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Evaluation of E-services from the Viewpoint of Insurance Clients in Iran Using Ahp and Extended Topsis Based on Possibility Theory (Case Study: Iran, Asia, Sina, Mihan, Dana and Razi Insurance Agencies)

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Abstract: This study aims to prioritize the effective factors in people's use of e-services and to evaluate e-services from the viewpoint of insurance clients in Iran using AHP and extended TOPSIS based on possibility theory. This study is an applied research which involves Iran, Asia, Sina, Mihan, Dana and Razi insurance agencies. We selected 62 insurance clients using descriptive-survey method and prioritized the factors using AHP and extended TOPSIS based on possibility theory. The factors involved were responsibility, efficiency, security, confidentiality, usefulness and ease of use. Usefulness, ease of use, security, responsibility, confidentiality and efficiency were respectively prioritized as effective factors in people's use of e-services provided by insurance agencies. Dana, Mihan, Iran, Razi, Sina and Asia insurance agencies were respectively ranked 1st to 6th in terms of the specified parameters.

Key words: E-services implementation, insurance, AHP, extended TOPSIS, possibility theory

INTRODUCTION

Information and communication technology has transformed all aspects of life as it has developed new methods for communication between individuals and their community.That is why the present age is called the age of information and communication technology. Today, human communities have developed into scientific communities and citizens have become the users of information networks (Izadikhah, 2009, Narver and Slater, 1990, JouyandehAbkenar *et al*., 2013).

As the result of these transformations, governmental environment has turned into a complicated and dynamic space in which managers are facing new challenges. Under such circumstances, survival entails change, development and dynamism (Ergun and Kuscu, 2013). E-government is a new approach to service provision and an efficient solution for environmental challenges and adaptability to the new world of business. In the age of information and communication technology,e-government has attracted the attention of governmental managers (Ebrahimi *et al*., 2013, Loiacono *et al*., 2002, Grandon and Pearson, 2004).

E-government is an important product of information and communication technology which has deeply transformed the human life (Chang, 1996). The goal of e-government is to utilize the modern technologies in order to provide better services to citizens. Some organizations believe that e-government means providing each employee with a PC on his desk (Liao and Cheung, 2002, SadeghiMoghadam *et al*., 2014). But e-government pursues more important goals; it aims to make a fundamental change in the performance of governmental tasks and in the communication between governments, citizens and other parts of the society.

E-government has been recognized as a major component of economic development. In the UN 2012 report which has recently been published under the title of "E-Government for the Public", Iran has been ranked 100th among 190 countries which means a 2-step promotion compared with 2010 Report in which Iran had been ranked 102nd.

In line with the goals of e-government and promotion of Iran's ranking in the world, applied researches need to be done about e-services in order to determine their efficiency and prioritize the effective factors in people's acceptance of these services. This paper evaluates the e-services of governmental insurance agencies and investigates the effective factors in people's satisfaction with e-services.

Theoretical Framework

E-government means the utilization of information and communication technology to change business structures and processes in governmental agencies (Han, J. K., Kim, N. &Shrivastava, R. 1998). In paper (Ram, S. & Jung, H. S. 1991), e-government has been defined as governmental use of the worldwide web with a view to providing online services to citizens and establishing an electronic interaction between citizens and organizations in various levels.

From the above definitions, we can conclude that e-government refers to the utilization of information and communication technologies in the provision of governmental services so that citizens can access the required information and services via their PCs in an interactive way. During the past decades, many researches have been done about people's acceptance and use of information technology (Divandari *et al*., 2013 Anderson and Srinivasan 2003, Reichheld and Schefter, 2000). Intention-based theories constitute a major part of these researches. Based on these theories, user's willingness to use information technology is explained by his intention influenced by his beliefs and attitudes. Therefore, it is necessary to investigate the effective factors in the formation or change of beliefs and attitudes about information technology. So far, a few theoretical models have been proposed to explain user's behavior and attitudes regarding new technologies. These theories include the Theory of Reasoned Action, Theory of Planned Behavior, Technology Acceptance Model and Innovation Diffusion Theory (Ellison and Hardey 2014, Jahanshahloo *et al*.,2006, Kim *et al*., 2009).

