Customer Satisfaction Fuzzy Cognitive Map in Banking Industry

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Abstract

Customer satisfaction is one of the key factors in modern marketing and customers' behavior analysis. Banking industry is one of the numerous services in which the customer satisfaction has had an ever increasing importance in the corresponding research areas. The problem here is the complexity of dealing with customer satisfaction due to superabundant factors engaged in it. In this paper the applications of Fuzzy Cognitive Maps (FCM's), as a decision making tool, in banking industry, a very vital part of a country's economy, have been discussed. The objective is to simulate and represent the factors affecting customer satisfaction with bank's services which is considered both a tool and a need in today's competitive society. The resulting Customer Satisfaction Fuzzy Cognitive Map from Mellat Bank's workers' opinions gives a clear perception of factors affecting customer satisfaction and their relations which help decision-makers analyze and come to their related decisions.

1. Introduction

Customer satisfaction is an important issue for marketing managers, particularly those in services industries (Bennett and Rundle-Thiele, 2004). In general, if the customers are satisfied with a provided goods or a particular service, the probability that they use the service again increases (East, 1997).

But the problem here is the complexity of dealing with customer satisfaction. With information societies flourishing, as one of the characteristics of the modern millennium, social interactions are becoming more complex and vague. It is apparent that decisions which, until a few decades ago, could have been made very easily, now lead to very complicated equations and formulas. This is noticeable in all aspects of the human society, in politics, economy, culture, etc. Due to the existence of these ambiguities and the numerous variables involved in decision making, Fuzzy Cognitive Map (FCM) has been introduced as a new approach to changing the decision-making into a clearer process. Using the FCM technique, we can observe the significance of each factor and its influence on other factors and the final decision. This is not possible with current practices (Bueno and Salmeron, 2007).

The objective in this paper is to establish a fuzzy cognitive map which represents the factors affecting customer satisfaction with bank's services and the relevance between these factors. The proposed map in our paper helps the decision makers have a clear picture of affecting factors and their relation in the context of customer satisfaction in banking industry. We have elicited the opinions of the workers of Mellat Bank, one of the biggest governmental banks in Iran, to identify the fuzzy cognitive map.

The remainder of this paper is structured as follows. In section 2 a review of the background of customer satisfaction and customer satisfaction in banking has been given. In section 3 the necessary explanations about FCM have been given. In section 4 we have described the methodology and the way in that the research has been conducted. The details and exact steps toward developing the FCM, including identifying the factors, determining their relations and defining the linguistic fuzzy weights, have been thoroughly explained in section 5. At the end of this section, our proposed Customer Satisfaction Fuzzy Cognitive Map has been introduced. In section 6 we have discussed the results and findings. Finally, concluding remarks have been provided in the last section, as well as the limitations and future research lines.

2. Background

2.1. Customer Satisfaction

Customer satisfaction is one of the key factors in modern marketing and customers' behavior analysis. Generally speaking, if the customers are satisfied with the provided goods or services, the probability that they use the services again increases (East, 1997). Also, satisfied customers will most probably talk enthusiastically about their buying or the use of a particular service; this will lead to positive advertising (File and Prince, 1992) & (Richens, 1983). On the other hand, dissatisfied customers will most probably switch to a different brand; this will lead to negative advertising. The importance of satisfying and keeping a customer in establishing strategies for a market and customer oriented organization cannot be neglected (Kohli and Jaworski, 1990). Customer satisfaction is often considered the most important factor in thriving in today's highly competitive business world.

Services have unique characteristics that distinguish them from the physical goods (Zeithaml and Bitner, 1996). Services are often characterized by intangibility, inseparability, heterogeneity, and perishability (Lovelock, 1996). The importance of the above characterizations is that using them for evaluation before, while, and after using a particular service by the customers is often very hard (Legg and Baker, 1996). Because of the quality of being intangible, understanding how the customers would evaluate the quality of the organization's services is often very hard (Zeithaml and Bitner, 1996). In addition, the services are real-time, i.e. they are used by the customers as soon as offered. They cannot be stored and quality passed like physical goods. Therefore any bad service will most probably be experienced by a customer, which results in customer's dissatisfaction while using the service (East, 1997).

Researchers have studied customer satisfaction in different contexts, e.g. Chen and Ko (2007) proposed fuzzy linear programming models to determine the fulfillment levels of parts characteristics under the requirement to achieve the determined contribution levels of design requirements for customer satisfaction. Grigoroudis et al. (2008), considered the problem of measuring user satisfaction in order to analyze user perceptions and preferences to assess website quality. Hsu (2008) proposed an index for online customer satisfaction, which is adapted from an American Customer Satisfaction Index (ACSI). Bodet (2008) explored the satisfaction–loyalty relationships according to an empirical analysis in a sports-service context. Yang and Peng (2008) developed a novel customer satisfaction evaluation model for construction project management services that was developed using a questionnaire-based survey and statistical analysis. Deng (2008) presented a Fuzzy Neural based Importance-Performance Analysis (FN-IPA) which integrates fuzzy set theory, back-propagation neural network and three-factor theory to effectively and adequately assist practitioners in identifying critical service attributes for customer satisfaction. Lindenmeier and Tscheulin (2008) examined on the extent to which seat inventory control and denied boarding influence customer satisfaction. The effects of these core components of revenue management were analyzed within dummy regression models and ANOVAs in the case of capacity-based airline revenue management.

