

# **A Solution for the Allocation of Customers Authentication Methods**

## **(The Case of Multimedia Contact Center in Agriculture Bank of Iran)**

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### **Abstract**

*In order to provide different services for the customers, banks embark on a multimedia contact center. Considering that, in this center, where several services such as transferring money, getting statement information and asking for check books are provided, the authentication is of high importance. How to allocate the appropriate authentication method for each customer is one of the challenges that the center confronts. Sometimes, it has been observed that using an inappropriate authentication method has caused customers' dissatisfaction. In this research, using the Kano Model, the factors influencing customers' satisfaction from the standpoint of*

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*authentication methods are extracted and ranked. In order to determine the effect of customers' individual characteristics on choosing each method, a two-stage clustering method has been used in SPSS. The results of this study indicated that it was possible to select an appropriate authentication method according to the individual customer' characteristics.*

**Keywords:** *Multimedia Contact Center, Authentication, Customer Satisfaction, Kano Model*

**JEL Classification:** *G21*

## 1. Introduction

The study of management theories and doctrines shows that after 1990s there was a tendency towards customers and increasing quality, diversity and speed of rendering of services in organization. The focus on customers, in this decade, is a concept, which has a key role in organization's sustainable competitive advantage. Customer satisfaction is an essential factor in competition in global market. As Peter Draker claimed, "customer satisfaction is the final goal of all activities". Therefore, each successful organization wants to offer services that provide customer satisfaction.

In this center, there is the possibility of using various authentication methods such as username and password, one-time password, smart card, magnetic card, biometric, and challenge-response. However, these methods are different in respect of several factors such as speed, cost, accessibility, security, and ease of use. Therefore, they can affect customers' satisfaction. For example, offering one-time password to an illiterate customer can make him/her confused and dissatisfied. That is to say in allocating an authentication method, customers' individual characteristics should be paid attention to.

## 2. Literature Review

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. 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. 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. 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. In another study, Stafford presented a list of bank service quality properties perceived by customers. He also specified the main dimensions of Kano service quality and examined the importance of these characteristics. Furthermore, another study has used neural network structure in order to determine the importance of customer needs. Johnston divides the dimensions of service quality into satisfying and dissatisfying categories, like Herzberg's motivational model, and says that subtle aspect of communication between employees and customers has an important positive or negative impact on service quality. Zhao & Dholakia use Kano model and multi-criteria decision models to evaluate the measurement of customer satisfaction. Baki by using SERVQUAL hybrid model and Kano model logistics has measured customer satisfaction of Turkish logistics companies' services. 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. In Iran, Shahin et al., have used a combination of clustering and hierarchical analysis methods and Kano model for describing bank services.

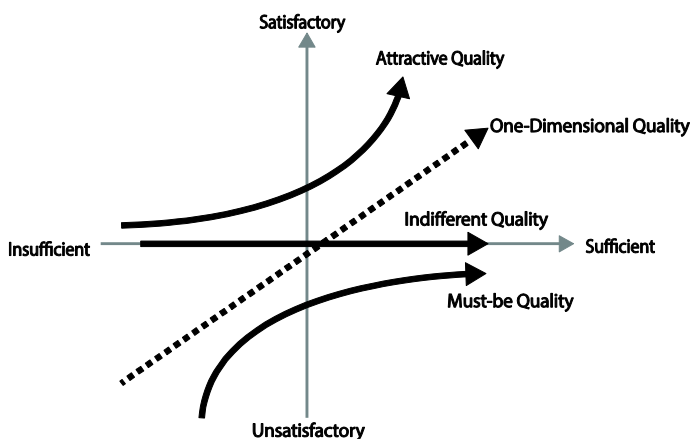
### **3. Kano Model**

Doctor Noriaki Kano, a professor in Tokyo and one of the best theorists of quality management has submitted a model, which is used in many models of customer satisfaction today. He categorized customers' needs or quality products into three groups and displayed each three types of needs in a two-dimensional graph (Figure 1).

Vertical axis shows customer satisfaction and horizontal axis shows the level of customers' quality requirements. The highest and lowest points of the vertical axis of the graph respectively represent customer total satisfaction and customer dissatisfaction. The confluence of vertical and

horizontal axis is the place where customer satisfaction and dissatisfaction are equilibrium. The right side of the horizontal axis shows the place, which the expected quality requirements are fully supplied and the left side displays the point that the production does not contain quality requirements.

