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Identifying and prioritizing of readiness factors for implementing ERP based on agility (extension of McKinsey 7S model)

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Abstract

Studies conducted by many researchers indicate high failure rate of projects of implementing ERP systems. To penetrate in global competition market, it seems necessary to carry out studies to assess organizational readiness prior to system implementation to identify weaknesses and strengths points of the organization. Furthermore, organizations should be agile to be able to respond to market changes fast and effectively to survive in competitive environment. ERP and agility are two important tools for achieving competitive advantages. The main goal of the present study was to identify and prioritize organizational readiness factors for implementing ERP based on organizational agility. In this study, along with extension of McKinsey 7S model (strategy, structure, systems, skills, style, staff, shared values) to 9S (7S+ self-evaluation and supportive factors) model, agility criteria were weighted and rated using group AHP with fuzzy logic approach; so that accountability, speed and flexibility have obtained the maximum score. The nine organizational readiness factors were ranked using integrated FAHP and TOPSIS method based on five criteria of agility. The framework was proposed to a real case of Shiraz distribution cooperative firms. Results showed that among the nine organizational dimensions based on agility, the two added to McKinsey dimensions (self-evaluation and supportive factors) are ranked in the first and fourth places. The proposed framework help the firms "to implement ERP system with agility approach" concentrate on effective empowerments and develop strategies based on their own priority.

Keywords: organizational readiness, ERP, organizational agility, McKinsey model

Introduction

Business environment has been increasingly complicated and market medium has shifted from domestic markets to global ones. Management under constant pressure results in improved competition through decreasing performance costs and promoting supplies. Organization should be, therefore, more responsive to costumers and competition. Around the world, large, medium and small organizations have appreciated that ability to provide necessary information in proper time can gain many benefits for business environment. Globalization, technology and encountering uncertainty in all sections empower the organization to adapt with unexpected changes to achieve and retain competitive advantages. The idea of adapting to unexpected changes has resulted in the evolution of agility concept (Ganguly et al, 2009). Achieving agility requires responding in aspects such as strategies, technologies, individuals and commercial processes. Therefore, all organizational sections need agility support for responding to market changes (Molla Hosseini and Mostafavi, 2007).

Moreover, large global organizations seek for high flexibility and agility to solve the problems and have attempted to approach to organizational systems to meet internal and external changes in their business. Advent of Enterprise Resources Planning (ERP) was one the most impressive technological innovation during recent decade. The main goal in performing an ERP system is to integrate business processes and operations for improving organization business. However, all the companies have not been successful in executing ERP. Lay out projects of ERP

systems are very complicated and one of the first steps to implement such systems is to assess organization readiness for implementing ERP systems. At international level, there has been limited number of investigations on proposing frameworks for evaluating readiness for implementing ERP systems. The frameworks have been proposed to identify the probable problems and challenges during system implementation and to exploit successful experience in implementing other items for problem solving. Framework proposed for evaluation of system implementing readiness in this research is based on McKinsey model. In this model, various organizational dimensions are identified and modeled in the context of seven major dimensions (Hanafizadeh and Zare ravasan, 2011).

In the present study, along with developing McKinsey 7S model, the nine dimensions of the organization are prioritized based on five agility factors. Organizational readiness factors for establishing ERP and also agility criteria are identified via literature review. Then, integrated fuzzy AHP and TOPSIS model is used to evaluate and degree the organizational readiness factors based on agility criteria.

Factors and models for organizational readiness assessment

Organizational readiness assessment is a method by using of which, different dimensions of the organization is assessed and readiness of each organizational section for adopting ERP system is evaluated. Since implementing ERP system is a large key project in organizations, it is necessary to use this tool to assess organizational readiness to implement ERP system. In this method organizational readiness to implement ERP system is determined using managerial and organizational, human force, structural, process, technical, infrastructural and cultural dimensions. Using outputs of this tool, it is impossible to identify the defects and limitations for implementing the system and set the plan to address them (Hanafizadeh and Zare ravasan, 2011).

