



# Customer Needs Analysis as Product Design Base of Refilled Bottled Water for Adults using Kano Models

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**Abstract** — Drinking water is a basic need for human beings. The higher level of awareness, activities, and mobility of people, the more people who consuming water. However, most people today prefer to buy water packaged in disposable bottled water that could adversely affect the environment. Furthermore, disposable bottled water can only be used once, and when it used repeatedly can harm the human body. The purpose of this study was to determine the needs of bottled water that can be refilled in order to meet the needs of customer and eco-friendly. This study analyses using Kano model, then the results obtained 10 attributes in bottled water product which 5 of them are included in One-Dimensional category, 3 attributes included in attractive, and each of the attributes in the category of must-be and indifferent. Referring to ten attributes, affordable price is the most influence attributes on customer satisfaction level, while the attribute of safety or not easily spill is the most influence on the customer dissatisfaction level.

**Keywords** — Need analysis, Bottled Water, Kano

## I. INTRODUCTION

One of the basic human needs to establish a life is “water,” where the water composes the human body weight about 50% to 60%. Water has important functions in the human body, especially to transport and to circulation of nutrients, along to control body temperature [10]. In general guideline of balanced nutrition (Pedoman Umum Gizi Seimbang, PUGS), Indonesian people are advised to consume drinking water as much as 2 litres or 8 glasses a day, in order to maintain a healthy body, and to optimize the physical ability. However, the results study of The Indonesian Hydration Regional Study (TIHRST) states that 46.1% of the subjects studied suffered mild hypovolemia or lack of water [4]. References [1] states that human cannot survive more than 4-5 days without drinking, and have consequences fatal for human. Water loss approximately 15% from body can lead to dehydration, even death. It means that knowledge about benefit and importance of sufficient water in the body is not matched by people’s behaviour in their consumption [4]. There are other factors which also affected such as the availability of water and the flurry of activities.

Nowadays, the policy on water consumption, as well as the mobility of people actively, encouraging more people to realize the importance of consuming adequate water, especially the Indonesian people who live in tropical climate. The need of drinking water is different for each person, depending on the age, gender, activities, and ambient temperatures. In abroad, tap water available to water fulfillment. Although several studies represent customers prefer to consume bottled water than tap water, even tap water quality is considered excellent [3][13]. According to References [3], the world’s market of bottled water volume amounted to 89 billion litres a year, with an average of 15 litres of bottled water consumed per person per year, and the largest consumption on Western Europe (46%). Many people in Indonesian still consume tap water, unfortunately the tap water not available in considerable public areas, and also not all areas have quality of clean / fresh water based in Kepmenkes RI No. 907/Men.Kes/SK/VII/2002. It triggers the public/people to consume bottled water, especially disposal bottled water, perceived more practical and available everywhere.

The use of disposal bottled water is certainly impact on increasing utilization of plastic as raw material of bottled water production, annually. Bottled water consumption in Indonesia was recorder reached 23.1 billion litres in 2014. In fact, the use of plastics has a negative impact for the environment. According to References [14], plastic for disposal bottled water packaging using a type of plastic that is not heat resistant, and potentially release harmful compounds that are derived from the residual monomers from polymers and plastics. The plastics bottles are made for one-time usage cannot be used to refilled and difficult to biodegradable which can be pollutant.

One effort to overcome this problem is diversion to refilled bottled water, in order to water need fulfilment and to safeguard the environment from the waste of disposal plastic bottles. The increasing usage of bottled water represents a change in ways of life. Successful economic of product design depends on suitability of product functionality to meet the customer needs. To achieve successful product development, the initial step is to identify the customer needs. Customers need bottled water development to be more interesting and able to accommodate the hidden need or more function. In order to create an appealing product design, companies must be able to identify the desires and needs of customers. Therefore, this study aims to determine customer demand for “refilled” bottled water, so it can become the basis for design and development of product.

## II. LITERATURE STUDY

### A. THE IMPORTANCE OF CUSTOMER NEEDS ON PRODUCT DESIGN AND DEVELOPMENT

Product planning and design is a set activities starting from encouraging perception of market opportunities, and ends with the production, sale, and delivery of the product [11]. Successful economic of manufacturing designer depends on the ability to identify customer needs and then create the product based customer needs accurately with the low cost. According to References [11], there are 6 steps of product design product planning, concept development, system level design, detail design, testing and improvement, initial production. In concept development phase, customer need identified. To be successful, an organization should focus its efforts primarily to the collection, knowledge, understanding and meeting requirements, needs and expectations of all its internal, external, current and potential customers [2]

### B. KANO MODEL

References [7] states the Kano Model builds a combination of the level of functional fulfilment and emotional satisfaction on that a customer, that can help designers focus their effort on developing product attributes. The enhancement of attributes performance of product is not always has a straight impact on the level of satisfaction [2][9]. References [6] studied about Kano model as an effective approach to categorizing or classifying the customer attribute, also successful classifying product features of digital cameras. This model also implemented in services as in references [2] at healthcare system.

