The Identification Level of Security, Usability and Transparency Effects on Trust in B2C Commercial Websites Using Adaptive Neuro Fuzzy Inference System (ANFIS)

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Abstract

With the rapid development of Internet, the number of online customers is growing fast. This growth is supported by spreading of Internet usage around the globe. However, the question of security and trust within e-commerce has always been in doubt. This study generates general knowledge about e-commerce. This study specifically gives an overview to understand different factors about security and trust between companies and their consumers. In order to Three e-stores and their websites were examined based on the model proposed .This study also mentions that security and trust work parallel and close to each other. If a consumer feels that an online deal is secured and they can trust the seller, it leads to a confident e-commerce's trade. The main focus of this study is to find out a suitable way to resolve security and trust issues that make e-commerce an uncertain market place for all parties. The findings of this study indicate that, character of security is regarded as the most important to building trust of B2C websites. The proposed model applies Adaptive Neuro-Fuzzy model to get the desired results. Two questionnaires were used in this study. The first questionnaire was developed for e-commerce experts, and the second one was designed for the customers of commercial websites. Also, Expert Choice is used to determine the priority of factors in the first questionnaire, and MATLAB and Excel are used for developing the Fuzzy rules. Finally, the Fuzzy logical kit was used to analyze the generated factors in the model.

Keywords: ANFIS, E-commerce, Trust, Security.

1. INTRODUCTION

These years many researchers have put eyes on this new academic area of online environment because of the rapidly popularity of Internet. Some researchers examined impact of online shopping environments on consumer choices and factors which influence shopping online, some researchers have discussed the role of Internet shopping as a channel of distribution, and some researchers pointed out impact of online shopping on price sensitivity. There are also other researchers; they are interested in the people who are not willing to shopping online. According to the findings of Sandra, Forsythe and Shi (2003), Internet users are classified into Internet shoppers (those who have made purchases on the Internet) and Internet browsers (those who have browsed online for product/service but not made purchases on the Internet) [1, 12].

The Previous findings in e-commerce trust area has showed that trust is an interpersonal determinant of behavior that deals with beliefs about the integrity, benevolence, ability and predictability of other people [11].

The detailed information on trust and the security system that is implemented by companies for secure transactions are important attributes in B2C e-commerce. According to Lightner the rewards of B2C e-commerce are realized partially through well-designed websites, since they act as the primary contact with customers. There are some factors for consumers trust in online buying when they plan to buy, and also there are more factors and matter of interactions when they are on the buying process in online and after one[13].So website designers must consider factors, in a website allowing the emergence of confidence between an online seller and a customer. A significant survey, which took place in United States between educators and practitioner, was about the security issues in e-commerce. The survey's result showed that most of educators and practitioners were worried about their online payment and personal information, because the lack of trust regarding the security issues within the e-commerce. They were even unhappy to get unpleasant long mailing list from different places, which could cause variants of virus attack, spreading of their personal information and their credit card number. (Carr et al., 2010) Security and trust issues could be found both within companies that engaged with small businesses and companies doing broader businesses. Jonathan (2003) means that the criminals often try to crop the information of the online consumers by establishing so called "spoof sites", which are fake Web sites. He means that such Web sites are being created by using the HTML code of the Web sites that are legitimate. By doing this the criminals manage to create a site that exactly looks like the legitimate businesses' site[2,14].

Further the author means that the criminals could misuse the consumers of that Web site by different ways, like sending them e-mails with false information in order to gain consumers' personal information. He means that the whole process could end up with criminals tricking the consumers and get access to their financial accounts and so on.

Technical competence is a key factor when it comes to gaining the customers trust. It is imperative that the e-commerce website is completely functional. Make sure all words are spelled correctly, there are no broken links or dead images, search engines yield proper results, etc. If the website does not function properly, it gives an unprofessional impression. Customers will rather put their trust in a website that seems qualified [3,10].There are many factors that are important within e-commerce, which should be improved. But

considering our limited resource we have chosen to focus on security within e-commerce. The study is limited to only e-commerce companies, i.e. security issue and solutions for it would be studied from business to consumers' (B2C) perspective. This study will be about finding ways to create trust for consumers while doing businesses within e-commerce. So a key element in e-commerce is trust. Without trust it would be impossible to do business at all. It is not easy for customers to know if an e-commerce site is trustworthy or not. Therefore, it is essential to have a well structured site where the customer can find the information needed. Security is also an important issue when developing an e-commerce site. The customers should always know that the information they provide will not be sold or misused in any other way. This is essential since the customers might provide sensitive information such as their credit card number [4, 5, 6, and 8].Importance of trust makes it a critical success factor for most suppliers/retailers to focus on it more, comparing other issues necessary for their business. As the Internet develops and grows, its success will largely depend on gaining and maintaining the trust of visitors. Such trust will be paramount to sites that depend on consumer commerce. The concept of trust is crucial because it affects a number of factors essential to online transactions, including security and privacy. Trust is also one of the most important factors associated with branding. Without trust, development of e-commerce can not reach its potential. In a joint research project conducted by Cheskin and Studio Archetype/Sapient, released in January 1999, the factors that produce a sense of trustworthiness on a website were identified [33].

In a follow-up study begun early in 2000, Cheskin probed the dimensions of online trust across the Americas by linking the learning in both studies, understanding of the nature and dynamics of website trust can be dramatically enhanced [33].

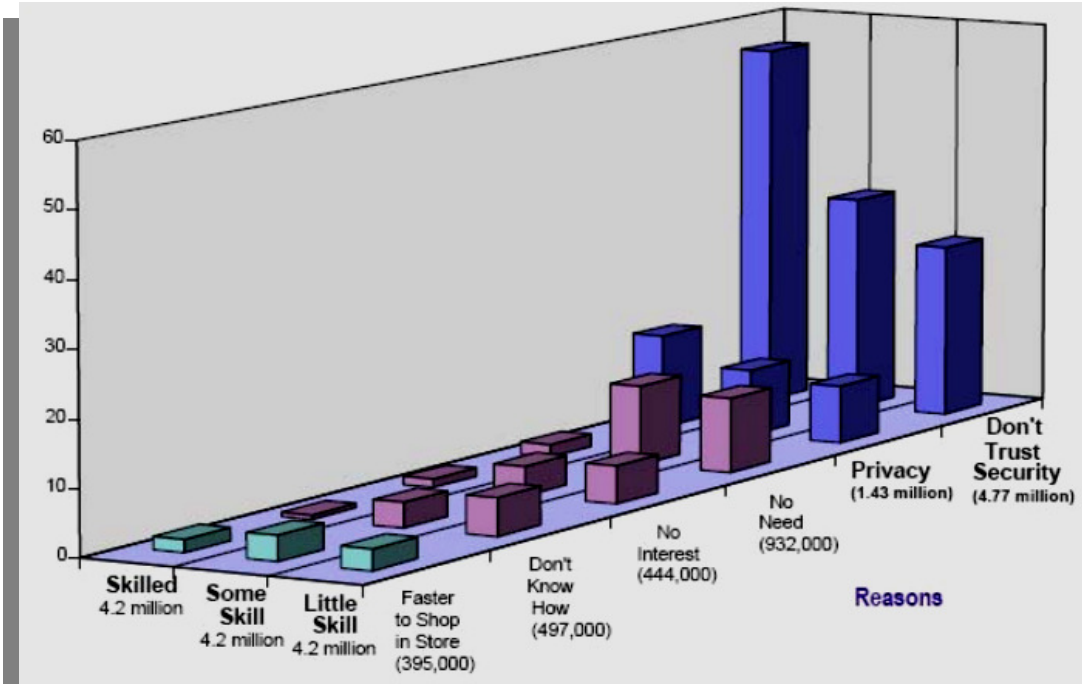

FIGURE 1: Attitudes impact customer internet to buy on the web.

In Figure 1, they have examined the relationship between online experience, closely correlated with and reported here as skill and also the reasons for not shopping online [33].

They have examined only that combination of web users who have never shopped online and never plan to. Overall, the most important reasons that non-buyers are uninterested in online shopping and it's not important for them not to shop online are not functional, but those are related to issues of controlling their personal information.

It is apparent that negative perceptions regarding security and privacy increase with increasing levels of online proficiency. The reverse is true for the functional reasons; web users do not shop online, including no perceived need, no interest, no knowledge of how to shop online and the belief that it is faster to shop in physical stores. In essence, the more experience one acquires online, the less important are the functional barriers to online shopping and the more important are concerns of control over personal information. Trust is an essential component of all successful buyer-seller relationships; the emergence of online business has brought about new challenges for building trust. On Business to customer relations, trust is very hard to achieve because comparing to Business to Business relations, it is for a short time and it is more transaction focused.

By developing the technology world, due to high investments, lack of a sudden shift for a better transaction and safer one, always is noticed and considered.

2. BASIC CONCEPTS

2.1. BACKGROUND OF ANFIS

Fuzzy logic was introduced by Zadeh in 1965 to represent and manipulate data and information in which there are various forms of uncertainty. Fuzzy rule-based systems use linguistic variables to reason using a series of logical rules that contain IF-THEN rules which connect antecedent(s) and consequent(s), respectively. An antecedent is a fuzzy clause with certain degree of membership. Fuzzy rules can have multiple antecedents connected with AND or OR operators, where all parts are calculated simultaneously and resolved into a single number.

Consequents can also be comprised of multiple parts, which are then aggregated into a single output of a fuzzy set [18].Fuzzy inference is a process of mapping from a given input to an output using the fuzzy set methods.