2.2. Customer satisfaction in Banking

As discussed in previous section, customer satisfaction is an outstanding research topic among scientists of different areas. Banking industry is not an exception here. Banking is one of the numerous services in which the customer satisfaction has had an ever increasing importance in the corresponding research areas. This is essentially because the banking sector is becoming more and more competitive (Levesque and McDougall, 1996). Retail banks are pursuing this strategy, in part, because of the difficulty in differentiating based on the service offering. Typically, customers perceive very little difference in the services offered by retail banks and any new offering is quickly matched by competitors (Coskun and Frohlich, 1992) and (Devlin et al., 1995).

Other economic systems are also experiencing the same changes occurring in their external environments. In such systems, moving toward privatization and economic liberalization have increased the rivalry and have prepared the system for foreign rivals. The outcome of this increasing rivalry is that a lot of financial institutions are focusing on increasing the customer satisfaction and trying to keep them by any possible means (Levesque and McDougall, 1996).

Customer satisfaction in banking has not been neglected by researchers. Kearsley (1985) in his article discussed the types and uses of computer-based training (CBT) in bank training to achieve better customer satisfaction. Rust and Zahorik (1993) provided a mathematical framework for assessing the value of customer satisfaction. The framework enables managers to determine which customer satisfaction elements have the greatest impact, and how much money should be spent to improve particular customer satisfaction elements. They demonstrated the application of their

approach in a pilot study of a retail banking market. Athanassopoulos (2000) performed a complete survey on customer satisfaction in retail banking services in Greece. The study proposed an instrument of customer satisfaction that contains service quality and other attributes. The performance implications of the customer satisfaction instrument are also explored. Manrai L. A. and Manrai A. K. (2007) developed and tested some hypotheses regarding the relationship between customer satisfaction and bank service switching behavior as it is mediated by the importance of a particular bank service to a particular customer and by the nature of competitive offerings for different types of banking services available from other banks. Gil et al. (2007), in their research exhibited that services encountered directly and significantly affect perceived service value which is the final antecedent to customer satisfaction in banking industry. Finally, Sweeney and Swait (2008) investigated the important role of brand of banks in managing the churn of current customers and improving their satisfaction.

3. A brief review of Fuzzy Cognitive Maps

In this section, the necessary theories about the concepts of Fuzzy Cognitive Maps, are described in order to support the readers of the paper with the essential background they need.

Cognitive Maps (CMs) were proposed and applied to ill-structured problems by Axelrod (1976). Axelrod develops CM's, i.e. signed digraphs designed to capture the causal assertions of a person with respect to a certain domain and then uses them in order to analyze the effects of alternative, e.g. policies, business decisions, etc. upon certain goals. Axelrod presents case studies in the policy domain. A cognitive map has only two basic types of elements: Concepts and Causal Beliefs. The concepts are represented as variables and the causal beliefs as relationships among variables.

Causal relationships link variables to each other and they can be either positive or negative. Variables that cause a change are called *Cause Variables* while those that undergo the effect of the change in the cause variable are called *Effect Variables*. If the relationship is positive, an increase or decrease in a cause variable, causes the effect variable(s) to change in the same direction. If the relationship is negative, then the change which the effect variable undergoes is in the opposite direction. Fig. 1 is a graphical representation of a cognitive map, where variables (X, W, etc.) are represented as nodes, and causal relationships as directed arrows between variables, thus constructing a signed digraph.

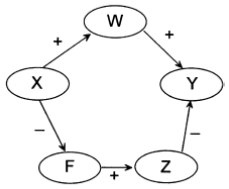

Fig.1 An example of Cognitive Map

Cognitive maps were developed in simulation, organizational strategies modeling, support for strategic problem formulation and decision analysis, knowledge bases construction, managerial problems diagnosis, failure modes effects analysis, modeling of social and psychological processes, modeling virtual worlds and analysis of their behavior, requirements analysis and systems requirements specification. (Kardaras and Karakostas, 1999).

Kosko (1986) introduces FCM i.e. weighted cognitive maps with fuzzy weights. It is argued, that FCM eliminate the indeterminacy problem of the total effect. Since its development, fuzzy set theory has been advanced and applied in many areas such as experts systems and decision making, control engineering, pattern recognition, etc (Zimmermann, 1991). It is argued that people use fuzzy data, vague rules, etc. and fuzzy sets as a mathematical way to represent vagueness (Editorial, 1993). Fuzzy sets are characterized by a membership function, which is also called the degree or grade of membership.

