋯, S_k, ⋯, S_N), then $S_k \in$ {A, B, C} for all i = 1,⋯, N. If the simulation process is perfect the relative frequencies of A, B, and C in **S** should be equal to Pr (A), Pr (B), and Pr(C), respectively. For example, if Pr (A) = 0.85, Pr (B) = 0.1, and Pr(C) = 0.05, then out of 100 iterations (N = 100) 85 iterations will result A, 10 iterations will result B, and 5 iterations will result C, i.e., relative frequencies of A, B, and C become equal to the given probabilities. In reality this does not happen because of the limitation of the computer-generated random number r_i. Therefore, an error occurs. This yields an error function Error = |Pr (A) - Pr ′(A)| + |Pr (B) - Pr ′(B)| + |Pr(C) - Pr′(C)|. Here, Pr ′(A), Pr ′(B), and Pr′(C) denote the relative frequencies of A, B, and C in **S**, respectively. Thus, the objective is to keep the value of Error close to zero. One of the ways to achieve this objective is to increase the number of iterations N. Figure 2 shows two plots of Error against number of iterations N. The left hand side plot corresponds to Pr (A) = 0.8, Pr (B) = 0.15, and Pr(C) = 0.05 (i.e., one of the event is most likely to occur), whereas the right hand side plot corresponds to Pr (A) = Pr (B) = Pr(C) = 1/3 (i.e., all events are equally likely to occur). As seen from Fig. 2, for both cases the Error is as low as 5%, if the number of iteration is at least 2000. This critical number of iterations (i.e., N is 2000 or above will make sure Error less than 5%) is valid only for simulating three events. For other cases, it is important to construct similar plots of Error versus N and then determine the critical number of iterations.

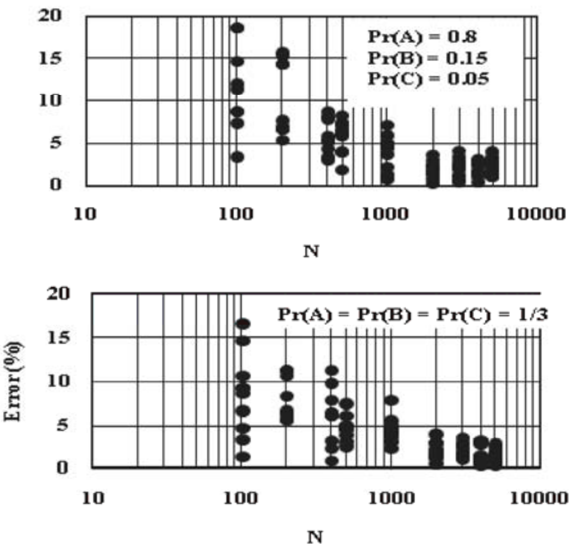

Figure 2. Relationship between simulation error and num-

However, the above result also implies that irrespective of the fact that an event is most likely to occur (the top side case in Fig. 2) or all events are equally likely to occur (the bottom side case in Fig. 2). The aforementioned three-event simulation process can be generalized for *n*-event simulation process, as defined by (1). In (1), $E=(E_1, \ldots, E_n)$ is the event vector, **P** = (Pr (E_1), Pr (E_n)) is the probability vector, and **S** = (S_1, S_N) is the simulated event vector. Other symbols in (1) have the same meaning as explained in the above.

```
Input :
  $\mathbf{E} = (E_1, \cdots, E_n)$ //event vector
  $\mathbf{P} = (\Pr(E_1), \cdots, \Pr(E_n))$ //probability vector
  $N$ //number of iterations
Calculate :
  For $i = 1, \cdots, n$
    $\mathrm{CPr}(E_i) = \Pr(E_1) + \cdots + \Pr(E_i)$ // cumulative probability
  End For
Simulate :
  For $k = 1, \cdots, N$
        generate $r_k$ //$r_k$ is a random number in the interval $[0, 1]$
          If $r_k \in [0, \mathrm{CPr}(E_1))$ Then $S_k = E_1$
          Else
          For $i = 2, \cdots, n-1$
          If $r_k \in [\mathrm{CPr}(E_{i-1}), \mathrm{CPr}(E_i))$ Then $S_k = E_i$
          End For
          If $r_k \in [\mathrm{CPr}(E_{n-1}), \mathrm{CPr}(E_n)]$ Then $S_k = E_n$
    End For
Output :
$\mathbf{S} = (S_1, \cdots, S_k, \cdots, S_N)$ //simulated event vector
```
(1)

Probability (strictly speaking the relative frequency) of events E_1,⋯, E_N in **S** denoted by Pr′(.) can be determined using the formulation defined by (2).

```
Input:
  $\mathbf{S} = (S_1, \cdots, S_k, \cdots, S_N)$ //simulated event vector
Calculate:
  For $i = 1, \cdots, n$
      $count_i = 0$
        For $k = 1, \cdots, N$
          If $S_k = E_i$ Then $count_i = count_i + 1$
        End For
      $\Pr'(E_i) = \frac{count_i}{N}$ //probability of $E_i$ in $\mathbf{S}$
  End For
Output:
  $\mathbf{P}' = (\Pr'(E_1), \cdots, \Pr'(E_n))$ //simulated probability vector
```
(2)

Therefore, simulation *Error* (summation of absolute difference between given and simulated probabilities of each event) can be defined by the expression in (3).

$$Error = \sum_{i=1}^{n} \left| \Pr(E_i) - \Pr'(E_i) \right| \tag{3}$$

4. A STUDY ON KANO MODEL

4.1 Introduction of Kano Model

Kano model of customer satisfaction defines the relationship between product attribute and customer satisfaction and provides five types of product attributes: 1) *Must-be*, 2) *One-dimensional*, 3) *Attractive*, 4) *Indifferent*, and 5) *Reverse*, as schematically illustrated Fig. 3 and Table 1. The combination of *functional* and *dysfunctional* answers is then used to identify the status of the attribute in term of: 1) *Must-be*, 2) *One-dimensional*, 3) *Attractive*, 4) *Indifferent*, or 5) *Reverse* from Table 1.