Theory of Reasoned Action assumes that individual's behavior is influenced by his behavioral tendencies which is a function of his attitude towards a certain behavior and the surrounding mental norms. The attitude towards a behavior refers to the positive or negative feeling towards that behavior and mental norm refers to the beliefs of important individuals about what should or should not be done. This theory suggests that behavior is exclusively under the control of behavioral intention, so it is limited to intentional behaviors (behaviors which require individual's intention) and overlooks the fact that behavior also needs skills, resources and opportunities which are not easily accessible (Singh and Sirdeshmukh, 2000, Zeithaml *et al*., 1996, Porter, 1980).

This theory has been widely used in researches about the acceptance of information technologies (SeyedJavadin, 2010). In 1991, Ajzen proposed the Theory of Planned Behavior (TPB) by adding the variable of Perceived Behavior Control which meant the perceived difficulty or easiness of behavior. This theory is the foundation of Technology Acceptance Model and helps to better understand the effective factors in the acceptance of a system. Particularly in e-banking area, clients have many choices due to intense competition. The theory of planned behavior assumes that behavior stems from tendencies (Chaudhuri and Holbrook, 2001).

Behavioral tendency is a function of individual's attitude, the surrounding mental norms and the perceived easiness of the behavior (behavioral control). Behavioral control refers to the perceived difficulty of the behavior. The perceived behavioral control means the perceived control of behavior which reflects the facilitators and obstacles to the behavior (Reichheld *et al*., 2000).

Compared with the theory of reasoned action, the theory of planned behavior is more efficient in certain behaviors (Salar and Ebrahimi, 2014). Some researchers have discussed the perceived behavioral control and its distinction with self-efficiency. Ajzen, the innovator of the Theory of Planned Behavior, believes that no difference exists between the perceived behavioral control and self-efficiency (Jimenez and Valle, 2008). He considers PBC structure as the easiness and difficulty of behavior and a predictor of intention and behavior. Individual's tendency towards a behavior positively affects his intention. Here, the relationship between "actual control" and "perceived control of behavior" plays an important role. If PBC is a good representative for actual control, it will be a good substitute for behavioral control and determination (Villatoro *et al*., 2015).

Once the perceived behavioral control was proposed, there were some degrees of clarity and ambiguity with respect to the relationship between this structure and self-efficiency which plays the main role in the theory of social recognition (Park *et al*.,2003). Self-efficiency refers to individual's belief on his ability to perform an action. People with strong feeling tend to approach difficult challenges. These definitions clearly indicate some degrees of overlap between these two structures. Control is the main concern in both structures (S-E) (Narver *et al*., 2004). Among the models proposed for investigating the acceptance of e-commerce, Technology Acceptance Model, proposed by Davis in 1989, is the most widely used (Schoder and Yin, 2000; Wagner and Rydstrom 2001). This model which has been modified by many researchers (sterreichischerGemeindebund 2015, Serdült *et al*., 2015, Hui *et al.,* 2000) is still considered as the theoretical foundation of many studies and models.

Technology Acceptance Model is used to determine why clients accept or reject a new technology. This model assumes that the perceived easiness and usefulness explains the willingness of people to use a system instead of the real one (VazifehDoost *et al*., 2006). Based on Technology Acceptance Model, two beliefs play the determining role in the acceptance of a new technology. These two beliefs which may be influenced by exogenous variables are Perceived Usefulness (PU) and Perceived Ease of Use (PEOU). These two beliefs develop an attitude towards the use of a new system which in turn influences the intention of individual and determine actual level of use. According to Davis, Bagoozi and Warshow, the goal of Technology