Different approaches were proposed for the specification of the fuzzy weights in an FCM (Taber, 1991). One suggestion is to ask the experts to assign a real number from the interval (0, 1) for each relationship and then calculate the average. However, it is difficult for the experts to assign a real number in order to express their beliefs with regard to the strength of relationships. This is the reason why partially ordered linguistic variables such as weak < moderate < strong, etc. are preferred instead of real number. It is assumed that a concept in an FCM can be represented by a numerical vector (V), whereas each element (v) of the vector represents a measurement of the concept.

Another way of representing a cognitive map is possible through an adjacency matrix where one can clearly observe the sign of the relationship, while keeping in mind that in case of there being an absence of relationship between these two factors, the corresponding entry will be empty. Fig. 2 shows this matrix (E) that represents an example of a cognitive map (Bueno and Salmeron, 2007).

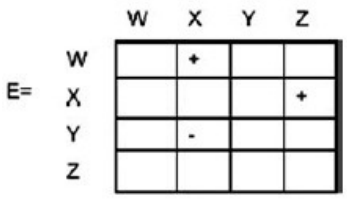

Fig. 2. Adjacency matrix associated with a cognitive map.

4. Research Method

The proposed fuzzy cognitive map in this paper considers the variables affecting the customer satisfaction in banking and the relationships among them. Each mutual relationship includes one linguistic fuzzy weight which determines the accuracy of the expert choice. The model includes 31 variables and 34 relationships. Aiming to develop the FCM, the research has been done through three steps:

In step one, the variables have been identified by studying and analyzing the literature of customer satisfaction in banking.

In Step 2, we have used a panel of 10 experts to determine the relation between factors. This has been accomplished through a two round Delphi process to reach a consensus among experts. Step 2 leads to obtain the customer satisfaction cognitive map (but not a fuzzy one).

In step 3, the obtained cognitive map has been extended to a *fuzzy* cognitive map by establishing a linguistic fuzzy weights for each relation. To identify the linguistic fuzzy weights, a 34 point (as many as the number of relationships) fuzzy questionnaire has been designed and used to collect the opinions of another panel of experts. From the 330 branches of Mellat Bank in seven regions of Tehran, 35 branches (five branches from each region) have been chosen by clustering method and 2 experts have been selected in each branch. These 70 experts have asked to fill out the questionnaire and 62 of them done this. Then, based on the output of questionnaire, by using the fuzzy toolbox in MATLAB software, the linguistic fuzzy weights have been established. At the end of step 3, we are able to propose the Fuzzy Cognitive Map regarding customer satisfaction with bank's services. Fig. 3 expresses the steps of research using a schematic representation.

In the next section of this paper, we will completely explain the above steps and the way the research has been conducted.

5. Using Fuzzy Cognitive Maps in Simulating the Customer satisfaction in Mellat Bank

5.1. Step 1: Identifying the factors of model

After reviewing a host of factors corresponding to customer satisfaction in retail banking discussed in (Lele and Sheth, 1988), (Richens, 1983), (Manrai and Manrai, 2007) and (Sweeney and Swait, 2008), three main items which include subcategories were reached. The main items are as follows: i) Service Quality, ii) Service Features, and ii) Complaint Handling.

Extensive research has been conducted on developing and measuring service quality (Brown et al., 1993), (Cronin and Taylor, 1992), (Parasuraman et al.,1988), (Teas, 1993), (Athanassopoulos , 2000) and (Gil et al.., 2007). Service quality components according to the above researches are aggregated as follows: comfort, security, cleanliness, aesthetics, friendliness, care, helpfulness, courtesy, communication, reliability, integrity, functionality, competence, commitment, availability, flexibility, access and responsibility

Customer satisfaction is also related to the service offering. We extracted the components of service features from the work of (Levesque and McDougall, 1996) which proposed the following items: convenience, complete range of services, competitiveness, interest rate, service cost, easily understood statements and branch location.

