Assessing customer satisfaction in food industry with Fuzzy Kano approach: A case study in Food Company

Dr Sajjad Shokouhyar[1], Dr Rouallah Tavallaee[2], Fereshte Mohsenian[3] (Corresponding author)

[1]Assistant professor of information technology, faculty of management and accounting, Shahid Beheshti university, Velenjak.
[2]Assistant professor of information technology, faculty of management and accounting, Shahid Beheshti university, Velenjak.
[3]MA student of information technology, faculty of management and accounting, Shahid Beheshti university, Mahalati, fereshtemohsenian @gmail.com, 09127625539

Abstract: With increasing competitions in markets, organizations have well understood that customer satisfaction is very important and it is much more rewarding to keep current customers loyal and happy than getting new customers. The goal is having long term relationship with customers to gain more benefits for the organization. Therefore organizations should monitor their interactions with customers and create value for customers by providing their needs and keeping them satisfied. In this study, important factors in food quality have been determined according to previous research papers and consultation with specialists and a fuzzy Kano questionnaire has been designed accordingly. This questionnaire has been distributed to 512 customers; Using k-Means, 3 clusters have been identified and for each cluster, their needs have been recognized by fuzzy Kano. This study shows that some characteristic features are the same in all clusters and also highlights the other distinguishing features. For each feature, satisfaction ratio has been calculated and dissatisfaction ration whether it is exist or not, has been determined. The results could help service based organizations to improve their customer satisfaction.
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1. Introduction

Nowadays considering of existence of organizations in competitive and unsustainable market environment, design, developing and marketing for new products are important and necessary for organizations which have innovative characteristic. Organizations to capture and keep their market share, should provide customers' needs and expectations and with meaning of product innovation should go beyond customers' needs.

In last decades, organization services and products are the results of innovative design of designer rather than corresponding of customers' needs and expectations. In other words, role of customer limited to a sufficient customer and actually the designer engineering were the main roles in developing products. But this attitude did not last for more than last century, market environment changing and collapsing of business boundaries and globalization of economy and ultimately increasing of expectation level of customers are the causes for paying more attention to customers' needs and expectations (Kavusi & Saghaee, 2005).

In the meantime, food distribution organization managers, almost know the customers' satisfaction factors, but the main issue is the amount of satisfaction will be made by the mentioned factors. To response this question, Kano model with its logical mechanism can provide this need and specify the levels of satisfaction of the factors. Furthermore, Kano model can highlight the amount of investment on these factors and prevent from more cost on the factor that will not increase customer satisfaction much more than this (Pakzad, 2010).

These organizations have different kind of customers which their needs and expectations and their value and benefits are not the same for organizations, thus these organizations need to classify their customers and give their service by the clustering of their customers. Through customer clustering, similar customers with same condition and features will be placed in one cluster, therefore knowing better of their needs and characteristics and because of one cluster has similar needs, makes the organization off of knowing the individual need of customers. For classifying customers can use clustering which is one of data mining (Salehzade, 2013).

Quality features of customer satisfaction, play main role in long term success in business. One of important usage of analyzing quality features is designing the features of products, services and process which have most effect on customer satisfaction. Lot studies have been done about relation of physical and mental aspects on how special features of products and services effect on satisfaction or

dissatisfaction of customers. Among them, Kano model is efficient tool for classifying of quality features, which is introduce by Kano and his colleagues (Xu et al, 2009; Saba et al., 2015).

Many researchers have been done in different contexts by Kano model and for improving this model, researchers have presented the developed the Kano model methods. Mansky said that human process of thinking is with uncertainty and data from traditional Kano questionnaire cannot reflecting customers need properly. Other researchers such as Lee and Haung confirmed this. Lee has proved in his research that interviewees have multiple feelings when they were responding to Kano questionnaire and they had to choose one option which was caused to be ignored their partial feelings. Therefore, fuzzy approach of Kano questionnaire was presented to answer the uncertainty of customers when they are responding to questionnaire. Above this, fuzzy Kano questionnaire can receive whole willing of customer which is more compatible with human thinking models (Lee & Haung, 2009).