**Figure 1: Kano model**



Customer satisfaction was considered as one-dimensional process previously. It was considered that high quality perception of goods result in more satisfied customers and conversely. However, the fulfillment of each product features at high levels does not necessarily provide customer satisfaction. Thus, Kano customer satisfaction model introduced the methodology that determines what components of the characteristics of goods and services have influenced on customers' satisfaction. In this model, customers' needs are divided into three main groups:

- A) Basic needs: If the product does not contain this need, the customer will not buy this product. This need must be contained in the product because the customer wants it, although it does not lead to customer satisfaction.

- B) Expected or Functional needs: If the product does not meet these requirements, it will result in customer dissatisfaction, but if these requirements are fulfilled, it leads to customer satisfaction. Therefore, if Expected needs are not met, the customer will not buy that product.
- C) Excitement or Motivational needs: A fulfilled motivational need leads to customer over satisfaction. Nevertheless, lack of this need in a product does not result in customer dissatisfaction. The relationship between these needs is shown in Kano figure. Of course, meeting basic needs does not pass over indifference boundary and the more the Expected needs are met, the greater customer satisfaction happens.

**Table 1: Evaluation table of undesirable customer requirements results**

Customer requirements		Dysfunctional (negative) question				
		1. like	2. must be	3. neutral	4. live with	5. dislike
Functional (positive) question	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

M: Must be

R: Reverse

O: One-dimensional

Q: Questionable

I: Indifferent

## 4. Research Methodology

Research methodology according to its purpose: it is a kind of applied research. Research methodology according to the type of data: is a descriptive-survey. Research methodology according to implementation: This study includes all Branches of Agri- Bank on Guilan province at the

period of April 2013 to the end of August 2013. Method and data collection tools collecting necessary data of the study that is type of primary data, was done during two stages: the first stage was literature review information which was collected through library (including books, journals, and internet search in sites). In the second stage, a questionnaire was used to describe the views of customers who use E-banking services. Kano spectrum is used in the questionnaire. Opinions of 3 professors and experts were used to determine the validity of questionnaires and Cronbach's alpha test was used to determine the reliability of the questionnaire for customers which was 0.78.

## 5. Data Analysis Proposed Model

After collecting data, authentication factors were classified using *Kano Model*. Considering that, each factor is a part of must-be, one-dimensional, attractive or indifferent needs, it can be prioritized for commissioning it.

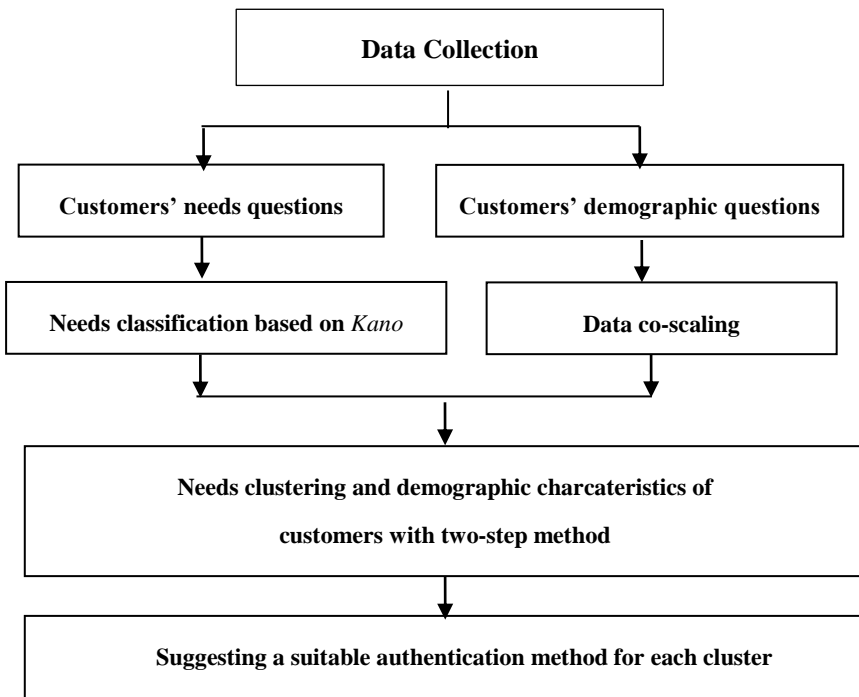
The specific offer of an authentication method to customers requires extraction of relation between demographic features and output of *Kano Model*. For this purpose, clustering method has been used. The clustering algorithms try to separate input dataset into clusters so that similarity between records in the cluster is maximal and the similarity out of cluster is minimal.