ANFIS is the implementation of fuzzy inference system (FIS) to adaptive networks for developing fuzzy rules with suitable membership functions to have required inputs and outputs. FIS is a popular and cardinal computing tool to which fuzzy if-then rules and fuzzy reasoning compose

bases that performs mapping from a given input know-ledge to desired output using fuzzy theory. This popular fuzzy set theory based tool have been successfully applied to many military and civilian areas of including decision analysis, forecasting, pattern recognition, system control, inventory management, logistic systems, operations management and so on. FIS basically consist of five subcomponents (Topçu and Saridemir, 2008), a rule base (covers fuzzy rules), a database (portrays the membership functions of the selected fuzzy rules in the rule base), a decision making unit (performs inference on selected fuzzy rules), fuzzification inference and defuzzification inference. The first two subcomponents generally referred knowledge base and the last three are referred to as reasoning mechanism (which derives the output or conclusion) [34].

An adaptive network is a feed-forward multi-layer Artificial Neural Network (ANN) with; partially or completely, adaptive nodes in which the outputs are predicated on the parameters of the adaptive nodes and the adjustment of parameters due to error term is specified by the learning rules. Generally learning type in adaptive ANFIS is hybrid learning (Jang, 1993). General structure of the ANFIS is illustrated in Figure 2 [35].

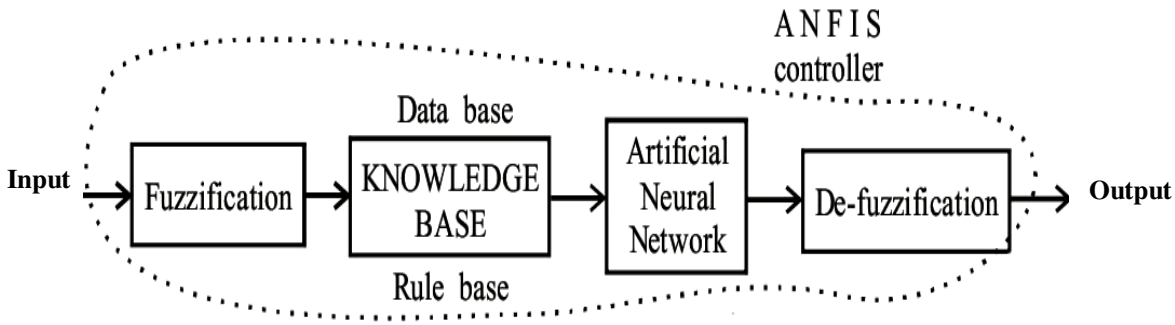

FIGURE 2: Schematic diagram of Fuzzy building blocks

The ANFIS is a multilayer feed-forward network which uses neural network learning algorithms and fuzzy reasoning to map inputs into an output. Indeed, it is a fuzzy inference system (FIS) implemented in the framework of adaptive neural networks. For simplicity, a typical ANFIS architecture with only two inputs leading to four rules and one output for the first order Sugeno fuzzy model is expressed [15, 16, 17, 18, 22, 23, and 24].
The ANFIS architecture is shown in figure3.

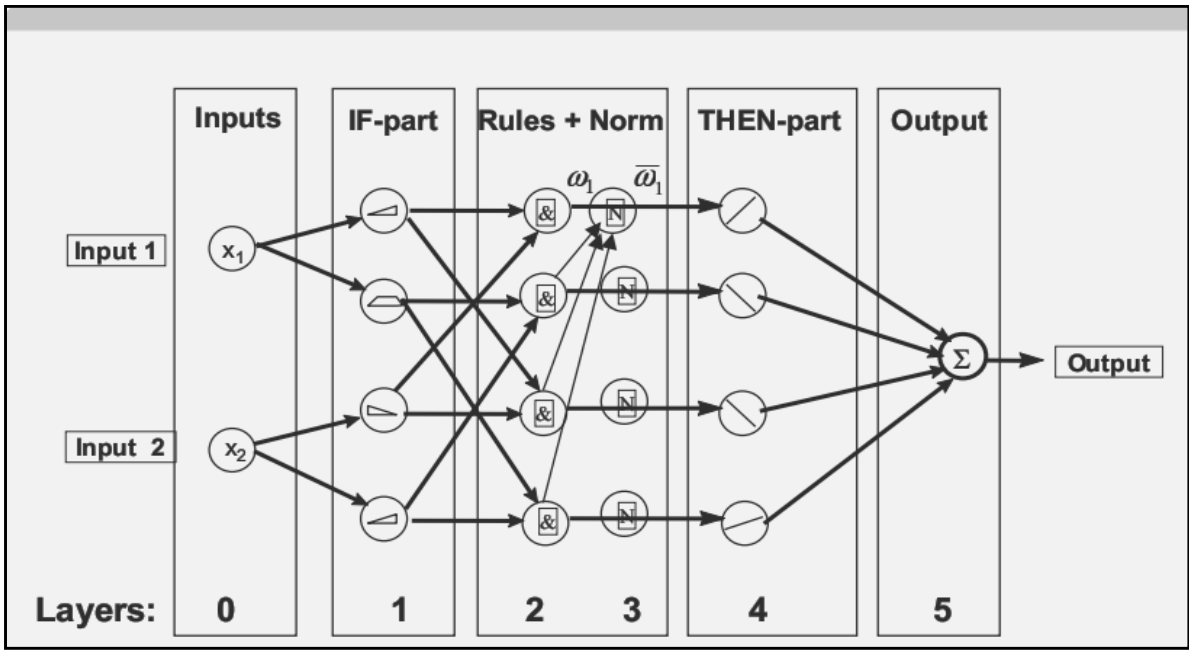

FIGURE 3: A typical ANFIS architecture for a two-input Sugeno model with four rules

Using a given input/output data set, the ANFIS method constructs a fuzzy inference system (FIS) whose membership function parameters are tuned (adjusted) using either a

backpropagation algorithm alone, or in combination with a least squares type of method. This allows fuzzy systems to learn from the data they are modeling. FIS Structure is a network-type structure similar to that of a neural network, which maps inputs through input membership functions and associated parameters, and then through output membership functions and associated parameters to outputs.

In our case ANFIS is a four-layer neural network that simulates the working principle of a fuzzy inference system. The linguistic nodes in layers one and four represent the input and output linguistic Variables, respectively. Nodes in layers two are term nodes acting as membership functions for input variables. Each neuron in the third layer represents one fuzzy rule, with input connections representing preconditions of the rule and the output connection representing consequences of the rules. Initially, all these layers are fully connected, representing all possible rules.

The suggested ANFIS has several properties:

- The output is zero ^{the} order Sugeno-type system.
- It has a single output, obtained using weighted average defuzzification. All output membership functions are constant.
- It has no rule sharing. Different rules do not share. The same output membership function, namely the number of output membership functions must be equal to the number of rules.
- It has unity weight for each rule.

Three feature variables are selected as inputs of the ANFIS. Three membership functions (Mfs) are assigned to each linguistic variable. The suggested ANFIS model is shown in Fig. 4. It shows the fuzzy rule architecture of ANFIS consists of 27 fuzzy rules. In this study for space trust problem, the cross sectional areas of the structures are selected as ANFIS inputs and nodal displacements, element stresses and ultimate load factor can be separately considered as ANFIS output. For each input two Gaussian membership functions are adopted and the maximum number of epochs in training mode is set to 250. Figure 5 shows the flow chart for trust model via ANFIS.

