

How Ready are Organizations to Adopt with Information Technology?

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Abstract

The issue of applying Information Technology (IT) has become an undeniable necessity in every governments and organizations, but while applying information technology is expanding rapidly as a competitive advantage used by many governments and organizations, electronic-readiness (e-readiness) issue related to IT, are not being widely discussed or considered; especially in developing country like Iran. E-readiness prepares organization to leverage information technology in order to gain competitive advantage and improve business efficiency. The goal of this paper is indicate critical attributes of e-readiness and propose the model of combination of main e-readiness factors base on e-readiness standard models and experts' view by using Delphi-Fuzzy method, to authenticate the model. This research describes importance of e-readiness as a critical infrastructure in today's knowledge based organizations and propos the customized model of e-readiness for Iranian organizations. This model helps managers to perform gap analysis between existing level and desired one. To gain this goal,

Keywords

E-Commerce, E-Readiness, Information Technology.

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 knowledge- based society, accessing to electronic information-based structures is critical. The other issue in importance of IT applying is that the global electronic economy relies on connectivity, infrastructure and skills, and companies that lack these attributes are excluded from participating in the global exchange of information and accessing to competitive advantages, that is now possible through developments in information technology and telecommunications. But the main problem is "What are the critical e-readiness attributes? And by applying these attributes how can improve organizational position in global network?" To this end, we try to represent the comprehensive model that contains essential attributes of e-readiness for Iranian service companies. It can be said generally, the main reason for failure of some organization along creating electronic company, was their lack of recognition about e-readiness and its importance. This fact makes organization have an overview about their issues by offering factors and models and then enter to e-commerce network, step by step and systematically. Every field and activity, need some changes and should be adopt with new information technology to survive in e-commerce network and they need the proper model to guide them. This paper tries to improve initial designed model by applying Delphi-Fuzzy method till the final model extract by their points.

2. Paper review

According to studies of Rizk (2004), e-readiness points the ability of acceptance and usage of IT and applying its relevant tools in societies. There are different definitions and models for e-readiness, which all try to present a structural form of e-readiness factors to decision makers. Kirkman, Osorio & Sachs (2002) define e-readiness as 'the degree to which a community, government or organization is prepared, and has the potential, to participate in the Networked World'. Generally means, e-readiness can be considered as organizational or partial ability to accept, acquire and take advantage of IT like e-commerce (Mutula&Brakel, 2006). Key factors of success in achieving e-

readiness are as follow: having staff with sufficient skill to understand and undertake IT options and tools and essential substructure to support business (Choucri, 2003). There are different descriptions and models for e-readiness, all tries to present a structural frame of factors, to decision makers (Table 1). These types of e-readiness models indicate the degree of development and the strength of the government’s e-readiness and a few of them for organizations in their different levels, and provide it with an obvious level of e-readiness framework. As it is seen on Table 1, most of the definitions are focused on e-readiness government; it shows there isn’t an exact model for e-readiness in organizations especially in service organizations like insurance or bank. These kinds of companies help government to create e-society and enhances digital network in government; and of course helps other organizations to enter e-commerce network; therefore, we want to propose a comprehensive model by use of essential e-readiness criteria.

Table 1. Key Features of e-Readiness Studies

Model	Author	Date	Description	Focus
Readiness for the Networked World	Center for International Development (CID) at Harvard University and IBM	2007	Readiness is the degree to which a community is prepared to participate in the Networked World. It is gauged by assessing a community’s relative advancement in the areas that are most critical for IT adoption and the most important applications of ITs.	Access, Learning, Society, Economy, Policy.
ECommerce Adoption for Businesses in Developing Country(Perceived e-Readiness Model-PERM)	Molla and Licker	2005	Their research found that organizational factors had a greater influence on e-commerce adaptation than environmental factors did. They recommended that, alongside nationwide infrastructure development, business must purpose organizational &managerial development	Awareness,Human Resources, BusinessResources, TechnologyResources, CommitmentGovernance, Market Forces e-readiness, Support Industries e-readiness.
E-Governance assessment of Central government departments &ministries – (The P3I3 Model)	National Council of Applied Economic Research (NCAER) and Indian Market Research Bureau (IMRB)	2003	This model, along with assessing the overall e-readiness,also measures the various factors that are impacting the e-readiness.According to the model, various criteria havebeen evaluated as the factors affecting e-readiness.	Hardware/Software Infrastructure,ITPolicy, Networking Infrastructure, Website Infrastructure, Business Process, Re-engineering, Mode of Interaction for Processes, Status of Automation for Processes, Status of Integration for Processes,Database Maintenance,Security Mechanisms deployed, Responsibilityof the IT Function,Basic Working Knowledge of computers, IT Training&Development
Global Technology Index	Howard A. Rubin and MetricNet	2002	Qualitative and quantitative statistics on country's technological sophistication and Strength using 25 indicators in 5 categories. Ranking graphs.	Knowledge Jobs, Globalization, Economic Dynamism and Competition, Transformation to a Digital Economy, Technological Innovation Capacity
Information Society Index	World Times / IDC	2002	Statistical ranking based on 23 indicators in 5 categories.	Computer infrastructure, Information Infrastructure,