In the known clustering algorithms like k-mean, there is no general rule for determining the optimal number of clusters and the number of clusters depends on the desired problem. On the one hand, since output of *Kano Model* is as categorical variables, therefore, clustering method should be able to cluster these variables.

To specify the number of optimal clusters automatically, two-step clustering method has been used in SPSS software. This method uses Bayesian Information Criterion (BIC) algorithm for clustering. In this

method, clustering is done in two steps. In the first step, records are divided into several clusters and in the next step; the clusters resulting from the first step are formed in optimal number. Output of this algorithm is the optimal number of clusters along with members of each cluster. General model for performing analysis in this thesis is shown in (Figure 2).

**Figure 2: Research Proposed Model**



## 6. Empirical Results

From 294 questionnaires which were distributed between bank's customers, 294 questionnaires were usable. Demographic attributes of Kano's questionnaire respondents have been analyzed in Table 2.



**Table 2: General information of respondents**

<b>Gender</b>	Man:96 Woman:198	<b>Risk</b>	A level:86 B level:100 C level:108
Age	56:18-25 years  132:26-35 years  66:36-45 years  40:46 years and higher	<b>Income</b>	400000 Tomans and less: 96 401-700 thousands Tomans:46 701-999 thousands Tomans: 83 1000000 Tomans and higher: 69
IT knowledge level	Very little:25 Little:68 Middle:165 High:36	<b>Favorite equipment</b>	Mobile:189 Tokens: 90 Biometric sensors:15

Source: Author's

## 7. Inferential Results

To perform inferential analysis, features were classified in the first step using Kano Evaluation Table. In the second step, similar customers were clustered using data mining method to suggest essential, attractive and one-dimensional needs.

### 7.1. Classification of Research Variables Using Kano Model

Using the second part of the questionnaire, 13 cases of the most important authentication factors were raised as a question pair and answer of each question included 5 choices. At the end, factors were classified using Kano evaluation model the results of which are shown in Table 3.

**Table 3: Classification of 13 factors according to Kano needs**

Classification Kano					Factor	
Type of need	I	A	O	M		
M	24	96	23	151	Speed of operations	1
A	26	187	-	81	Based on SMS	2
M	32	81	10	171	Ease of use	3
M	24	-	105	165	Availability	4
A	24	194	61	15	Biometric	5
M	93	83	-	120	Mutual authentication	6
A	93	105	81	15	Multifactorial	7
O	8	-	247	39	Support Services	8
I	113	-	100	81	Cost	9
A	93	162	24	15	One-time password	10
I	255	-	39	-	Anonymity	11
O	24	-	223	47	SSO	12
O	81	-	152	61	Mental effort	13

Source: Author's

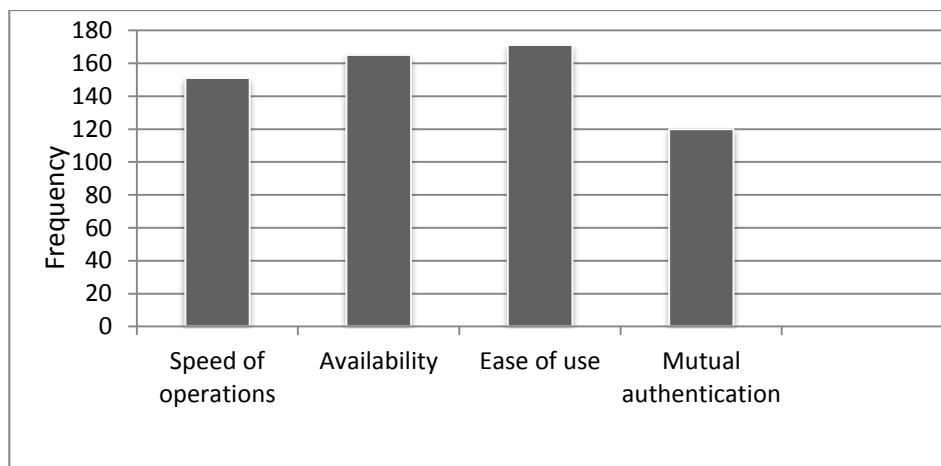
**Notes:** M: Must-be      A: Attractive      O: One Dimensional  
 I: Indifferent      R: Reverse      Q: Questionable

### 7.1.1. Studying Must-be Needs of KANO Model

As specified in Tables 4-7, 4 cases of 13 factors studied in this paper were included in essential needs class. These cases indicate that any negligence and inefficiency in these factors by bank cause intensive dissatisfaction among customers because customers necessitated fulfillment of these needs and regard them as their primary needs. These four cases i.e. speed; easy access, easy use and identification of the service provider are of the important and must-be factors because in case they are not fulfilled, customers will not tend to receive service from the bank.

