Analysis of Customer Needs for Food Products Using Kano Model, A Case Study of Steamed Brownies

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Abstract. Recently, the increased interest in the food business has led to fierce competition among players in the sector. Due to this condition, the quality of food produced needs to be evaluated and systematically designed. Conventionally, the development of products such as ingredient formulation, re-engineering process, installation of new, and more sophisticated type of equipment is driven by technology. However, in a competitive business environment, customer satisfaction becomes the major theme, and the development of products that relies only on technology push may result in failure as the developed products may not meet the customer expectations. Therefore, controlling products that the customer needs is an important issue to be addressed. This research aimed to analyze the quality of a food product that met the customer's needs. Moreover, the product was steamed brownies and was produced by small-medium enterprises (SMEs) in Surakarta (Indonesia). Kano model was applied to ascertain the customer satisfaction attributes and the result showed that there were twelve quality attributes that were identified as the ‘voice’ of the brownie customers. The Kano diagram categorized two attributes into Attractive elements, eight into One Dimensional group and the other two into Indifferent attributes. In addition, the quality attribute classification was beneficial for the brownie producers to determine the direction of product development that brought about a higher level of customer satisfaction.

1. Introduction
Quality brings about customer satisfaction [1], and is the key factor to sustaining a highly competitive market [2]. Therefore, enterprises need to place more focus on the identification and fulfillment of customer needs (CNs) before determining the product design and development direction [3]. Kano model [4] is widely implemented in industries as an effective tool for understanding CNs [5]. In addition, this model is commonly used in recognizing whether a quality attribute may produce customer satisfaction or dissatisfaction [6]. Kano model classifies the attribute of products into attractive, must-be, one-dimensional, and indifference attributes [5]. Although customers are usually unaware of the attractive attributes in a product, when they are available, they lead to a great level of satisfaction. However, must-be attributes are expected by the customers and their absence would lead to extreme
dissatisfaction with the product. One-dimensional attributes have a linear correlation with customer satisfaction, as better fulfillment results in a higher level of customer satisfaction, meanwhile, customers are not interested in the level of appearance of indifferent attributes i.e. a higher or a lower fulfillment will have a limited impact on customer satisfaction.

Extensive research has been carried out using the Kano model to address many issues in product design and customer satisfaction, however, only a few were related to food [7, 8]. Therefore, an empirical test was conducted in the food and beverage industry using the Kano model to classify quality attributes [2]. In addition, the model was used to understand and classify the oral processing and sensory attributes of some selected confectionary products. However, some studies combine the Kano model with other methods (e.g. conjoint analysis, quality function deployment and principal component analysis) to analyze the quality attribute of food products such as milk, eggs, black beans and cottage cheese [10-13].

In Surakarta (Indonesia), due to the promising nature of the food business, the number of small and medium enterprises in this sector continuously increases [14]. According to research carried out, it was discovered that there were 1224 small-medium enterprises (SMEs) in Surakarta that offer various food commodities [15] and one of the food products was a steamed brownie. In addition, there were more than ten SMEs that produced brownies in Surakarta, and preliminary research was conducted on one of them. From the marketing data, it was discovered that the original steamed brownie was the most favorable compared to baked brownies as it had a softer and moister sensory property [16]. However, since competition in this area was quite intense, the SME needed to continuously evaluate and improve the quality of their product.

Several studies have been carried out to develop the quality of the brownies [16-20] and a majority of them deal with formula improvement. However, the brownie’s SME may need a more practical approach relating to the improvement of customer satisfaction. Therefore, before deciding the development direction, research on the identification of quality attributes that play a significant role in the elevation of customer satisfaction is needed. In this study, the Kano model was applied to identify the CNs and to understand and classify the quality attributes of the original steamed brownies produced by SMEs in Surakarta.

2. Methods
The research was conducted in several stages with the first stage being an interview phase conducted for capturing the customer needs. In this stage, within 10-15 minutes, customers freely mentioned what they wanted from the product and all the attributes mentioned were noted and listed. The second step was categorization based on Garvin quality dimension which made use of the affinity diagram i.e. performance, features, reliability, durability, conformance aesthetic, perceived quality and serviceability [21]. In the third phase, validation of the attributes was carried out by twelve panelists who constructed the content validation ratio (CVR) table with four being the brownie’s SME employees (from R&D, marketing and quality control division) while eight were the academic staffs (lecturing sensory evaluation, marketing and food product development). The panelists were then asked to classify if an attribute was essential, useful but not essential, or not essential [22]. The results were tabulated and calculated using a formula [22]. In addition, the CVR value of each attribute was compared in the CVR table to determine whether an attribute was valid or invalid. Finally, based on the valid attributes the questionnaire was created, distributed and used in creating the Kano diagram.

