Presenting a Model for Ranking Insurance Organizations Based on Electronic Readiness Using a Combination of ANP and DEMATEL Techniques

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ABSTRACT

Activities of insurance, like other work fields, have been greatly influences by new technologies; therefore, they must be at the suitable level of electronic readiness to provide more effective information services in line with the needs of new era. But the question is, are the insurance companies in Iran ready to use the e-commerce opportunities efficiently? To answer, it is necessary to recognize influential factors on preparation for this and current organization positions, based on electronic- readiness. This would be the first step to enter e-commerce.

The goal of this paper is ranking organizations about the level of the electronic readiness by presenting a model based on the knowledge of multi criteria decision making. So, first of all, the different models, presented in the electronic readiness, were studied. After determining e-readiness criteria, weight devoting was performed by using the expert's views in the IT departments of three chosen organizations. Ultimately, ranking of these organizations based on the level of electronic-readiness was done by using a combination of ANP and DEMATEL techniques.

Keywords

Electronic readiness, Electronic insurance, ANP technique, DEMATEL technique.

1. INTRODUCTION

Nowadays, the most precious property of the organizations is information and applying necessary technologies to use this information. In the other words, to set up to knowledge- based society, accessing to electronic information-base structures, is essential.

Actually, applying information technology (IT) in business, create a competitive advantage for organization and in macro study, applying IT create information societies and e-government forms. Therefore, evaluation for using this technology, introduces efficient planning to achieve the organizational goals and competitive advantage, based on their activity. It can be said generally, the main reason for failure of some organization along this path, was their lack of recognition about their position in electronic-readiness.

This fact makes organization have an overview about their issues by offering factors and models and then enter the e-commerce network, step by step and systematically. Further the findings from reports indicated the main inhibitor to IT investments, is the lack of knowledge to guide the managers to applying these technologies in business processes to achieve competitive advantages in global ecommerce. In a way which e-insurance in its actual concept, initially needs studying of the level of readiness in organization Recognition of essential factors to create this electronic structure is discussable issue in form of e-readiness models [1].

The aim of this paper is presenting a model for ranking different organizations based on the level of the electronic readiness and was performed in three main phases:

1) Verifying the criteria for evaluating of the level of the e-readiness in selected organizations (By using e-readiness models).

2) Refining and finalizing electronic readiness attributes by Delphi process

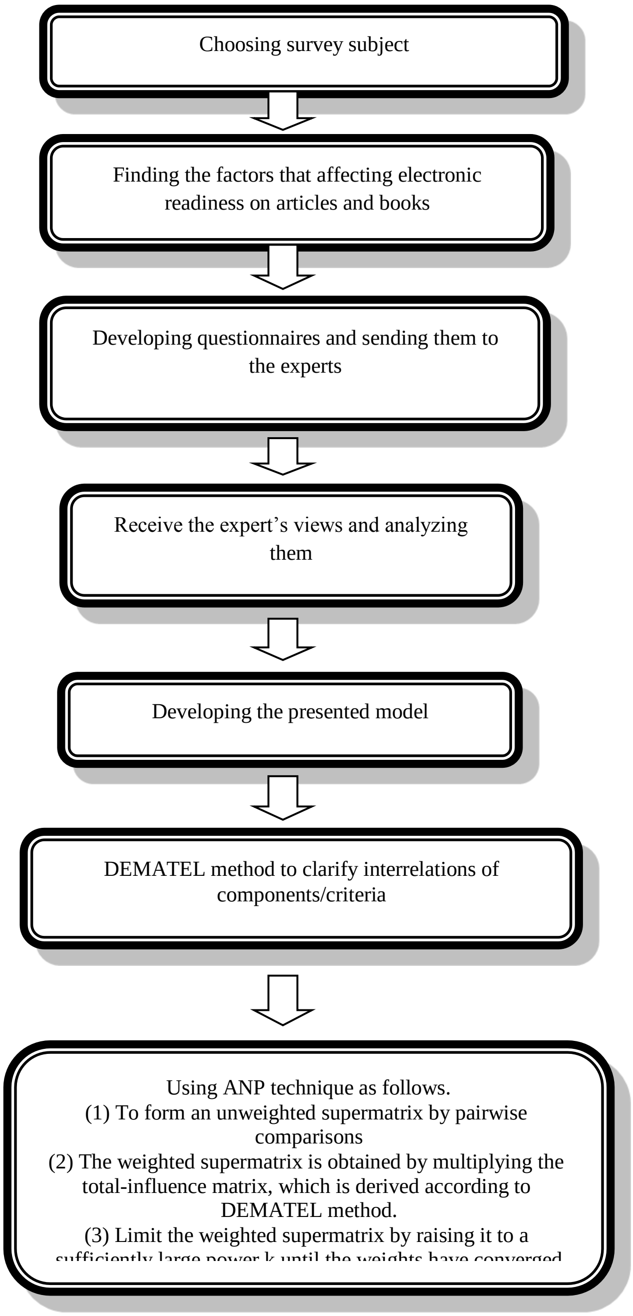
3) Ranking organizations based on the level of the e-readiness (using combination of ANP and DEMATEL techniques).