Considering Figure 3, the highest frequency relates to easy use, therefore, bank should pay special attention to this need. Studies have shown that easy use can be provided with cases such as simple operational signs and keys, low number of stages, graphic representation and auxiliary programs.

**Figure 3: Must-be Needs**

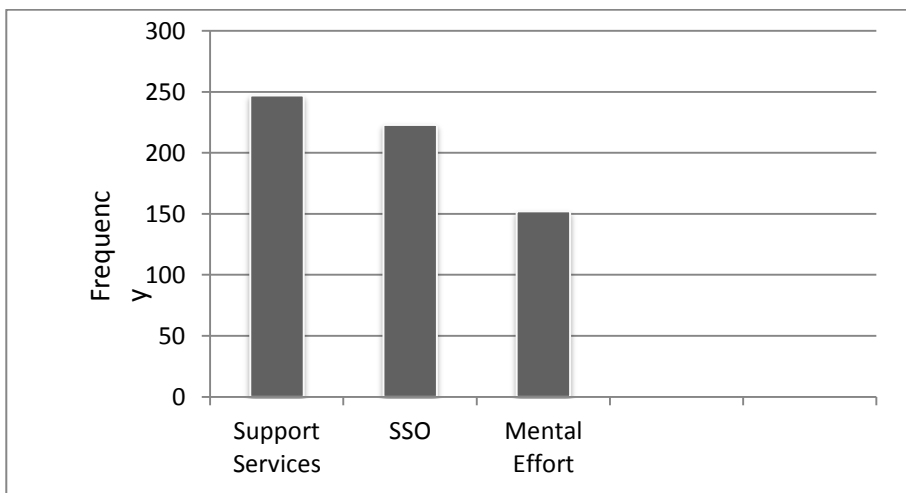


### 7.1.2. Studying One-dimensional Needs of Kano Model

In this research, 3 factors of: Support services, SSO and Mental effort have been classified as one-dimensional factors. Based on the explanations of Kano Model, customer satisfaction in such requirements is based on fulfillment level of these features. It means that more desirable level of service provision in the cases of this class, increases customers' satisfaction and vice versa. One-dimensional qualitative requirements are so important that their fulfillment is the minimum effort which preserves commercial position of bank in competitive market.

As specified in Figure 4, support services factor has the highest frequency among one-dimensional needs. It means that the better the support services authentication method, the higher the customer satisfaction will be.

**Figure 4: One-dimensional needs**



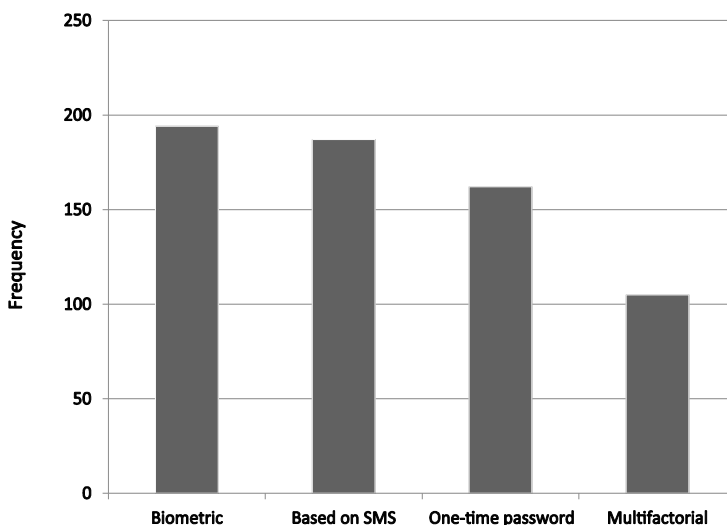
### 7.1.3. Studying Attractive Needs of Kano Model

As Table 4 shows, attractive class has included 4 factors. The cases which are included in this class will have the highest effect on customers' satisfaction. Attractive requirements are not expected by customers but if

they are fulfilled, they will be highly satisfied. The important point is that if these cases are neglected by bank, they will not be disastrous like two other classes because it does not cause dissatisfaction among the customers. Value of attractive qualitative requirements is that they cause competitive advantage for organization in case they are fulfilled.