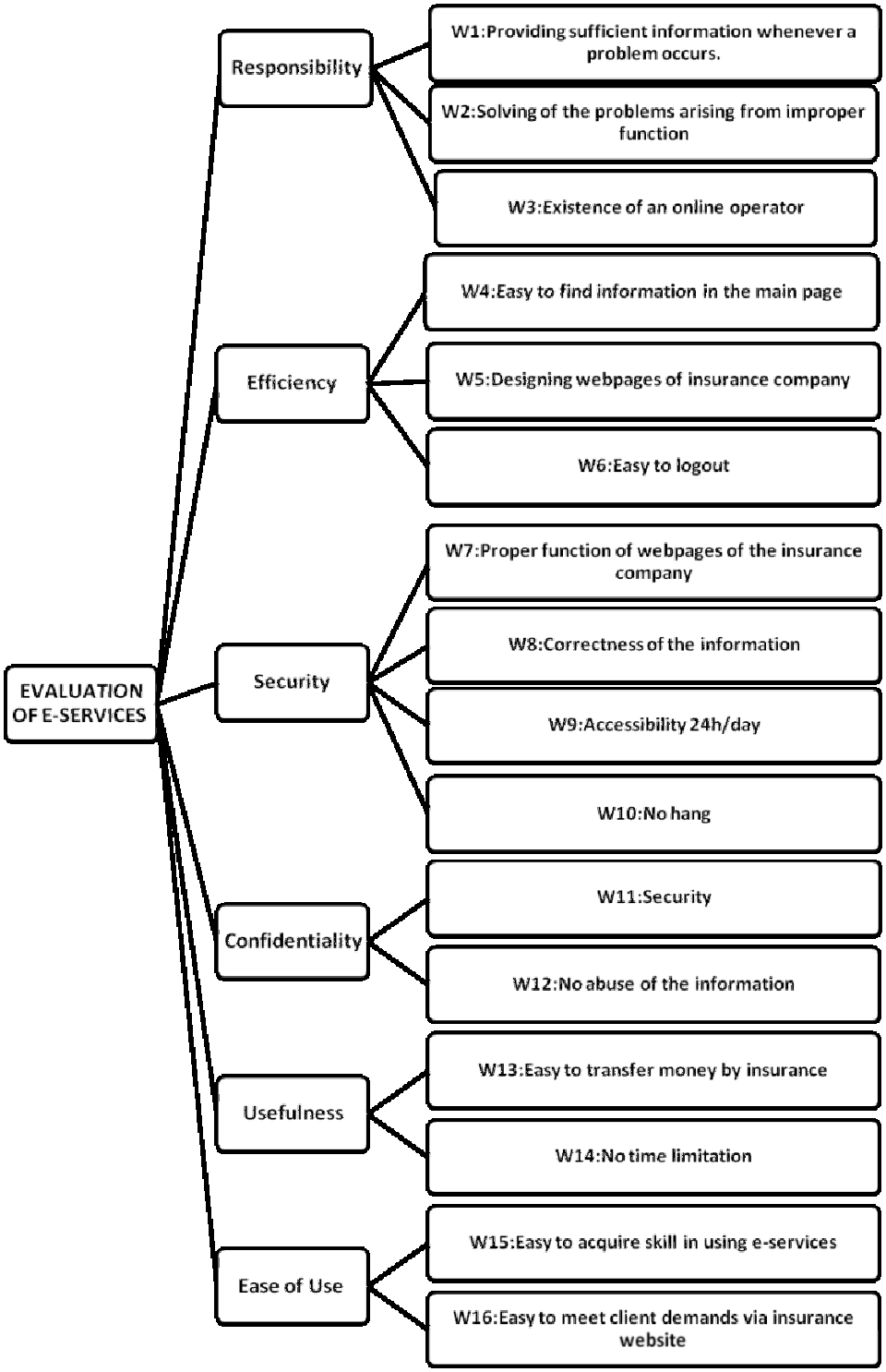

Fig. 1: Research Model

Acceptance Model is to explain the determining factors in the acceptance of computer which is also able to explain user's behavior (Askarzadeh 1978, Urban *et al.,*2000).

Innovation Diffusion Theory assumes that innovation is transmitted over time through certain social channels and systems. According to this theory, individuals have varied degrees of willingness to use an innovation. This theory also assumes that innovation is influenced by four attributes: relative advantage, adaptability, trainability and visibility.

Figure 1 illustrates the proposed model and the structure of prioritizing the effective factors in the acceptance of insurance e-services.

Research Method

This study was carried out by descriptive-survey method. For this purpose, we prepared a questionnaire using AHP and an extended TOPSIS based on possibility theory and distributed it between the users of e-services.

Statistical Population

The statistical population consists of the users of e-services in six insurance agencies.