2. LITRETURE REVIEW

The e-readiness concept was invented to provide a unified framework to evaluate the breadth and depth of the digital divide between more and less developed or developing countries in the late 1990s. The first efforts in defining e-readiness were undertaken in 1998 by the Computer Systems Policy Project (CSPP) when it developed the first e-readiness assessment tool known as Readiness Guide for Living in the Networked World. CSPP defined e-readiness with respect to a community that had high-speed access in a competitive market; with constant access and application of ICTs in schools, government offices, businesses, healthcare facilities and homes; user privacy and online security; and government policies which are favorable to promoting connectedness and use of the network [2]. With the development of the first e-readiness tool, several e-readiness tools have been emerged by development agencies, research organizations, universities, business enterprises and individuals [3].

3. RESEARCH METHOD

The method of this research is shown as figure 1



4. RESULTS AND DISCUSSION

A. Conceptual Model Construction

Different models have been proposed over the years in the field of electronic readiness. All tries to present a structural frame of factors, to decision makers. These e-readiness models show the degree of development and the strength of the organization's e-readiness in their different levels, and provide organization with an obvious level of e-readiness framework. 8 main criterion and 32 sub criterion were obtained from different models.

B. The DELPHI process

The Delphi method is a structured communication technique, originally developed as a systematic, interactive forecasting method which relies on a panel of experts. The experts answer questionnaires in two or more rounds. After each round, a facilitator provides an anonymous summary of the experts' forecasts from the previous round as well as the reasons they provided for their judgments. Thus, experts are encouraged to revise their earlier answers in light of the replies of other members of their panel. It is believed that during this process the range of the answers will decrease and the group will converge towards the "correct" answer. Finally, the process is stopped after a pre-defined stop criterion. and the mean or median scores of the final rounds determine the results [4]. Final attributes and sub-attributes is shown in figure 2 as a research conceptual method and Table 1 shows attributes of the conceptual model and references.