				Internet Infrastructure, Social Infrastructure
Risk E-Business: Seizing the Opportunity of Global E-Readiness	McConnell International & World Information Technology & Services Alliance (WITSA)	2000	E-Readiness measures the capacity of nations to participate in the digital Economy. E-Readiness is the source of national economic growth in the networked century and the prerequisite for successful e-business.	Connectivity, E-Leadership, Information Security, Human Capital and E-Business Climate (competition, political and financial stability, foreign investment, financial infrastructure).
E-Commerce Readiness Assessment Guide	Asian Pacific Economic Cooperation (APEC) Electronic Commerce Steering Group	2000	Readiness is the degree to which an economy or community is prepared to participate in the digital economy. Every economy, regardless of its level of development, presents a readiness profile on the global stage, composed of its national policies, level of technology integration, and regulatory practices.	Basic infrastructure and technology, Access to necessary services, Level and type of use of the Internet, Promotion and facilitation activities, Skills and human resources, Positioning for the digital economy.
The E-Business Maturity Model (EMM)	PricewaterhouseCoopers, with the assistance of Carnegie Mellon University	2000	Helps organizations in two key ways: first, to understand how well the organization has adopted - or can adapt to E-business, and second, to identify ways to enhance E-business capabilities. The model is designed to cover the entire e-business life cycle and provides both management and internal audit with a valuable assessment and design tool.	Security, Legal, Tax, Delivery and Operations, Systems and Technology, Performance Management, Processes, Organizations and Competencies, Strategy
Readiness Guide for Living in the Networked World	Computer Systems Policy Project (CSPP)	1998	Rates communities along 4 progressive stages of development in 5 categories. Based on 23 questions	Infrastructure access, Applications & Services economy, and "Enablers" (policy, privacy, security, ubiquity).
Global Diffusion of Internet	The Mosaic Group	1998	Indicates stages of Internet growth and usage through combination of statistics, narrative description and comparison. Focuses on 6 Internet statistics.	Pervasiveness, Geographic dispersion, Sectorial absorption, Connectivity infrastructure, Organizational infrastructure and Sophistication of use.

3. General approach to e-Readiness

E-Readiness is generally defined as the degree to which a government or organization is prepared to participate in the digital network world, by use of IT, with the underlying concept that applying IT can help to be more effective in global network. E-readiness is recognized by determining the relative electronic standing of society and organization, in the areas that are most critical for participation to the networked world. A review of recent experiences in the developing world shows that the government or companies who are the most successful in creating a local favorable e-readiness for the use of information technologies, are those that make it a priority. To progress toward this priority, they rely on a strategic framework that set up their priorities and maintaining impetus. Studies show the complete e-Readiness process comprises four main phases:

- Phase I is the recognition of e-readiness attributes
- Phase II is the presenting conceptual model of these attributes
- Phase III is development of a strategy and the preparation of an action plan
- Phase IIII is the implementation of the action plan

Each phase, building on the results of the previous one. Recognition accompanies implementation and with new data emerging, strategies, action plans and projects can be improved or even modified to adjust to new conditions. Phase I should contain all organization components and levels; this illustrates importance of surveying e-readiness criteria. In this paper we focus on phases I and II, and proposed conceptual model with critical attributes for the e-readiness that lead managers to apply IT efficiency.