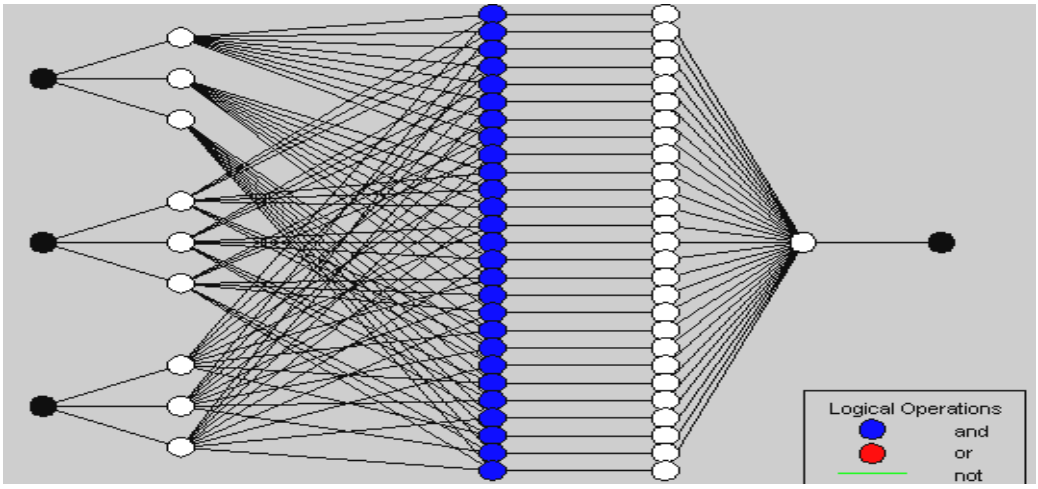

FIGURE 4: The ANFIS structure for research model

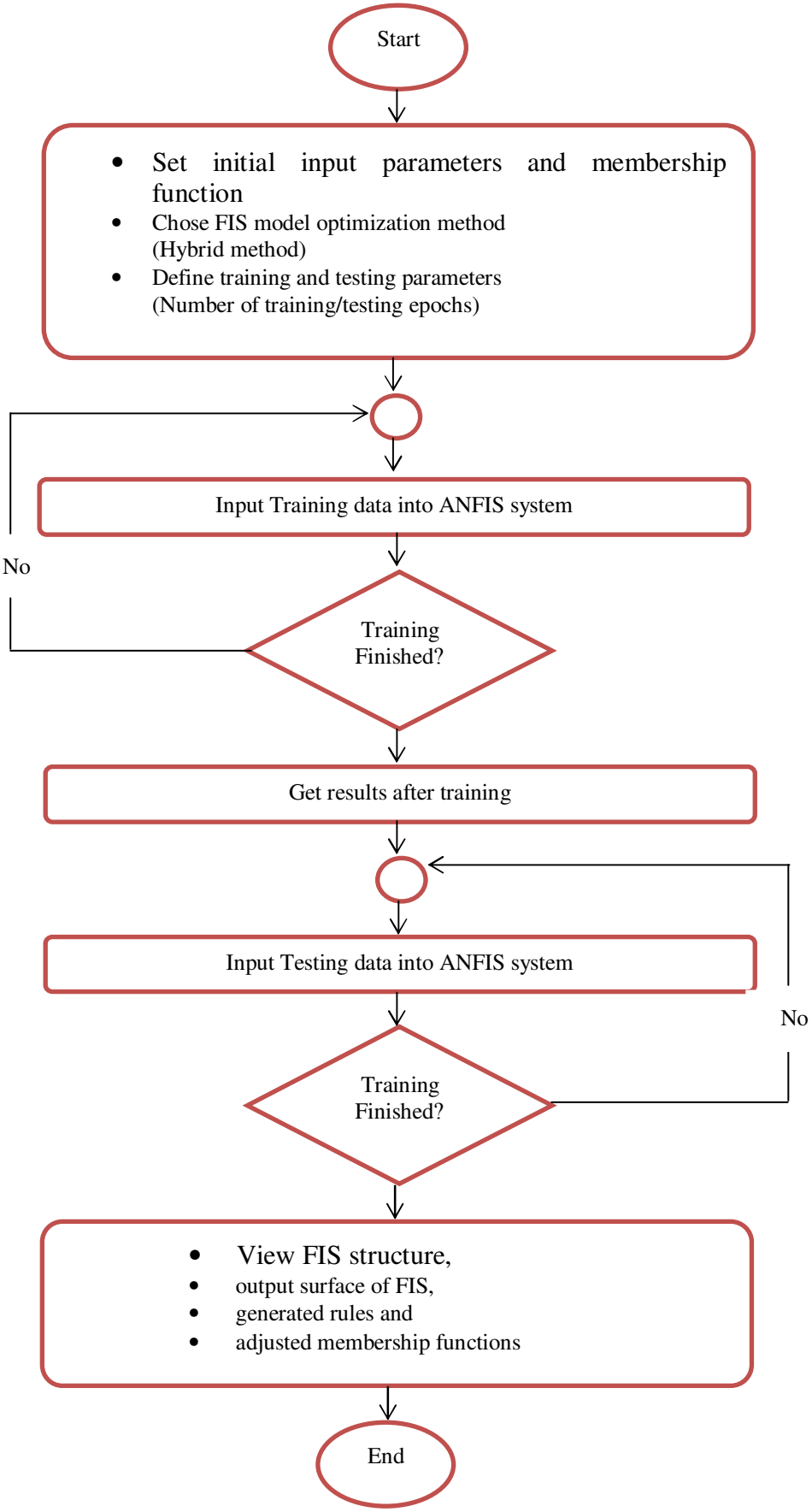

FIGURE 5: Flowchart of force prediction of ANFIS system

2.2 ANALYTIC HIERARCHY PROCESS (AHP)

Fundamentally, AHP provides a "ratio scale" of relative magnitudes expressed in dominance objects to represent judgments in the form of paired comparisons. An overall ratio scale is then synthesized to obtain a ranking of the objects, and thus ratio transitivity is also implied in the process of deriving the relative weight for objects.

Saaty developed the following steps for applying the AHP:

1. Define the problem and determine its goal.

2. Structure the hierarchy from the top (the objectives from a decision-maker's viewpoint) through the intermediate levels (criteria on which sub-sequent levels depend) to the lowest level which usually contains the list of alternatives.

3. Construct a set of pair-wise comparison matrices (size n □ n) for each of the lower levels with one matrix for each element in the level immediately above by using the relative scale measurement shown in Table 1. The pair-wise comparisons are done in terms of which element dominates the other.

4. There are n(n-1)/judgments required to develop the set of matrices in step 3. Reciprocals are auto- magically assigned in each pair-wise comparison.

5. Hierarchical synthesis is now used to weight the eigenvectors by the weights of the criteria and the sum is taken over all weighted eigenvector entries corresponding to those in the next lower level of the hierarchy.

6. Having made all the pair-wise comparisons, the consistency is determined by using the igenvalue, λmax, to calculate the consistency index, CI as follows: $CI = (\lambda_{\max} - n)/(n-1)$, here n is the matrix size. Judgment consistency can be checked by taking the consistency ratio (CR) of CI with the appropriate value in Table 1. The CR is acceptable, if it does not exceed 0.10. If it is more, the judgment matrix is inconsistent. To obtain a consistent matrix, judgments should be reviewed and improved.

7. Steps 3-6 are performed for all levels in the hierarchy [25, 26, 27, and 28].

Numerical rating Verbal judgments of preferences	Numerical rating Verbal judgments of preferences
Extremely preferred	1
Very strongly preferred	2
Strongly preferred	3
Moderately preferred	4
Equally preferred	5
Very strongly to extremely	6
Strongly to very strongly	7
Moderately to strongly	8
Equally to moderately	9

TABLE 1. Pair-wise comparison scale for AHP preferences

Fortunately, there is no need to implement the steps manually. Professional commercial software, Expert Choice, developed by Expert Choice, Inc., is available on the market which simplifies the implementation of the AHP's steps and automates many of its computations.

3. THE METHODOLOGY OF RESEARCH

Figure 6 shows the research methodology of ANFIS trust model.

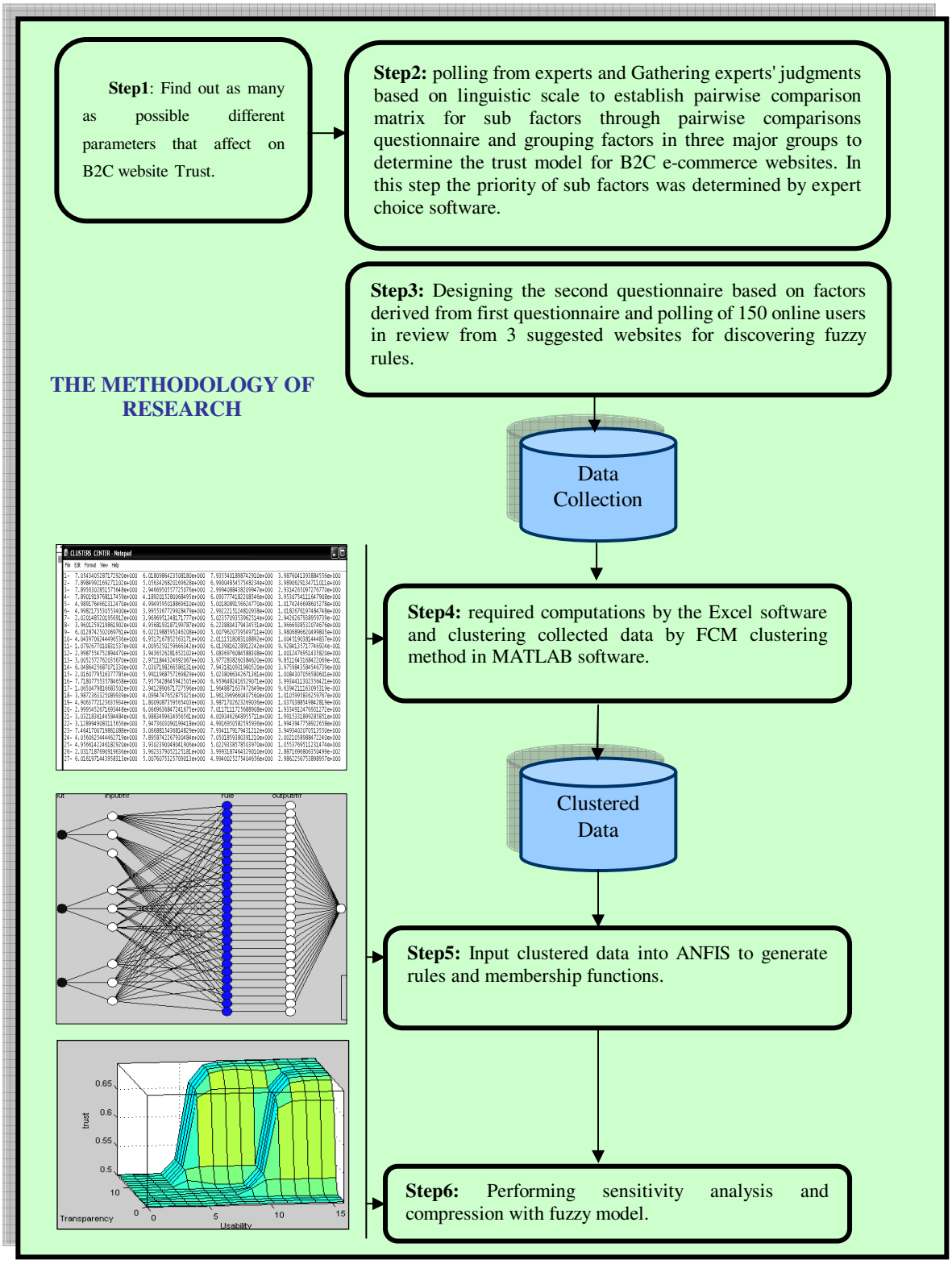

FIGURE 6. The schematic form of research methodology of this research

4. CONCEPTUAL FRAMEWORK

The proposed model has been established based on this principle that trust in B2C websites includes three factors as follows:

- Transparency: what we say is what we do". To all participants it must be clear, understandable, and logical and, if possible, verifiable with whom they are dealing and about what, subject to what conditions, and what information is relevant or being used for that purpose. Transparency forms the basis of trust.
- Usability:" Usability is defined as a set of attributes that bear on the effort needed for the use and on the individual assessment of such use by a stated or implied set of users. According to ISO 9126, usability's sub-characteristics are understandability, learn ability and operability. Based on the definition, it is obvious that the quality factor of us-ability is related to characteristics of e-commerce systems, such as provision of accurate informative texts about products and services offered, as well as provision of thumbnails, photographs and videos presenting the services and products available [31].
- Security: Different threats in e-commerce, like data transaction attacks and misuse of financial and personal information, generate security threats. Thus, security is protection against such threats [32].