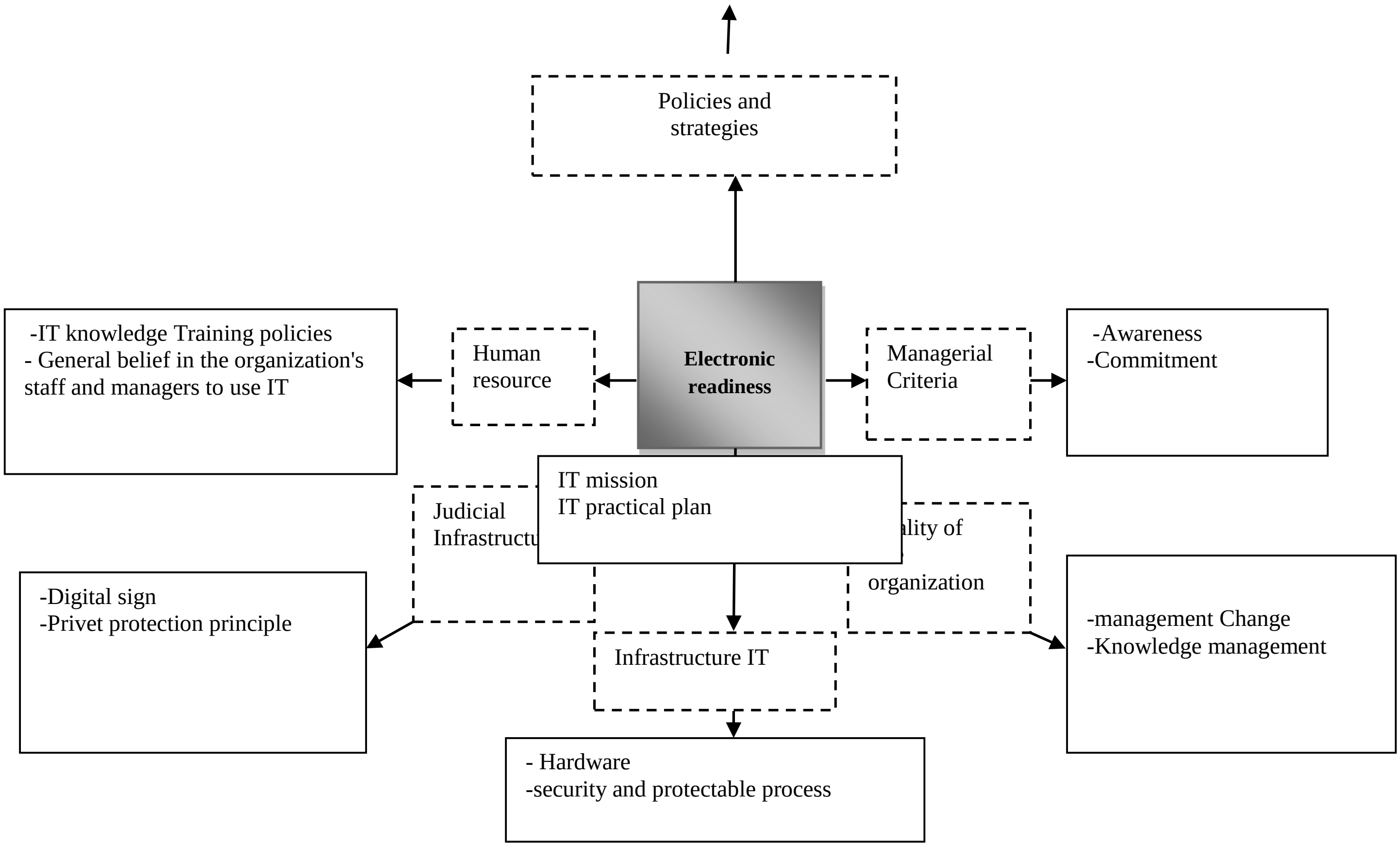


Figure 2: electronic readiness conceptual model

C. the DEMATEL process

The DEMATEL method is used to construct the interrelations between criteria to build an IRM. The method can be summarized as [9, 10]:

Step 1: Calculate the initial average matrix by scores. In this step, respondents are asked to indicate the degree of direct influence each factor/element i exerts on each factor j, which is denoted by a_{ij}. We assume that the scales 0, 1, 2, 3 and 4 represent the range from “no influence” to “very high influence”3. The average matrix A is represented as following equation:

$$\boldsymbol{A} = \begin{bmatrix} a_{11} & \cdots & a_{1j} & \cdots & a_{1n} \\ \vdots & & \vdots & & \vdots \\ a_{i1} & \cdots & a_{ij} & \cdots & a_{in} \\ \vdots & & \vdots & & \vdots \\ a_{n1} & \cdots & a_{nj} & \cdots & a_{nn} \end{bmatrix} \qquad (1)$$

Step 2: Calculate the initial influence matrix. The initial direct influence matrix $\boldsymbol{X}$ $(\boldsymbol{X} = [x_{ij}]_{n\times n})$ can be obtained by normalizing the average matrix A. Specifically, the matrix $\boldsymbol{X}$ can be obtained through equations (2) and (3), in which all principal diagonal elements are equal to zero.

$$\boldsymbol{X} = s \cdot \boldsymbol{A} \qquad (2)$$

$$s=\min\left[\frac{1}{\max\limits_{i}\sum\limits_{j=1}^{n}|a_{ij}|},\frac{1}{\max\limits_{j}\sum\limits_{i=1}^{n}|a_{ij}|}\right] \quad (3)$$

Step 3: Derive the full direct/indirect influence matrix. A continuous decrease of the indirect effects of problems along the powers of $\boldsymbol{X}$, e.g., $\boldsymbol{X}^2,\boldsymbol{X}^3,...,\boldsymbol{X}^k$ and $\lim\limits_{k\to\infty}\boldsymbol{X}^k=[0]_{n\times n}$, where $\boldsymbol{X}=[x_{ij}]_{n\times n}$, $0\le x_{ij}<1$ and $0\le\sum_i x_{ij}$ or $\sum_j x_{ij}<1$ only one column or one row sum equals 1. The total-influence matrix is listed as follows.