2. Theory and literature

In the last years of the 20th century, the issue of improving the performance of organizations and detection of customer satisfaction has always been one of the basic needs of the managerial systems and workplaces (Yuk-Lan Wong and Kanji, 2001). In an environment where the customers are knowledgeable and have the power of choice, it is not possible to neglect their needs. Many researches showed the relationship between customer satisfaction and loyalty. These studies also found that satisfied customers are the most loyal customers (Anderson, 2001). Kenningham et al studied the existence of relationship between employee's interaction with customers and the level of customer satisfaction in retails. They stressed on the importance of this relationship (Keiningham et al., 2006). Ennew & et al addressed the problems of service quality measurement and represented a collection of indicators for measuring customers' perceptions and expectations and general customer satisfaction (Ennew et al., 1993). In another study, Stafford presented a list of bank service quality properties which perceived by customers. He also specified the main dimensions of bank service quality and examined the importance of these characteristics (Stafford, 1996). Furthermore, another study has used neural network structure in order to determine the importance of customer needs (Che et al., 1999). Johnston divides the dimensions of service quality into satisfying and dissatisfying categories, like Herzberg's motivational model, and say, that subtle aspect of communication between employees and customers has an important positive or negative impact on service quality (Johnston, 1997; Younus et al., 2015; Al-Ameen et al., 2015). Zhao & Dholakia using Kano model and multi-criteria decision models to evaluate the measurement of customer satisfaction (Zhao and Dholakia, 2009). Baki by using SERVQUAL hybrid model and Kano model logistics has measured customer satisfaction of Turkish logistics companies' services (Baki et al., 2009). Gul & Ozgen have used a hybrid model that contains of Kano, AHP and GFD models to investigate the level of customer satisfaction of Library services (Bayraktaroglu and Ozgen, 2008). In Iran, Shahin & et al have used a combination of clustering and hierarchical analysis methods and Kano model for describing bank services (Kaufmann and Gupta, 1988).

3. Clustering

Clustering is a data mining technique. Clustering issues have a set of records that each have a set of features and a similarity measure is defined between them. The similarity measure varies in different issues (Saba et al., 2015; Rahim et al., 2013). Clustering is done in such a way that the records with the most similarity to each other (according to defined similarity measure) are placed in a cluster. As a result, the data in different clusters have the lowest similarity to each other. The output of clustering algorithms will be reanalyzed to reveal possible irregularities in clusters. An important point that should be considered is that clustering is always based on the input of sample features (Han and Kamber, 2006; Ahmad et al., 2014; Husain et al., 2015).

4. The Kano model

Kano's model of customer satisfaction is a quality management and a marketing technique used to measure customer satisfaction. Kano model helps us understand the relationship between meeting needs and customer satisfaction (Nodehi et al., 2014; Saba et al., 2014; Lung et al., 2014). Kano model is related to the social science theories about increasing customer satisfaction which have been proposed by Herzberg. Kano's customer satisfaction algorithm identifies six categories of the factors that, in the meantime, the first three classes are really affecting customer satisfaction (Rezai, 2005).

1. Basic features: minimum requirements which if not met, will lead to customer dissatisfaction and if they are met or even more, the results will not result to satisfactory (Rezai et al., 2005).

2. Operational features: factors that cause satisfaction through their eligible and excellent performance and dissatisfaction will happen by their poor performance. Generally, the effect of this feature

on satisfaction is linear and symmetric (Sadeghi Moghadam et al., 2012).

3. Attractive features: factors by which customer satisfaction increases, but will not cause dissatisfaction if they are not provided. These factors surprise the customer and cause them happiness (Rezai et al., 2005).

4. Indifferent features: in this group of quality requirements, customer satisfaction will not be affected by these factors and the presence or absence of these features does not matter to customers (Witell and Löfgren, 2007).

5. Reverse features: other category of quality features in Kano model is reverse features that will cause customers get dissatisfied and satisfactory is gained by their absence (Witell and Löfgren, 2007).

6. Questionable features: the latest category of quality features, is questionable features that do not specify whether the customer is waiting for such features and it indicates the situation in which the customer does not understand the question, there a is a misunderstanding about the information, terms of questioning is inappropriate or having incomplete information in the question (Shahin and Salehzadeh, 2013).