The level of trust obtains of these three parameters performance. Figure 7 Presents a model based on our which illustrates the relationships between the different concepts.

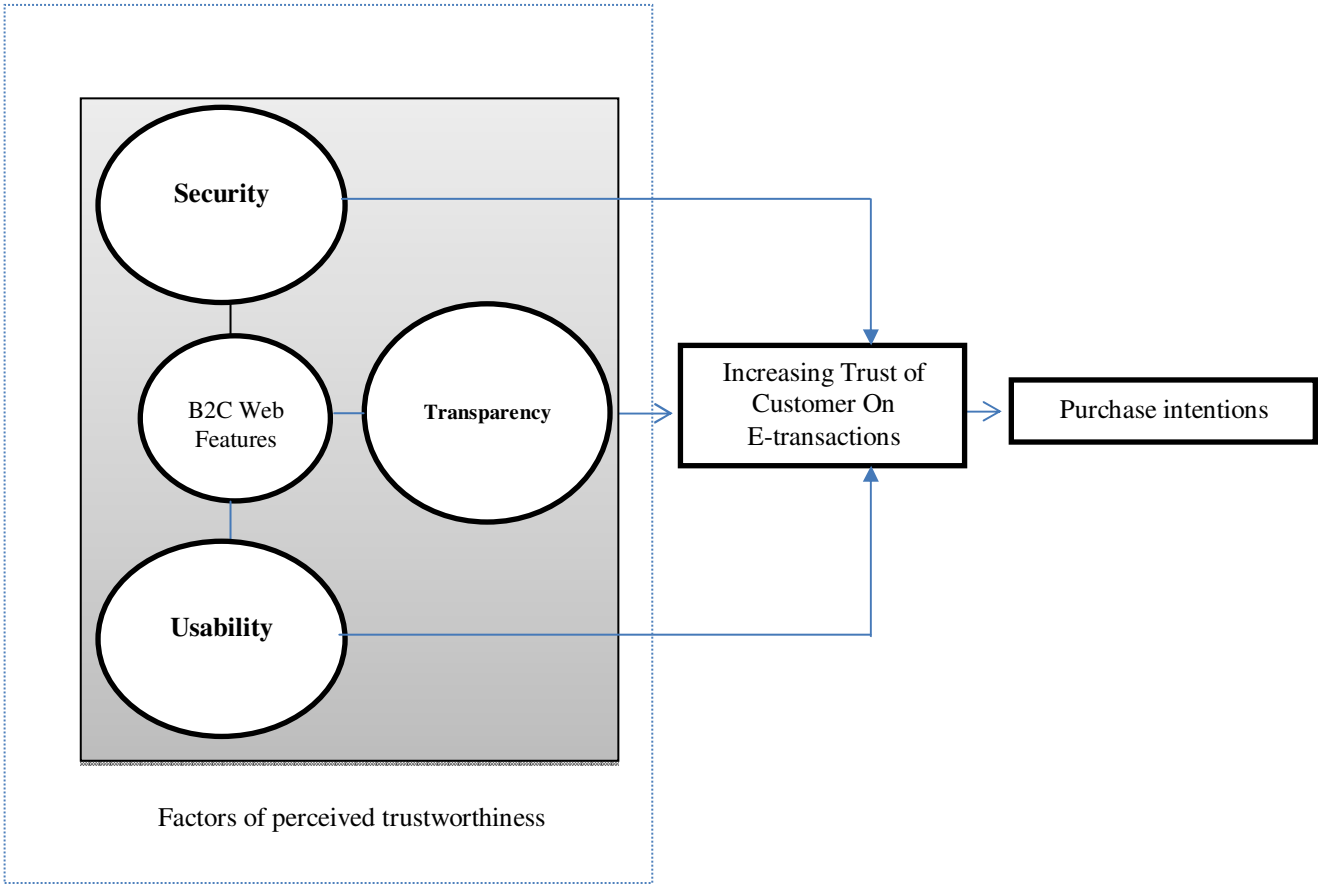

FIGURE 7. Relationships between Trust, Security, Transparency and Usability

4.1. DATA COLLECTION AND ANALYSIS

This study used a web-based survey because of its advantages such as convenience; viable, effective way to access difficult-to-reach respondents [7].

Questionnaire method was used for collecting data: the questionnaire was prepared by using 51 parameters that was shown in the table 3. All the affected parameters on website quality were mentioned in previous findings.

It had also five options (index) ranked by 0-4 for the raised questions could be found as follows:

very low (1) low (2) moderate (3) high (4) very high

The selected population in this study was included in two groups. The first group was included ten experts in the field of e-commerce and the Second group was included 150 numbers of E-Commerce and IT students.

The first group completed the first questionnaire and after obtaining results from the first questionnaire and the second group completed the second.

After collecting data of first questionnaire and finding factors with higher priority, the second questionnaire was designed .it involves 3 major groups. The method of scoring was chosen based on the likert scale of 5 degrees and 13 given questions in questionnaire were scored like 5 selections.

In this questionnaire 12 questions are relative to 3 major groups, and 1 question has been observed relative to the trust level of website.

Cronbach's Alpha method is applied to calculate the reliability of measurement tool e.g. questionnaire or tests which measure different characteristics. According to Jamal & Naser (2002:154) [29] a tool with Cronbach's Alpha greater than the minimum quantity level 0.7 suggested by Nunnally [30] (1987) is considered reasonable from reliability aspect.

To assess the reliability of the questionnaires in this research, Cronbach's Alpha was used. The results of reliability test by using SPSS have been presented in table 2:

Table 2. The counted credit coefficient of second questionnaire

kronbach's alpha coefficient for each website		
Irshop.ir	Tobuy.ir	Parsim.com
0.85	0.83	0.83

The inserted credit trust in table 1 shows the acceptance of second questionnaire credit.

After that customers referred to special website for experimental buying, it was asked the respondents to analyze three websites as parsim.com, Tobuy.ir, irshop.ir

During this process, they should answer some questions in security groups, usability groups, transparency groups, and trust level.

The order of answering the questions is that first of all the respondents should analyze the website and answer the questions in security groups, usability, transparency and then they

were asked to count the trust level and after that the it was weighted respondents were asked to evaluate the selective website for b2c dealings based on their expectation level of trust.

4.2. COUNTING THE LEVEL OF SECURITY

To count the level of security sheet1 was created in EXCEL (security sheet) and linguistic values questionnaire were changed to numerical values. Actually it was related numerical value to each linguistic value (0, 1, 2, 3 and 4) in order to count the level of security the counted level of security is made by adding these values for each factor whose maximum for four factors is number 16.Also, its percent for level of security was counted that has been in table 2, and in general second equation has been used for level of security .Table 3 shows the linguistic scales to evaluate security level.

$$AccumulatedSecurityLevel = \sum_{i=1}^{4} x_i$$
$$PercentageOfMaximum = (AccumulatedSecurityLevel) \Big/ 16) * 100 \quad (9)$$

Table 3. Linguistic and numeric values for security level

domain of values percent	Linguistic value
0-33	low
34-66	moderate
66-100	high

Some Pseudo code for counting the level of factors was written with VBA programming in excel software. The sample Pseudo code for counting the level of security is shown in following:

```
Sub Security_Ind_Prot_Auth ()
Dim i as Integer
Dim col As Integer
Dim x as String
Worksheets ("security").Activate
   For col = 2 To 6 Step 2
      For i = 4 To 153 Step 1
      Cells (i, col).Select
         ActiveCell.Value = Trim ((ActiveCell.Value))
       If StrComp (ActiveCell.Value, "very low", vbTextCompare) = 0 Then
            ActiveCell.Offset (0, 1).Value = 0
         End If
         If StrComp (ActiveCell.Value, "low", vbTextCompare) = 0 Then
            ActiveCell.Offset (0, 1).Value = 1
         End If
         If StrComp (ActiveCell.Value, "moderate", vbTextCompare) = 0 Then
            ActiveCell.Offset (0, 1).Value = 2
         End If
          If StrComp (ActiveCell.Value, "high", vbTextCompare) = 0 Then
            ActiveCell.Offset (0, 1).Value = 3
         End If
          If StrComp (ActiveCell.Value, "very high", vbTextCompare) = 0 Then
            ActiveCell.Offset (0, 1).Value = 4
         End If
      Next i
   Next col
End Sub
```

4.3 THE PRIORITIZED FACTOR RESULTED THROUGH AHP METHOD

In this study the priority of Sub-Criteria in security, Usability and Transparency groups was counted by expert choice software that uses ahp method. Thus Rank and Weight of Criteria, Sub-Criteria Counted by Expert Choice has been noted in Table 4.