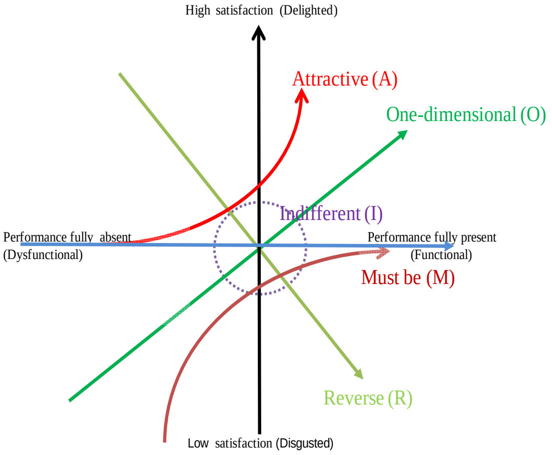

Figure 3. Kano model for customer satisfaction.

All possible combinations of customer answers and the corresponding type of product attribute are summarized in Table 1. As seen from Table 1, besides the above mentioned five types of attribute in Table 1, there is one more type of attribute called *Questionable*.

Table 1. Kano Evaluation.

Functional Answer (FA)	Dysfunctional Answer (DFA)				
	Like (L)	Must-be (M)	Neutral (N)	Live-with (Lw)	Dislike (D)
Like (L)	Q	A	A	A	O
Must-be (M)	R	I	I	I	M
Neutral (N)	R	I	I	I	M
Live-with (Lw)	R	I	I	I	M
Dislike (D)	R	R	R	R	Q
Attractive (A), Indifferent(I), Must-be(M), One-dimensional (O), Questionable (Q) Reverse (R)					

This occurs (*Questionable)* when one selects Like or Dislike from both *functional* and *dysfunctional* sides (i.e., when an answer does not make any sense). Kano model is helpful for integrating the VOC into product development.

Table 2. Five categories of product attributes based on Kano *et al.* (1984).

Type of Attribute Perception	When attribute is present?	When attribute is absent?
One-dimensional	Satisfied	Dissatisfied
Must-be	No feeling	Dissatisfied
Attractive	Satisfied	No feeling
Indifferent	No feeling	No feeling
Reverse	Dissatisfied	Satisfied

Kano questionnaire for headlight of bicycle is shown in Table 3.

Table 3. Kano questionnaire.

Customer Needs (CN)

Your bicycle has a headlight

☐ Like
☐ Must-be
☐ Neutral
☐ Live-with
☐ Dislike

☑

Your bicycle don't have a headlight

☐ Like
☐ Must-be
☐ Neutral
☐ Live-with
☐ Dislike

☒

But real answer of customer feedback is summarized in Table 4 and Table 5.

It is important that Table 4 shows individuals opinion or customer answer the Kano model-based questionnaire (Table 3). Table 4, encompassing respondents (column 1), Functional Answer (column 2), Dysfunctional Answer (column 3). As seen from Table 3, a customer (respondent) can to select one of the states out of *Like*, *Must-be*, *Neutral*, *Live-with*, and *Dislike* from the *functional* side stating his/her level of satisfaction, if the attribute is added to the product.

The customer also can to select one of the states (out of the same choices) from the *dysfunctional* side stating his/her level of satisfaction, if the attribute is not added to the product. As an example, a customer can selects "Like" from the *functional* side (your bicycle has a headlight) and "Live-with" from the *dysfunctional* side (your bicycle has a headlight). As result, for specific this makes the headlight attribute of bicycle an Attractive attribute. Where 27 respondents answer is illustrated in Table 4. According to their answer and Kano evaluation Table 1, Evaluation answer is shown in

Table 5. Majority individuals are considered headlight attribute of bicycle is Must-be. Thus, this survey result is focused headlight of bicycle as a Must-be.

Table 4. Real Customer Answer for bicycle headlight.

Your bicycle has a headlight		
No	Functional Answer	Dysfunctional Answer
1	Must-be	Dislike
2	Live-with	Live-with
3	Must-be	Dislike
4	Must-be	Dislike
5	Like	Dislike
6	Like	Dislike
7	Must-be	Live-with
8	Like	Dislike
9	Must-be	Dislike
10	Must-be	Dislike
11	Neutral	Neutral
12	Must-be	Dislike
13	Must-be	Dislike
14	Like	Must-be
15	Must-be	Neutral
16	Must-be	Dislike
17	Like	Must-be
18	Must-be	Dislike
19	Must-be	Dislike
20	Like	Dislike
21	Must-be	Dislike
22	Like	Neutral
23	Like	Live-with
24	Like	Dislike
25	Must-be	Dislike
26	Must-be	Dislike
27	Must-be	Dislike

Table 6. Simplification form of Kano evaluation.

Sl	FA	DFA	Combination of FA and DFA	KE
1	Like	Like	Like Like	Questionable (Q)
2	Like	Must-be	Like Must-be	Attractive (A)
3	Like	Neutral	Like Neutral	Attractive (A)
4	Like	Live-with	Like Live-with	Attractive (A)
5	Like	Dislike	Like Dislike	One-dimensional (O)
6	Must-be	Like	Must-be Like	Reverse (R)
7	Must-be	Must-be	Must-be Must-be	Indifferent (I)
8	Must-be	Neutral	Must-be Neutral	Indifferent (I)
9	Must-be	Live-with	Must-be Live-with	Indifferent (I)
10	Must-be	Dislike	Must-be Dislike	Must-be (M)
11	Neutral	Like	Neutral Like	Reverse (R)
12	Neutral	Must-be	Neutral Must-be	Indifferent (I)
13	Neutral	Neutral	Neutral Neutral	Indifferent (I)
14	Neutral	Live-with	Neutral Live-with	Indifferent (I)
15	Neutral	Dislike	Neutral Dislike	Must-be (M)
16	Live-with	Like	Live-with Like	Reverse (R)
17	Live-with	Must-be	Live-with Must-be	Indifferent (I)
18	Live-with	Neutral	Live-with Neutral	Indifferent (I)
19	Live-with	Live-with	Live-with Live with	Indifferent (I)
20	Live-with	Dislike	Live-with Dislike	Must-be (M)
21	Dislike	Like	Dislike Like	Reverse (R)
22	Dislike	Must-be	Dislike Must-be	Reverse (R)
23	Dislike	Neutral	Dislike Neutral	Reverse (R)
24	Dislike	Live-with	Dislike Live-with	Reverse (R)
25	Dislike	Dislike	Dislike Dislike	Questionable (Q)

Table 6 is a straightforward outline of Kano model. This is a real picture of relationship among FA, DFA and KE. It is also shown frequency 25 for each FA, DFA and KE regarding events, which are defined in Tables 7-8. This rule is applied for selection of the simulated KE $\in \{A, O, M, I, R, Q\}$ from simulated FA and DFA.