5. Fuzzy Kano Model

Menski[1] (1990) stated that the human thinking process is associated with uncertainty and the data derived from Kano's traditional questionnaire, is not a true reflection of the customer demand .lee[2] in his research represented that respondents in answering to Kano's questionnaire, have multiple feelings, in return they have to answer one question, which ignores the detail of their feelings toward other questions. The Fuzzy approach of Kano questionnaire was presented in order to deal with the customer uncertainty in answering the questionnaire. Thus Fuzzy Kano approach of questionnaire was presented to cope with the customer uncertainty in answering the questions. In addition to its able to receive the full demands of the respondents are more consistent with models of human thinking. Lee also offered the Fuzzy approach of Kano model and compared the results of their research with the Kano model of traditional classification, but to analyze his questionnaires, he continued using the Kano model of traditional assessment (Lee and Huang, 2009). In the traditional Kano questionnaires, by giving unique answers the ability of reflecting complexities will disappear. So, if people are able to use membership function in expressing the level of their feelings according to their choice, this answer is closer to the human real thought. The first step is to collect information based on fuzzy style (Matzler and Hinterhuber, 1998). But the both Fuzzy and traditional Kano questionnaires, use the functional and non-functional models to respond to the feelings of customers about services.

6. Research questions

In this study, according to the studied background and the research's subject, the questions which have been raised for the researcher is given below:

The main question: How can we use data mining techniques to identify patterns and clustering the customers of the food company service?

Sub-question 1: What are the appropriate criteria for determining the clusters?

Sub-question 2: What is the level of satisfaction and dissatisfaction in each cluster?

7. Research Methodology

The target population includes all the customers of the Shirin Asal Company in Tehran who used company products. The research is theory-practical in purpose and is a descriptive-survey category sampling was used, containing 535 customers through Cochran formula. Data collection was conducted through the database of Shirin Asal Company, questionnaires and experts' comments. The questionnaire distributed among the customers consists of two parts, the first part involves the characteristics of the clients such as gender, age, education, income, etc. which are common with the critical criteria for customers clustering. There are 9 questions in this section. The second part of the questionnaire includes 25 questions related to the Fuzzy Kano model. The validity of interviews was checked by interviewing the experts and scholars and a sample of 168 were analyzed for the reliability by SPSS software through Cronbach's alpha which values were 0.836 and 0.942 for positive and negative questions, respectively. The software used in this study include SPSS, Excel, and IBM SPSS Modeler.

7-1- Case Study

A case study was done under the proposed model in Shirin Asal Food Company. The reason for choosing a service organization and in particular food service provider is that food organizations are highly dependent on customer satisfaction. The research was conducted in the following steps.

7-2 clustering

For clustering we should consider criteria that have the ability to separate customers into different groups (Meethongjan, et al., 2013; Rahim et al., 2012). In each cluster should be customers that are most similar (have the same needs and desires) to each other and also different clusters must have the biggest difference together. For this purpose, according to the experts, 3 criteria based on RFM Model were identified as follows.

Recency: It represents when was the last time a customer made a purchase order with your business? According to the RFM model, a customer who has recently interacted with your store is more inclined to accept another interaction that you initiate.

Frequency: How regularly does this customer make a purchase with your business? Over time, the frequency of a purchase can, in most cases, predict the likelihood and schedule of future purchases.

Monetary Value: How much money does this customer spend over a period of time? Depending on what makes more sense for your company, you might decide to calculate monetary value as revenue or profitability. Either way, this input adds monetary spend into the equation to calculate your RFM.

8. Data and results

After scaling, the data inserted in to the Excel software. After calling the file by IBM SPSS Modeler software and using K-Means algorithm for clustering modeling, to build the data, first an Excel file that has been created as the data source is inserted and in the Type tab the features of qualities are defined, then by using the Sample node 80% of the data are randomly selected for analysis and then K-Means algorithm run on the data. After that, the Aggregate node has been used to reduce the size of data sets (Saba and Rehman, 2012). The Transpose node has been used to swap the data in rows and columns, the type node for has been used to identify the features of quality and finally for each cluster the Graph board node is used to display the results as graphs.

Figure 1 shows the construction steps of data flows and results of clustering algorithm on the Excel file.