Sample Size

Sample size was determined using AHP method $\left[n\frac{(n-1)}{2}\right]$. In this formula, n represents the number of parameters involved in the research. Given that 10 main parameters are used in this research, we determined a sample size of 62.

Research Materials

In this study, we used a questionnaire consisting of 37 items.

Validity and Reliability of the Questionnaire

We assessed the validity of the questionnaire using content validity assessment method. In doing so, we collected the views of experts, specialists and managers of insurance agencies, based upon which we modified and completed the questionnaire. Also, the reliability of the questionnaire was confirmed by Cronbach's Alpha of 0.894. Table 1 represents the linguistic scales of the paired comparisons:

Table 1: Linguistic Scales of Paired Comparisons

Fuzzy Numbers	Triangular Fuzzy Numbers	Linguistic Variables
1	(0¡1¡3)	Very Bad
2	(1¡3¡5)	Bad
3	(3¡5¡7)	Average
4	(5¡7¡9)	Good
5	(7¡9¡10)	Very Good

THE EXTENDED TOPSIS BASED ON POSSIBILITY THEORY

The model used in this study which is an extended TOPSIS using possibility theory, is derived from Ye and Li, Y (49). The fundamentals of this method are as follows:

1. Formation of possible choices set $X=\{X_i \mid i=1,\ldots,n\}$ and index set $X=\{C_j \mid i=1,\ldots,m\}$ with W_j weights for each C_j;
2. Formation of triangular fuzzy decision matrix $L=[I_{n\times m}]_{n\times m}$ based on linguistic variables of and formation of normal matrix $L=[I_{ij}]_{n\times m}$. Equations 1 and 2 convert triangular fuzzy numbers to fuzzy numbers.

If $j\in\theta_1$, then $(a_{ij}+\beta_{ij})^+=\max_i(a_{ij}+\beta_{ij})$ and if $j\in\theta_2$, then $(a_{ij}+\beta_{ij})^+=\max_i(a_{ij}-\beta_{ij})$

Where θ_1 represents positive indexes and θ_2 represents negative indexes.

3. Computation of possible average value matrix $M(L)=[M(I_{ij})]_{n\times m}$ and possible standard deviation value $StD(L)[StD(I_{ij})]_{n\times m}$ using equations 3 and 4.
4. Computation of ideal positive and negative matrix for possible mean matrix using equations 5 and 6, where if i=1, 2, …, n, then $M(I_j)^+=\max_i M(I_{ij})$ and $M(I_j)^+=\min_i M(I_{ij})$ and computation of ideal positive and negative matrix for possible standard deviation matrix StD(L) using equations 7 and 8 where if i=1,2…,n, then $StD(I_j)^+=\min_i StD(I_{ij})$ and $StD(I_j)^-=\max_i M(I_{ij})$
5. Computation of possible choices mean distance from ideal positive mean $M(L)^+$ and negative ideal mean $M(L)^-$ using equations 9 and 10 and computation of possible choices standard deviation $StD(I_j)^+$ distance from positive ideal standard deviation and negative ideal standard deviation $StD(I_j)^-$ using equations 11 and 12.
6. Computation of closeness coefficient of each X'_i choice for possible mean values and possible standard deviation using equations 13 and 14 and computation of general closeness coefficient X'_i of choice and its rating.

The symbols used in this study

$$I'_{ij}=\left(\frac{a_{ij}-\alpha_{ij}}{(a_{ij}+\beta_{ij})^+},\frac{a_{ij}}{(a_{ij}+\beta_{ij})},\frac{a_{ij}-\beta_{ij}}{(a_{ij}+\beta_{ij})^+}\right),\quad j\in\theta_1 \qquad (1)$$

$$I'_{ij}=\left(\frac{(a_{ij}-\alpha_{ij})^-}{a_{ij}+\beta_{ij}},\frac{(a_{ij}-\alpha_{ij})^-}{a_{ij}},\frac{(a_{ij}-\alpha_{ij})^-}{a_{ij}+\alpha_{ij}}\right),\quad j\in\theta_2 \qquad (2)$$

$$M(I'_{ij})=a_{ij}+\frac{1}{6(\beta_{ij}-a_{ij})} \qquad (3)$$

$$Var(I^{\sim t}-_{\perp}ij)=1/24(\beta'_{\perp}ij-\alpha_{\perp}ij) \qquad (4)$$