As Figure (5) shows, biometric factors and SMS receipt are the most frequent. By applying these cases in authentication methods, customers' satisfaction will increase considerably because customers don't expect to receive these methods and are regarded as the most attractive authentication requirements.

**Figure 5: Attractive Needs**

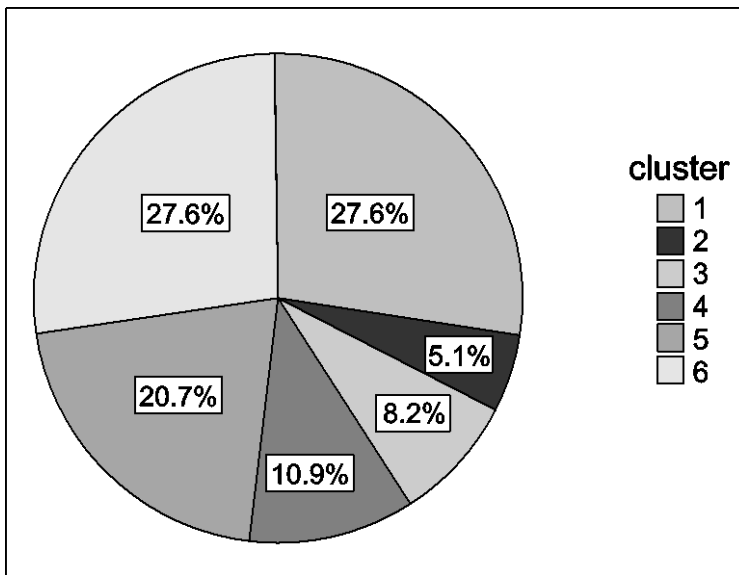


## 7.2. Kano Model's Needs Clustering

The analyses which have been conducted so far were applied for determining all kinds of needs in Kano Model. Results of these analyses suggest bank

what feature is must-be, essential or attractive but don't give demographic classification. To specify effect of demographic features of customers on selection of each need, two-step clustering methods were used in SPSS software. In this algorithm, the optimal number and size of clusters were automatically determined according to Figure 6.

**Figure 6: Showing the number of clusters using the Two-step clustering algorithm**



As it is evident, optimal number of clusters is 6 of which the largest cluster was 27.6% and the smallest one was 5.1% in size. Members of each cluster are specified in Table 4 .

**Table 4: Analysis of results and classifying customers using the Two-step method**

Cluster 6 (81)	Cluster 5 (61)	Cluster 4 (32)	Cluster 3 (24)	Cluster 2 (15)	Cluster 1 (81)		
C(100%)	B(59%)	B(100%)	C(100%)	C(100%)	C(55.6%)	IT knowledge level	1
A(59.3%)	A(78.8%)	C(62.5%)	C(100%)	C(100%)	D(70.4%)	Income	2
B(98.8%)	A(100%)	A(75%)	B(100%)	C(100%)	C(100%)	Risk	3
B(98.8%)	A(100%)	A(100%)	A(58.3%)	C(100%)	A(100%)	Favorite equipment	4
O(100%)	O(100%)	M(75%)	O(100%)	M(100%)	O(100%)	Support services	5
O(100%)	M(100%)	I(75%)	O(100%)	M(100%)	M(100%)	Availability	6
A(100%)	A(57.4%)	A(100%)	A(100%)	A(100%)	M(100%)	Based on SMS	7
M(100%)	O(100%)	O(75%)	I(100%)	O(100%)	I(100%)	Cost	8
O(100%)	O(100%)	M(100%)	I(100%)	M(100%)	O(100%)	SSO	8
A(100%)	O(100%)	I(75%)	A(100%)	M(100%)	A(100%)	Biometric	10
A(100%)	I(100%)	I(100%)	M(100%)	M(100%)	M(100%)	Mutual authentication	11
O(100%)	I(100%)	I(100%)	M(62.5%)	A(100%)	A(100%)	Multifactorial	12
A(100%)	M(100%)	I(100%)	M(100%)	M(100%)	M(100%)	Ease of Use	13
A(100%)	I(100%)	I(100%)	O(100%)	M(100%)	A(100%)	One-time password	14
I(100%)	I(100%)	I(100%)	O(91.7%)	O(100%)	I(97.5%)	Anonymity	15
A(98.8%)	M(100%)	I(71.9%)	O(95.8%)	A(100%)	M(100%)	Speed of operation	16
O(100%)	M(100%)	O(100%)	O(100%)	O(100%)	I(100%)	Mental effort	17