Organizational readiness factors Saremi et al model

Saremi et al (2007) classified organizational readiness factors for ERP implementation in to five categories:

1. Cultural factor: presence of team working culture within the organization, capacity for changing, personnel participation in ERP project and active presence of the project pioneers
2. Organizational power factor: organizational ability to devote suitable and permanent finance for ERP implementation, organization ability in exploiting appropriate consultation, ability to predict and plan to address probable errors and organization ability in holding sufficient and appropriate education
3. Supportive factor: supporting from top management, delegating decision making power to ERP project forces and pioneers and efficient change management
4. Motivational factor: organization feeling in being present in competitive market and organization total knowledge about ERP system
5. Information technology (IT) infrastructure factor: presence of IT engineers in organization, presence of appropriate hardware and communication infrastructures in organization, reviewing and reengineering the processes and avoiding over-customization of ERP

Model proposed by Razmi et al

In a study conducted by Razmi et al (2008), after evaluating success key factors presented in literature of ERP systems, fifteen factors were selected categorized in to five general groups as project, scope and goals, systems and processes, culture and structure, and human resource. Using fuzzy ANP, the authors rated the factors and finally proposed a structural framework for organizational readiness assessment. The model assesses organizational readiness in three dimensions including organizational readiness, project management readiness and change

management readiness. The model was finally applied in an industry and readiness of the organization was assessed regarding implementation of ERP systems.

BEST[1] model

BEST is a framework initiated in the context of a project by European FP in 2002. The goal of this project is to understand dynamics of implementation of IT projects and to help improve organizational readiness. The project has a comprehensive approach and seeks to consider all the factors effective in IT project implementation. The purpose of the project is to identify dynamics pattern, to perceive complicated dynamics of IT project and reduce the complicacy, to gather suitable data and analyze them, and finally to present visual results to project experts and specialists. The framework tries to identify all organizational components and properties influencing implementation of an organizational information system. The framework identifies technical, human and organizational aspects playing considerable role in the processes. In the BEST framework, the processes are called dimensions and include business processes, project management processes and organizational IT processes. Moreover, there are six organizational aspects namely strategies and goals, structure, processes, knowledge and skills and social dynamics. Therefore an 18-cell matrix (3 dimensions × 6 dimensions) is proposed (Hanafizadeh and Zare ravasan, 2011).

Disosia and Nanayakkara's model

The model developed by Disosia and Nanayakkara (2006) is another model which, after identifying success key factors, risk factors and ERP implementation traps, proposed 37 factors as the key readiness factors for successful implementation of ERP system. Finally an ERP readiness assessment model with four major technological, human, informational and organizational dimensions was proposed. Technological dimension includes physical technologies such as machines and equipment required for processes, software required for appropriate function of machines and so on. Human dimension includes skills, knowledge, experience, innovation, etc. informational dimension involves designing parameters, properties and attributes, instructions and guidelines, theories, technical plans and so on. Organizational dimension includes effective and efficient organizational support for better use of technical and human aspects (Hanafizadeh and Zare ravasan, 2011).

McKinsey 7S model

The model was developed based on seven dimensions (strategy, structure, systems, skills, style of management, staff, and shared values) which all are initiated by S letter. These seven dimensions are accompanied by 23 factors, they are: project champion, common understandings, organization-wide commitment to project, centralization, specification, formalization, size of organization, role of IT in organizations, vision and mission, objectives, strategic plan of IT, legacy systems and infrastructure of IT, business process systems, available data and information, The attitude of senior management, organizational commitment, organizational culture, Human Resource Management, project team, education, senior management skills, users skills, personnel skills of IT.

Organizational readiness factors Nazemi and Naderi model

Nazemi and Naderi (2012) proposed three factors as organizational readiness factors:

1. Strategic factors: organization scope, organization vision, education and infrastructure for process changing, employees' vision, input data, top managers' supporting, top managers' awareness, organizational culture, change management, explicit strategic goals and project strategic hero.

2. Tactical factors: exploiting consultation in budget allocation, motivational system in project progression, time and cost of reengineering, process reengineering, project team

[1]Better Enterprise System implementation

composition, education for change management, education, supervision and feedback work team, powerful project management, inter-section collaboration, performance, supervision and feedback.

3. Operational factors: ERP infrastructure, employees' participation rate, inter-team collaboration, technology progress, service system, user properties, data accuracy, internal and external experts, previous projects with similar scale and assumptions of current system.