$$M(\bar{L})^+=(M(\bar{l}_1)^+,M(\bar{l}_2)^+,\ldots,M(\bar{l}_m)^+) \qquad (5)$$

$$M(\bar{L})^-=(M(\bar{l}_1)^-,M(\bar{l}_2)^-,\ldots,M(\bar{l}_m)^-) \qquad (6)$$

$$StD(L)^+=(StD(\bar{l}_1)^+,StD(\bar{l}_2)^+,\ldots,StD(\bar{l}_m)^+) \qquad (7)$$

$$StD(L)^{-} = (StD(\tilde{I}_1)^{-}, StD(\tilde{I}_2)^{-}, ..., StD(\tilde{I}_m)^{-}) \quad (8)$$

$$d_i(M(L)^{+}) = \sqrt{\sum_{j=1}^{m}\left((M(\tilde{I}_j)^{+} - (M(\tilde{I}_{ij})W_j\right)^2} \quad i = 1,2,...,n \quad (9)$$

$$d_i(M(L)^{-}) = \sqrt{\sum_{j=1}^{m}\left((M(\tilde{I}_j)^{-} - (M(\tilde{I}_{ij})W_j\right)^2} \quad i = 1,2,...,n \quad (10)$$

$$d_i(StD(\tilde{L})^{+}) = \sqrt{\sum_{j=1}^{m}\left((StD(\tilde{I}_j)^{+} - (StD(\tilde{I}_{ij})W_j\right)^2} \quad i = 1,2,...,n \quad (11)$$

$$d_i(StD(\tilde{L})^{-}) = \sqrt{\sum_{j=1}^{m}\left((StD(\tilde{I}_j)^{-} - (StD(\tilde{I}_{ij})W_j\right)^2} \quad i = 1,2,...,n \quad (12)$$

$$\mu_i\left(StD(L)^{-}\right) = \frac{d_i\left(StD(L)^{-}\right)}{d_i(StD(L)^{-}) + d_i(StD(L)^{+})} \quad i = 1,2,...,n \quad (13)$$

$$\mu_i\sqrt{\left(StD(L)^{-}\right) \times M(L)} \quad i = 1,2,...,n \quad (14)$$

RESULTS

In the first step, we assessed the parameters using triangular fuzzy numbers. Each question consisted of five modes. The mean of questionnaires specified the final value of the questions. The produced figures were put in paired comparisons matrix and were compared two by two.

Next, the parameters and sub-parameters were weighed using EA method and were finally prioritized. We first assessed all parameters in each layer compared with the upper layer and then put the ratios in the paired comparisons matrix. The matrixes were made using the means of fuzzy numbers obtained from the questionnaires. In this matrix, upper and lower elements of the main diameter are inverse to each other. In the next step, we normalized each matrix by linear method and determined the weight of each sub-parameter using EA method. The weights obtained for each sub-parameter are shown in Fig. 2. Next, we determined the weights of main parameters and put them in paired comparisons matrix as shown in Table 2. Figure 3 illustrates the prioritization of sub-parameters.

Determination of the weight of each choice based on fuzzy TOPSIS and possibility theory

Based on linguistic scales of paired comparisons and the above equations, we analyzed the data obtained from the questionnaire. Based on the analysis, we obtained the normalized fuzzy decision matrix and computed the value of possible standard deviation. Figures 4 and 5 illustrate the results.

We computed the positive and negative ideal matrixes, possible mean matrix M(L) and possible standard deviation matrix StD(L) (Fig. 6).

