

Provide a solution for the allocation of Customers authentication methods (Case study: multimedia contact center, Agriculture Bank of Iran)

Mohsen Ebadi Jokandan, Master of Science in IT Engineering

(Asadollah Shahbahrami, Assistant Prof., University of Guilan(

Abstract:

In order to provide different services for their customers, banks embark on a multimedia contact center. Considering that, in this center, 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 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

1-Introduction

The study of management's theories and doc trines 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 competition advantage [1]. Customer satisfaction is an essential factor in competition in global market [2]. 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 [3].

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 [4]. 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 [5]. Kenningham et al studied the existence of relationship between employee's interaction with customers and the level of customer satisfaction in retail. They stressed on the importance of this relationship [6]. 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 [7]. In another study, Stafford presented a list of bank service quality properties which perceived by customers. He also specified the main dimensions of knab service quality and examined the importance of these characteristics [8]. Furthermore, another study has used neural network structure in order to determine the importance of customer needs [9]. 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 [01]. Zhao & Dholakia using Kano model and multi-criteria decision models to evaluate the measurement of customer satisfaction [11]. Baki by using SERVQUAL hybrid model and Kano model logistics has measured customer satisfaction of Turkish logistics companies' services [21]. 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 [31]. In Iran, Shahin & et al have used a combination of clustering and hierarchical analysis methods and Kano model for describing bank services [41].

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 point 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 is fully supplied and the left side display the point that the production does not contain quality requirements.

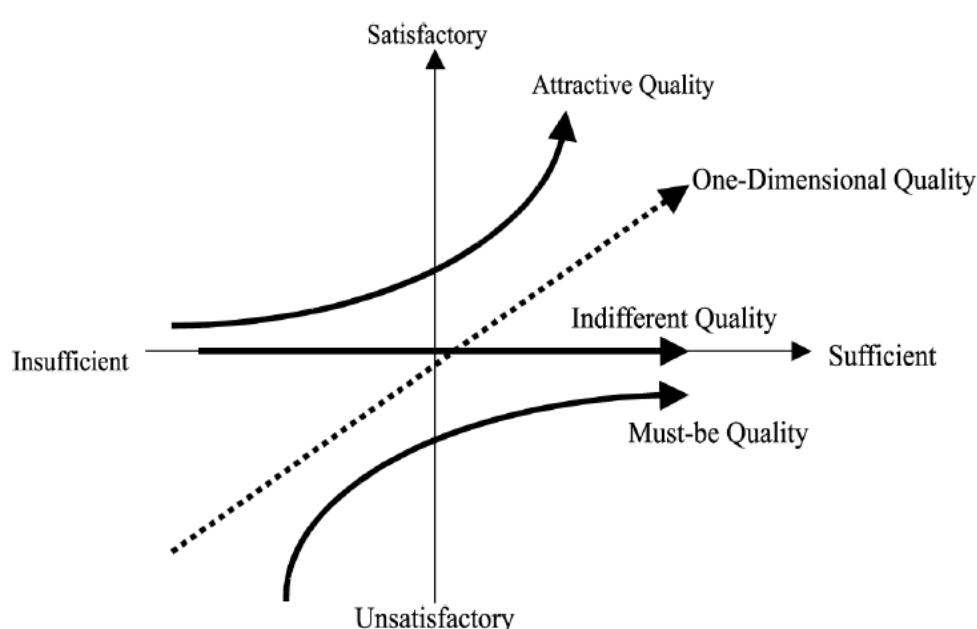


Figure 1:Kano model[51]

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 influence on customers' satisfaction. In this model, customers' needs divide into three main groups)Table 2 (:

- A) Basic needs: If the product does not contain this need, the customer will not buy this product. This need must be contain in the product because the customer want it, al-though 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, leads to cus-tomer satisfaction. Therefore, if Expected needs do not meet, the customer will not buy that product.
- C) Exitement or Motivational needs : A fulfilled motivational need lead to customer over satisfaction. Nevertheless, lack of this need in a product does not result in customer dissatisfaction [61]. The relationship between these needs is shown in Kano figure. Of course meeting basic needs do not pass over indifference boundary and the more the Ex-pected needs are met the greater customer satisfaction happen [71].[

Table 1. Evaluation table of undesirable customer requirements results[51]

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

O: One-dimensional

M: Must-be

Q: Questionable

R: Reverse

I: Indifferent

4- Research Methodology

Research methodology according purpose: it is a kind of applied research. Research methodology according type of data: it is descriptive-survey Research methodology according implementation: This study is includes all Branches of Agri Bank on guilan province has been at period of April 2013 to the end of August 2013 Method and data collection tools: for collect necessary data of the study that is type of primary data. Data collection was done during two stages, the first stage of the Literature review information section was collected through library (Including books, journals, and Internet Search in Site). In the second stage using a questionnaire 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 was obtained 0.78.

5- Data Analysis Proposed Model

After gathering data, authentication factors are 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 to 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, because 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, clustering is done in two steps. In the first step, records are divided into many 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 .(

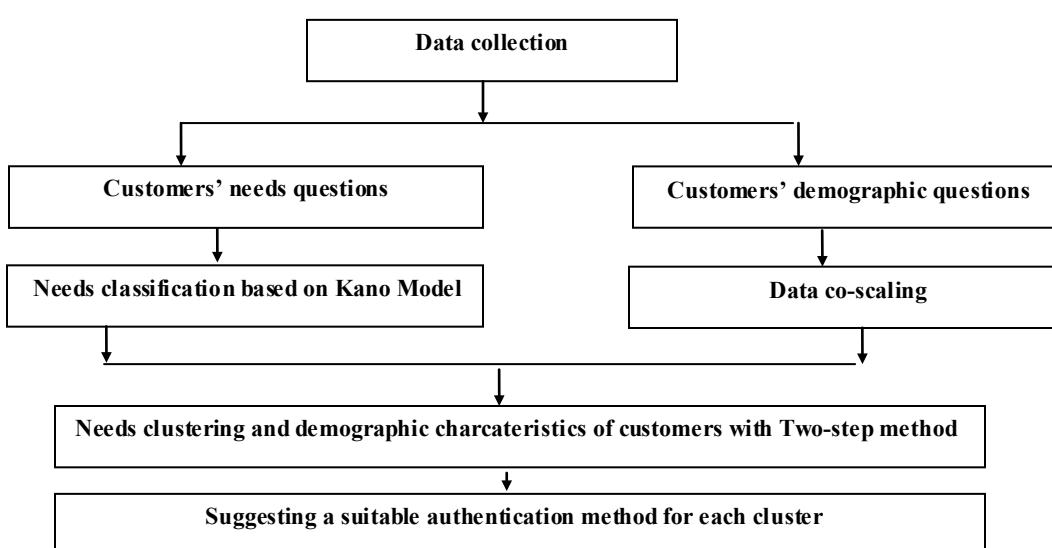


Figure 2- Research Proposed Model

6- Empirical Results

From 294 questionnaires which were distributed between bank customers, 294 questionnaires were usable. In Table (2), demographic attributes of Kano questionnaire respondents have been analyzed.

Table 2- General information of respondents

Gender	Man:96 Woman:198	Risk	A level:86 B level:100 C level:108
Age	81:65-25 years 62:231-35 years 63:66-45 years 40:46 years and higher	Income	400000 Tomans and less: 96 104-700 thousands Tomans:46 107-999 thousands Tomans: 83 1000000 Tomans and higher: 69
IT knowledge level	Very little:25 Little:68 Middle:165 High:63	Favorite Equipment	Mobile:981 Tokens: 09 Biometric sensors51:

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 methods 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 of which results are shown in Table 3 .(