Probability provides the real knowledge when outcome of events is uncertain. In the present study, events

Table 5. Compile the Customer Answer from Table 4.

				Evaluation of Answer	
Functional Answer		Dysfunctional Answer		Attractive (A)	4
Like	9	Like	0	Indifferent (I)	4
Must-be	16	Must-be	2	**Must-be (M)**	**14**
Neutral	1	Neutral	3	One-dimensional (O)	5
Live-with	1	Live-with	3	Questionable (Q)	0
Dislike	0	Dislike	19	Reverse (R)	0

probabilities are equivalent to relative frequency of those events. Generally, an event is a set of outcome to which a probability is assigned. Events of FA, DFA and KE are considered from above Table. These are described in Tables 7-8. Following table shows both FA and DFA events, mutually exclusive probability vector Pr (.) and cumulative probability CPr (.):

Table 7. Probability of the events of FA and DFA FA/DFA.

Events(E)	Frequency, f	Probability, Pr (.)	Cumulative Probability, CPr (.)
Like (L)	5	0.2	0.2
Must-be (M)	5	0.2	0.4
Neutral (N)	5	0.2	0.6
Live-with (Lw)	5	0.2	0.8
Dislike (D)	5	0.2	1

Table 8. Mutual Exclusive Probability of the Events of Kano Evaluation (KE)/ inputs of scenario 2.

Your bicycle has a headlight						
Event (Ei)	Frequency	f(.)	LL(.)	TV(.)	Pr(.)	CPr(.)
Attractive	4	0.14815	LL	0.3	0.204638472	0.204638472
Indifferent	4	0.14815	LL	0.3	0.204638472	0.409276944
Must-be	14	0.51852	SL	0.5	0.34106412	0.750341064
One-dimensional	5	0.18519	LL	0.3	0.204638472	0.954979536
Questionable	0	0	VU	0.033	0.022510232	0.977489768
Reverse	0	0	VU	0.033	0.022510232	1

According to the Kano events, the following model is proposed for considering as a scenario 2:

4.2 Kano Rule

The following table represents FA, DFA and KE

Table 9. A Kano rule with events probability in tabular form.

Sl. No.	Customer Kano Evaluation (KE)	Frequency, f	Functional Answer (FA)	Probability	Cumulative Probability	Dysfunctional Answer (DFA)	Probability	Cumulative Probability
1	Attractive	1	Like	0.333	1	Live-with	0.333	0.333
2	Attractive	1	Like	0.333		Must-be	0.333	0.666
3	Attractive	1	Like	0.333		Neutral	0.333	1
	Frequency for Attractive =	3						
4	One-dimensional	1	Like	1		Dislike	1	1
	Frequency for One-dimensional=	1						
5	Must-be	1	Live-with	0.333	0.333	Dislike	0.333	
6	Must-be	1	Must-be	0.333	0.666	Dislike	0.333	
7	Must-be	1	Neutral	0.333	1	Dislike	0.333	
	Frequency for Must-be =	3						
8	Indifferent	1	Live-with	0.111111111	0.3333	Live-with	0.11111111	
9	Indifferent	1	Live-with	0.111111111		Must-be	0.11111111	
10	Indifferent	1	Live-with	0.111111111		Neutral	0.11111111	
11	Indifferent	1	Must-be	0.111111111	0.666	Live-with	0.11111111	
12	Indifferent	1	Must-be	0.111111111		Must-be	0.11111111	
13	Indifferent	1	Must-be	0.111111111		Neutral	0.11111111	
14	Indifferent	1	Neutral	0.111111111	1	Live-with	0.11111111	0.333
15	Indifferent	1	Neutral	0.111111111		Must-be	0.11111111	0.666
16	Indifferent	1	Neutral	0.111111111		Neutral	0.11111111	1
	Frequency for Indifferent =	9						
17	Reverse	1	Dislike	0.142857143	0.571428571	Live-with	0.14285714	0.142857143
18	Reverse	1	Dislike	0.142857143		Must-be	0.14285714	0.285714286
19	Reverse	1	Dislike	0.142857143		Neutral	0.14285714	0.428571429
20	Reverse	1	Dislike	0.142857143		Like	0.14285714	
21	Reverse	1	Live-with	0.142857143	0.714285714	Like	0.14285714	
22	Reverse	1	Must-be	0.142857143	0.857142857	Like	0.14285714	
23	Reverse	1	Neutral	0.142857143	1	Like	0.14285714	1
	Frequency for Reverse =	7						
24	Questionable	1	Dislike	0.5	0.5	Dislike	0.5	0.5
25	Questionable	1	Like	0.5	1	Like	0.5	1
	Frequency for Questionable =	2						
	Total Kano Evaluation =	25						