Next, we computed the distance of possible mean of the choices (insurances) from positive and negative ideal

Table 2: Paired comparisons matrix for computation of the weights of parameters

Variables	Responsibility	Efficiency	Security	Confidentiality	Usefulness	Ease of Use
Responsibility	1.0000	1.0213	0.9811	1.0161	0.9659	0.9661
Efficiency	0.9385	1.0000	0.9311	0.9525	0.965	0.9632
Security	1.0159	1.0306	1.0000	1.0121	0.9865	0.9820
Confidentiality	0.9838	1.0150	0.9650	1.0000	0.9618	0.9601
Usefulness	1.0111	1.0360	1.0132	1.0156	1.0000	0.9852
Ease of Use	1.0160	1.0359	1.0151	1.0102	1.0118	1.0000

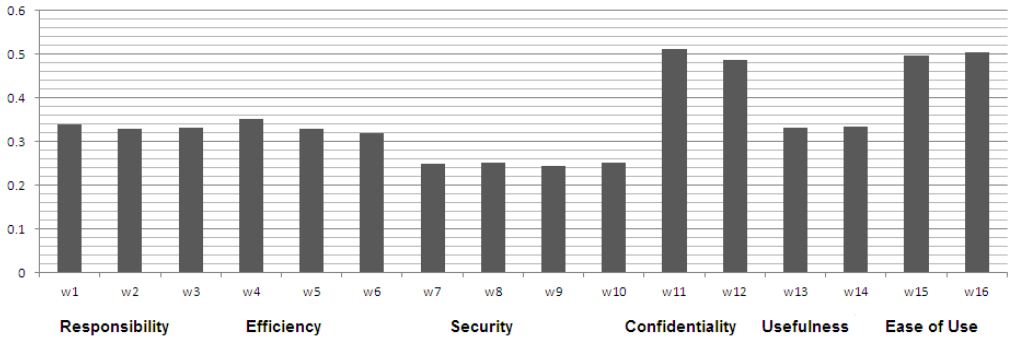

Fig. 2: The weights of parameters and sub-parameters

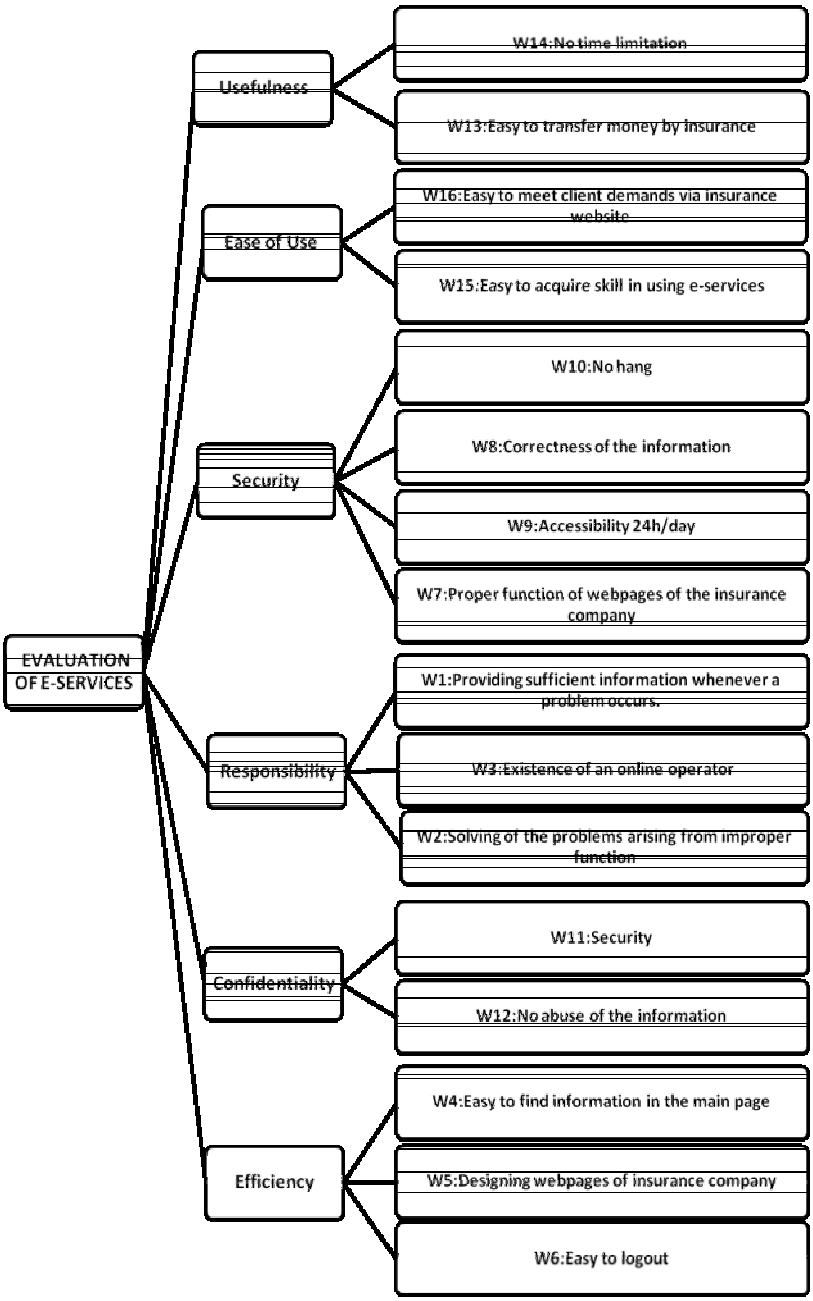

Fig. 3: The prioritization of sub-parameters influential in in the use of e-services

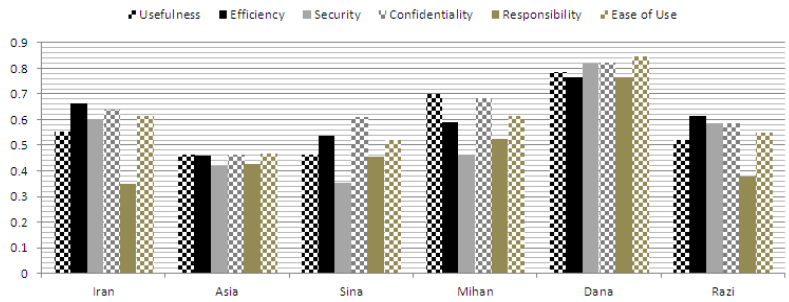

Fig. 4: Possible mean value and standard deviation matrixes by M(L)

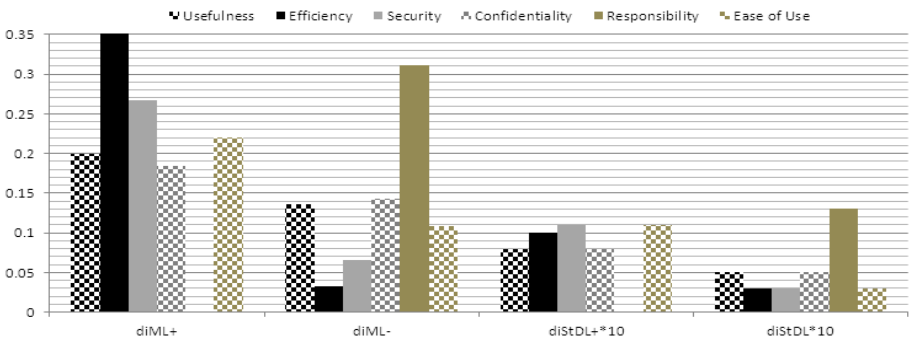

Fig. 5: Possible mean value and standard deviation matrixes by StD(L)

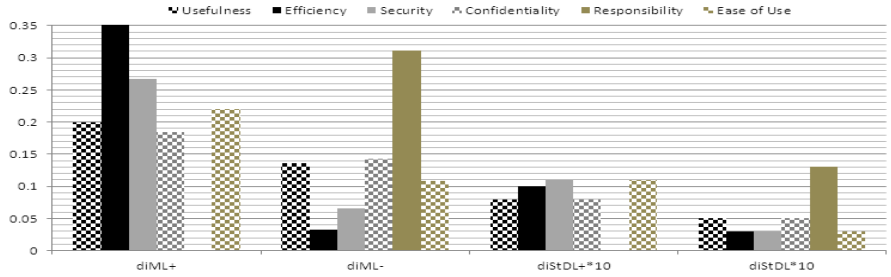

Fig. 6: Positive and negative ideal matrixes based on M(L) and StD(L) .