TABLE 4: Sixteen of most important parameters that affect on website trust ranked by their weight via Expert Choice

Objective : **Assessment and prioritizing affective criteria of Security, Usability and Transparency**													
Sub-Criteria Ranking And Their Weighs Counted By Experts.										Priorities of Criteria	CR.	Criteria	
10	9	8	7	6	5	4	3	2	1				
0.24	0.216	0.292	0.224	0.238	0.184	0.257	0.24	0.206	0.23	0.224	0.03	**Secure Payment Systems**	**Security**
0.179	0.226	0.17	0.206	0.227	0.166	0.163	0.229	0.243	0.172	0.204		**privacy**	
0.177	0.189	0.226	0.166	0.145	0.166	0.198	0.201	0.164	0.184	0.189		**Policies to ensure**	
0.121	0.109	0.088	0.106	0.121	0.142	0.136	0.109	0.133	0.146	0.118		**Security protocols**	
0.263	0.272	0.224	0.2	0.304	0.251	0.229	0.241	0.266	0.249	0.266	0.03	**Direct delivery of the products**	**Usability**
0.212	0.215	0.213	0.241	0.184	0.297	0.3	0.19	0.152	0.23	0.187		**Notification by E-mail**	
0.148	0.155	0.191	0.261	0.132	0.149	0.12	0.136	0.179	0.254	0.207		**Possibility to returning the product**	
0.17	0.142	0.166	0.119	0.169	0.114	0.126	0.15	0.164	0.103	0.129		**Thanking message after each purchase**	
0.197	0.22	0.175	0.189	0.136	0.288	0.286	0.191	0.274	0.285	0.25	0.04	**description of the product**	**Transparency**
0.237	0.211	0.207	0.224	0.19	0.201	0.233	0.16	0.232	0.161	0.198		**Information concerning our company**	
0.131	0.16	0.252	0.168	0.212	0.141	0.139	0.203	0.141	0.145	0.14		**sales conditions**	
0.145	0.128	0.138	0.15	0.206	0.113	0.127	0.156	0.12	0.137	0.155		**the way in which the Customer can record transaction data**	

4.4. DEVELOPING EXPERT SYSTEM

4.4.1. FCM CLUSTEING AND FUZZY RULES FOR INDICATING TRUST LEVEL

The most important step of structure identification is the rule generation. Clustering of the input-output data is an intuitive approach to rule generation. The idea of clustering is to produce a concise representation of a system's behavior by dividing the output data into a certain number of fuzzy partitions. The fuzzy C-Means (FCM) clustering algorithm (Bezdek 1981, Bezdek et al. 1987) has been widely studied and applied in many applications.

The number of rules is an important parameter of the FIS. Clearly, the appropriate number of rules depends on the complexity of the system. According to Sugeno and Yasukawa (1993), the number of fuzzy rules corresponds to the order of a conventional model where an optimal model minimizes both the order and the output error. A statistical analysis for evaluating the optimal order of a model is discussed by Akaike (1974). A large number of rules, similar to a high order of a model, will bias the model towards specific data that can be imprecise or even erroneous. On the other hand, less number of rules will likely increase the output error, which is essentially equivalent to disregarding the effect of some of the data points containing valuable information.

Thus, the optimal number of rules n can be obtained from a tradeoff between the numbers of rules and the output error.

The number of rules will be automatically determined through clustering the input and output spaces. Each cluster center is used as the basis of a rule that describes the system behavior.

For refining and finding the rules of fuzzy model, it has been the clustering technique, and the kind of clustering has been chosen the fuzzy C-means (FCM) clustering in MATLAB software.

Equation 1 is as a major function in clustering k-means.

$$J_m(U,V)=\sum_{j=1}^{n}\sum_{i=1}^{c}u_{ij}^{m}\left\|X_j-V_i\right\|^2,\quad 1\le m<\infty \tag{1}$$

Where m is any real number greater than 1, uij is the degree of membership of Xj in the cluster i, Xj is the jth of d-dimensional measured data, Vi is the d-dimension center of the cluster, and ||*|| is any norm expressed the similarity between any measured data and the center.

Fuzzy partition is carried out through an iterative optimization of Equation 8 with the update of membership uij and the cluster centers VI by Equation 2 and 3:

$$u_{ij}=\frac{1}{\sum_{k=1}^{c}\left(\frac{d_{ij}}{d_{ik}}\right)^{\frac{2}{m-1}}} \tag{2}$$

$$V_i=\frac{\sum_{j=1}^{n}u_{ij}^{m}X_j}{\sum_{j=1}^{n}u_{ij}^{m}} \tag{3}$$

The criteria in this iteration will stop when $\max_{ij}\left[\left|u_{ij}-\bar{u}_{ij}\right|\right]<\varepsilon$, where ε is a termination criterion between 0 and 1 [21].

All clustering activities were done in MATLAB software. For example 27 centers of clusters for counting the level of trust is shown in figure 8.after obtain the centers of clusters and save into DAT files, the centers of cluster were loaded into ANFIS. In fact this data is used as training data in ANFIS model.

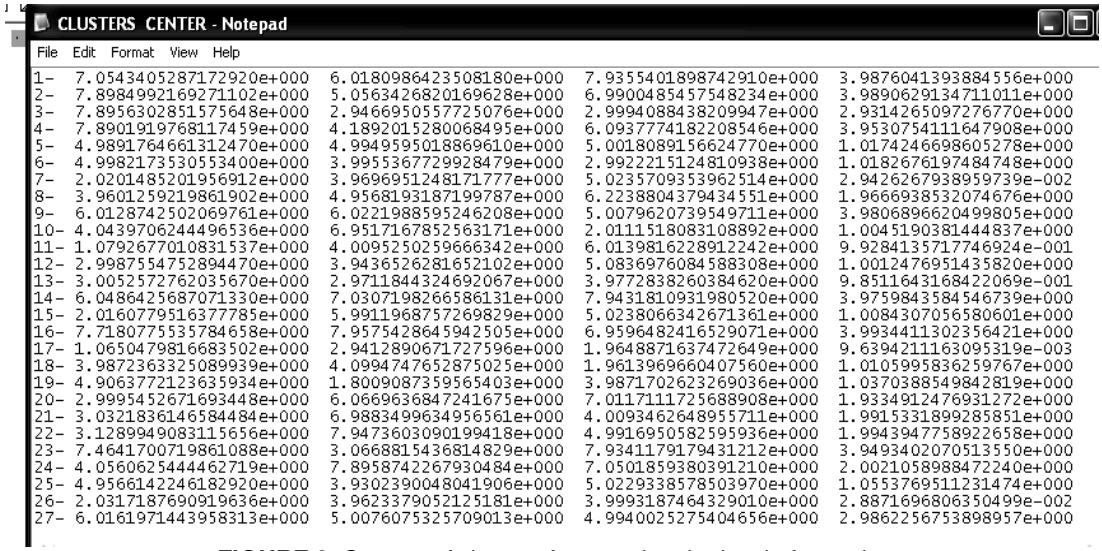

FIGURE 8. Centers of clusters for counting the level of security

After clustering, ANFIS was proposed in an effort to formalize a systematic approach to generating fuzzy rules from an input-output data set.
In ANFIS model 27 rules for trust level is used. The rules describing the trust level are based on the degree of security, usability, and transparency that these degrees have been formulated like linguistic variable .similarly, the degree for trust level has been graded from very low to very high in 5 distinctive fuzzy,collections .these rules have been reached from the users ' answers after ordering ,analyzing ,and clustering. Figure 9 shows some of the rules from ANFIS after raining data.

One of the collection rules of confidence level can be like following:

If (security = high and usability = low and transparency = moderate) then (trust =moderate).

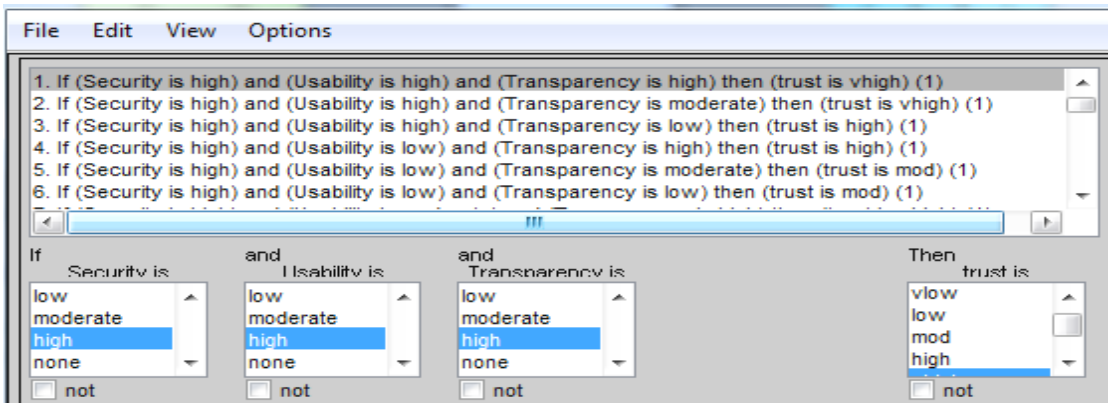

FIGURE 9. Shows the GUI for the rule editor

4.4.2. EXPERT ANFIS SYSTEM

The ANFIS system based on Expert knowledge contains 27 rules, 3 inputs and one single output for trust level. The structure of expert ANFIS is shown in figure 10.
The fuzzy logic toolbox using the MATLAB software is employed to create the ANFIS model.
In fuzzy logic tool box, relevant FIS for trust model is created. In this model type of FIS is selected Sugeno type.