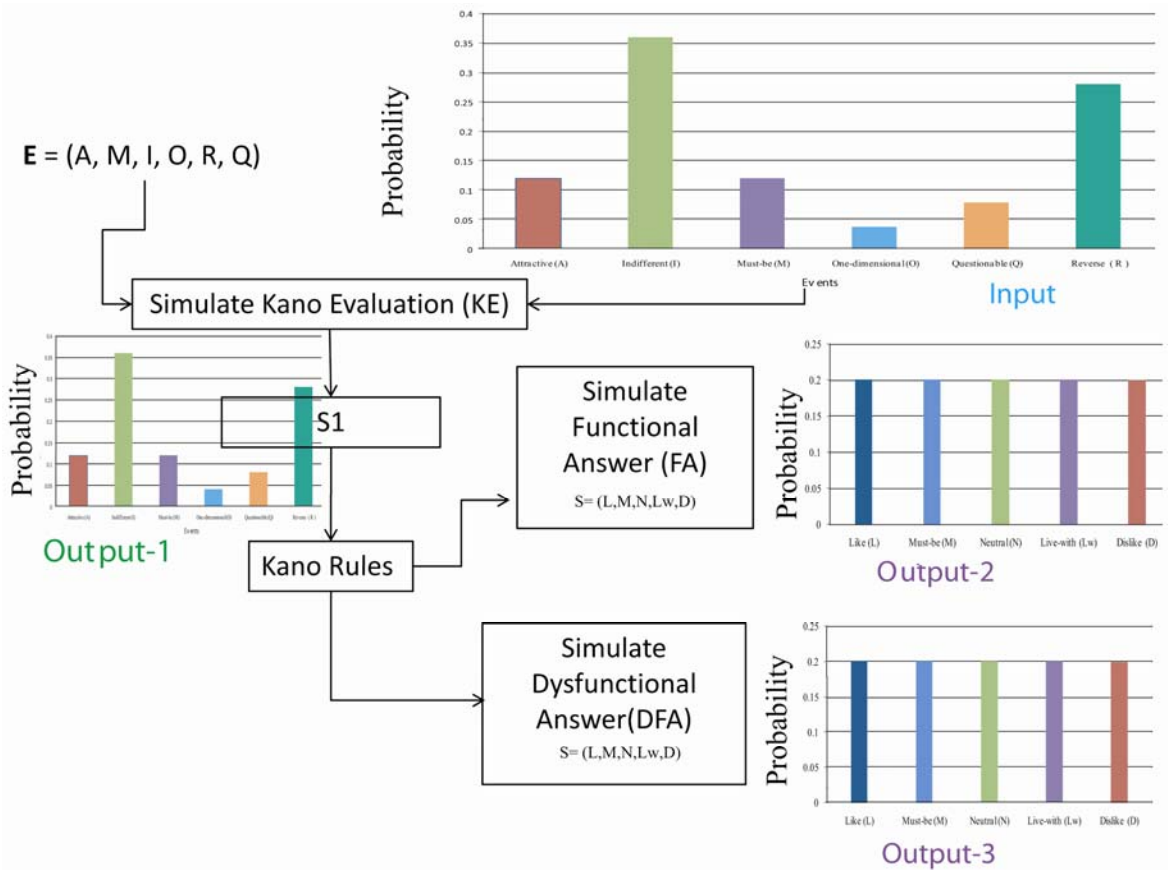

Figure 4. A developed numerical Kano model.

events and probability of Kano model. Accordingly second column of Table 9 represents the customer Kano evaluation and then next column shows the frequency of Kano evaluation.

4th~6th column show the Functional answer (FA) and 7th~8th column show the dysfunctional answer (DFA) with probability and cumulative probability of respective Kano evaluation (KE).

According Table 9 with following figure 5 is framed a Kano rule in graphical form. This rule is guided functional and dysfunctional answer from given Kano evaluation, likes E = (A, M, I, O, R, Q). These rules are used to develop a numerical Kano model.

4.3 Simulation Process for Selection FA and DFA from KE

In this simulation process, event vectors, probability vector, cumulative probability has been applied. Their applications are shown in Figures 4 and 5 according to steps 1~8. These figures show a customer need analysis model for the proposed simulation process and representation of the relationship among KE, FA and DFA of Kano model. The proposed simulation process is constructed for the selection of simulated FA and simulated DFA from the simulated KE; as described below:

Input Steps:

Step 1: Choices of events and probability vector of Kano evaluation (KE), E $\in$ (A, M, I, O, R, Q) according to scenarios 1~3 and figures 4~5.

Step 2: Determine the number of iterations (a set of random number).

Calculate:

Step 3: Generate a set of random inputs in the interval [0, 1].

Step 4: Applied the concept of cumulative probability of the Events.

Step 5: Simulated events vector according to Eq. 1.

Output: Outputs-1~3

Step 6: Simulated events of KE of customer according to Eqs. 1~2 (Output-1).

Step 7: Simulated events of FA from output 1 of customer according Kano rule and Eqs. 1~2(Output-2)

Step 8: Simulated events of DFA from output 1 of customer according Kano rule and Eqs. 1~2 (Output-3)