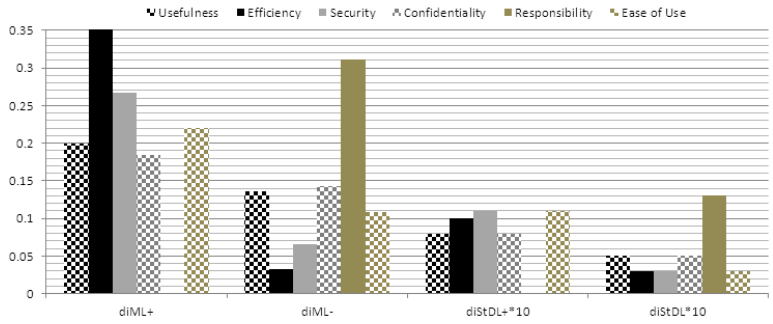

Figure7. Distance of possible mean of insurance agencies and positive and negative ideal standard deviation

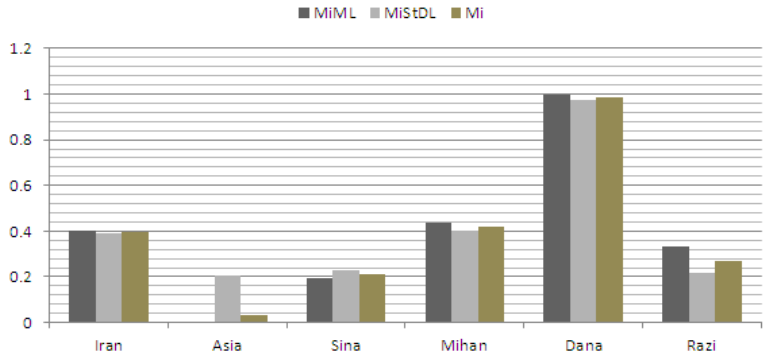

Fig. 8: Closeness Coefficient and rating of each insurance company based on $\mu_1(M(L))$ and $\mu_2(StD(L))$

means and the distance of possible standard deviation from positive and negative ideal standard deviation. Figure 7 contains the results. Finally, we computed the closeness coefficient of each insurance agency based on the distance of possible mean and possible standard deviation and determined the general closeness coefficient. Figure contains the results.

Based on the obtained μ_i, we ranked the insurance agencies in terms of the specified indexes. Finally, Dana, Mihan, Iran, Razi, Sina and Asia were ranked 1st to 6th respectively.

Figure7. Distance of possible mean of insurance agencies and positive and negative ideal standard deviation

CONCLUSION

Insurance agencies need to evaluate the effective factors in people's use of e-services. The model proposed in this study includes the main parameters which constitute the theoretical framework based on AHP. The finding of this study may be used to develop e-services systems in insurance agencies. Given that the development of insurance e-services entails huge costs, it is essential to evaluate the effective factors in people's use of these services. Since the usefulness plays a significant role in the use of e-services, the managers of insurance agencies should introduce e-services to the public using efficient advertising and marketing (Agarwal *et al*., 2003, Pitta *et al*., 2006, Baker and Sinkula, 2005). Ease of use is the second effective factor in the use of e-services, so clients should be provided with the necessary information so that they can easily perform insurance operations via electronic system without any problem in learning how to use e-services.

With respect to the feasibility as the third effective factors, client request should be met as soon as possible and confirmation of services should be notified via the website (Brown and Jayakody 2008, Gabarino and Johnson, 1999, Johnston, Kevin Desouza 2015). As regards the reliability as the second effective factor, website should be properly designed so that the clients can access it whenever needed. With respect to the responsibility as the fifth factor, client should be provided with correct and sufficient information whenever a problem occurs. Regarding the confidentiality as the sixth effective factor insurance e-services should have full security so that clients makes sure that their information is fully protected and so prefers e-services to conventional services (Kim *et al*., 2006, Gummerus *et al*., 2004, S. Vissers and D. Stolle2013).

With respect to the efficiency of e-services as the seventh factor, websites should be efficiently designed so that client can easily login and logout and find the needed information in the main page of the website. As regards the importance of attitude, mental norm and behavioral supervision as the eighth, ninth and tenth factors, managers of insurance agencies should promote their services so that people are persuaded to use e-services and the existing clients encourage other people to use these services. Insurance agencies should provide attractive cultural packages in both electronic and non-electronic forms including CDs, gift cards and special discounts, whereby encouraging people to use insurance e-services (Wolfinbarger *et al*., 2009, Pavic *et al*., 2007, Tsai *et al*., 2008).

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