3. Results And Discussion
3.1. Voice of customer identification
In this phase, an interview was carried out on 25 brownies customers using a one on one experimental interview method which enabled the identification of 90% of CNs [23]. From the interview phase, 112 attributes were listed and taken note of. To make them manageable, an affinity diagram was used to
group the attributes [23], therefore, attributes with similar essences were combined and/or omitted which resulted in twenty-six attributes as seen in Figure 1.

| Performance           | Features                        | Reliability                     |
|-----------------------|---------------------------------|---------------------------------|
| • balance taste of sweet-chocolate combined | • environmentally friendly-based materials for packaging | • fresh appearance within the display period |
| • the aftertaste is easily removed | • served with cake-knife | |
| • aroma of sweet-chocolate combined | • safe to be consumed by diabetics | |
| • soft and smooth texture | • have topping | |
| • tidy and homogenous size (for sliced brownies) | • various size and form of brownies | |
| • smooth physical appearance with small and homogeneous pores | • additional information on package (e.g. social media, tagline, and storage suggestion) | |
| • unique taste and aroma | | |

| Durability            | Conformance                  |
|-----------------------|------------------------------|
| • longer shelf life   | • information on packaging following the standard required by Indonesian FDA |
| | • packaging’s ability to protect the product |
| | • trustworthy label claims |

| Aesthetic            | Perceived quality            | Serviceability                |
|----------------------|------------------------------|-------------------------------|
| • evenly chocolate placed in the middle of brownie’s layers | • product brand image | • product is easy to find |
| • evenly brown color | | • offering brownies in smaller packaging |
| • unique design of packaging (handy and eye catching) | | • providing tester on outlet |
| • non-sticky material product wrapping | | |

**Figure 1.** Quality attributes in the affinity diagram

### 3.2. Attribute validation phase

In the validation phase, twelve panelists were asked to evaluate the twenty-six attributes and judge if an attribute was either i) essential, ii) useful but not essential, iii) not essential [22]. The results were tabulated and using Lawshe’s content validity method, the CVR value of each attribute was calculated (25). According to the CVR table (21), attributes that had a value lower than 0.475 were categorized as invalid. Twelve attributes were discovered to be valid while fourteen were invalid. The valid attributes can be seen in Table 1.
Table 1. Valid attribute based on the value CVR

| No | Quality attributes                                                                 | CVR value |
|----|-------------------------------------------------------------------------------------|-----------|
| Q1 | balance taste of sweet-chocolate combined                                           | 0.83      |
| Q2 | aroma of sweet-chocolate combined                                                   | 0.50      |
| Q3 | soft and smooth texture                                                             | 0.83      |
| Q4 | additional information on package (e.g. social media, tagline, and storage suggestion) | 0.50      |
| Q5 | fresh appearance within the display period                                          | 1         |
| Q6 | information on packaging following the standard required by Indonesian FDA          | 0.67      |
| Q7 | packaging’s ability to protect the product                                         | 0.67      |
| Q8 | trustworthy label claims                                                            | 1         |
| Q9 | unique design of packaging (handy and eye catching)                                 | 0.83      |
| Q10| non-sticky material product wrapping                                                | 0.83      |
| Q11| product brand image                                                                 | 1         |
| Q12| product is easy to find                                                             | 1         |

3.3. Kano model

Based on the valid attributes listed in Table 1, the Kano questionnaire was constructed with both functional and dysfunctional questions. Customers were asked about how they felt when an attribute ‘appeared’ (functional) and ‘did not appear’ (dysfunctional) in the product. They had five optional answers as follows:
1. I enjoy it that way,
2. I expect it that way,
3. I am neutral,
4. I dislike it but I can accept it that way and
5. I dislike it, and I cannot accept it

The customers’ responses were summarized and using Blauth’s formula and the values of the customer satisfaction coefficient were calculated. The result can be seen in Table 2.