$$\boldsymbol{T}=\boldsymbol{X}+\boldsymbol{X}^2+\cdots+\boldsymbol{X}^k=$$
$$\boldsymbol{X}(\boldsymbol{I}+\boldsymbol{X}+\boldsymbol{X}^2+\cdots+\boldsymbol{X}^{k-1})(\boldsymbol{I}-\boldsymbol{X})(\boldsymbol{I}-\boldsymbol{X})^{-1}$$
$$=\boldsymbol{X}(\boldsymbol{I}-\boldsymbol{X}^k)(\boldsymbol{I}-\boldsymbol{X})^{-1},$$

then $\boldsymbol{T}=\boldsymbol{X}(I-\boldsymbol{X})^{-1}$ when $\lim\limits_{k\to\infty}\boldsymbol{X}^k=[0]_{n\times n}$ (4)

where $\boldsymbol{T}=[t_{ij}]_{n\times n}$, $i,j=1,2,...,n.$ In addition, the method presents each row sum and column sum of matrix T.

$$\boldsymbol{r}=(r_i)_{n\times 1}=[\sum_{j=1}^{n}t_{ij}]_{n\times 1} \quad (5)$$

$$\boldsymbol{c}=(c_j)_{n\times 1}=(c_j)'_{1\times n}=[\sum_{i=1}^{n}t_{ij}]'_{1\times n} \quad (6)$$

Step 4: Set a threshold value and obtain the IRM. Setting a threshold value, α, to filter the minor effects denoted by the factors of matrix T is necessary to isolate the relation structure of the factors. In order to illustrate clearly the procedures of the DEMATEL method, opinion of 3 expert person on IT issues and 5 expert person on insurance job is asked. We assume 7 codes for attributes: code P for Policies and Strategies, code H for Human resource, code LB for Judicial infrastructure, code IB for Infrastructure IT, code A for quality of the organization, code M for managerial Criteria and code C for insurance companies (Iran, Saman and Parsian company).

First, we operate from Step 1 to Step 4 above to derive the total-influence matrix T; then we set a threshold value, 0.2 (consulting with 5 expert people) to filter the minor effects in the elements of matrix T, as in table 2. If the highlighted parts are lower than the value of 0.2 in the following table, then their final diagraph can be shown, as in Fig. 3.

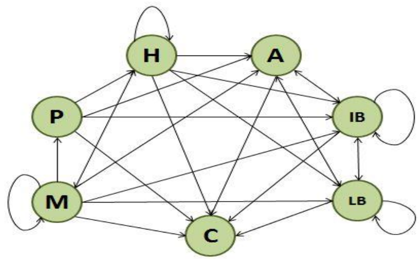


Fig.3. Final diagraph

We will use the following steps of the ANP method to overcome the problem of interdependence and feedback between criteria.

D. The Analytic Network Process (ANP)

ANP is a generalization of the AHP, where the assumption of a hierarchical structure is relaxed. It resembles a network, consisting of clusters of elements, which are the DM criteria and the alternatives. The relations between elements depend on the DM case.

The process of ANP comprises four major steps [11, 12]:

Table2. Final matrix

	P	H	A	IB	LB	M	C
P	0.01515	0.359808	0.642135	0.430532	0.201614	0.087112	0.999495
H	0.062827	0.492147	0.506108	0.530541	0.287086	0.361257	0.997906
A	0.002673	0.063496	0.191749	0.703427	0.310089	0.015373	0.999911
IB	0.006684	0.158739	0.479373	0.758568	0.775222	0.038432	0.999777
LB	0.003342	0.079369	0.239687	0.879284	1.137611	0.019216	0.999889
M	0.225465	0.354796	0.50419	0.6557	0.484151	0.296424	0.992484
C	0	0	0	0	0	0	0

Step 1: Model construction and problem structuring: The problem should be stated clearly and decomposed into a rational system like a network. The structure can be obtained by the opinion of decision makers through brainstorming or other appropriate methods.

Step 2: Pair-wise comparisons matrices and priority vectors: Decision elements at each cluster are compared pair-wise with respect to their importance towards their control criterion, and the clusters themselves are also compared pair-wise with respect to their contribution to the goal. Decision makers are asked to respond to a series of pair-wise comparisons where two elements or two clusters at a time will be compared in terms of how they contribute to their particular upper level criterion. The relative importance values are determined with a scale of 1 to 9, where a score of 1 represents equal importance between the two elements and a score of 9 indicates the extreme importance of one element compared to the other one.