The Kano model used to divide the characteristics of products in three categories i.e. dissatisfiers, satisfier and delighters [2][6][9][12]. The third category has a different impact on customer satisfaction. As the explanation of the three categories as follows [2][6][7][9][12].:

- **Dissatisfiers**, or *must-be*, *basic*, or *expected*.  
*Dissatisfiers* category is the existence of product characteristics received by customer, and when it does not exist it will cause dissatisfaction. It is something has never asked by customer, because they expect that product characteristics must be available. The examples of *dissatisfiers* can be seen in Table 1.
- **Satisfiers**, or *one-dimensional*, or *straight-line*.  
Something that customer wants in their products and usually asked by them, it categorizing on *satisfier*. The more we provide satisfiers attributes, the customer will be happier. *Satisfier* often called *desired quality* because it represents the aspects of product defined to customer. In examples are increased capacity, lower cost/price, higher reliability, faster speed, and easier to use.
- **Delighters**, referred to *attractive* or *exciting* characteristics.  
The pleasant surprise attributes or product features to customers, included in *delighter* category. However if delighters attributes not exist in the product, the customer will not realize what is missing from these products.

In addition to the three categories above, there are three other categories, namely indifferent, questionable and reverse [6][7][9]. Indifferent is an attributes that do not cause customer satisfied neither dissatisfied although it is functioning or not. It is parallel to the horizontal line.

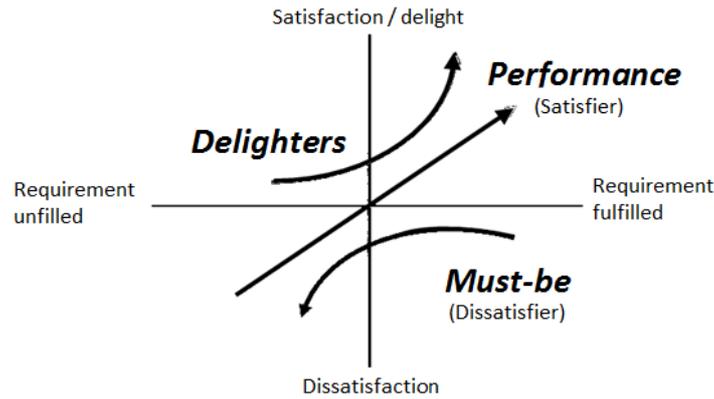


Fig. 1 Kano Model [12]

For the questionable category, the attributes need to be asked more to customer. While the reverse means the assessment of whether or not an attribute function contrary to customer need. Kano evaluation table is used to determine the category of attributes.

functional form of the question	
If the gas mileage is good, how do you feel?	1. I like it that way. 2. It must be that way. 3. I am neutral. 4. I can live with it that way. 5. I dislike it that way.
If the gas mileage is poor, how do you feel?	1. I like it that way. 2. It must be that way. 3. I am neutral. 4. I can live with it that way. 5. I dislike it that way.
dysfunctional form of the question	

Fig. 2 Sample question on Kano Model Questionnaire [5]

Customer Requirements		Dysfunctional				
		1. like	2. must-be	3. neutral	4. live with	5. dislike
Functional	1. like	Q	A	A	A	O
	2. must-be	R	I	I	I	M
	3. neutral	R	I	I	I	M
	4. live with	R	I	I	I	M
	5. dislike	R	R	R	R	Q

Customer Requirement is:  
 A: Attractive                      O: One-dimensional  
 M: Must-be                        Q: Questionable result  
 R: Reverse                         I: Indifferent

Fig. 3 Kano Evaluation Table [5]

Kano model developed the theory to understanding of how customers evolve, evaluate and perceive quality attributes and focused the attention on the attributes considered more important by customers in order to improve them [2]. References [7] mentioned about the customer satisfaction (CS) coefficient stated by Berger et al (1993), whether satisfaction can be increased by meeting a product requirement, or whether fulfilling this product requirement merely prevents the customer from being dissatisfied. We can determine the influential value or score of each attributes of customer needs at the satisfaction level, symbolized by letter  $S$ , which means the higher positive value or score, then the higher affect to increasing customer satisfaction [8]. The value of  $S$  is in the range between 0 to 1, and will vary depending on customer preferences, and obtained from the Equation 1 below.

$$S = \frac{A + O}{A + O + M + I} \dots\dots\dots (Eq. 1)$$

Otherwise,  $S'$  is the value or score of attributes that have an influence on dissatisfaction, and the value in the range of -1 to 0.  $S'$  obtained from the Equation 2.

$$S' = \frac{O + M}{A + O + M + I} \dots\dots\dots (Eq. 2)$$

Further, after obtained the value of  $S$  and  $S'$ , company can see the most importance attributes of customer needs. The attributes that closed to -1 should be noted because it will highly affect to customer dissatisfaction.