Table 3- Classification of 13 factors according to Kano needs

Kano Classification					Factor	
Type of need	I	A	O	M		
M	۲۴	۹۶	۲۳	۱۵۱	Speed of operations	1
A	۲۶	۱۸۷	-	۸۱	Based on SMS	۲

M	۳۲	۸۱	۱۰	۱۷۱	Ease of use	۳
M	۲۴	-	۱۰۵	۱۶۵	Availability	۴
A	۲۴	۱۹۴	۶۱	۱۵	Biometric	۵
M	۹۳	۸۲	-	۱۲۰	Mutual authentication	۶
A	۹۳	۱۰۵	۸۱	۱۵	Multifactorial	۷
O	۸	-	۲۴۷	۳۹	Support Services	۸
I	۱۱۳	-	۱۰۰	۸۱	Cost	۹
A	۹۳	۱۶۲	۲۴	۱۵	one-time password	۱۰
I	۲۵۵	-	۳۹	-	Anonymity	۱۱
O	۲۴	-	۲۲۳	۴۷	SSO	۱۲
O	۸۱	-	۱۵۲	۶۱	Mental effort	۱۳

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 Table (4-7), 4 cases of 13 factors studied in this thesis 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 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.

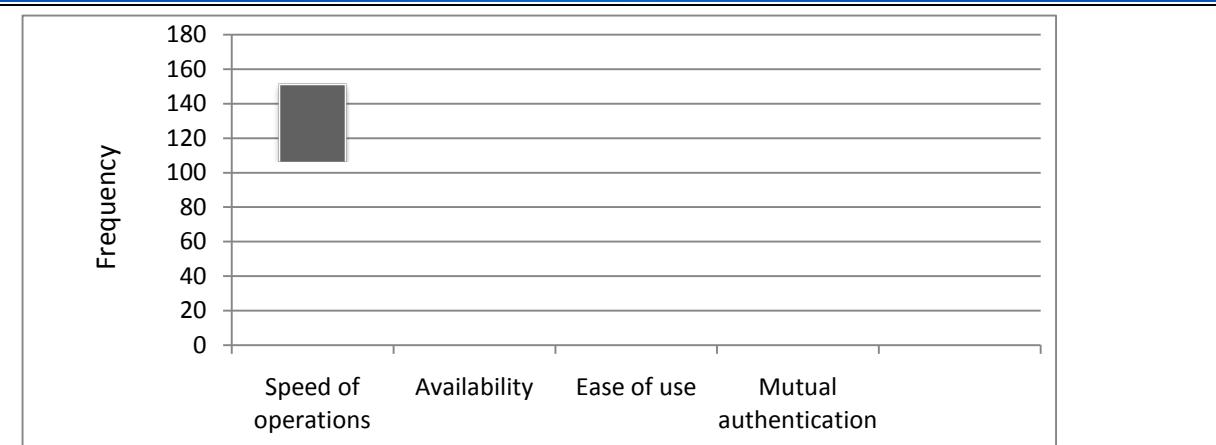


Figure 3- Must-be Needs

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. 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 services 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.