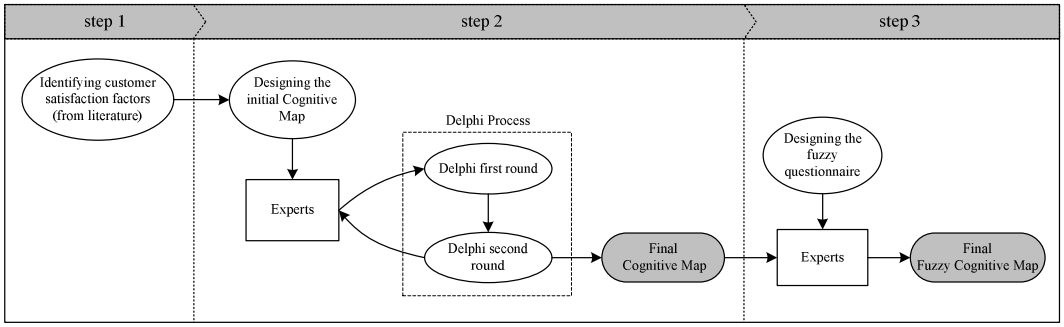

Fig 3. Schematic representation of research

A major reason why customers switch service providers is unsatisfactory problem resolution. As a matter of fact complaint handling is of high value in determining customer satisfaction. Given that the customer complaints, the bank's response can lead to customer states ranging from dissatisfaction to satisfaction (Levesque and McDougall, 1996). According to (Hart *et al.,* 1990), constituting sub-factors are service providers accepting responsibility and problem resolving time.

In next section we are going to determine how these factors affect each other and customer satisfaction.

5.2. Step 2: Identifying the relation between factors and prepare the Customer Satisfaction Cognitive Map using Delphi methodology

The objective of this step is to understand and define the relation between customer satisfaction factors which have been identified in the previous step. When the factors and their relations are clearly recognized, it is possible to establish the cognitive map of customer satisfaction in banking.

With the purpose of determining the relation between factors, advice was taken from a panel of 10 experts. These experts are selected based on their academic background and long time experiences in banking managerial or consulting positions. This team composition guarantees the experts who are finally chosen having profound knowledge of banking industry. The optimal number of experts depends on the characteristics of the study itself. However, one of the most recent studies suggests a range of 10 to 18 to be an ideal number for each panel of experts (Okoli and Pawlowski, 2004).

Among various techniques (Bryson et al., 1997) available in order to reach a consensus among the experts, we have adopted the Delphi methodology. The Delphi methodology is a method used to structure the process of communication in a group of experts in order to reach a consensus regarding a complex problem. One of the main characteristics of the Delphi study is when the experts receive feedback reports, they have the opportunity of improving their own opinion based on this feedback (Dalkey and Helmer, 1963). This was done through consulting with two rounds of questioning which provided the experts with information about deviations from previous rounds to provide them with the chance to obtain consensus and get all experts to go toward the average (Bueno and Salmeron, 2007).

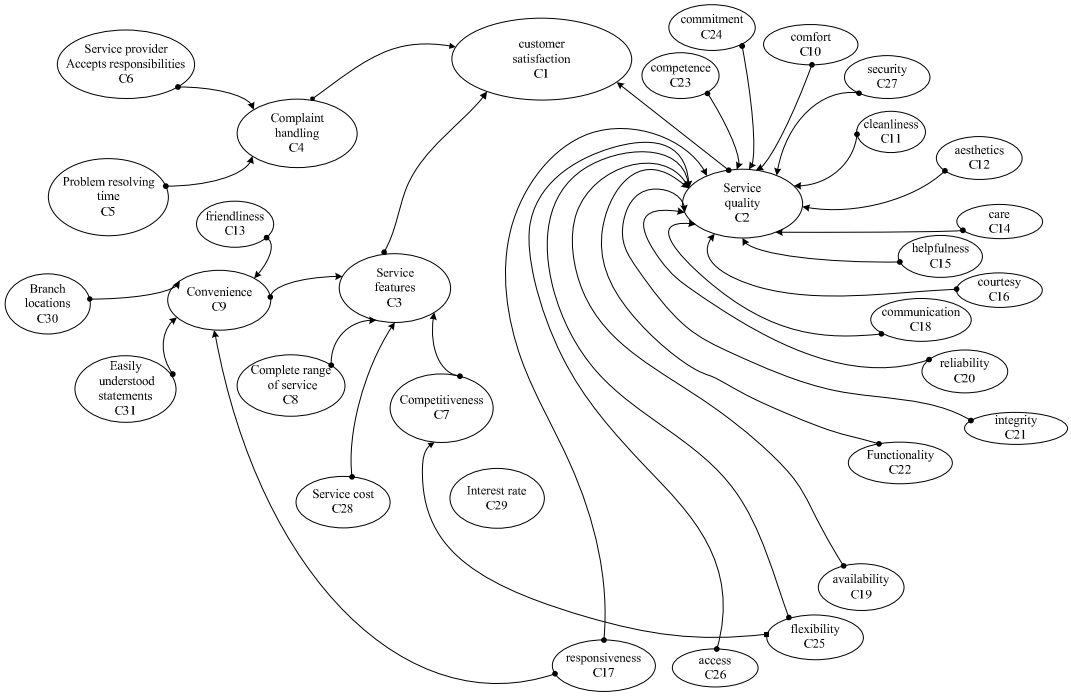

Fig 4. Initial (draft) Cognitive Map

In order to obtain the relation between factors, according to aforementioned factors retrieved from literature survey and the consultation with one of the most qualified experts, we prepared the initial (draft) version of the cognitive map. This map represented the relations between affecting factors in customer satisfaction in banking (Fig. 4).