### 7.2.1. The First Customer Cluster Analysis

Considering clustering output which was shown in Table 4, customers of the first cluster have high computer knowledge and high income and tend to perform level 3 transactions (all transactions, reports, ATM and ACH transfer). Considering risk level of this cluster, authentication using common

confidential information is not a suitable method. On the one hand, the customers included in this cluster have selected mobile phone as the most accessible tool. It means that it is better to use mobile phone-based authentication methods. At the end, it is suggested to produce One Time Password on mobile phone, to use biometric methods based on mobile phone and combination of these two methods considering attractive needs in this cluster. Of course, it should be noted that cost has been mentioned by the customers as part of indifferent needs. It means that security is recommended with expensive methods such as hardware tokens for customers of this group. Table 5 has classified summary of the proposed methods for customers of cluster.

**Table 5: The proposed authentication method for cluster 1**

	<b>Favorite equipment</b>	<b>Priority</b>
Produce One Time Password on mobile phone, Biometric authentication based mobile and Multifactorial method.	Mobile	First
Biometric authentication, hardware tokens, Smart Card	Tokens and Biometric sensors	Second

### **7.2.2. Second Customers Cluster Analysis**

Considering clustering output which was shown in Table 4, customers of the second cluster have high computer knowledge and high income and are willing to use high-risk transactions. The only difference of customers in this class is accessibility of biometric sensors. Thus, it can be said that the proposed methods for this cluster are similar to the first cluster by changing priority as shown in (Table 6).



**Table 6: The proposed authentication method for cluster 2**

	<b>Favorite equipment</b>	<b>Priority</b>
<b>Biometric authentication, hardware tokens, Smart Card</b>	<b>Tokens and Biometric sensors</b>	<b>First</b>
<b>Produce One Time Password on mobile phone, Biometric authentication based mobile and Multifactorial method.</b>	<b>Mobile</b>	<b>Second</b>

### 7.2.3. Third Customers Cluster Analysis

Considering clustering output which was shown in Table 4, The customers included in this cluster are more cautious than the first and second cluster customers. It means that they want to perform low-risk transactions like bills and installment payment or balance account report. In this cluster, mobile phone-based methods are preferred. Magnetic cards and *One Time Password token* are in the second priority. The proposed method for this cluster is show in Table 7.

**Table 7: The proposed authentication method for cluster 3**

	<b>Favorite equipment</b>	<b>Priority</b>
Produce One Time Password on mobile phone, Mobile-based authentication	Mobile	First
Hardware tokens, Magnetic card, Scratch List	Tokens and Biometric sensors	Second

### 7.2.4. The Fourth and Fifth Customers Clusters Analysis

Although income level in customers of these two clusters is different, both groups are not willing to use electronic financial services. Therefore,

authentication methods based on common confidential information such as password are sufficient for these two classes of customers. The proposed authentication methods for this class of customers are shown in Table 8.

**Table 8: The proposed authentication method for cluster 4, 5**

	<b>Favorite Equipment</b>	<b>Priority</b>
Password-based authentication, Challenge-Response authentication, Image-based Authentication	Mobile	First
Magnetic card, Scratch List	Tokens	Second

### 7.2.5. Sixth Customers Cluster Analysis

Considering clustering output which was shown in Table 4, customers of this cluster have high computer knowledge but have low income and risk. Accessible facilities of this group are all kinds of tokens, magnetic cards and smart cards. Considering that cost is compulsory in this cluster, authentication methods are suggested for this class of customers according to Table 9.

**Table 9: The proposed authentication method for cluster 6**

	<b>Favorite Equipment</b>	<b>Priority</b>
Smart Card, Scratch List and Magnetic card	Tokens	First
Voice-based authentication	Mobile	Second

## 8. Research Results

Satisfaction factors were analyzed based on Kano Model. At the end, requirements of speed, easy access, easy use and identification of the service provider were regarded as must-be requirements. Requirements such as support services, SSO and mental effort were regarded as one-dimensional

requirement and biometric requirements, SMS receipt, and One Time Password were regarded as attractive requirements.

To extract relationship between personal features and authentication methods, two-step clustering was used. Results of the conducted research indicated that authentication methods based on common confidential information such as password are sufficient for the applicant customers with low risk level. For the customers who select mobile phone as the most accessible facility, mobile phone-based authentication methods can be used. Relationship between average monthly income and cost of authentication method was very evident so that it is recommended to allocate this method to customers with medium to high income considering high expense of token for the customer.

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