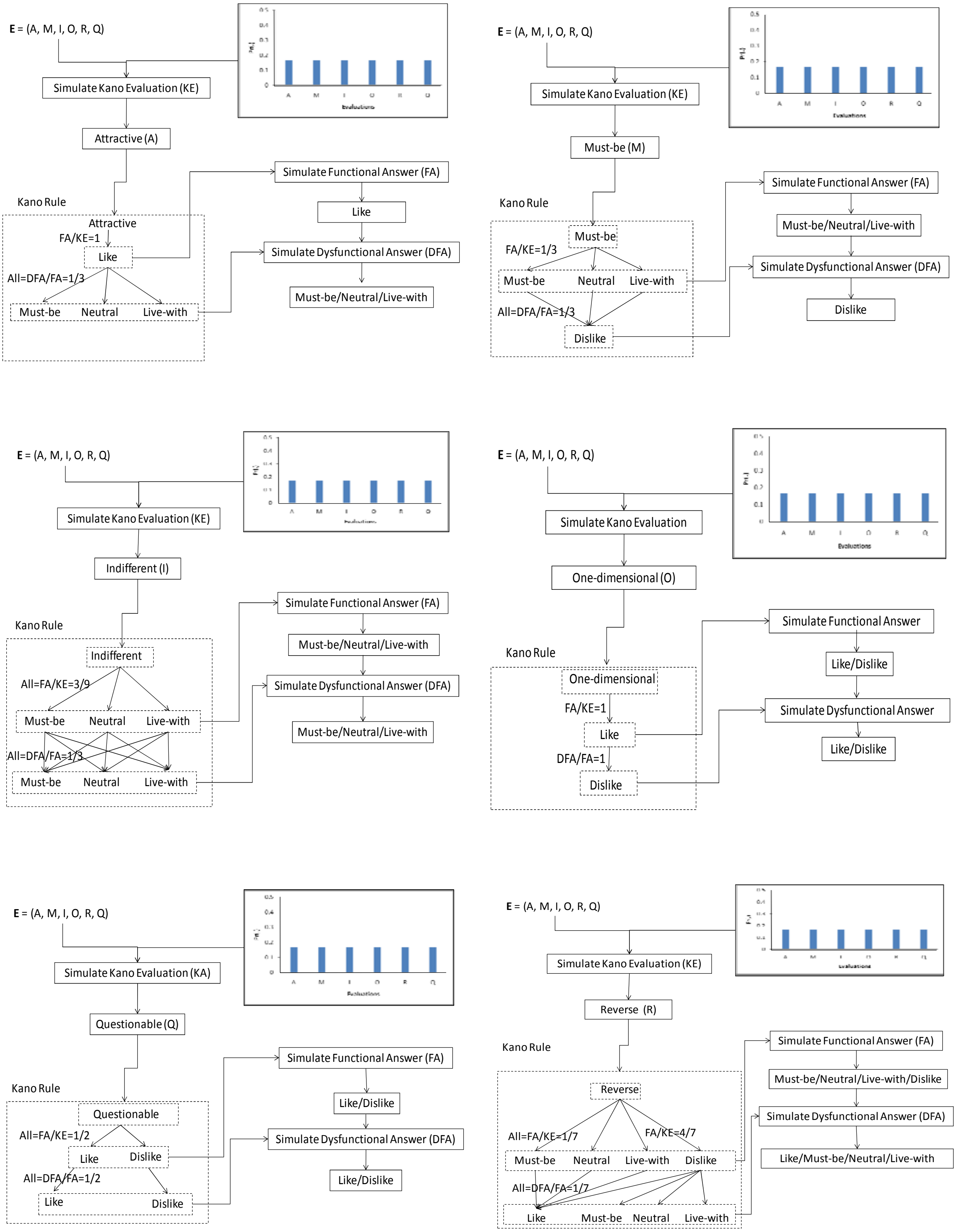

Figure 5. Graphical forms of the Kano rule

Generic individuals are considered in step 1 and it is expected that these individuals opinion are enough for product design information. These individuals are redefined with vector in Eq. 1. Choices of Evaluation $E \in \{A, O, M, I, R, Q\}$ of generic individuals (known and unknown customers) are considered uniform event probability vector, while cumulative vector probability is considered in Eq. 1. According to step 2, a set of random number inputs has been generated by using the RAND (). A set of numbers was generated between 0 and 1 by using Eq. 1. The graphical rules are described in previous subsection of both functional and dysfunctional answer separation from Kano evaluation. Therefore, a system is developed to implement the simulation.

5. INPUTS OF THE MODEL

First scenario 1 is considered as uniform vector of KE. For the scenario following table acts as an input of the system. It shows the generic system of unknown customer needs analysis on the system input equal probability vector (0.16667). A unique probability distribution may be hard to identify, when information is scarce, vague, or conflicting (Autonsson and Otto, 1995; Coolen *et al*., 2010). In that case probability represents the real knowledge, and provides tools for modeling and work weaker states of information. As a result, the unknown customers' choices of evaluation *i.e.* Attractive (A), Indifferent (I), Must-be (M), One-dimensional (O), Questionable (Q), Reverse (R) is generally unknown, *i.e.*, scarce, vague etc.

It is facilitated to consider equal probability of choice. This formulation also guarantees that the summation of all choices probabilities is equal to 1 (*i.e.*, the axiom of Normality as required by the concept of classical probability). This system input is straight forward demonstrated in Table 10.

Table 10. Input of the system for scenario 1.

Kano evaluation (KE)	Probability, Pr (.)	Cumulative Probability, CPr (.)
Attractive (A)	1/6 = 0.166667	0.166667
Indifferent (I)	1/6 = 0.166667	0.333333
Must-be (M)	1/6 = 0.166667	0.500000
One-dimensional (O)	1/6 = 0.166667	0.666667
Questionable (Q)	1/6 = 0.166667	0.833333
Reverse (R)	1/6 = 0.166667	1

For scenario 2: an input is illustrated in Table 8 for existing Kano model.

For scenario 3, a survey has been done according to Table 3 for Kano questionnaire and obtained customer answer in Table 5, and their evaluation is shown in Table 4. This evaluation is considered inputs for scenario 3 in the following Table 11. The relative frequency is turning to probability through Fuzzy method (Ullah and Tamaki, 2010); as described next 5 steps:

Step 1: Determine relative frequencies of the states of known answers.
Step 2: Determine Linguistic Likelihood.
Step 3: Determine Truth Values.
Step 4: Determine Probability.
Step 5: Determine Cumulative Probability.

Table 11. Input of the system for scenario 3.

Your bicycle has a headlight						
Event (Ei)	Frequency	f(.)	LL(.)	TV(.)	Pr(.)	CPr(.)
Attractive	4	0.14815	LL	0.3	0.204638472	0.204638472
Indifferent	4	0.14815	LL	0.3	0.204638472	0.409276944
Must-be	14	0.51852	SL	0.5	0.34106412	0.750341064
One-dimensional	5	0.18519	LL	0.3	0.204638472	0.954979536
Questionable	0	0	VU	0.033	0.022510232	0.977489768
Reverse	0	0	VU	0.033	0.022510232	1