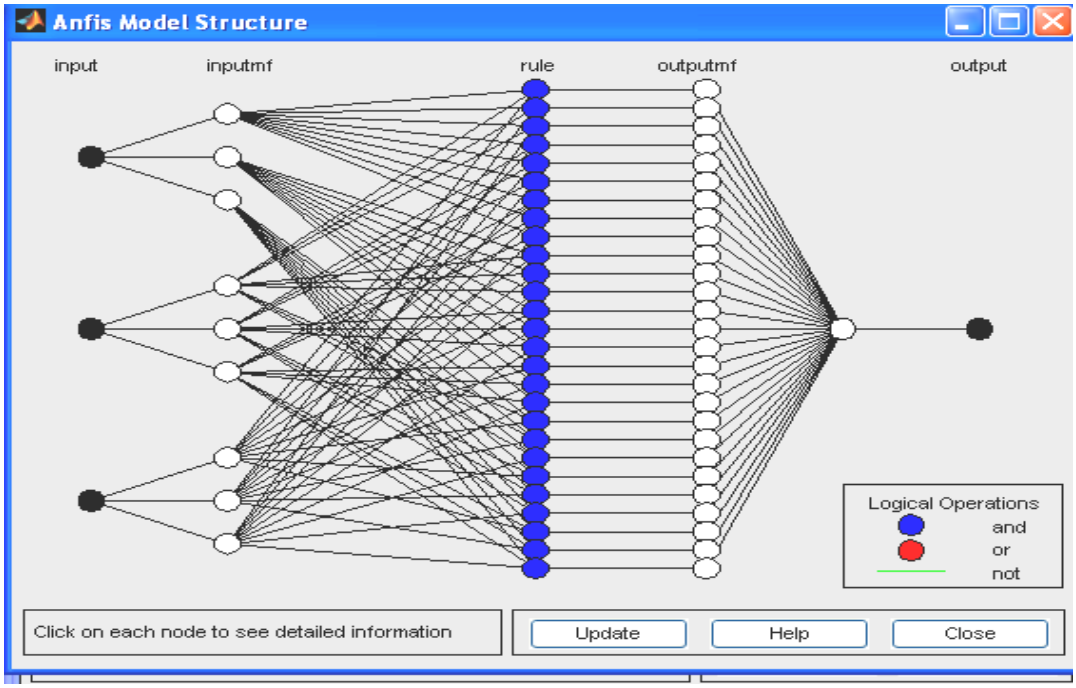

FIGURE 10. ANFIS trust structure

4.4.3. MEMBERSHIP FUNCTION FOR EXPERT ANFIS

Gaussmf are used to build the expert ANFIS model. The shape of membership functions after training the AFNIS for 100 epochs is shown figure 11.

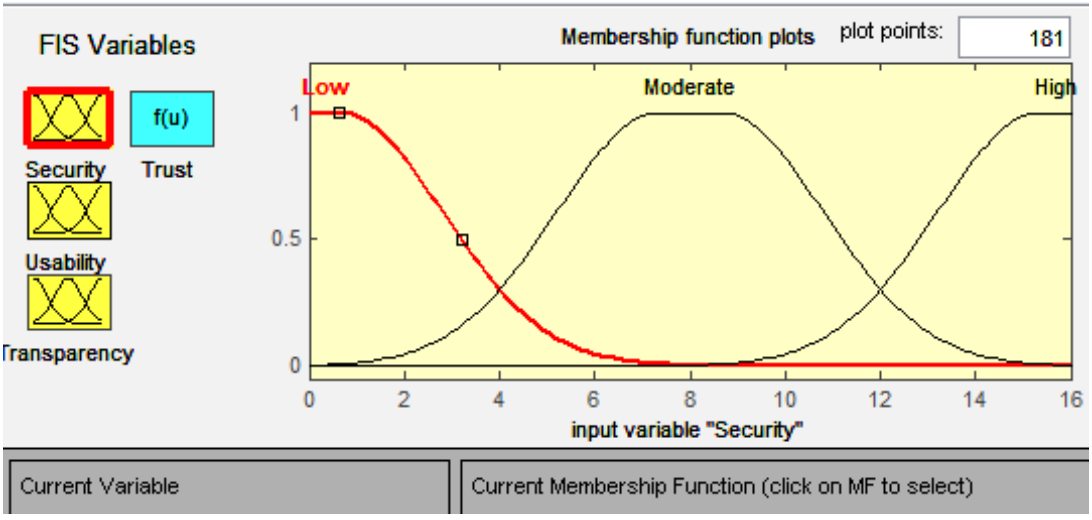

FIGURE 11. Membership function editor

4.4.4. TRAINING DATA FOR TRUST LEVEL

The entire data set of trust level is 27 samples. They are referred to as training data, testing data and checking data. Upon training, the ANFIS shows the training error which reflects the how good the mapping function is. To validate the model, we further apply the testing data to see how the ANFIS behaves for known data. ANFIS maps the function onto the testing data as per the training.

Having created the data set the next step is to train the network. This means we create a new FIS to fit the data into membership functions. Using the grid partitioning method, the ANFIS automatically selects the membership function and also generates the new FIS.
Figure 12 shows training and testing data in ANFIS network that is loaded.

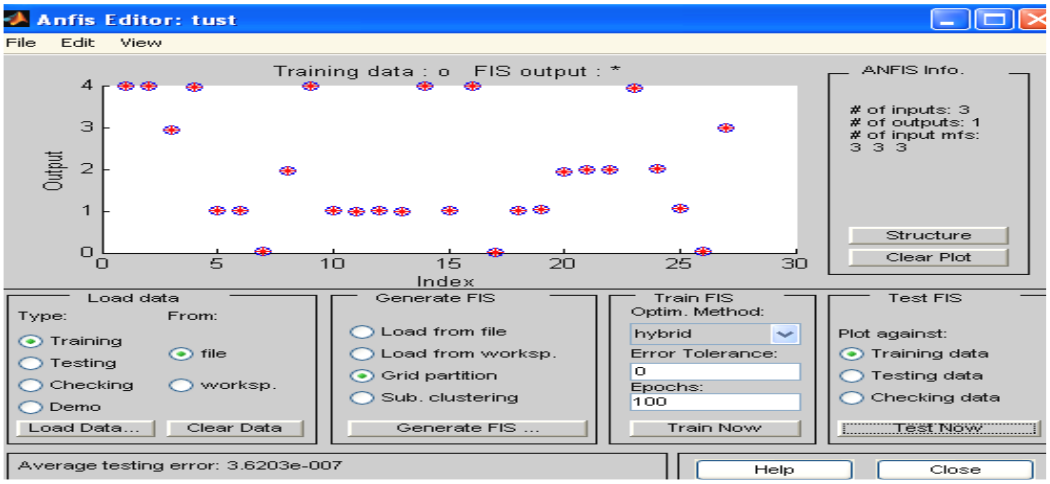

FIGURE 12. ANFIS editor: Training the rules

In figure 13, the course of error during the training of adaptive network is shown.

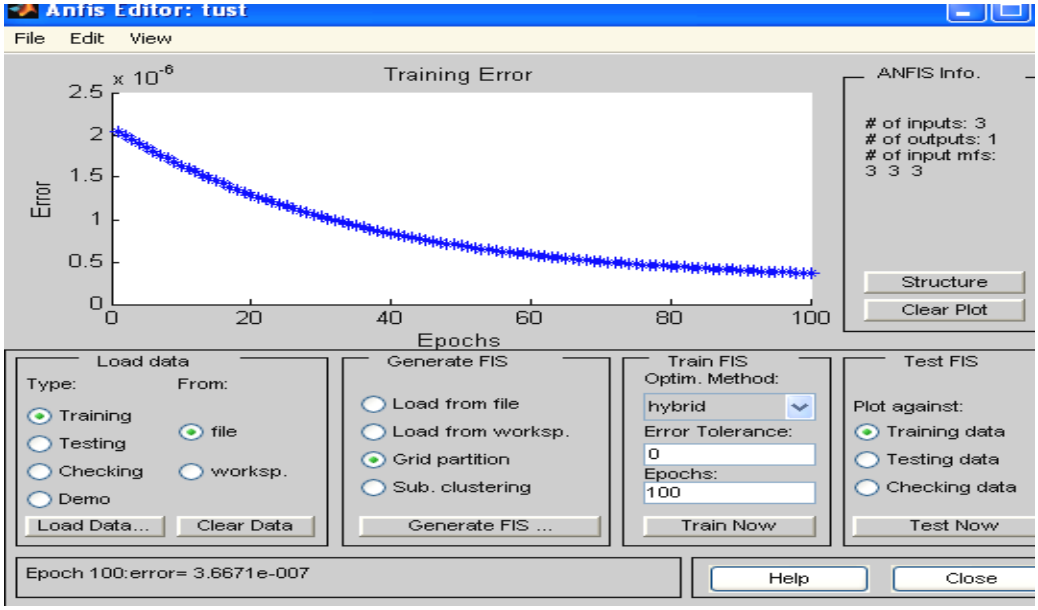

Figure 13. Course of error during the training of adaptive network

At the end of 100 training epochs, the network error (mean square error) convergence course of each ANFIS was derived. From the curve, the final convergence value is 3.6671e–007.
The rule viewer for the 3 inputs and 1 output can be observed pictorially in the Figure 14.

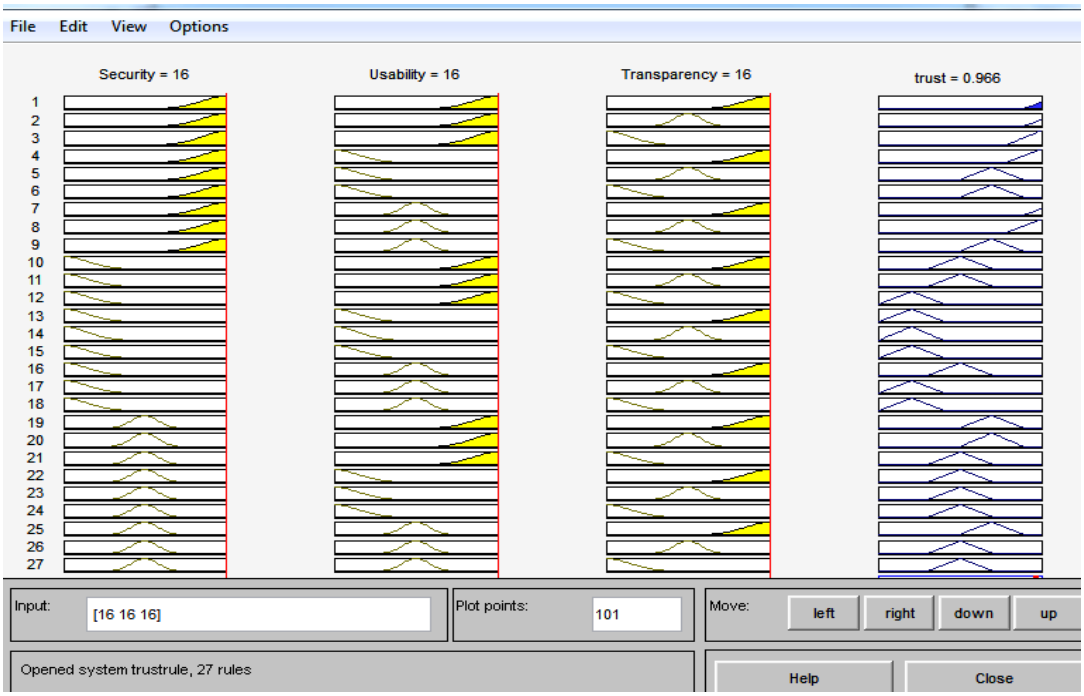

FIGURE 14. Rule viewer window

5. DEVELOPMENT AND ANALYZING FUZZY SYSTEM

After discovering the rules related to trust level, relevant inputs and outputs for earning trust level in fuzzy tool box to be organized and were created relevant membership for input and output figure 15 shows the fuzzy system that can be used to derive the trust level.