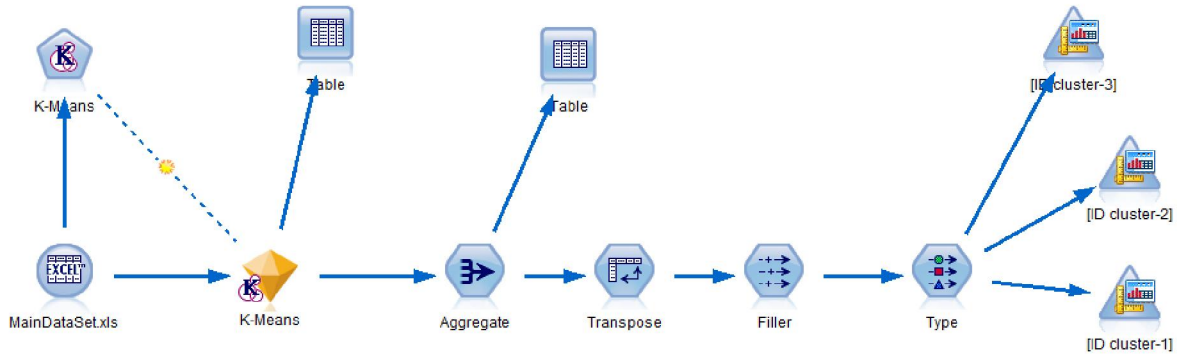

Figure 1. Data flow chart for clustering Food Company customers

The results of clustering was obtained. The number and percentage of samples in the clusters:

Cluster 1: 5182 (96.1%)

Cluster 2: 51 (0.9%)

Cluster 3: 154 (2.8%)

For example, the first cluster has 380 customers which includes men whose ages are mostly between 31-40 years old and their education range in diploma and associate degree, bachelor and master. Their average income is more than two hundred dollars. Approximately there are 6 days gaps between every purchase. Totally every customer in cluster 1, 39 times have done purchasing in a year and each purchase, approximately costs 92 dollars.

8.1. Assessing the customer needs by using Fuzzy Kano model

After clustering, now it is the turn to identify the needs and demands of the customers of food industrial company. As mentioned before, in fuzzy approach customers must answer the questions in percentage form. Based on fuzzy approach which Lee introduced in 2009, if the scores given to the positive question are illustrated in columnar matrix of $P_5 \times 1$ and the given scores to the negative question are shown in row matrix of $N_5 \times 1$, then by their multiplication. S matrix is obtained. The elements of the matrix is precisely the same as Kano assessment table.

$$\begin{pmatrix} a_{11} & a_{12} & a_{13} & a_{14} & a_{15} \\ a_{21} & a_{22} & a_{23} & a_{24} & a_{25} \\ a_{31} & a_{32} & a_{33} & a_{34} & a_{35} \\ a_{41} & a_{42} & a_{43} & a_{44} & a_{45} \\ a_{51} & a_{52} & a_{53} & a_{54} & a_{55} \end{pmatrix}$$

Equation 1)

$S = P_{5*1} \otimes N_{1*5} =$

Then, based on the Kano assessment table, the percentage of each class will be calculated by the following formula (Lee and Huang, 2009).

Equation 2) fundamental = $a_{25} + a_{35} + a_{45}$

Equation 3) functional = a_{15}

Equation 4) reverse = $a_{21} + a_{31} + a_{41} + a_{51} + a_{52} + a_{53} + a_{54}$

Equation 5) motivational = $a_{12} + a_{13} + a_{14}$

Equation6) apathetic = $a_{22} + a_{23} + a_{24} + a_{32} + a_{33} + a_{34} + a_{42} + a_{43} + a_{44}$

Equation 7) questionable = $a_{11} + a_{55}$

For every individual based on the type of given relations, the type of need for each question is specified and then by using the highest frequency method along with the assessment table of Fuzzy Kano model, the needs for each cluster is determined (Rehman et al., 2013; Saba et al., 2010). For example, in the first cluster that has 5182 customers if there is a need to ask by most of them, in this case the need is considered as a basic requirement in the cluster. The table below Lists 25 (required) indicators on the basis of Fuzzy Kano model asked customers with the results of the analysis to determine the type of needs in the clusters.