6. RESULTS AND DISCUSSION

A generic simulation model is presented to know the Kano-model-based any known and unknown customer answer evaluation regarding product development. Input (Table 8, Table 10, Table 11) is applied in the model for following respective output (Table 13, Table 12, Table 14) of simulated events probabilities of Kano evaluation (KE), Functional Answer (FA) and Dysfunctional Answer (DFA). All simulated Kano evaluation (KE) probability range, 0.15815~0.17385 is consistent of the system input value 0.166667 (lower portion of output 1 of the scenario 1). The average simulated functional answer, Like is 0.41799; Must-be, Neutral and Live-with are likely equal around 0.1349, whereas Dislike attributes range is 0.177 (top portion of output 2 of the scenario 1). The scenario also shows that average simulated dysfunctional answer Like attributes is around 0.179 Must-be, Neutral and Live-with is likely equal around 0.1355 where as Dislike attributes range is 0.4171 (middle portion of output 3 of the scenario 1). This output shows the summation of event vector to one. The results of simulated of the scenario 2 events probabilities of KE, FA and DFA are shown in Table 13. All simulated KE, FA and DFA average probability is consistent of Kano model. The average simulated functional answer (FA) and dysfunctional answer (DFA) Like, Must-be, Neutral and Live-with, Dislike is occurred equally likely. It is shown a proposition for generic unknown customer evaluation according to Ullah and Tamaki, 2010. For this reason, the Kano evaluation of existing Kano model of the scenario 2 can be also considered for generic unknown customer evaluation. In the presented study, random inputs gave deterministic result, because of Table 13 shows that simulated probability range combined of Indifferent and Reverse is 0.6361~0.6463, which is also consistent with

0.64 (Ullah and Tamaki, 2010). This result ensures that the simulation provides the consistent deterministic result not uniquely deterministic. Ullah and Tamaki, 2010 also conclude generic unknown customer evaluation "Indifferent or Reverse". This study shows that always the probability of Indifferent attribute range 0.3517~0.366 is always greater than Reverse attribute range 0.2722~0.28535. It shows that this proposition of Ullah and Tamaki, 2010 regarding Kano model based generic customer evaluations is not completely appropriate. While, Indifferent attribute is predominated for generic unknown customer evaluation.

Simulated results have been presented in Table 14 for the scenario 3. All simulated Kano evaluation (KE) average probability is consistent of the system input value of Table 11. The average simulated functional answer (FA), Like is 0.418; Must-be, Neutral and Live-with are likely equal around 0.186, whereas Dislike attributes is 0.0238. The scenario also shows that average simulated dysfunctional answer like attributes is around 0.0243 must-be, Neutral and Live-with is likely equal around 0.14 where as Dislike attributes range is 0.555. It shows the summation of event vector to one.

The main findings from the presented simulation model are summarized below: All scenarios show the consistent outputs. Random inputs are furnished consistent deterministic result. The summation of simulated events vector probability for each Kano evaluation, Functional answer and Dysfunctional is 1. The difference between maximum values and minimum value has been found consistent with average value.

Moreover, suppose a producer is considered 0.80

Table 12. Output for the scenario 1.

Successive Simulation																			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16			
Simulation Results of Functional Answer																	Average Pr (.)	Maximum Pr (.)	Minimum Pr (.)
Like	0.4192	0.42205	0.4141	0.41335	0.4147	0.4138	0.42105	0.41755	0.42025	0.421	0.42	0.41995	0.4202	0.4188	0.41865	0.4192	0.417994118	0.42205	0.41175
Must-be	0.1336	0.1344	0.13355	0.13725	0.13535	0.1361	0.1321	0.1352	0.13	0.1325	0.135	0.1336	0.1349	0.128	0.13525	0.1351	0.133958824	0.13725	0.128
Neutral	0.1349	0.1329	0.1342	0.1375	0.13385	0.1358	0.13375	0.1346	0.13665	0.1345	0.133	0.13775	0.1322	0.136	0.13625	0.13665	0.134997059	0.13775	0.1322
Live-with	0.1362	0.13355	0.1397	0.1373	0.1364	0.13345	0.13115	0.1358	0.13875	0.1341	0.133	0.13165	0.1362	0.13795	0.1305	0.13555	0.135082353	0.1397	0.1305
Dislike	0.1761	0.1771	0.17845	0.1746	0.1797	0.18085	0.18195	0.17685	0.17435	0.178	0.178	0.17705	0.1765	0.17925	0.17935	0.1735	0.177967647	0.18375	0.1735
Summation	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1.0205	0.97595
Simulation Results of Dysfunctional Answer																	Average Pr (.)	Maximum Pr (.)	Minimum Pr (.)
Like	0.1748	0.18575	0.1744	0.1774	0.1793	0.1777	0.17895	0.1807	0.17765	0.1814	0.18	0.18275	0.17445	0.18115	0.1765	0.1826	0.179067647	0.18575	0.1744
Must-be	0.1354	0.1324	0.1336	0.13495	0.13405	0.1343	0.13285	0.13275	0.1361	0.1348	0.135	0.13575	0.13405	0.13985	0.1422	0.1375	0.135514706	0.1422	0.1324
Neutral	0.13315	0.1331	0.1341	0.1342	0.1356	0.13405	0.13335	0.13205	0.13305	0.1379	0.1335	0.135	0.13425	0.1319	0.13485	0.13185	0.133902941	0.13785	0.13185
Live-with	0.1348	0.1326	0.1322	0.13595	0.133	0.13745	0.13675	0.13295	0.1389	0.1348	0.14	0.133	0.1367	0.12875	0.13115	0.1316	0.134391176	0.13985	0.12875
Dislike	0.42185	0.41615	0.4257	0.4175	0.41805	0.4165	0.4181	0.42155	0.4143	0.4112	0..412	0.4125	0.42055	0.41835	0.4153	0.41645	0.417123529	0.4257	0.4112
Summation	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1.03135	0.9786
Simulation Results of Kano Evaluation																	Average Pr (.)	Maximum Pr (.)	Minimum Pr (.)
Attractive	0.16765	0.1628	0.16595	0.1634	0.16725	0.16675	0.17065	0.1664	0.16865	0.1697	0.168	0.1676	0.16745	0.1679	0..17	0.16715	0.167214706	0.17065	0.1628
Indifferent	016525	0.167	0.1643	0.1723	0.1633	0.1682	0.15815	0.1622	0.16845	0.1671	0.169	0.1681	0.16535	0.161	0.1664	0.1644	0.165770588	0.1723	0.15815
Must-be	0.16925	0.16095	0.17325	0.16615	0.17005	0.1642	0.16695	0.1706	0.1659	0.1635	0.161	0.16435	0.16925	0.166	0.16585	0.16835	0.166497059	0.17325	0.16095
One-dimensional	0.17125	0.1703	0.1666	0.1686	0.16315	0.1665	0.16745	0.1668	0.1691	0.1655	0.17	0.1649	0.1701	0.1686	0.16435	0.1671	0.167352941	0.17125	0.16315
Questionable	0.16165	0.17385	0.1674	0.1641	0.16915	0.16635	0.16665	0.1685	0.1618	0.1681	0.164	0.1707	0.16385	0.16605	0.1694	0.16595	0.1667	0.17385	0.16165
Reverse	0.16495	0.1651	0.1625	0.16545	0.1671	0.168	0.17015	0.1655	0.1661	0.1663	0.169	0.16435	0.164	0.17045	0.164	0.16705	0.166464706	0.17045	0.1625
Summation	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1.03175	0.9692