Step 3: Super-matrix formation: The super-matrix concept is similar to the Markov chain process. To obtain global priorities in a system with interdependent influences, the local priority vectors are entered in the appropriate columns of a matrix, known as a super-matrix. As a result, a super-matrix is actually a partitioned matrix, where each matrix segment represents a relationship between two nodes (components or clusters) in a system. Let the components of a decision system be Ck; k=1,.., n, and each component k has mk elements, denoted by ek1, ek2,…, ekmk. The local priority vectors obtained in Step 2 are grouped and located in appropriate positions in a super-matrix based on the flow of influence from a component to another component, or from a component to itself as in the loop.

A recommended approach by Saaty is to determine the relative importance of the clusters in the super-matrix with the column cluster (block) as the controlling component. That is, with pair-wise comparison matrix of the row components with respect to the column component, an eigenvector can be obtained. This process gives rise to an eigenvector for each column block. For each column block, the first entry of the respective eigenvector is multiplied by all the elements in the first block-of that column, the second by all the elements in the second block-of that column and so on. In this way, the blocks in each column of the super-matrix are weighted, and the result is known as the weighted super-matrix, which is stochastic. Raising a matrix to powers gives the long-term relative influences of the elements on each other. To achieve a convergence on the importance weights, the weighted super-matrix is raised to the power of 2k+1; where k is an arbitrarily large number, and this new matrix is called the limit super-matrix. By normalizing each block-of this super-matrix, the final priorities of all the elements in the matrix can be obtained.

Step 4: Selection of best alternatives: If the super-matrix formed in Step 3 covers the whole network, the priority weights of alternatives can be found in the column of alternatives in the normalized super-matrix. On the other hand, if a super-matrix only comprises of components that are interrelated, additional calculation must be made to obtain the overall priorities of the alternatives. The alternative with the largest overall priority should be the one selected.

In evaluating which of the three alternatives to choose, after the determination of clusters and their elements and subnets, the dependencies and interactions between them are constructed. And these dependency and interactions are shown with the arrows in the related figures. Because of the high quantity of data and calculations, we only present the final normal output of the three models. Considering three super matrixes which one of them (limit super matrix) is shown as table 3 prioritizing for insurance companies is shown as table 4.

Table 3: Limit super matrix

Ideals	**Normal’s**	**Raw**	**Name**
0.53	0.27	0.06	Iran insurance
0.43	0.22	0.05	Saman insurance
1.00	0.50	0.12	Parsyan insurance

Table 4: prioritizing of insurance companies

Cluster Node Lables		Policies and strategies		Managerial Criteria		Judicial infrastructure		Quality of the organization	
		IT practical plan	IT mission	Commit ment	Awaren ess	Digital sign	Privet protection principle	managemen t Change	Knowledge management
Alternatives	Iran	0.000	0.000	0.000	0.069	0.069	0.069	0.069	0.069
	Saman	0.000	0.000	0.000	0.056	0.056	0.056	0.056	0.056
	Parsyan	0.000	0.000	0.000	0.129	0.129	0.129	0.129	0.129
Infrastructure IT	Hardware	0.000	0.000	0.000	0.110	0.110	0.110	0.110	0.110
	security and protectable process	0.000	0.000	0.000	0.184	0.184	0.184	0.184	0.184
Policies and strategies	IT practical plan	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	IT mission	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Managerial Criteria	Commitment	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

5. CONCLUSION

Nowadays, organizations should attain essential readiness to adopt with new business methods, by creating or re-engineering in business process and use IT as a tool to achieve competitive advantages and improve business efficiency. The main question in this research was:" How can organization attain essential readiness, to adopt with appliance of IT?" The answer is, identify e-readiness of organization. Indeed, in the research, rather than finding this answer, following results achieved:

- By following steps that are mentioned in proposed methodology and also by combining ANP and DEMATEL techniques for evaluating electronic readiness, electronic readiness in Parsian insurance company ranked first place in research prioritizes (score: 0.50), Iran insurance company is in second place (score: 0.27) and finally Saman insurance company is in third place (score: 0.22).
- This research is a careful classification of criteria that is obtained by the electronic readiness standards, based on the studies upon the available electronic readiness on countries and organizations models, and also is consolidated by using the expert's views of e-readiness in insurance organization, so everyone can be used as references in practical researches.

The most important reason which influence on gaining such score by Parsian insurance company is using knowledge sharing. In addition, hardware infrastructure, security and protectable process like SSL, using appropriate database like Oracle, documentation based on RUP and creating security management plan are the other reasons for this company to place in the first rank

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