4. The initial conceptual model

In this part, we have proposed an initial conceptual model. This model contains attributes and sub-attributes of e-readiness (after identifying four attributes the decision committees were asked to distinguish sub-attributes of these attributes) which have been derived to finalize the structure of the model. The conceptual model has been derived from literature of e-readiness and attributes are the combination of all standards e-readiness model. The initial model presents readiness in four main criteria of e-readiness: management and strategies, human resource, IT infrastructure, process and quality, and 11 sub-attributes (Table 2). Conceptual model presents a way for evaluating electronic-readiness in companies. And in order to refine and finalize the e-readiness components and consensus of experts' view is used Delphi–Fuzzy method.

Table 2. Attributes and Sub Attribute of Conceptual Model

Main attribute	Sub-attribute	Reference	Main attribute	Sub attribute	Reference
Managerial Criteria	Awareness Commitment skills	McConnell(2000), P3I3(2003), PERM(2005), WITSA(2000),	Quality of the organization	Risk management IT Project Management, Change management, CRM,Knowledge management	PERM(2005), Mosaic Group(1998), P3I3(2003), EMM(2000)
Policies and strategies	IT mission IT practical plan IT budget process	EMM(2000) CID(2007), PERM(2005), EMM(2000)	Human resource	IT knowledge Training policies	CID(2007),APEC(2000), CSPP(1998),McConnell(2000), P3I3(2003),EMM(2000)
IT Infrastructure	Hardware,Software Website,Assessable technology,Security &protectable process	CID(2007),APEC(2000), CSPP(1998), McConnell(2000), Mosaic Group (1998), EMM(2000)	Judicial infrastructure	Digital sign Privet protection principle	APEC(2000),CSPP(1998), McConnell(2000), EIU(2000), EMM(2000)
Process	Reengineering Automation process Update Database e-readiness of various organizational level	WITSA(2000), PERM(2005), P3I3(2003), EMM(2000)	Enhancer e- Network	Macro infrastructure(e- government) Coefficient,influence Transmission& Internet in organization	CSPP(1998), CID(2007), APEC(2000), McConnell(2000), EIU(2000), WITSA(2000)

4.1 Process to achieve the conceptual model by Fuzzy-Delphi Method

Delphi-Fuzzy method is the combination of strengths of Delphi method and Fuzzy approach for decision making and predicting future conditions. In this method, experts' view are gathered by Delphi method and by using Fuzzy numbers making real approach to topics and improve decision makings. A main advantage of this method is, providing flexible framework which covers many of obstacles related to lack of accuracy and explicitly. And also decisions making by experts are based on individual qualifications and subjective, so it is better to present data as the Fuzzy number instead of definitive numbers. Figure 1 shows the proposed algorithm of Delphi-Fuzzy method.

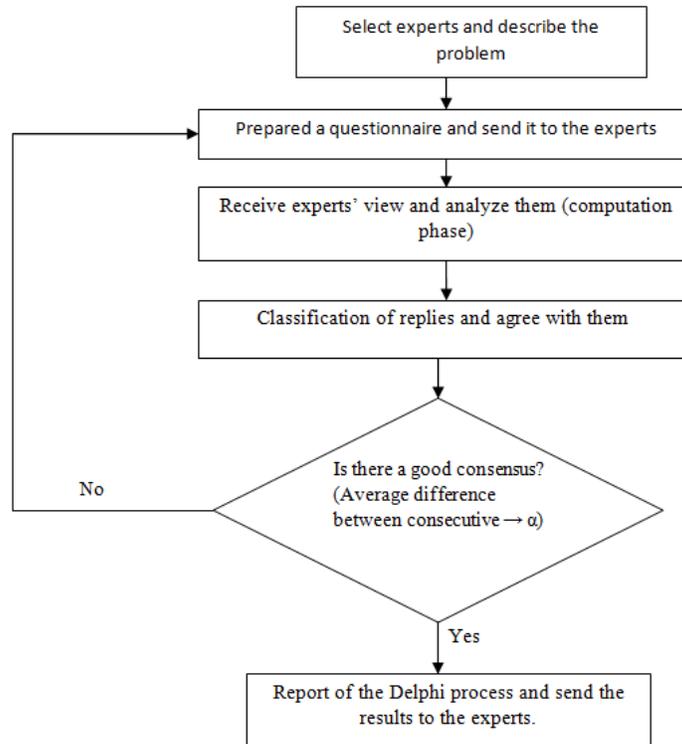


Figure 1: Algorithm of fuzzy- Delphi method (Montazer et al, 2008)