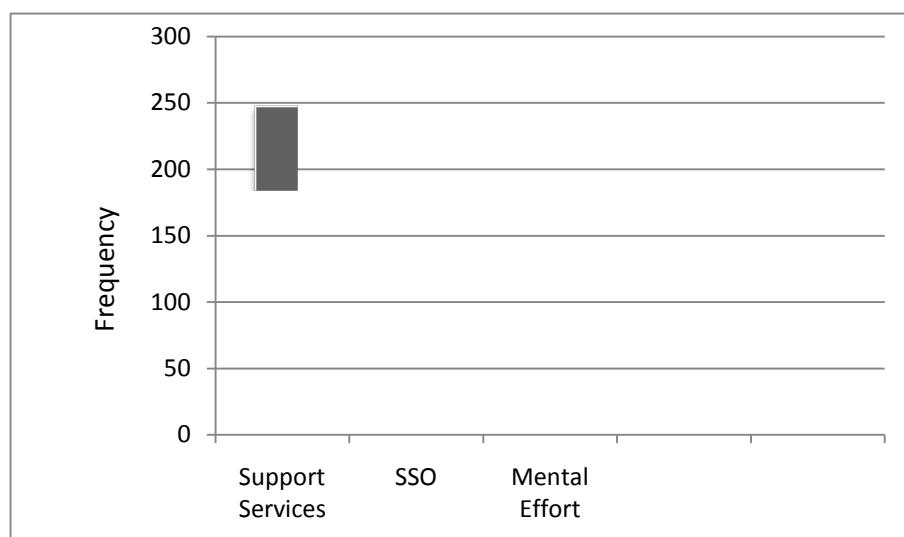


Figure 4- one-dimensional needs

7-1-3- Studying Attractive Needs of Kano Model

As Table (4-7) 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 doesn't 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 m 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.

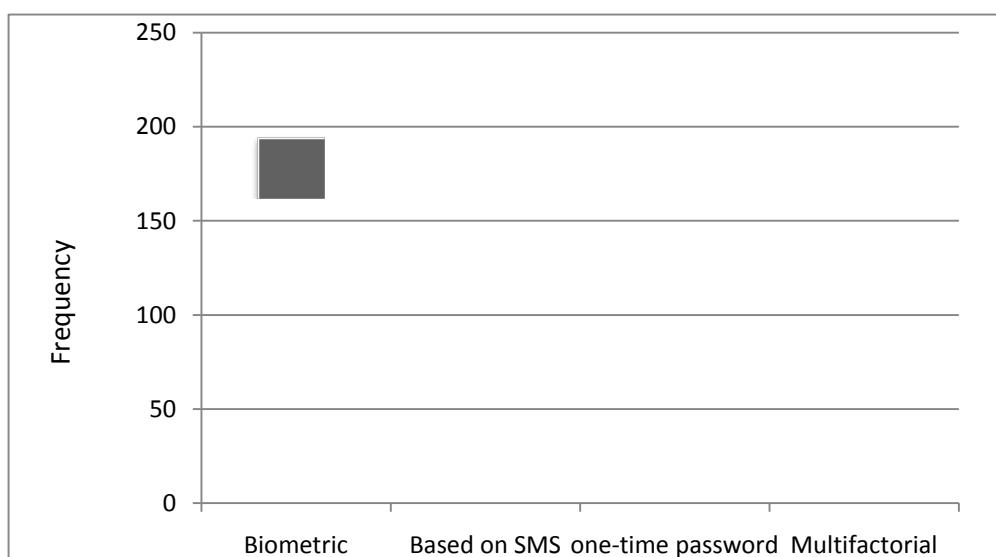


Figure 5- Attractive Needs

7-2- Kano Model's Need 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 was used in software SPSS. In this algorithm, the optimal number and size of clusters were automatically determined according to)Figure 6 .(