After that, to perform Delphi first round, we arranged separate consultation interviews with each expert. In each session, after giving necessary explanations to the expert, we asked him/her to carefully study the relations between factors presented in the draft cognitive map and advise his/her comments and corrections. They were also asked to determine the sign of relation (positive or negative). They put P for positive relation and N for negative relation. If they did not believe in a relation between any two factors, they announced it by putting N.R (No Relation) for the relation.

After doing the first round, we had the results represented in Table1 (the results from the first round of Delphi process).

Table 1: The frequency of responds by experts (Delphi first round results)

Relation	Positive Relation	Negative Relation	No Relation
C2-C1	10	-	-
C3-C1	10	-	-
C4-C1	10	-	-
C6-C4	10	-	-
C5-C4	-	10	-
C30-C9	8	1	1
C31-C9	10	-	-
C17-C9	8	-	2
C13-C9	3	-	7
C9-C3	10	-	-
C8-C3	8	-	2
C7-C3	10	-	-
C28-C3	1	1	8
C29-C7	10	-	-
C25-C7	7	-	3
C10-C2	10	-	-
C27-C2	9	1	-
C11-C2	10	-	-
C12-C2	10	-	-
C14-C2	10	-	-
C15-C2	9	-	1
C16-C2	7	-	3
C18-C2	8	-	2
C20-C2	10	-	-
C21-C2	8	-	2
C22-C2	10	-	-
C23-C2	8	-	2
C24-C2	6	-	4
C19-C2	10	-	-
C25-C2	10	-	-
C26-C2	10	-	-
C17-C2	10	-	-

In addition, some experts believed in new relations between some factors that had not been taken into account in the initial cognitive map. These relations are addressed in Table 2.

Table 2: New relations addressed by experts (in Delphi first round)

Relation	Positive Relation	Negative Relation
C11-C9	1	-
C24-C3	1	-
C19-C8	7	-
C13-C2	7	-
C26-C30	9	-
C28-C7	8	-
C31-C9	1	-
C22-C3	2	-
C20-C4	1	-

In the results obtained from Table 1 and Table 2, one can observe that the experts attained a majority consensus in the total of the relationships. In this sense, in most cases the total number of experts has responded in the same way, or rather only 3 or fewer experts have disagreed with the majority.

According to the consequences of first round of Delphi methodology, we found out the some improvements and corrections are needed in the initial cognitive map. Results showed that majority of experts did not agree with the relations between "friendliness" and "convenience" and they preferred the relation between "friendliness" and "service quality". So we replaced the relation (C13-C9) by relation (C13-C2). Similarly, experts argue that the relation between "service cost" and "competitiveness" is more meaningful than the relation between "service cost" and "service features". So we corrected relation (C28-C3) to relation (C28-C7).

Furthermore, experts introduced two more relations between "complete range of service" and "availability", and also between "branch locations" and "access". Thus, relations (C8-C19) and (C30-C26) were added to the model.

After applying the above revisions, we started the second round of Delphi. The revised cognitive map was sent to the experts through an email. In addition, the frequency of response in the first round was declared in the email. They were asked to explore the relations in the new cognitive map and insert their opinions. The instruction for giving the advised was the same as first round (P for

positive, N for negative and N.R for absence of relation). Also, it was possible for them to introduce new relations if applicable.

The results of Delphi second round is collected in Table 3. It is concluded from this table that the experts have made some compromises. Also a larger consensus than the first round can be observed. In these cases a consensus is reached either because the experts are influenced by the others in the second round, or because they have realized that their previous opinion was erroneous.

Table 3: The frequency of responds by experts (Delphi second round results)

Relation	Positive Relation	Negative Relation	No Relation
C2-C1	10	-	-
C3-C1	10	-	-
C4-C1	10	-	-
C6-C4	10	-	-
C5-C4	-	10	-
C30-C9	9	-	1
C31-C9	10	-	-
C17-C9	8	-	2
C9-C3	10	-	-
C8-C3	8	-	2
C7-C3	10	-	-
C29-C7	10	-	-
C25-C7	8	-	2
C28-C7	-	9	1
C10-C2	10	-	-
C27-C2	9	-	1
C11-C2	10	-	-
C12-C2	10	-	-
C13-C2	8	-	2
C14-C2	10	-	-
C15-C2	10	-	0
C16-C2	10	-	0
C18-C2	8	-	2
C20-C2	10	-	-
C21-C2	8	-	2
C22-C2	10	-	-
C23-C2	9	-	1
C24-C2	8	-	2
C19-C2	10	-	-
C25-C2	10	-	-
C26-C2	10	-	-
C17-C2	10	-	-
C30-C26	9	-	1
C8-C19	8	-	2