In order to collect the data needed for theoretical research and to create conceptual model, we use documentation of models and the library of the latest scientific articles and books. And in addition to refining and finalizing the components of e-readiness, Delphi-Fuzzy technique is used. So after selecting the experts of e-readiness and decision making committee, Delphi-Fuzzy questioners was designed and has been defined the linguistic variables of this method for experts, in order to submit their opinion. Questioner is designed for attributes and their sub attributes, so that agreement with the main attributes means their subs, too are agreed. In this paper according to the trait of expert group, the following steps were performed:

a) Linguistic variables defined

The experts were asked to describe their agreement about variables by using terms like: very low, low, medium, high and very high. Since the different characteristics of people influence on their mentally interpretations of the qualitative variables, by defining the scope of qualitative variables, experts have answered with the same mentality. These variables According to Table 2 and Figure 2 are defined as triangular fuzzy numbers.

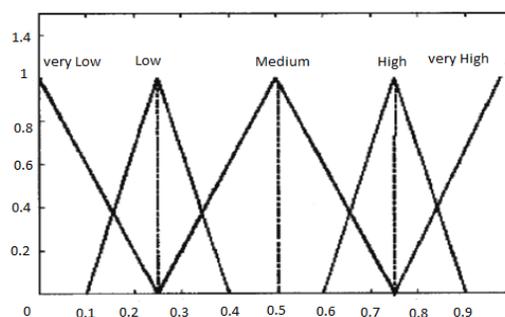


Figure 2: Verbal variation definition (Montezar et al, 2008)

Table 3. Triangular fuzzy numbers & Verbal variables

Verbal variables	Triangular fuzzy numbers	The final fuzzy number
Very High	(1·0.25·0)	0.9375
High	(0.75·0.15·0.15)	0.75
Medium	(0.5·0.25·0.25)	0.5
Low	(0.25·0.15·0.15)	0.25
Very Low	(0·0·0.25)	0.0625

In Table 3, the final fuzzy numbers in are calculated by using the formula:

$$X = m + \frac{\beta - \alpha}{4} \tag{1}$$

(Cheng & Lin, 2002)

Here X is final fuzzy number, m is central triangle number, β is right range and α is left range.

b) First phase of survey

In this step, selected attributes are sent to experts; amount of their agreement with each of the components and recommendations is obtained and collected (according to proposed attributes and linguistic variables defined in questionnaire). The average fuzzy of each attributes (which are present in questioners by experts) is calculated according to the following relations.

$$A_i = (a_1^{(i)}, a_2^{(i)}, a_3^{(i)}), i = 1, 2, 3, \dots, n \tag{2}$$

$$A_{ave} = (m_1, m_2, m_3) = \left(\frac{1}{n} \sum_{i=1}^n a_1^{(i)}, \frac{1}{n} \sum_{i=1}^n a_2^{(i)}, \frac{1}{n} \sum_{i=1}^n a_3^{(i)} \right) \tag{3}$$

(Cheng & Lin, 2002)

In this function, Ai represents each expert’s view and Aave shows the average of experts’ view. a1, a2, a3 indicate triangular Fuzzy numbers. The results of computations are contained in Table 4.

Table 4: Average experts’ view in firs survey

Attribute	triangular fuzzy average	Defuzziation average
Enhancer e-Network	(0.69, 0.18, 0.13)	0.68
Judicial infrastructure	(0.5, 0.15, 0.14)	0.5
Process	(0.5, 0.5, 0.14)	0.5
Policies and strategies	(0.71, 0.17, 0.12)	0.70
Human resource	(0.7, 0.16, 0.12)	0.69
Managerial Criteria	(0.73, 0.14, 0.1)	0.71
Quality of the organization	(0.74, 0.16, 0.1)	0.72
IT Infrastructure	(0.79, 0.16, 0.9)	0.77

As it seen, Fuzzy average is calculated by use of function 3 and by Minkowski function has been defuzziation. In this step, the most agreement is with It infrastructure factor. After data gathering and consulting experts group it was decided that skills component is removed (because of closely with other managerial factors).