Table 13. Output for the scenario 2.

Successive Simulation																			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16			
Simulation Results of Functional Answer																	Average Pr (.)	Maximum Pr (.)	Minimum Pr (.)
Like	0.20035	0.20125	0.20035	0.2042	0.1996	0.1972	0.20035	0.202	0.20165	0.2036	0.202	0.2045	0.1951	0.1954	0.19845	0.2003	0.200379412	0.2045	0.1951
Must-be	0.2026	0.19665	0.19555	0.19385	0.204	0.2014	0.19955	0.1965	0.1973	0.1979	0.20465	0.1997	0.20305	0.20435	0.19995	0.2016	0.200182353	0.20465	0.19385
Neutral	0.20145	0.2002	0.19895	0.20185	0.1994	0.19795	0.2019	0.2037	0.1982	0.2037	0.20195	0.1968	0.2022	0.19785	0.19935	0.1967	0.200029412	0.2037	0.1968
Live-with	0.19745	0.20075	0.2022	0.1999	0.19925	0.2039	0.20245	0.19825	0.2015	0.19625	0.196	0.19895	0.2007	0.2023	0.2032	0.1982	0.200020588	0.2039	0.196
Dislike	0.19815	0.20115	0.20295	0.2002	0.19775	0.19955	0.19575	0.19955	0.20135	0.19855	0.1954	0.20005	0.19895	0.2001	0.19905	0.2032	0.199388235	0.20295	0.1954
Summation	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1.0197	0.97715
Simulation Results of Dysfunctional Answer																		0	0
Like	0.20435	0.2003	0.19435	0.2075	0.20325	0.1966	0.2016	0.19945	0.20165	0.1985	0.2042	0.2024	0.19765	0.19705	0.19465	0.1962	0.199944118	0.2075	0.19435
Must-be	0.1999	0.20085	0.2037	0.19935	0.1967	0.2001	0.19835	0.20255	0.1987	0.20055	0.20175	0.2037	0.1989	0.2024	0.19915	0.203	0.200420588	0.2037	0.1967
Neutral	0.19945	0.20345	0.19775	0.19665	0.1989	0.2044	0.20085	0.20165	0.2012	0.2036	0.19985	0.19875	0.2056	0.1983	0.206	0.20345	0.201105882	0.206	0.19665
Live-with	0.20095	0.19485	0.20565	0.1971	0.2016	0.2021	0.20295	0.2036	0.19675	0.2024	0.1985	0.19485	0.2005	0.2007	0.2024	0.19635	0.200311765	0.20565	0.19485
Dislike	0.19535	0.20055	0.19855	0.1994	0.19955	0.1968	0.19625	0.19275	0.2017	0.19495	0.1957	0.2003	0.19735	0.20155	0.1978	0.201	0.198217647	0.2017	0.19275
Summation	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1.02455	0.9753
Simulation Results of Kano Evaluation																		0	0
Attractive	0.1197	0.1222	0.11965	0.12125	0.11885	0.1205	0.1208	0.1241	0.1184	0.12265	0.12205	0.1229	0.1173	0.11695	0.12065	0.12015	0.120302941	0.1241	0.11695
Indifferent	0.36165	0.3578	0.3659	0.3517	0.3599	0.36455	0.3629	0.3616	0.3588	0.3618	0.36245	0.3568	0.36625	0.3647	0.36615	0.36235	0.361688235	0.36625	0.3517
Must-be	0.1156	0.12085	0.11735	0.12015	0.12035	0.1191	0.11965	0.1174	0.11735	0.11805	0.11805	0.1184	0.1214	0.12055	0.12005	0.11735	0.118832353	0.1214	0.1156
One-dimensional	0.04125	0.03985	0.0414	0.04065	0.0396	0.03825	0.0382	0.03795	0.04155	0.03985	0.03865	0.04035	0.03875	0.0391	0.03975	0.04165	0.039876471	0.04155	0.03795
Questionable	0.0779	0.07905	0.0791	0.0809	0.08075	0.0779	0.07975	0.07735	0.0845	0.07815	0.0803	0.0828	0.07625	0.08125	0.07605	0.0805	0.079708824	0.0845	0.07605
Reverse	0.2839	0.28025	0.2766	0.28535	0.28055	0.2797	0.2787	0.2816	0.2794	0.2795	0.2785	0.27875	0.28005	0.27745	0.27735	0.278	0.279591176	0.28535	0.2766
Summation	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1.02315	0.97485
Indifferent and Reverse	0.64555	0.63805	0.6425	0.63705	0.64045	0.64425	0.6416	0.6432	0.6382	0.6413	0.64095	0.63555	0.6463	0.64215	0.6435	0.64035	0.0641279412	0.6463	0.63555

Table 14. Output for the scenario 3.