Proposed 9S model (extended McKinsey model)

Based on literature review, two dimensions namely supportive factors (Rahmati, 2010; Nasir & Sahibuddin, 2011; Alaskari et al., 2013; Saleh et al., 2013) and self-evaluation (Hauswald et al., 2011; Pinheiro et al., 2013; Boehm et al., 2013; Hidayanto et al., 2013; González-Villar et al., 2014) were identified as major dimensions of ERP, by which McKinsey 7s model is proposed as 9S model (Table 1).

Table 1- Dimensions of the 9 organizational readiness for ERP implementation

Dimensions McKinsey	Factors	Resources
Shared values	Project champion	Rosario, 2000; Willcocks & Sykes, 2000; Nah et al., 2001; Murray&Coffin, 2001; Somers & elson, 2001; Legare, 2002; Kræmmergaard & Rose, 2002; Mandal & Gunasekaran, 2003; Zhang et al., 2003; Umble et al., 2003; Mandal & Gunasekaran, 2003; Amoako-Gyampah & Salam, 2004; Somers & elson, 2004; Yusuf et al., 2004; Zhang et al., 2005; Law & Ngai, 2007.
	common understandings	
	organization-wide commitment to project	
structure	centralization	Willcocks & Sykes, 2000; Strong et al., 2001; Bernroider & Koch, 2001; Enns et al., 2003; Ocker & Mudambi, 2003; Hunton et al., 2003; Morton & Hu, 2004;Buonanno et al., 2005; Laukkanen et al., 2005; Lee & Xia, 2006;Nah & Delgado, 2006; Remus, 2007; DellaVechia et al., 2007; Leidner & Mackay, 2007; Chien et al., 2007; Rai et al., 2008; Preston et al., 2008; Chun & Mooney, 2009.
	specification	
	formalization	
	size of organization	
	role of IT in organizations	
strategy	vision and mission	Rosario, 2000; Shanks et al., 2000; Esteves & Pastor, 2000; Davenport, 2000; Nah et al., 2001; Kearns & Lederer, 2001; Holland & Light, 2001; Somers & Nelson, 2001; Murray & Coffin, 2001; Stratman & Roth, 2002; Nah et al., 2003; Zhang et al., 2003; Mabert et al., 2003; Al-Mashari et al., 2003; Bajwa et al., 2004; Bajwa et al., 2004; Nah & Delgado, 2006; Oh & Pinsonneault , 2007; Law & Ngai, 2007; Soja, 2008; Ngai et al., 2008; Razmi et al., 2009.
	objectives	
	strategic plan of IT	
systems	legacy systems and infrastructure of IT	Rosario, 2000; Kremers & Van Dissel, 2000; Davenport, 2000; Markus & Tanis, 2000; Jarrar et al., 2000; Nah et al., 2001; Murray & Coffin, 2001; Somers & Nelson, 2001;Palaniswamy & Frank , 2002; Hong &Kim, 2002; Kræmmergaard & Rose, 2002; Xuet al., 2002; Mabert et al., 2003; Umble et al., 2003; Al-Mashari, 2003; Kumaret al., 2003; Somers & Nelson, 2003; Bajwa et al., 2004; Somers & Nelson, 2004; Ho & Lin, 2004; Yusuf et al., 2004; Motwaniet al., 2005; Ward et al., 2005; Zhanget al., 2005; Vervilleet al., 2005; Peslak, 2006; Soja, 2006; Finney&Corbett, 2007; Yang et al., 2007; Chuang & Shaw, 2008; Ngai et al., 2008.
	business process systems	
	available data and information	