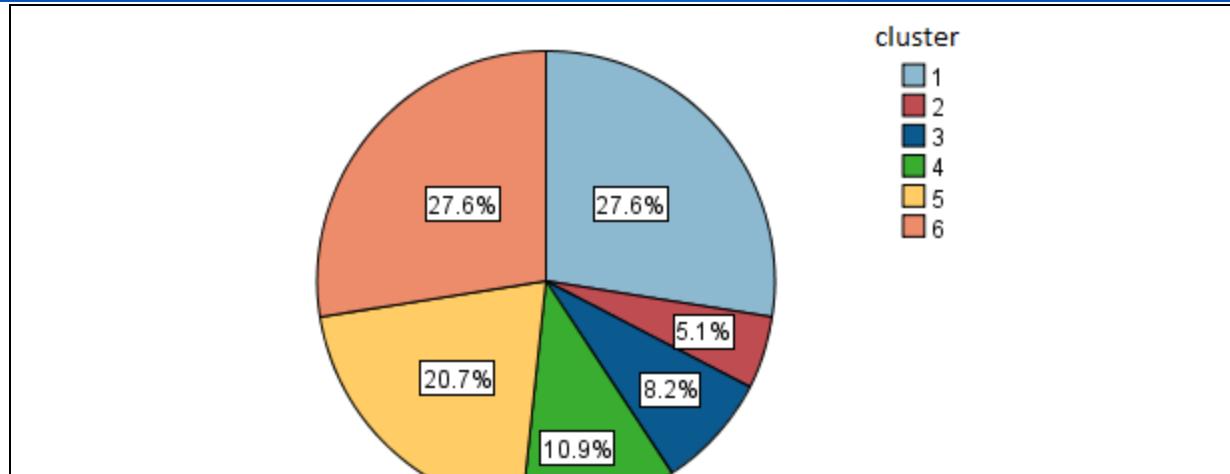


Figure 6- Showing the number of clusters using the Two-step clustering algorithm.

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. In)Table 4), members of each cluster were specified.

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

Cluster6 (18)	Cluster5 (16)	Cluster4 (23)	Cluster3 (42)	Cluster2 (51)	Cluster1 (18)		
C(100%)	B(59%)	B(100%)	C(100%)	C(100%)	C(55.6%)	IT knowledge level	۱
A(59.3%)	A(78.8%)	C(62.5%)	C(100%)	C(100%)	D(70.4%)	Income	۲
B(98.8%)	A(100%)	A(75%)	B)۷۵۰۰	C(100%)	C(100%)	Risk	۳
B(98.8%)	A(100%)	A(100%)	A(58.3%)	C(100%)	A(100%)	Favorite Equipment	۴
O(100%)	O(100%)	M(75%)	O(100%)	M(100%)	O(100%)	Support Services	۵
O(100%)	M(100%)	I(75%)	O(100%)	M(100%)	M(100%)	Availability	۶
A(100%)	A(57.4%)	A(100%)	A(100%)	A(100%)	M(100%)	Based on SMS	۷
M(100%)	O(100%)	O(75%)	I(100%)	O(100%)	I(100%)	Cost	۸
O(100%)	O(100%)	M(100%)	I(100%)	M(100%)	O(100%)	SSO	۹
A(100%)	O(100%)	I(75%)	A(100%)	M(100%)	A(100%)	Biometric	۱۰
A(100%)	I(100%)	I(100%)	M001%)	M(100%)	M(100%)	Mutual authentication	۱۱

O(100%)(	I(100%)(	I(100%)(	M(62.5%)(	A(100%)(	A(100%)(	Multifactorial	۱۲
A(100%)(	M(100%)(	I(100%)(	M(100%)(	M(100%)(	M(100%)(	Ease of Use	۱۳
A(100%)(	I(100%)(	I(100%)(	O(100%)(	M(100%)(	A(100%)(	one-time password	۱۴
I(100%)(	I(100%)(	I(100%)(	O(91.7%)(	O(100%)(	I(97.5%)(	Anonymity	۱۵
A(98.8%)(	M(100%)(	I(71.9%)(	O(95.8%)(	A(100%)(	M(100%)(	Speed Operation	۱۶
O(100%)(	M(100%)(	O(100%)(	O(100%)(	O(100%)(	I(100%)(	Mental Effort	۱۷

7-2-1- The First Cluster Customers 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

	Favorite Equipment	Priority
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 Cluster Customers 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

	Favorite Equipment	Priority
Biometric authentication, hardware tokens, Smart Card	Tokens and Biometric sensors	First
produce One Time Password on mobile phone, Biometric authentication based mobile and Multifactorial method.	Mobile	second

7-2-3- Third Cluster Customers 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 installation payment or receipt of account balance. 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

	Favorite Equipment	Priority
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 Clusters Customers 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 ,45

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

7-2-5- Sixth Cluster Customers 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 according to)Table 9 (for this class of customers.