Table-1. Satisfaction indicators in clusters

Satisfaction indicator	**Cluster**		
	1	2	3
1. Quality	60% M	51% O	40% O 40% M
2. Appearance Features	50% O	43% O	40% A 40% O
3.Brand Name	40% O 40% M	48% O	40% O
4.Packaging	40% O	56% O	40% A 40% O
5.Size	41.6% A	40% O	33.3% O 33.3% A
6.Services	40% O	54% M	33.3% O 33.3% I
7.Warranty	40% O	53% M	50% I
8.Returned Products	60% O	55% O	50% A
9.Expiration Date	50% O	37% A	50% M 50% I
10.Commercials	40% O	45% M	75% I
11.Visitor Behavior	40% O	35% O	50% I
12.Visitor Stability	33.4% O	47% O	75% A
13. Continuous Visit	50% O	49% M	50% O
14.Utilities	60% O	59% M	50% A
15.Stock	50% O	43% O	50% I
16.Transportation	40% I	42% A	50% I
17.Order Delivery	30% O 30% A 30% I	48% A	50% A 50% I
18.Price List	30% A 30% I	45% O	50% A
19.Discount	30% O 30% A 30% I	46% O	100% A
20.Credit Purchase	80% I	42% M	75% I
21.Credibility	40% A	39% A	50% I
22.Price Adjustment	44.4% A	44% O	50% A 50% I
23.Profit Margin	40% A	35% A	50% A 50% I
24.Price Fluctuation	40% A 40% O	50% A	50% A
25.Price	40% A	40% A	50% O 50% I

8.2. Satisfaction and dissatisfaction in clusters

Customer satisfaction index suggests that whether specific features of the service would provide customer satisfaction or only prevent them from being dissatisfied (Berger et al., 1993). Different market segments usually have different needs and expectations. So sometimes it is not clear that a feature can be attributed to which of the requirements. Also it is very important to be aware of the average impact of product features on customer satisfaction. As a result, customer satisfaction index shows how hard the desired characteristics may influence on satisfaction or in the case of non-submission feature, affect customer dissatisfaction (Berger et al., 1993).

Equation 8) Satisfaction:

$$SSI = \frac{A + O}{A + O + M + I}$$

Relationship 9) the amount of dissatisfaction:

$$DDI = -\frac{O + M}{A + O + M + I}$$

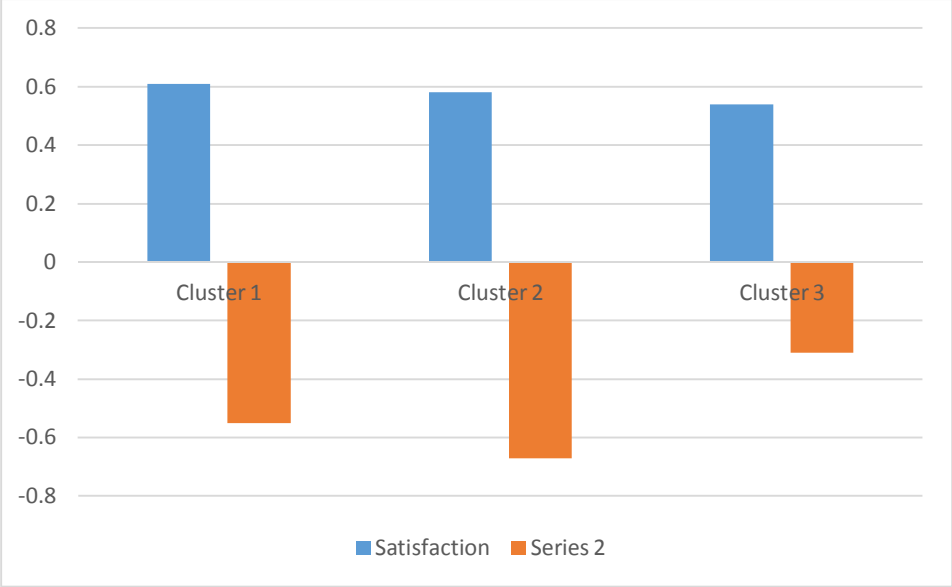

Figure 1: Satisfaction and dissatisfaction index in clusters

The negative sign on the formula of dissatisfaction index, concentrates on the factor's negative impact on customer satisfaction if it is not provided. Positive factor for customer satisfaction, varies from zero to one. As the value gets closer to one, it has more impact on customer satisfaction and if the value is close to zero, indicates that the factor has the minimum impact on customer satisfaction. Similarly, in the negative customer satisfaction index, if the value is closer to -1, it has more impact on customer dissatisfaction in the case that its feature is not provided and value of zero indicates that the lack of its feature will not cause customer dissatisfaction. The study also measures the impact of indicators on customer satisfaction and dissatisfaction according to formulas presented in Figure 1.