style	The attitude of senior management Organizational communication Organizational Culture	Soh et al., 2000;Davenport, 2000; Cabrera et al., 2001; Krumbholz & Maiden, 2001; Hong & Kim, 2002;Al-Mashari et al.,2003; Umble et al., 2003; Nah et al., 2003; Sarker & Lee, 2003;Yusuf et al., 2004; Somers & Nelson, 2004; Amoako-Gyampah & Salam, 2004; Zhang et al., 2005; Bozarth, 2006; Peslak, 2006; Achanga et al., 2006; Soja, 2006; Al Mudimigh, 2007; Law & Ngai, 2007; Remus, 2007;Finney & Corbett, 2007; Häkkinen & Hilmola, 2008; Ke& Wei, 2008; Chuang & Shaw, 2008; Xu& Ma, 2008;El Sawah et al., 2008; Snider et al., 2009; Karsak & Özogul, 2009; Hanafizadeh et al., 2010.
staff	human resource management project team education	Willcocks & Sykes, 2000; Rao, 2000; Shanks et al., 2000; Aladwani, 2001; Nah et al., 2001; Somers & Nelson, 2001; Skok & Legge, 2002; Trimmer et al., 2002; Kumar et al., 2003; Mandal &Gunasekaran, 2003; Al-Mashari et al., 2003; Somers & Nelson, 2003; Umble et al., 2003; Amoako-Gyampah & Salam, 2004; Yusuf et al., 2004;Kim et al., 2005; Metaxiotis et al., 2005; Verville et al., 2005;Bozarth, 2006; Peslak2006; Soja, 2006; Achanga et al., 2006; Finney & Corbett, 2007; Häkkinen &Hilmola, 2008; Ngai et al., 2008; Xu & Ma, 2008.
skills	senior management skills users skills personnel skills of IT	Davenport, 2000; Willcocks & Sykes, 2000; Markus & Tanis, 2000; Esteves & Pastor, 2001; Kræmmergaard & Rose, 2002; Duplaga & Astani, 2003; Lee & Lee, 2004; Razmi et al., 2009.
Supportive factors	senior managers middle and key managers budget	Jarrar et al., 2000; Somer & Nelson, 2001; Nah et al., 2001; Zhang et al., 2002; Soh et al., 2003; Finney & Corbett, 2007; Dezdar et al., 2009; Rahmati, 2010; Nasir & Sahibuddin, 2011; Alaskari et al., 2013; Saleh et al., 2013.
Self-assessment	assessment process participation process devolution authority effective communication	Hauswald et al.2011; Pinheiro et al.2013; Boehm et al.2013; Hidayanto et al.2013; González-Villar et al.2014.

So, one of the main objectives is extension of McKinsey model from 7S TO 9S. The conceptual model is presented in Fig. 1.

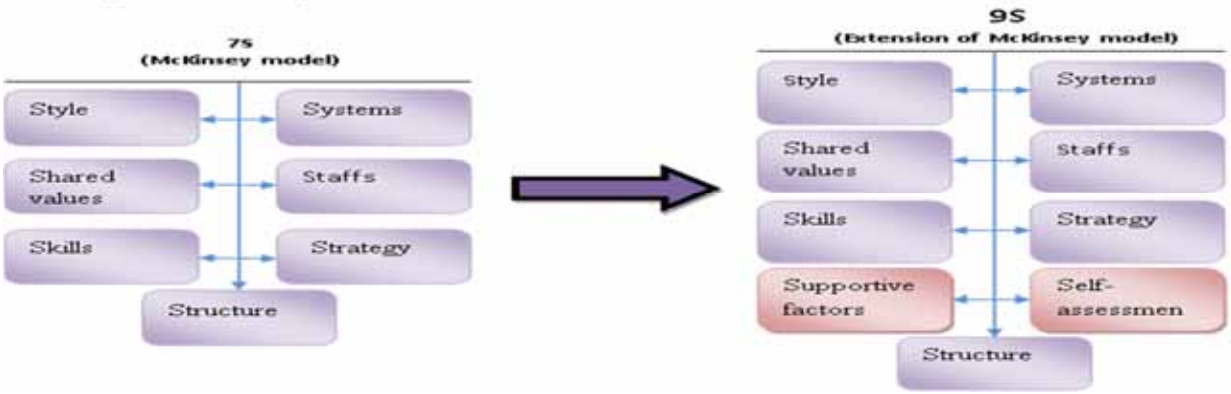

Figure 1 - A conceptual model of this research

Organizational agility and its criteria

Meaning of agile word in dictionary is quick, fast and active motion; and agility means ability to move easily and fast (Ganguly et al, 2009), and to think fast and in a wise manner. In today environment, each organization needs to be able to produce different products with short life, redesign products, to change production methods and to respond efficiently to be called an "agile organization" (Pan and Nagi, 2010). In a more comprehensive saying, agility can be defined as the result of awareness to changes, in a comprehensive manner (recognizing opportunities and challenges) both in internal and external environments with a qualified ability in exploiting the resources to respond flexibly to changes in suitable time in such a way that the organization can afford (Braunscheidel and Suresh, 2009).