	Successive Simulation																		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16			
Simulation Result of Functional Answer																	Average Pr (.)	Maximum Pr (.)	Minimum Pr (.)
Like	0.42225	0.418	0.4202	0.41735	0.4207	0.41915	0.424	0.4137	0.4231	0.4161	0.41645	0.419	0.4193	0.4178	0.4181	0.4178	0.4189375	0.424	0.4137
Must-be	0.1877	0.1894	0.1865	0.18645	0.1877	0.18735	0.1867	0.18935	0.18165	0.1856	0.18745	0.1839	0.1846	0.1903	0.1871	0.18775	0.18684375	0.1903	0.18165
Neutral	0.18265	0.1877	0.1825	0.1878	0.17995	0.1879	0.1811	0.18895	0.18585	0.1866	0.19245	0.187	0.19025	0.18435	0.18055	0.1875	0.18581875	0.19245	0.17995
Live-with	0.18355	0.18205	0.1851	0.1851	0.1865	0.18235	0.1838	0.185	0.18585	0.18815	0.1811	0.1871	0.1821	0.1835	0.18775	0.18325	0.1845125	0.18815	0.1811
Dislike	0.02385	0.02285	0.0257	0.0233	0.02515	0.02325	0.0244	0.023	0.02355	0.02355	0.02255	0.0231	0.02375	0.02405	0.0265	0.0237	0.0238875	0.0265	0.02255
Summation	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1.0214	0.97895
Simulation Result of Dysfunctional Answer																	Average Pr (.)	Maximum Pr (.)	Minimum Pr (.)
Like	0.0256	0.02235	0.02485	0.02475	0.02495	0.02325	0.0265	0.02545	0.0244	0.02235	0.0247	0.0234	0.02605	0.02285	0.0235	0.02395	0.02430625	0.0265	0.02235
Must-be	0.14555	0.1411	0.1447	0.1373	0.13805	0.14155	0.14195	0.1364	0.1369	0.1381	0.139	0.1395	0.14365	0.1391	0.1447	0.1366	0.140259375	0.14555	0.1364
Neutral	0.13815	0.1402	0.1391	0.1334	0.1406	0.14	0.1368	0.1421	0.14125	0.1411	0.1416	0.1421	0.1406	0.14085	0.14035	0.1371	0.13970625	0.1421	0.1334
Live-with	0.13825	0.13915	0.14065	0.14455	0.1379	0.14235	0.14045	0.14205	0.14185	0.14115	0.1415	0.1379	0.14005	0.13745	0.14095	0.14265	0.14055	0.14455	0.13745
Dislike	0.55245	0.5572	0.5507	0.56	0.5585	0.55285	0.5543	0.554	0.5556	0.5573	0.5532	0.5572	0.54965	0.55975	0.5505	0.5597	0.555178125	0.56	0.54965
Summation	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1.0187	0.97925
Simulation Result of Kano Evaluation																	Average Pr (.)	Maximum Pr (.)	Minimum Pr (.)
Attractive	0.20655	0.20505	0.20675	0.19915	0.2057	0.2058	0.20865	0.20375	0.2045	0.2025	0.20635	0.2035	0.2085	0.2023	0.2042	0.20195	0.2047	0.20865	0.19915
Indifferent	0.20545	0.206	0.20725	0.2061	0.20085	0.2075	0.20095	0.2074	0.20635	0.208	0.20795	0.2075	0.20575	0.20605	0.21085	0.20535	0.206203125	0.21085	0.20085
Must-be	0.3376	0.3437	0.3378	0.3435	0.34435	0.3411	0.339	0.3455	0.3374	0.344	0.34365	0.3414	0.3408	0.3432	0.33485	0.3444	0.3413875	0.3455	0.33485
One-dimensional	0.20425	0.2027	0.2014	0.2065	0.2025	0.2016	0.20315	0.19815	0.2073	0.20285	0.1983	0.2051	0.19885	0.2047	0.20345	0.20435	0.202821875	0.2073	0.19815
Questionable	0.02205	0.02105	0.02355	0.0217	0.02415	0.0219	0.02435	0.02215	0.0222	0.0212	0.02305	0.0211	0.02195	0.02265	0.02265	0.02245	0.022384375	0.02435	0.02105
Reverse	0.0241	0.0215	0.02325	0.02305	0.02245	0.0221	0.0239	0.02305	0.02225	0.02145	0.0207	0.0215	0.02415	0.0211	0.024	0.0215	0.022503125	0.02415	0.0207
Summation	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1.0208	0.97475

probabilities for one dimensional and others 0.2 for a product attribute, what happens for customer functional answer (satisfaction) with customer dysfunctional answer (dissatisfaction) for this product. This system can to evaluate functional answer (FA) and dysfunctional answer (DFA) regarding above product attribute (KE) information. This system can evaluate any kind of customer requirements (FA and DFA) from product attribute (KE).Therefore, in real life producers can use this system to evaluate their product attribute. This system can also compare the field survey result and proposed standard for product decision making.

Demographic and psychographic factors of custommer are not considered in this model. In traditional Kano model, functional answer and dysfunctional answer are considered to determine customer evaluation but in this study, customer evaluation is considered to determine customers' satisfaction and dissatisfaction. In built error is generated from Monte Carlo simulation method. In the present study, Maximum value, Minimum value and average value of simulated attributes are not same due to in built generated error, which is shown in Tables 12~14.

7. CONCLUSIONS

A numerical Kano model is developed for customer need analysis of product development on basis of Kano model. This model can compliance customers' needs with product development through different angle of probability of product attributes. Needs of Customers are changing due to their income, profession, age and technology etc. In this case producer can change their product development strategy quickly to adopt this numerical model to change probability of product attribute. Kano rule then can apply to find customer satisfaction i.e. functional answer and customer dissatisfaction i.e. dysfunctional answer. This work is better than traditional Kano model and any computational intelligence model for easier operation in computer with accuracy. Anybody can operate the model regarding product development compliance with customer needs. As a result, it will be easily conformed with any product development process. This model can forecast the relevant product development. These simulations also offer economic benefits by contributing human beings. Therefore, a simulation model is presented to know the simulated functional answer (FA) and dysfunctional answer (DFA) from a given Kano evaluation (KE). It has also been found that the selection of choice of generic unknown customer evaluation is predominately indifferent attribute than others product attributes. This study also ensures that the simulation provides the consistent deterministic result.

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