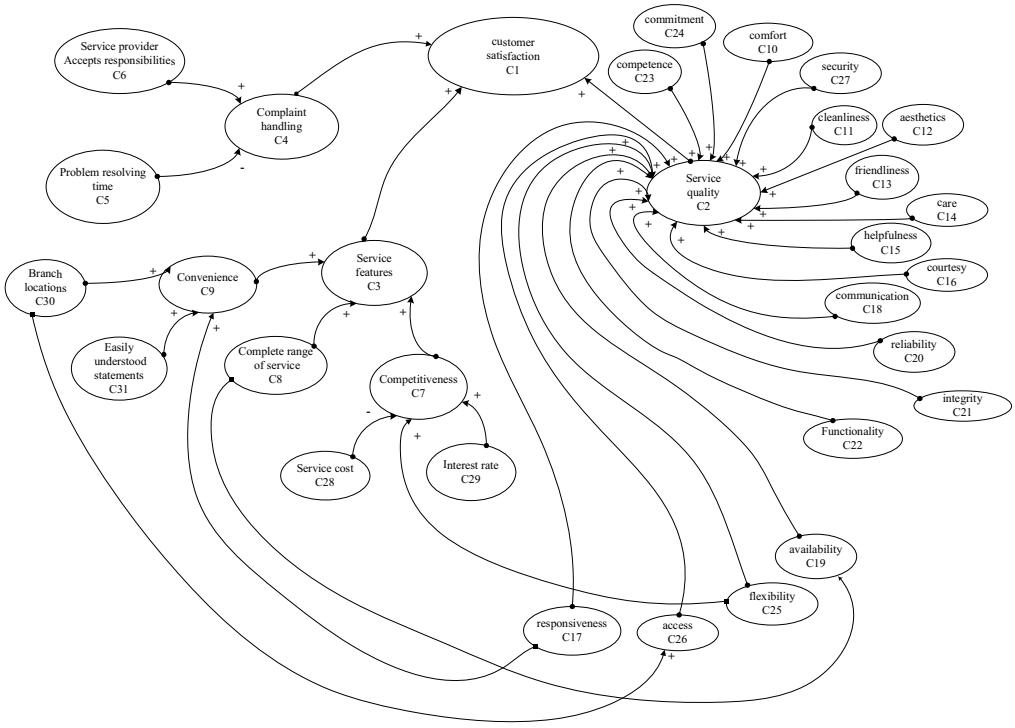

Fig 5. final Customer Satisfaction Cognitive Map

When Delphi methodology is applied, a consensus is reached when most of the opinions are found within the interquartile range (Linstone and Turoff, 1975). The results from Table 3 show that in all relations the majority of the experts opinions have been found to be within the interquartile range. This outcome allows us to claim that the expert positions have come close enough. Based on this analysis, it is possible to propose the cognitive map as the final result. This final Costumed Satisfaction Cognitive Map in banking industry is presented in Fig. 5.

The purpose of the next step is to extend this Cognitive Map to a Fuzzy Cognitive Map.

5.3. Step 3: Specifying the fuzzy weights and provide the Fuzzy Customer Satisfaction Cognitive Map

Up to the previous step, the cognitive map of customer satisfaction has been produced. In this cognitive map, no certain strengths for casual relations between factors are considered. The objective of this step is to provide such strength for the relations using the fuzzy set theory.

To do this, each mutual relationship includes one linguistic fuzzy weight which determines the accuracy of the expert choice.

It is proposed that linguistic fuzzy weights be used instead of real values for weights (Zhang, 1989) and (Zhang, 1992), as the linguistic fuzzy weights make it easier for the planners to express their beliefs. These linguistic fuzzy weights bring about a more thorough and understandable vision for the decision makers by mapping the ideas of the experts into a logic which could be processed (Klir and Youan, 2005).

To identify the linguistic fuzzy weights, a 34 point (as many as the number of relationships) questionnaire has been designed.

From the 330 branches of Mellat Bank in seven regions of Tehran, 35 branches (five branches from each region) have been chosen by clustering. A total of 62 experts (among 70 selected experts) of these branches filled out the questionnaire and assigned fuzzy weights to all of the relations in the cognitive map, in order to express their beliefs in the strength of a certain causal relationship as being strong, moderate, or weak. The corresponding fuzzy weights ranging between (0, 1) are shown in Fig .6. It is considerable which, this fuzzy number could be tune during the implementation of given FCM by a feedback processes.

Therefore, the specified weights have been customized to the environment of Mellat Bank. Fuzzy weights in our FCM show the belief which planners share with regard to the existence of a certain relationship, and not the magnitude of change that a variable may undergo because of its causal relationship with other variables. Planners during modeling should answer the following question for each relationship:

How strongly, do you believe, the causal relationship between variable (X) and variable (Y) is?