According to the graph, the customer satisfaction from the identified criteria in this study is one and it is two times more than their dissatisfaction. So the indicators will influence on customer satisfaction of these two clusters. In cluster two the dissatisfaction index is more than satisfaction index which indicates the given indicators in the study, cause more customer dissatisfaction. In cluster one, these two indicators are equal. So it can be concluded that the provision or non-provision of these services will have no impact on customer satisfaction in the cluster.

Conclusions and Recommendations

In this study, the Shirin Asal Food Company customers are clustered and based on the clustering needs and demands will be met to enable the company

attempt for customer satisfaction. For this purpose, in the study we have integrated clustering and Fuzzy Kano model by which clusters and their results we found that by using data mining technique, clustering algorithm. We formed 3 clusters of customers based on criteria set by experts and RFM Model. These criteria were defined in such a way to have the ability to share customers according to the research objectives. In the other step, by using the information from the questionnaire which were obtained by several customers, we recognized the customer needs to assess customer satisfaction by using Fuzzy Kano model. As survey results show and according to Kano model, need types of every clusters are different. 'Appearance Features', 'Brand Name' and 'Packaging' factors, in every 3 cluster are part of functional need, means that if company does not provide these needs, customer dissatisfaction will cause. Meanwhile if company provide these factors, customer satisfaction will appear. As results show, 'Quality' will be caused major dissatisfaction in case of absence in cluster one and three. Also 'credit Purchase' in case of its absence in cluster 3.

'Order Delivery', 'Profit Margin' and 'Price Fluctuation' in all clusters are motivational needs, means their absence will not cause customer dissatisfaction, but their presence will cause customer enthusiasm and motivation. Also 'Price Fluctuation' factor in case of its presence, will cause the most satisfaction.

'Quality' in first cluster is part of fundamental needs, in second cluster is part of functional need and in third cluster is part of both functional and fundamental need.

'Size' feature for the first cluster is part of motivational need, meanwhile for the second cluster is part of functional need and for the third cluster is part of both functional and motivational need.

Table-2 shows which factors belong to a need category.

Table-2. Research Result Framework

	Cluster 1	Cluster 2	Cluster 3
Fundamental	• Quality • Brand Name	• Services • Warranty • Commercials • Continuous Visit • Utilities • Credit Purchase	• Quality • Expiration Date
Functional	• Appearance Features • Brand Name • Packaging • Services • Warranty • Returned Products • Expiration Date • Commercials • Visitor Behavior • Visitor Stability • Continuous Visit • Utilities • Stock • Order Delivery • Discount • Price Adjustment • Price Fluctuation	• Quality • Appearance Features • Brand Name • Packaging • Size • Returned Products • Visitor Behavior • Visitor Stability • Stock • Price List • Discount • Price Adjustment	• Quality • Appearance Features • Brand Name • Packaging • Size • Services • Continuous Visit • Price
Motivational	• Size • Order Delivery • Price List • Discount • Creditability • Profit Margin • Price Fluctuation	• Expiration Date • Transportation • Order Delivery • Creditability • Profit Margin • Price Fluctuation • Price	• Appearance Features • Packaging • Size • Returned Products • Visitor Stability • Utilities • Order Delivery

	Cluster 1	Cluster 2	Cluster 3
	• Price		• Price List • Discount • Price Adjustment • Profit Margin • Price Fluctuation
Apathetic	• Transportation • Order Delivery • Price List • Credit Purchase		• Services • Warranty • Expiration Date • Commercials • Visitor Behavior • Stock • Transportation • Order Delivery • Credit Purchase • Creditability • Price Adjustment • Profit Margin • Price

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