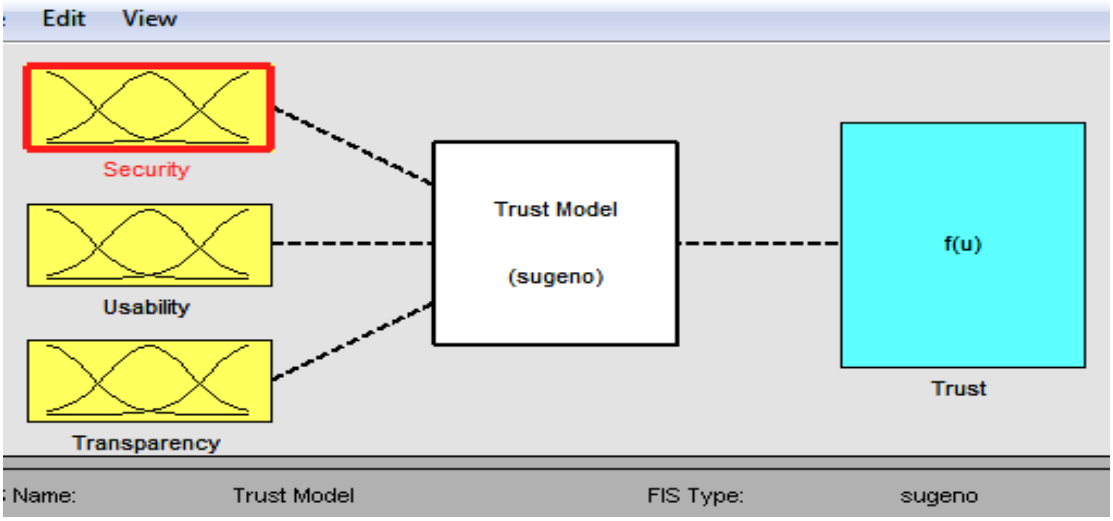

FIGURE 15. The ecommerce ANFIS trust model

5.1. ANALYSIS OF TRUST VERSUS SECURITY FACTOR

For complete understanding of participation needed in trust level, it is necessary to separately test the participation of each factor.

The Figure 16 shows contribution to Trust of a given Website originating from the Security. Therefore, the contribution from Usability and Transparency has been kept constant at high

level corresponding to numeric value for Usability and Transparency of (15). When T&U is high, then Trust remains high and is rather constant (at a value of about 0.9) with increasing security .Figure 12 shows that Trust level is monotonically increasing for increasing perceived security of a website for any given level of Usability and Transparency (However when both U and T is 'High' (numeric value of 15) the Trust level is at its maximum for maximum Security.

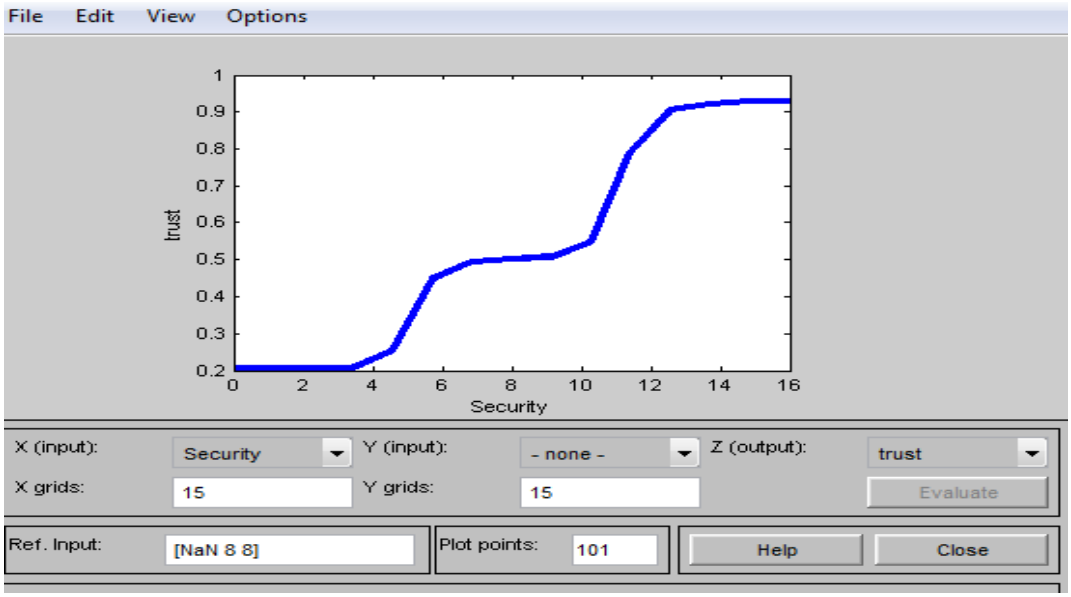

Figure 16. Trust versus security factor

5.2. ANALYSIS OF TRUST VERSUS TRANSPARENCY FACTOR

Figure 17 shows how Trust is contributed from transparency for constant values of Security and usability. The values for high has the same interpretations as explained in the previous section. This figure is considerably different from the previous one. One stunning point to note is that trust levels remain low for any value of transparency when S&U is low. When S&U is high, then Trust remains high and is rather constant (at a value of about 0.7) with increasing transparency. This tends to suggest that Trust is positively related to transparency for high S&U. Also, Trust is high for S&U levels being high with increasing transparency. This means that, although increasing transparency has a positive affect on Trust, the relative increase is more visible for moderate values of S&U.

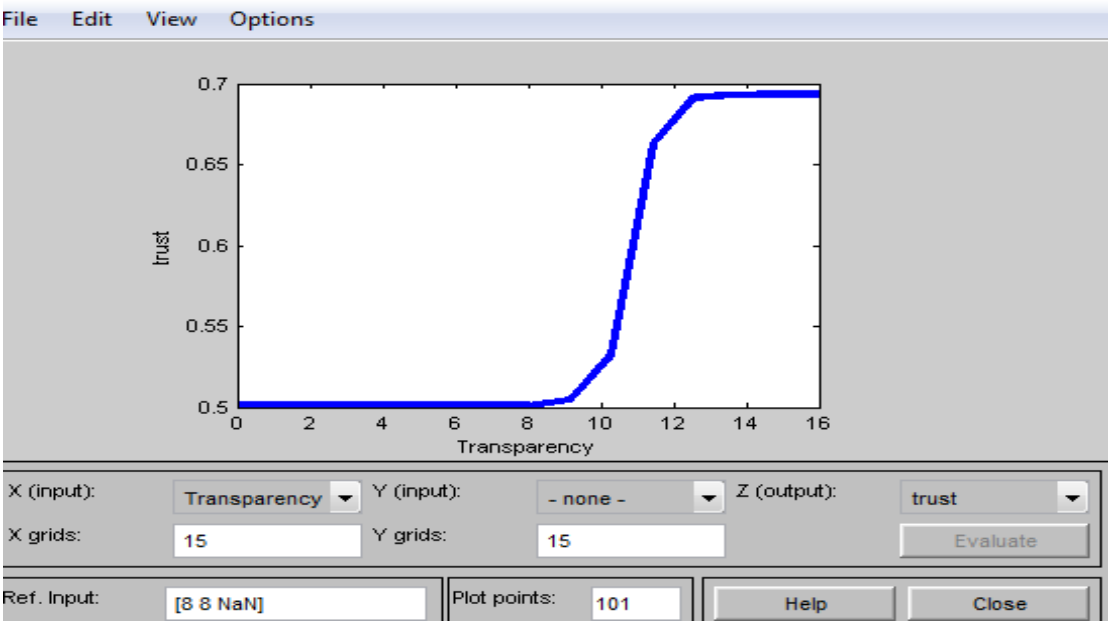

FIGURE 17. Trust versus Transparency factor

5.3. ANALYSIS OF TRUST VERSUS USABILITY FACTOR

Figure 18 is noticeably identical to the figure in the previous section on Trust as a function of transparency. This means that for all intentions and purposes, we can substitute transparency with usability.