Table 9- The proposed authentication method for cluster 6

	Favorite Equipment	Priority
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 facilities , 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.

8- References

-]1 [Goli.a(2007). *Principles of Marketing service institutions (banks)*. payeganpublish
-]2 [Chen, C.-C., & Chuang, M.-C. (2008 .*Integrating the Kano model into a robust design approach to enhance customer satisfaction with product design*. International Journal of Production Economics, Vol2, 766- .186
-]3 [Gass, S.I. .(6891) *A Process for Determining Priorities and Weights for Large-Scale Linear Goal Programmes*,Journal of Operations Research Society, Vol.37, No.8.
-]4 [Yuk-Lan Wong, W., & Kanji, G. K. (2001). *Measuring customer satisfaction: Evidence from Hong Kong retail banking industry*.Total Quality Management, VOL. ,21 939- 849
-]5 [Anderson K. .(1002) *The relationship between customer satisfaction ,customer loyalty and Customer profitability*. School of economic and management university of Aarhus,Denmark .
-]6 [Keiningham. T,L; Aksoy, L; Cooil,B; Peterson. K; Vavra.T.G. (2006).*A longitudinal examination of the asymmetric impact of employee and customer satisfaction on retail sales*.Managing Service Quality, Vol. 5244 ,-.954
-]7 [Ennew,c.,Reed.G.and Binks,M.(1993). *Importance-performance analysis and the measurement of SQ*.European journal of marketing, Vol. 2, 95- .07
-]8 [Stafford ,M.(1996). *Demographic discriminators of sq in the banking industry*. journal of service marketing, 10(4),6- 22
-]9 [Che, A; Lin, Z; Chen, K. (1999).*Capturing Weight of voice of the customer using artificial neural network in quality function deployment*. Journal of Jiaotong University. 57,(5)33- .87
-]01 [Johnston, R..(1997). *Determinants of SQ: satisfier and dis satisfiers*. international journal of Service Industry Management, 6(5),53- .17
-]11 [Zhao,M. Dholakia,R. .(9002) *A multi-attribute Model of web site interactivity and customer satisfaction: An Application of the Kano model*. Managing Service Quality, 19(3).
-]21 [Baki, B; Basfirinci, C,S; Cilingir, Z; Murat A,R, I. (2009 .*An application of integrating SERVQUAL and Kano's model into QFD for logistics services: A case study from Tur-key* .Asia Pacific Journal of Marketing and Logistics601 ,(1)12 ,- 1.62
-]31 [Bayraktaroglu,g;ozgen.(2008). *Integrating the Kano model,AHP and planning matrix QFD application in library services*. library Management)92 ,(4 723- 153
-]41 [Kaufmann, M. .(8991) *Fuzzy Mathematical Models in Engineering and Management Science* ,Elsevier Science Inc.New York.
-]51 [Kazemi, M. (2013). *Prioritizing factors affecting Bank customers using Kano model and Analytical Hierarchy Process*. Advanced Research in Economic and Management Sciences, Vol. 8, 14-51
-]61 [Vargas, L..(0991) *Marketing Applications of the AHP Management ,Science*. European Journal of Operation Research, Vol. 26, No. 7.

]71[Wilson, M., & Deborah. (2001).*(Making The Grade For Service, Safety .Wireless Week,* 7.(91)

منابع

[1]American Psychological Association. (2010). *Publication manual of the American Psychological Association* (6th ed.). Washington, DC: Author.

[2] Bandura, A. (1986). *Social foundations of thought and action: A social cognitive theory*. Englewood Cliffs, NJ: Prentice Hall.

تذکر ۱: مقالاتی که در قالب این فرم ارسال نشده باشد مورد بررسی قرار نخواهد گرفت.

تذکر ۲: اصل مقالات پس از تأیید چکیده توسط کمیته علمی پذیرفته خواهد شد.