Similarly, Lin et al proposed these items as agility capabilities: responsibility, competency, flexibility, speed (Swafford et al, 2006; Lin et al, 2006). By means of literature review and holding mind storm sessions, Agarwal et al proposed fifteen variables for agility. The variables include: sensitivity to market, speed, data accuracy, introducing new products, collaborative planning, process integration, applying technological tools, reducing delay time, improved service level, minimizing the cost, costumers' satisfaction, quality improvement, minimizing uncertainty, extending reliability and reducing resistance to change (Agarwal et al,2007). The main criteria for agility assessment include responsibility and flexibility.

An agile organization is more concerned about changes and uncertainty and unpredictable nature of business environment and tries to represent proper reaction to these conditions. The agile organization, therefore, needs potential capacities and adaptation to meet these changes and uncertainties in business environment. These capacities include five main elements. Based on this, agility properties are elements forming basic structure of an agile organization (Ren et al., 2003). Agility properties have been widely investigated in literature. Table 2 summarizes agility properties used as criteria in this research.

Table 2- Agility attributes used as criteria in this research

Agility attributes	Resources
Accountability	cho et al., 1996; Yusuf et al., 1999; Sharp et al., 1999; Mathiyakalan et al., 2005; Lin et al., 2006a;Lin et al., 2006b; Swafford et al., 2006; Sherehiy et al., 2007; Bottani, 2009; Tseng & Lin 2011;Avazpour et al., 2014.
Competency	cho et al., 1996; Yusuf et al., 1999; Sharp et al., 1999; Mathiyakalan et al., 2005; Lin et al., 2006a;Lin et al., 2006b; Swafford et al., 2006; Sherehiy et al., 2007; Bottani, 2009; Tseng & Lin, 2011;Avazpour et al., 2014.
Flexibility	cho et al., 1996; Yusuf et al., 1999; Sharp et al., 1999; Mathiyakalan et al., 2005; Lin et al., 2006a;Lin et al., 2006b; Swafford et al., 2006; Sherehiy et al., 2007; Bottani, 2009; Tseng & Lin, 2011;Avazpour et al., 2014.
Speed	cho et al., 1996; Yusuf et al., 1999; Sharp et al., 1999; Mathiyakalan et al., 2005; Lin et al., 2006a; Lin et al., 2006b; Swafford et al., 2006; Sherehiy et al., 2007; Bottani, 2009; Tseng & Lin, 2011;Avazpour et al., 2014.
Cost effectiveness	Menor et al., 2001; Tseng & Lin, 2011; Avazpour et al., 2014.

Definition of agility properties as follows:

Accountability: ability to identify the changes and quick respond to them (Sherehiy et al., 2007).

Competency: a wide collection of abilities defined as basis for effectiveness, efficiency and performance of activities of an enterprise (Sherehiy et al., 2007) or includes the ability to efficiently achieve enterprise goals (Lin et al., 2006b).

- **Flexibility:** the ability to process different products and achieve different goals with the same facilities (Sherehiy et al., 2007).
- **Speed:** ability to perform the tasks in the shortest time (Sherehiy et al., 2007).
- **Cost effectiveness:** as a financial index, cost effectiveness represents the only catalyzing factor in conducting agility stimuli (Ganguly et al., 2009).

Companies should be aware of relative importance of this property which forms a competitive basis. Since determining agility weight is a decision making qualitative problem, it involves human judgment ambiguity. In this investigation we proposed fuzzy series as a mathematical approach which can clarify ambiguity in decision making regarding determining weight of agility properties.

Methodology

As mentioned above, organizational readiness factors in McKinsey model includes seven items as: structure, systems, strategy, skills, staff, style and shared values.