c) Second phase of survey

At this stage, for the necessary changes in e-readiness attributes, second questioner is designed and sent for experts by focus on the previous point of view and difference between each of individual with others. After second phase of survey, according to initial experts’ views and comparing with the first phase, since the difference between the two phases is less than threshold (0, 0.1) the survey process is stopped (Cheng & Lin, 2002). The threshold value is measured.

$$S(A_{m2}, A_{m1}) = \left| \frac{1}{3} [(a_{m21} + a_{m22} + a_{m23}) - (a_{m11} + a_{m12} + a_{m13})] \right|$$

Here (am21, am22, am23) indicates expert's opinion in second step and (am11, am12, am13) shows expert's view in first step, and the difference of two steps indicates by S (Am2, Am1).

According to above process Managerial Criteria, policies and strategies, IT infrastructure, process, quality of the organization, human resource, judicial infrastructure, and enhancer e- network, as main attributes and their sub attributes are selected as critical criteria e-readiness for designing conceptual model. After using this method we can illustrate the conceptual model of e-readiness which is modified and revised by experts' view. Figure 3 shows the final conceptual model of e-readiness.

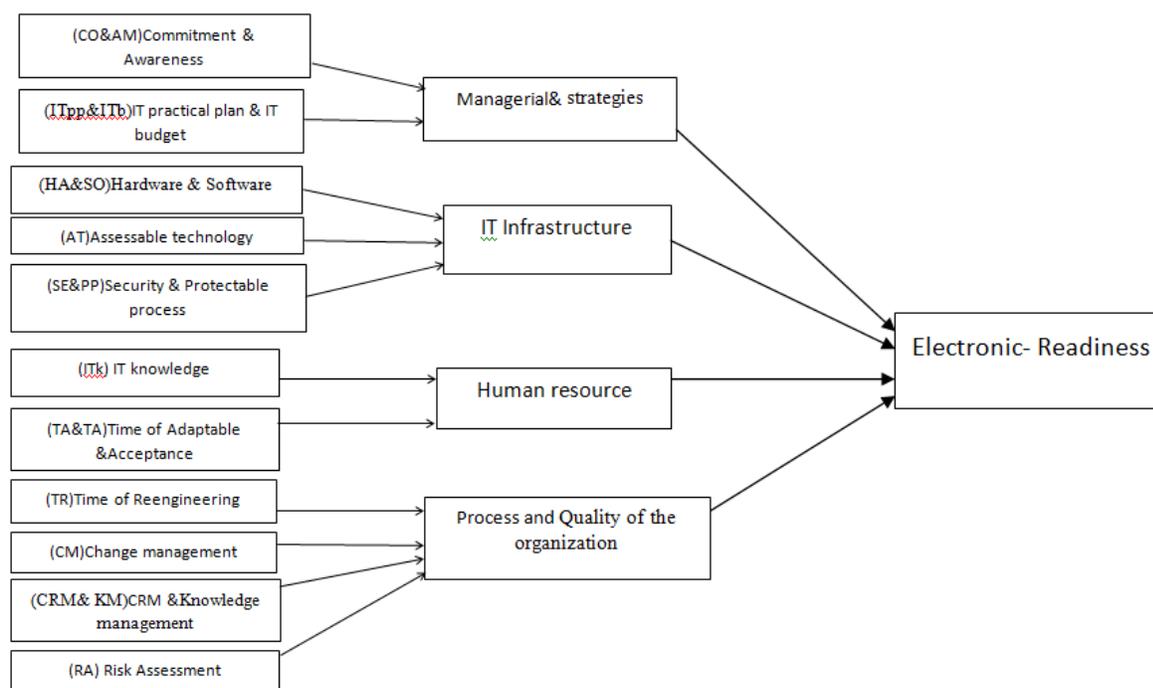


Figure 3: Influence diagram for assessing e-readiness

d) Conceptual Model Validation

In order to assess the validity of conceptual model, a questioner with 11 questions is designed and sent for 20 experts. The questionnaire contained the range of 0 to 100 for each question and the rate of respondents who agreed with the designed model, is shown in a hundred percent.