### III. RESEARCH METHOD

Determination of attributes in this study is conducted by brainstorming and interview with bottled water customer as a base in the preparation of the list questions that will be ask to respondent. The intended respondents are adults who use bottled water. Following the obtained attributes of product, the next step is to develop Kano questionnaires. This questionnaire consists of two questions for each attribute i.e. positive and negative questions. The questionnaires were distributed to 60 users in Central Java, Indonesia, and returning 42. The results of this questionnaire will be used to data processing.

Data compiled from result recapitulation of questionnaires, afterwards put data in Kano category in accordance with *Kano evaluation table*. Category with the highest value selected as the Kano category to the customer satisfaction attributes. Hereinafter, analysis and provides information on solutions to improve the performance of each attribute.

### IV. ANALYSIS

Based on brainstorming and interview, there are 10 (ten) attributes of customer preferences of “refilled” bottled water (shown in Table 1), specifically:

- *Bottled water easy to use. Bottled water should be easy to open or close, so that user does not need more effort or struggle to pull off the cover.*
- *Glass storage. Family/people often held picnics or walking around together, and they bring lunch including beverages. At the time, they share a drink to others. There are manners in drinking taught by Islam that is prohibition to drink from the bottle’s mouth directly. When user drink, saliva and breath can sign in the bottles, so that can be cause of disease transmission. Prophet recommends drink from a glass. An attribute added for is bottled water has a function as glass or have to store the glasses.*
- *Thermostat. The user desire the bottled water has temperature control like functionality in dispenser. They can regulate the water temperature either warm or cold.*
- *Elegant. Adults want bottled water with elegant appearance. The product looks luxurious, beautiful or classy, seen from the aesthetics aspect.*
- *Simple. Adults want simple design to the bottled water, means not have complex accessories/details (uncomplicated detail) and presentable.*
- *Light. Bottled water has a light weight or not heavy, making it easy to carry / handle.*
- *Large Capacity. Bottled water has a large capacity to meet the needs of water intake to the body in a few hours.*
- *Affordable price. Buying power of each person is different. An Affordable price can increase sales of the various classes of society, and also be able to compete with their competitors.*
- *Safety / not easy to spill. Bottled water must have a tight lid / cover, so that water is not easily spill and leak. Close the cover tightly will protect the water from dust, germs, or dirt that comes from outside, as well as protect from contaminant.*
- *Portable. Bottled water easy to move. Users are adults who have high activities and mobility.*

TABLE I - KANO EVALUATION OF ADULTS BOTTLED WATER

CR	M	A	O	I	Q	R	Grade
Ease of use	17	4	16	4	1	0	<b>M</b>
Glass storage	5	13	1	20	1	2	<b>I</b>
Thermostat	4	14	8	13	2	1	<b>A</b>
Elegant Appearance	8	18	8	7	1	0	<b>A</b>
Simple Design	11	7	15	9	0	0	<b>O</b>
Light	14	2	21	4	0	1	<b>O</b>
Large capacity	11	12	8	8	0	3	<b>A</b>
Affordable price	4	10	20	8	0	0	<b>O</b>
Safety / not easy to spill	18	1	19	4	0	0	<b>O</b>
Portable	15	2	19	5	0	1	<b>O</b>

Note: A-Attractive; M: Must-be; R-Reverse; O-One dimensional;  
 Q: Questionable; I-Indifferent

Based on Table 1 indicates there is one attribute included Must-be category i.e. “ease of use” attribute, which mean refilled bottled water required to easily use, not only open or close the cover, but also water storage, easy to hold, along pouring the water. If this attribute does not exist, customer will be disappointed or dissatisfaction. Moreover, there is one attribute included indifferent category, i.e. glass storage attribute. It means existences this attribute will no effect on customer satisfaction. In terms of the efficiency, these attributes can be removed from refilled bottled water product design.

There are three attributes included in attractive category i.e. thermostat, an elegant appearance, and large capacity. If we enhanced these attributes higher, it will improve higher satisfaction level. However, if this attribute does not exist, it will not affect the customer dissatisfaction. In efficiency, attributes in this category should not exist in product, it tends an additional which can increase customer satisfaction. If there is constraint to enhance this attributes, so it can be improved gradually.