The quantity space of the relationships' weights Q(w), is the following set: Q(w): {Undefined; Weak; Moderate; Strong}.

It is assumed that the following ordering applies for Q(w): {Weak < Moderate < Strong}.

The important point in this paper is that there are no intersections among the three sets of weak, moderate, and strong.

To aggregate the answers collected from experts, the mamdani fuzzy operator has been applied. By aggregating the answers with the aid of fuzzy toolbox in MATLAB software, the following results have been obtained (Table 4).

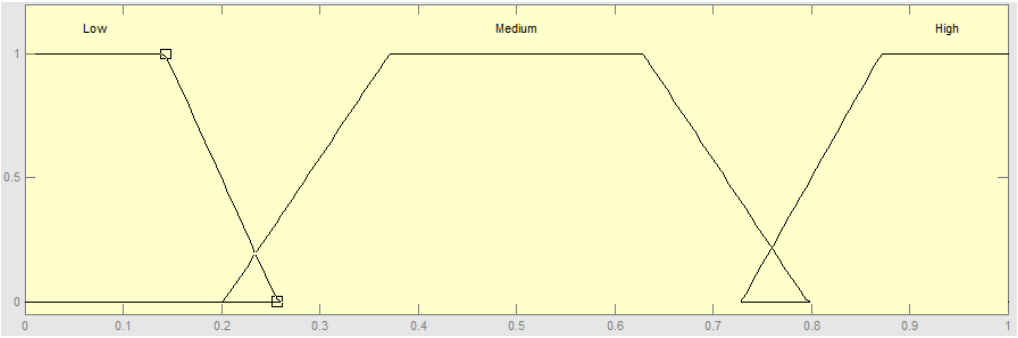

Fig 6. Linguistic Fuzzy Variables

Table 4: The linguistic fuzzy weights for relationship strengths between factors

Relation	Relation Strength
C2-C1	strong
C3-C1	strong
C4-C1	strong
C6-C4	medium
C5-C4	medium
C30-C9	strong
C31-C9	medium
C17-C9	weak
C9-C3	strong
C8-C3	medium
C7-C3	medium
C29-C7	medium
C25-C7	weak
C28-C7	weak
C10-C2	strong
C27-C2	strong
C11-C2	medium
C12-C2	medium
C13-C2	strong
C14-C2	medium
C15-C2	strong
C16-C2	medium
C18-C2	strong
C20-C2	strong
C21-C2	medium
C22-C2	strong
C23-C2	medium
C24-C2	medium
C19-C2	medium
C25-C2	strong
C26-C2	medium
C17-C2	strong
C30-C26	strong
C8-C19	medium

In Fig. 7, we have put the obtained fuzzy linguistic weights on each relation. This fuzzy cognitive map is the final result that covers the objective of reaching a "Customer Satisfaction Fuzzy Cognitive Map" in banking industry.