Table 2. Kano categorization for each quality attributes

| Attributes | A | O | M | I | R | Q   | Total | Category | IBT | IWT |
|------------|---|---|---|---|---|-----|-------|----------|-----|-----|
| Q1         | 18| 1 | 7 | 0 | 2 | 7   | 35    | A        | 0.758|-0.242|
| Q2         | 9 | 3 | 14| 1 | 1 | 7   | 35    | O        | 0.697|-0.515|
| Q3         | 9 | 0 | 19| 1 | 0 | 6   | 35    | O 0.824  | 0.676|-0.515|
| Q4         | 15| 4 | 9 | 0 | 1 | 6   | 35    | O        | 0.706|-0.382|
| Q5         | 7 | 4 | 6 | 0 | 3 | 15  | 35    | I        | 0.406|-0.313|
| Q6         | 6 | 3 | 14| 2 | 1 | 9   | 35    | O        | 0.625|-0.531|
| Q7         | 7 | 4 | 19| 1 | 0 | 4   | 35    | O 0.676  | 0.756|-0.676|
| Q8         | 3 | 5 | 20| 0 | 1 | 6   | 35    | O        | 0.676|-0.735|
| Q9         | 10| 2 | 16| 0 | 1 | 6   | 35    | O        | 0.765|-0.529|
| Q10        | 1 | 2 | 1 | 11| 1 | 19  | 35    | I        | 0.087|-0.130|
| Q11        | 12| 2 | 16| 0 | 1 | 4   | 35    | O 0.824  | 0.655|-0.529|
| Q12        | 11| 1 | 18| 1 | 0 | 4   | 35    | O 0.853  | -        |

Average 0.665 -0.475

A = Attractive R = Reverse
M = Must-be Q = Questionable
O = One dimensional IBT = Is Best Than
I = Indifferent IWT = If Worse Than

The IBT value indicated the level of customer satisfaction (from 0 to 1) i.e if the quality attribute was present in the product. Meanwhile, the IWT value represented the customer dissatisfaction degree (from 0 to -1) i.e. if the quality attribute was absent in the products. From table 1, the three quality
attributes with higher IBT values were Q3, Q11 and Q12 and they relate to the texture, brand and availability of the product. Meanwhile, Q7 and Q8 which are the attributes with higher IWT values, relate to packaging and label claim. Based on the IBT and IWT values of each attribute, the Kano diagram was constructed and the results are shown in Figure 2.

As seen in Figure 2, Q1 and Q4 were classified as Attractive attributes. Q1 was related to the proportional or balanced combination of sweet and chocolate taste in brownies, while Q4 was associated with the additional information on the product package e.g. social media, tagline, storage suggestion. The presence of these attributes greatly increased the level of customer satisfaction while their absence had a low impact (6). Furthermore, from the Kano diagram in Figure 1, eight attributes (Q2-3, Q6-9, Q11-12) were categorized as One-dimensional attributes and the higher the level of these attributes the greater the customer satisfaction (linear correlation). Finally, the last two attributes (Q5 and Q10) were categorized as Indifferent attributes. Customers did not have a specific requirement on these attributes and they had a limited impact on the customer's willingness to pay for the product.

![Figure 2. Kano diagram of steamed brownies](image)

It is interesting to note that extrinsic attributes such as information on the package were one of the ‘delighter’ elements of the product. Meanwhile, fresh appearance during the display period had a low impact on customer willingness to pay. Studies also [12] showed that extrinsic attributes such as package, label claims, and brand name affected the customer's delight in the cottages cheese. Furthermore, information related to these quality attributes helped marketers and product designers to focus on improving the attributes that significantly drove consumer purchasing decisions.

4. Conclusion
The result of the analysis of the Kano model showed that there were twelve quality attributes in the steamed brownie product and these attributes affected the level of satisfaction of the customer on different levels. In addition, the Kano diagram classified two attributes as Attractive elements, eight as One-dimensional, and two as Indifferent. This information was beneficial for brownie producers to prioritize which quality attribute they needed to improve. Although the priority decision in the enterprise was not only related to current resources (modal, man, equipment, etc.), the company's position compared to its closest competitor also needed to be considered. Therefore, further research related to company resources (voice of company) and competitor status (benchmarking) is a potential issue to be addressed.

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