In addition to attractive, must-be and indifferent, the other category is one-dimensional. Attributes included in this category are simple, light weight, affordable price, safety and not easy to spill, also portable design. If these attributes improved, it will increase satisfaction level significantly. Likewise, when these attributes is reduced, the satisfaction level would decline. The next step is to calculate satisfaction level and dissatisfaction in accordance with S and S<sup>1</sup> formulation. The result is shown in Table 2.

TABLE II- SATISFACTION AND DISSATISFACTION LEVEL OF BOTTLED WATER

CR	Satisfaction Lv. (S)	Dissatisfaction Lv. (S <sup>1</sup> )	Grade
Ease of use	0.49	-0.80	Must-be
Glass storage	<b>0.36</b>	<b>-0.15</b>	Indifferent
Thermostat	0.56	-0.31	Attractive
Elegant Appearance	0.63	-0.39	Attractive
Simple Design	0.52	-0.62	One-Dimensional
Light	0.56	-0.85	One-Dimensional
Large capacity	0.51	-0.49	Attractive
Affordable price	<b>0.71</b>	-0.57	One-Dimensional
Safety / not easy to spill	0.48	<b>-0.88</b>	One-Dimensional
Portable	0.51	-0.83	One-Dimensional

If the value of the satisfaction level close to zero (0), meaning that these attributes do not affect customer satisfaction. Conversely, when the score near to one (1), meaning that attributes very influential on customer satisfaction. Glass storage attributes score close to 0, both satisfaction and dissatisfaction level. This means when these attributes improved then it will not affect to satisfaction level, and if these attributes eliminated also has no effect on customer dissatisfaction. Conversely, affordable price becomes the most influential attributes on customer satisfaction. Meanwhile, attributes of safety or not easy to spill have the score of dissatisfaction level closest to -1. Customer will be disappointed if the 'refilled' bottled water when the cover cannot be hermetically sealed and causes water spilled out or exposed to contaminants. The next step is mapping the score into the coefficient chart of Kano satisfaction (seen in Fig. 4). Through Fig. 4, can be seen strong and weak attributes on customer satisfaction and dissatisfaction.

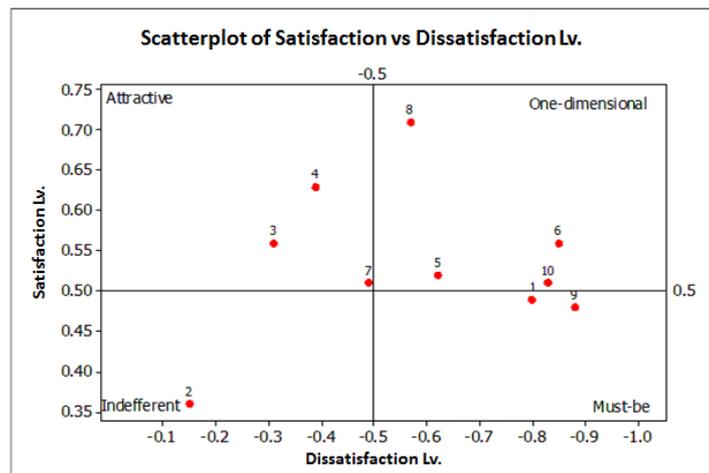


Fig. 4 Coefficient Graphs of Kano Satisfaction

Toward One-dimensional category, the highest point is eighth attribute (affordable price) while the lowest point is on the ninth attribute (safety or not easy to spill). The graphs shows there is a discrepancy between the calculation results with the number of the questionnaire used as the basis of category determining of Kano. The "safety or not easy to spill" included in the must-be category, both in calculation and graphs plot. Meanwhile, the results of the questionnaire categorize these attribute into one-dimensional. Evidently the number of respondent within a point between one-dimensional and must-be. The more in-depth study conducted by looking at the characteristics, these attribute in the must-be category.

## V. CONCLUSIONS

The conclusions obtained from the study are: (1) there are ten attributes on refilled bottled water, which five attributes in one-dimensional category, three attributes in attractive category, one attribute in must-be category, and other categorize in indifferent category; (2) affordable price is the most influential on customer satisfaction; (3) Attribute of safety or not easily spill is the highest level of customer dissatisfaction if these attribute is not fulfilled in bottled water; (4) attributes of safety or not easily spill categorize in must-be based on calculation, but in the results of the questionnaire is included in one-dimensional category. Suggestions on further research are: (1) Bottled water product design should consider the attributes that most affect customer dissatisfaction i.e. safety or not easy to spill attribute; (2) Bottled water should consider an affordable price in further product design and development.

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