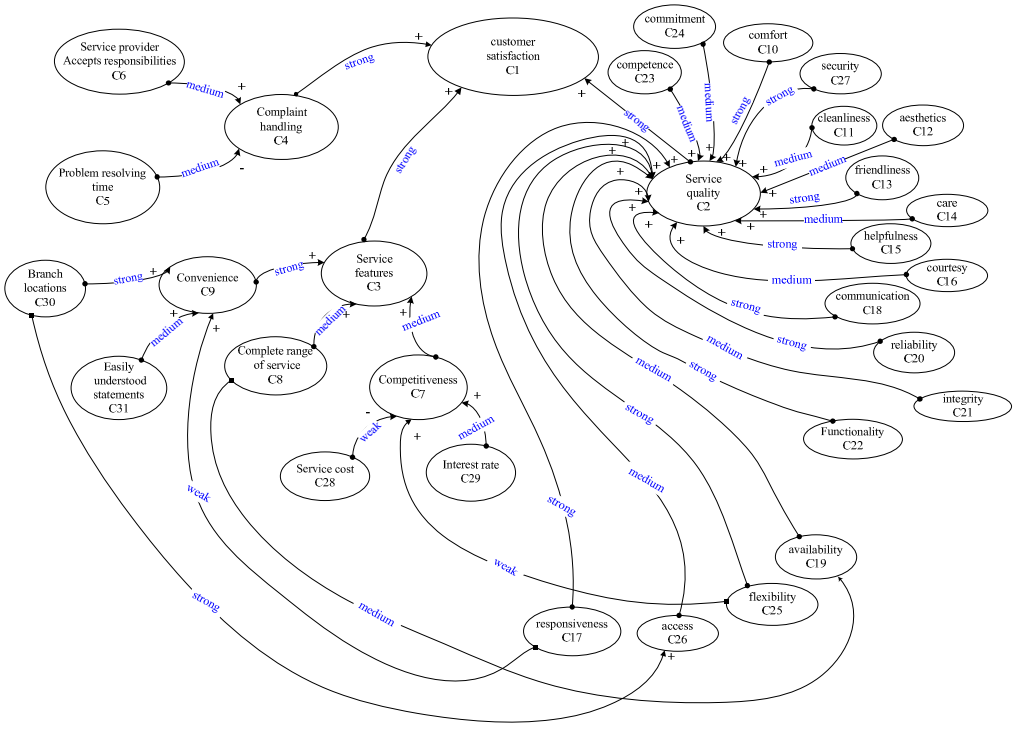

Fig 7. final "Customer Satisfaction Fuzzy Cognitive Map" in banking industry

6. Discussion

Fuzzy cognitive map (FCM) is a computing technique for modeling complex systems, which follows an approach similar to human reasoning and the human decision-making process. FCMs can successfully represent knowledge and human experience, introduce concepts to represent the essential elements and the cause and effect relationships among the concepts to model the behavior of any system. It is a very convenient, simple, and powerful tool, which is used in numerous fields.

Using the FCM to determine the customer satisfaction in the bank proves useful and looks promising for a move from the conventional modeling toward developing computer based models. The FCM is the only model that is capable of considering all the variables involved in the determination of the customers' satisfaction and the relationships among them. It is also capable of showing the dynamics involved in the customer satisfaction determination. The proposed model enables the experts to simulate different ideas from various viewpoints.

Another distinct characteristic of this model is its capability to react to changes in the factors involved in determining customers' satisfaction in the bank. This flexibility leads to the use of this model in banks and similar financial institutions and adaptation to the organizational environment.

In this approach, we utilize fuzzy linguistic labels instead of real numbers to determine the weights. This makes the FCM even more sensible.

The obtained FCM emphasizes the importance of the three main factors of customer satisfaction including service quality, service features and complaint handling by identifying their impacts as "strong" impacts on satisfying the customers. The map also leads managers to spend more of their resource on that group of factors which have stronger impacts on customer satisfaction.

The proposed FCM enables the managers to augment their jobs by establishing and developing scenarios and evaluating the alternative paths to reach the customer satisfaction. On the other hand, the model's state of being dynamic enables the managers to establish and analyze specific scenarios for different categories of the customers of the banks. Due to the diversity of the categories of the customers and even the diversity of culture in different regions, different solutions to increasing the satisfaction of customers are available. This Map, by producing a clear picture of the affecting factors, is a good means for bank managers to help them identify the solutions and alternatives.

Scenarios help the users understand the process of planning and state and analyze their own ideas about the future changes. The proposed FCM can be used as a basis for establishing scenarios for the following purposes:

- Evaluating the capabilities of the bank for gaining the customer satisfaction
- Analyzing different alternatives for determining the customer satisfaction

The example shown in Fig 8 shows a state in which the aim of the organization is to augment the quality of services. The managers and planners can use the proposed FCM in this paper to increase the competitiveness, offer a vast variety of services, or make the use of the services easier by analyzing different choices; such as increasing the interest rate, decreasing the cost of services, increasing the flexibility, etc.

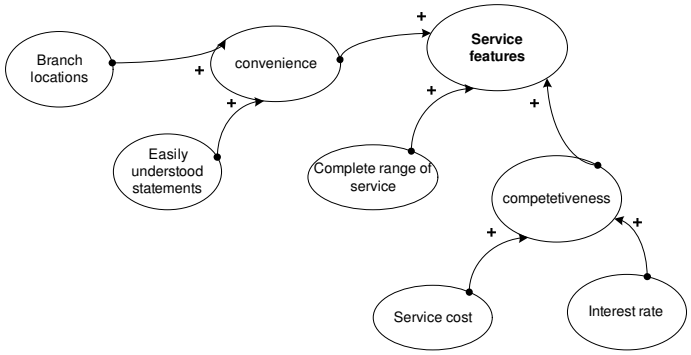

Fig 8. CM of augmenting the quality of the services

7. Conclusions and future research

Determining the customer satisfaction has always been important to the managers. On the other hand, the strategic factors involving this notion are complicated and vague and cannot be easily quantified. There are lot of qualitative techniques to analyze the structured problems but these techniques are not sufficient for analyzing such problems. In this paper, the usefulness of the FCM for modeling and simulating the customer satisfaction determination in the Bank has been studied. The proposed model is applicable to establishing projects and augmenting customer satisfaction programs. For future research, it is proposed to design an expert system based on the FCM. It is also very useful for making the proposed FCM, more dynamic by using a suitable learning method which can revise it through passing the time. In the end, this paper leads to proposing a new method for determining and demonstrating the customer satisfaction. The model considers a various variables and enables the managers to study the effect of different factors on the customers' satisfaction.

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