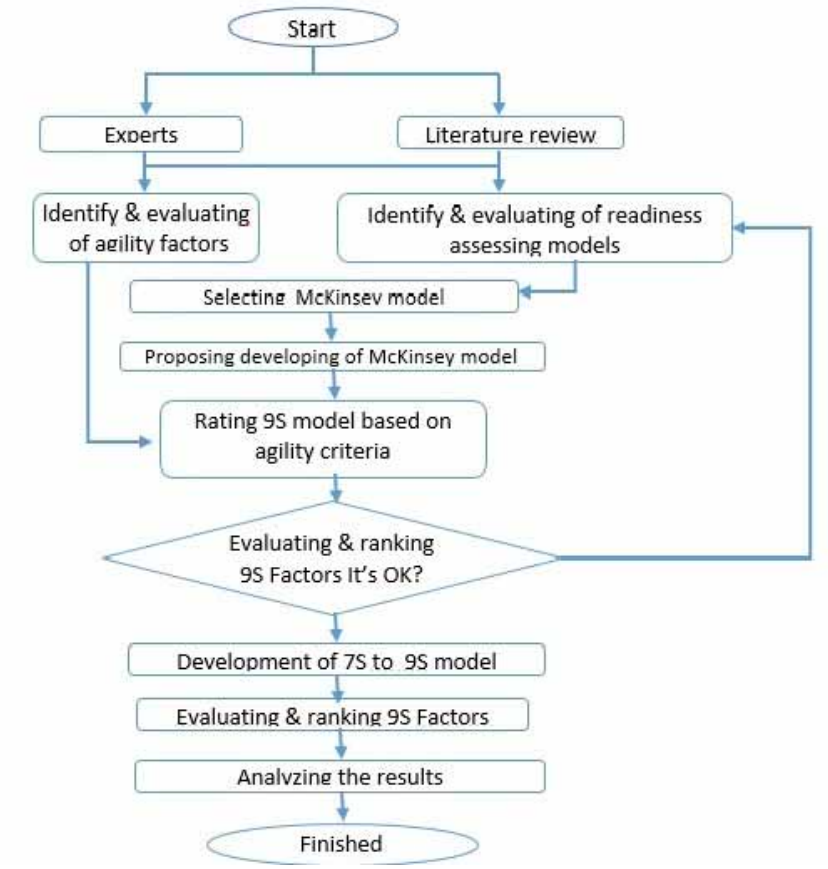

Figure 2 - A Flowchart of this study

According to literature review and interviewing with experts, two factors including self-evaluation and supportive factors were added to McKinsey model. Moreover, agility criteria – based on literature review (section 3) were determined as: responsiveness, competency, flexibility, speed, and cost effectiveness. Therefore we want to assessment the extended McKinsey model (9S) based on agility properties. A Flowchart of this study is shown in Fig. 2.

Models applied

The main purpose of this research was to identify readiness factors for ERP implementation, to extend McKinsey 7S model, to determine and rate agility criteria, and prioritize the nine factors of ERP implementation using fuzzy hierarchical method and TOPSIS. In addition to reviewing previous literature, exploiting experts' comments was also aimed so questionnaires were distributed among the experts. A questionnaire for pairwise comparison among the criteria and another one for comparing the alternatives based on the criteria were filled by five experts in IT and quality section of Shiraz cooperative distribution companies. Then, data were analyzed by TOPSIS, FAHP and AHP methods using EXCEL and EXPERT CHOICE software.

TOPSIS model TOPSIS is a powerful decision making method and a technique for prioritization based on similarity to ideal answer. In this method, the adopted choice should have the shortest distance from Ideal solution and the longest distance from the worst solution. This method is especially useful when decision n making should be done with many qualitative and quantitative factors (Jozi et al., 2013).

***AHP mode*l** Considering rational constrains that each man meets when he is alone, it looks that group collaboration is the only way to achieve a logical, ordered, comprehensive and complete decision. Analytical hierarchy process or AHP is a famous multiple criteria decision making method first developed by Iraqi Thomas L Saaty in 1970's. This method can be used when decision making is encountered with multiple competitive choice and criteria (Althuwaynee et al., 2014).

Fuzzy approach fuzzy logic proposed by Persian scientist Lotfi zadeh in 1965, in contrast to Aristotle's two-valued logic, accepts ambiguity as a part of system and implies uncertain and ambiguous concepts (Razmi et al., 2009). Fuzzy logic or theory is a kind of logic which replaces conclusion methods in human mind. Fuzzy series are useful for information retrieval, because the series can describe evidence issue. Moreover, since natural language is used instead of numerical variables for description of system performance and behavior in fuzzy logic, the series can be effectively exploited for information retrieval in information banks (Avazpour et al., 2014).

Calculation steps are as follow:

Determining inconsistency rate

Compatibility rate is used to ensure closeness of experts' judgment in scoring. In this step, the five criteria of the investigation are compared pairwise. Since compatibility rate was calculated lower than 0.1 (IR=0.06) <0.1; it is concluded that experts' judgment in scoring is close and has high validity.