For assessing validity of the model, approval of 50 percent is considered a good value. In this paper 60 percent agreement and higher for any criteria, is considered. Since 60 percent of experts agreed that all attributes and sub attributes, the conceptual model is designed with sufficient validity for recognition e-readiness. Final results of experts' view are shown in Table 5, since 60 percent of experts have agreed with all criteria, the conceptual model has sufficient validity for assessing e-readiness.

Table 5: Experts' scores for attributes of conceptual model

Criteria	Average	Variance	Standard deviation
Managerial Criteria	74.65	175.30	13.24
Policies and strategies	77.95	205.92	14.35
IT Infrastructure	73.98	186.32	13.65
Process	71.30	207.30	14.40
Quality of the organization	77.35	226.30	15.04
Human resource	73.70	205.50	15.82
Judicial infrastructure	70.65	287.10	16.94
Enhancer e-Network	72.17	313.20	17.70

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: "What is the critical e-readiness attributes? And by applying this attribute how can improve organizational position in global network?" This paper is careful classification of criteria that is mentioned in the Table 1. The attributes are obtained by the electronic readiness standards, based on the studies upon the available electronic readiness on countries and organizations models, and also are consolidated by using the expert's views of e-readiness and by Fuzzy-Delphi method; we can approve the conceptual model with the high validity. As it shown the most critical item for e-readiness in service organization is IT Infrastructure, after that Quality of the organization and Managerial Criteria have the high level of confirmation. This model illustrates the essential attributes for creating e-readiness in this kind of companies. This study helps manager to perform gap analysis between existent e-readiness level and the desired one. Gap analysis helps to identify obstacles within the organization that could block e-readiness achievement, and comfort moving to e-commerce network.

References

1. Asian Pacific Economic Corporation (APEC), 2000. "E-Commerce readiness assessment guide". Website: <http://www.InternetPolicy.net>
2. Bridges.org (2001a). "Comparison of E-Readiness Assessment Models". Retrieved: August 16, 2004, from <http://www.bridges.org/ereadiness/report.html>.
3. Bridgesorg (2005), "E-readiness assessment: Who is Doing What and Where?", Bridgesorg, Cape Town, South Africa <http://wwwbridgesorg/files/active/>
4. Basu, A and Jarnagin, C, 2008. "How to Tap ITs Hidden Potential", Wall Street Journal, <http://onlinewsj.com/article/SB120467900166211989.html> [Date accessed 10 October 2008].
5. Chang, Ping-Teng, Huang, Liang-Chih, Lin, Horng- Jiun, 2000, "The Fuzzy-Delphy via fuzzy statistics and membership function fitting and an application to the human resources", Fuzzy sets and Systems, 2000, Vol.112, p.51.
6. Chang, Ching-Hsue, Lin, Yin, 2002, "Evaluating the best main battle tank using fuzzy decision theory with linguistic criteria evaluation", European Journal of Operational Research, 2002, Vol. 142,p.147.
7. Choucri, N., Maugis, V., Madnick, S., Siegel, M., Gilet, S., O'Donnel, M., et al., 2003, "e-readiness for what?" Cambridge: MIT [online]. Available at: http://papers.ssrn.com/so13/papers.cfm?abstract_id.
8. Chen, T.-J. Globalization and E-commerce: Growth and Impacts in Taiwan. Irvine, CA, Center for Research on Information Technology and Organizations at University of California Irvine: Globalization of E-Commerce Project.
9. CID 2007. "Readiness for the Networked World A Guide for Developing Countries, Information Technologies Group", Center for International Development (CID), Harvard University, USA.
10. EIU 2009. "The e-readiness rankings 2009 the usage Imperative, Economist Intelligence Unit (EIU)" Research Reports and IBM Institute for Business Value.
11. Mutula, S. M., & Brakel, P. V., 2006. "An evaluation of e-Readiness assessment tools with respect to information access: Towards an integrated information rich tool", International Journal of Information & Management, 26, 212-223.
12. United Nations, 2006. "E-commerce and development report (UNCTAD/SDTE/ECB/2)", New York.
13. The 2006 e-readiness rankings, Economist Intelligent Unit, published time: 2006.
14. Ross.J.T, (2002), FUZZY LOGIC WITH ENGINEERING APPLICATIONS, 274-306.John Wiley.
15. [11].Pilevari,N.,Jassbi,J.,(2008),"Fuzzy logic supply chain agility assessment", IEEM. Singapore.