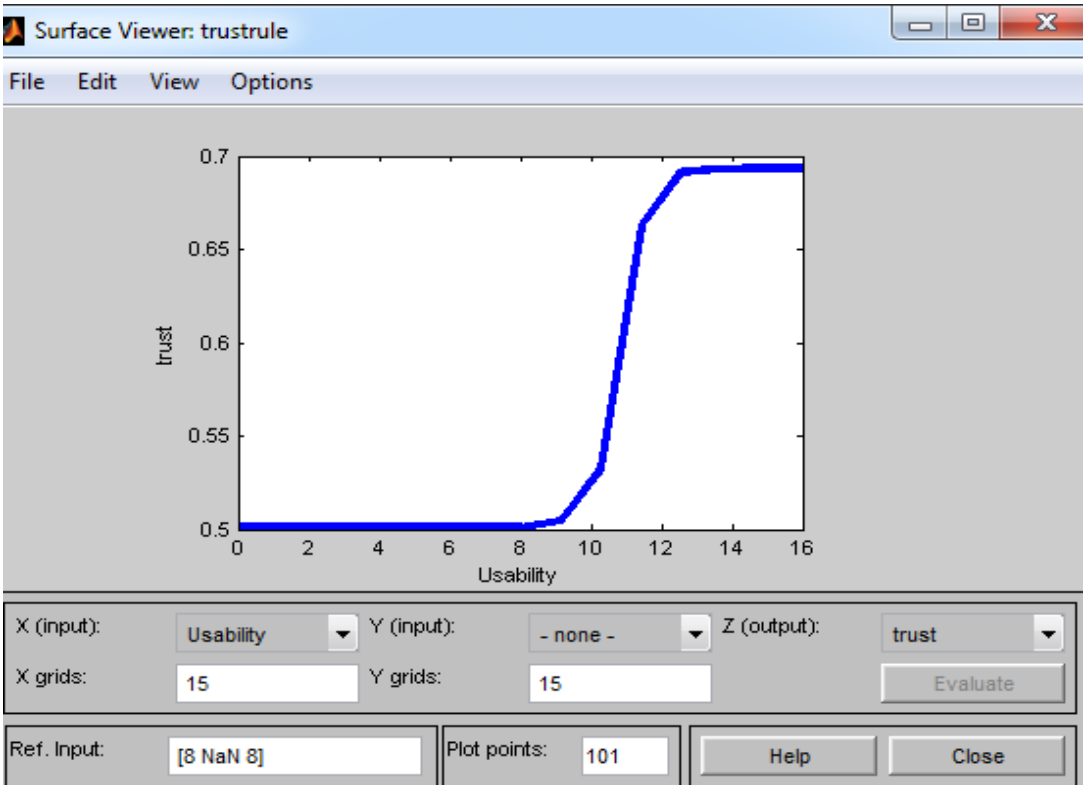

FIGURE 18. Plot of trust vs. usability

5.4. ANALYSIS OF TRUST VERSUS SECURITY AND USABILITY FACTOR

In this section Trust level is depicted as a continuous function of its input parameters as security and usability. Figure 18 intends to depicture variation of Trust as encapsulated in the rules for Trust. The highest gradient for Trust is when Usability is 'moderate' and Security is 'moderate' to 'high'. This suggest that when people are somewhat familiar with a website then a small increase in security levels from between moderate to high security will boost their trust in a significant way. Looking at Figure 18 diagonally from (low, low) to (high, high) levels of Security and Usability one observes three plateaus where the last one is around 0.966, and remains at that level even when the input factors are increased further.

One interesting point to note, however, is that for maximum usability and transparency, the Trust level is never higher than 0.695. This plateau also is reached fairly rapidly with high gradients from both sides of the input variables .figure 20 shows Trust level as a function of usability and transparency.

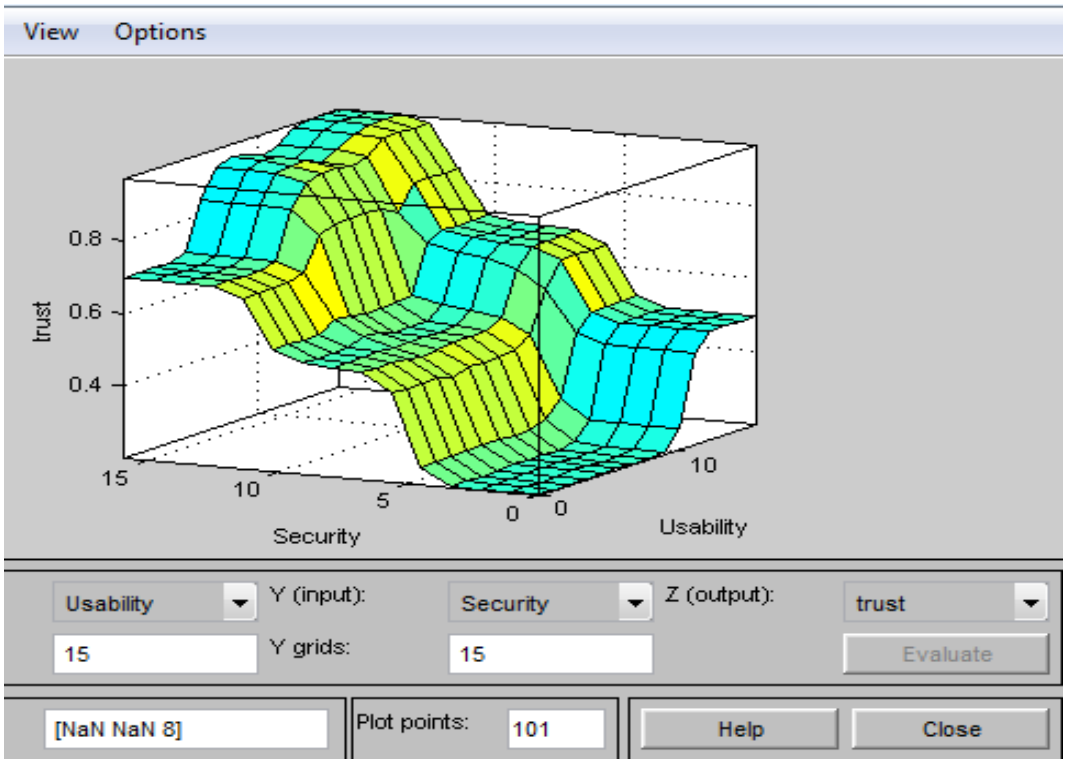

FIGURE 19. Trust level is positively related to levels of security and usability

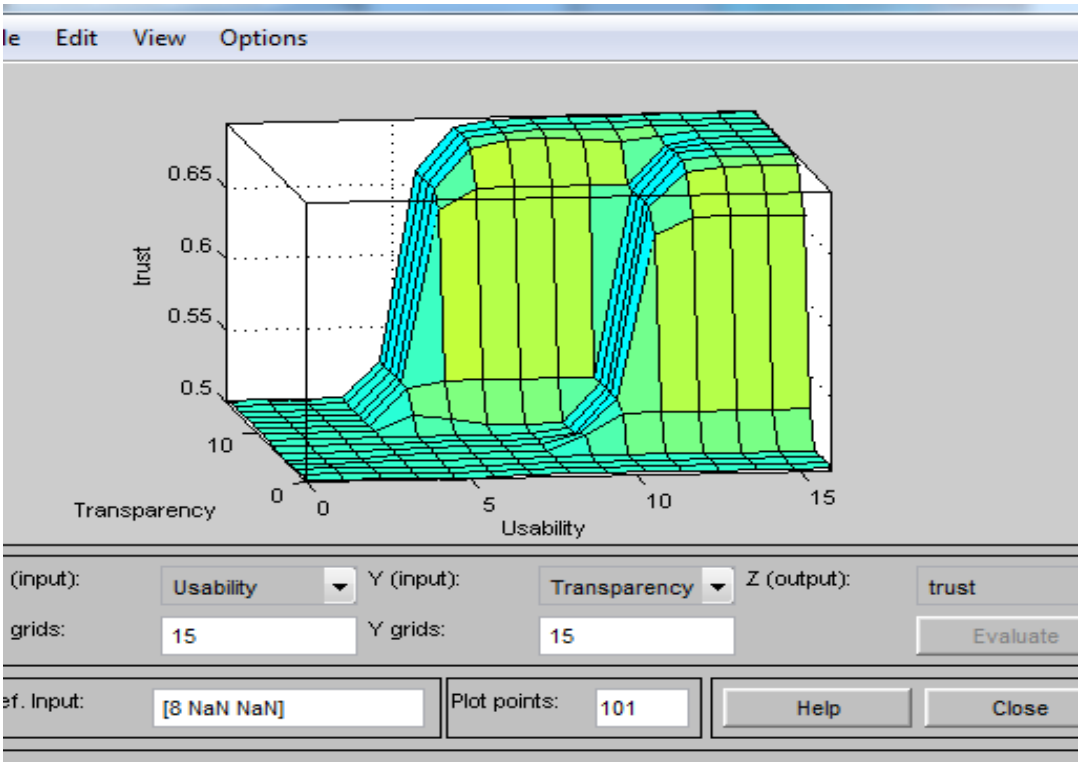

FIGURE 20. Trust level as a function of usability and transparency

6. CONCLUSION

This paper present a new conceptual model for online trust, which three important factors that affect on quality and trust B2C website were clarified completely. The proposed Model depends on fuzzy rules generated by ANFIS method in an e-Commerce support.

The case study was three B2C website in Iran. By using AHP method and completing questionnaire through face to face meeting we finally were able to provide ranking of all factors and sub-factors. This ranking shows the relative importance of success factors with comparison to each other. For the future growth of B2C electronic commerce, barriers such as security concerns must be torn down. There are many methods that can be employed to help engender this trust among online consumers. Security provided by vendor is just one such method.

The main purpose of this research is to tell the readers specially the managers of the B2C websites to understand how these B2C website to build trust, how the consumers' attitude to the issue of information security and how they influent the web trust during shopping. In this study, the connection of trustworthiness and security is disclosed.

This survey can be used to follow step by step the instructions and, based on actual level of a feature, decide its contribution in a category and consequently derive a total value of a factor, say Security. In addition, the vendor can use the survey data to ascertain the Trust level of the site as per the user's perception and rectify, if needed, if this is not obvious or if it is having a negative impact on the Trust level.

Finally in This study respondents mentioned that trust and security both have a high important relationship between them in strengthen the customer purchases with E-story so that he or she can use the buying online services.

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