Calculating criteria weights using fuzzy hierarchical analysis

In this step, data resulted from judgment of five experts in scoring the five criteria (by pairwise comparison) are calculated based on fuzzy triangular model (Fig. 3).

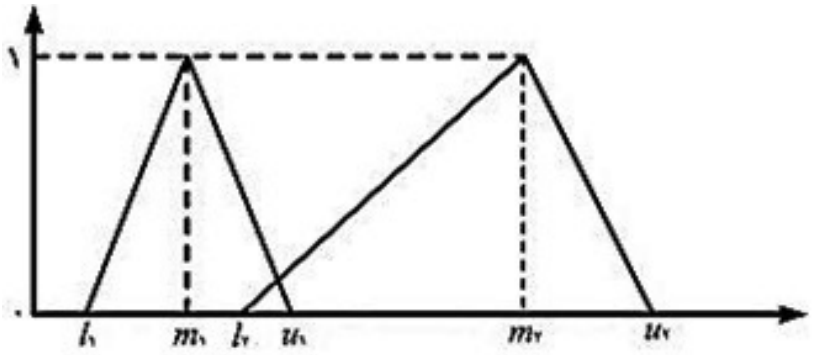

Figure. 3- Triangular numbers M1 and M2

Their arithmetic operators are defined as relations (1), (2) and (3):

After performing the calculations, results of criteria weights based on fuzzy are presented in Table 3.

Table3-Weights of criteria based on the results obtained from fuzzy hierarchical analysis

Criterion	Accountability	Competency	Flexibility	Speed	Cost effectiveness
W_i	0.27	0.09	0.21	0.25	0.18

Prioritizing organizational readiness factors (9S) using integrated TOPSIS and FAHP

Table 4 shows scoring of nine factors affecting organizational readiness based on five criteria for implementing ERP. This scoring has been performed by five experts.

Table 4- Rating nine alternatives based on five criteria by five experts

9 S factors of organizational readiness	Agility attributes				
	Accountability	Competency	Flexibility	Speed	Cost effectiveness
Style	(1,2,1,3,2)	(3,4,2,3,3)	(5,5,7,5,5)	(2,1,3,2,3)	(5,4,8,5,3)
Shared values	(4,3,4,3,3)	(4,4,4,3,5)	(4,5,4,3,7)	(3,2,2,2,3)	(5,5,5,3,7)
skills	(3,2,3,2,3)	(4,5,4,4,3)	(5,4,8,5,3)	(5,4,5,2,3)	(1,1,2, 2,5)
Supporting factors	(5, 5,5,4,9)	(5,4,5,3,7)	(3,3,3,2,5)	(5,4,4,2,9)	(3,2,3,2,3)
systems	(3,5,3,4,3)	(4,5,4,3,7)	(5,5,5,2,5)	(3,5,4,2,3)	(5,5,7,5,5)
staffs	(3,3,2,2,5)	(5,5,5,2,3)	(5,5,5,4,3)	(3,2,4,3,3)	(1,1,2, 2,5)
strategy	(4,5,4,4,7)	(4,4,4,3,3)	(2,3,2,2,3)	(3,2,2,2,7)	(5,5,5,2,3)
structure	(1,2,1,2,3)	(3,4,3,2,7)	(5,5,5,3,7)	(3,3,3,2,3)	(3,2,3,2,3)
Self-assessment	(5,1,5,2,7)	(5,3,5,3,3)	(3,2,2,2,3)	(4,4,5,2,7)	(5,5,5,2,3)

Calculating geometric mean

It is now necessary to convert each five-section cell of Table 4 to a number by geometric mean. Results of all operations are presented in Table 5.

Table 5- Geometric mean of rating matrix of nine alternatives based on five criteria

9S factors of organizational readiness		Agility attributes				
		Accountability	Competency	Flexibility	Speed	Cost effectiveness
Style	A1	1.64	2.93	5.35	2.05	4.74
Shared values	A2	3.37	3.95	4.42	2.35	4.83
skills	A3	2.55	3.98	4.74	3.59	1.82
Supporting factors	A4	5.38	4.62	3.06	4.28	2.55
systems	A5	3.52	4.42	4.16	3.25	5.35
staffs	A6	2.83	3.76	4.32	2.93	2.19
strategy	A7	4.68	3.57	2.35	2.79	3.76
structure	A8	1.64	3.47	4.83	2.77	2.55
Self-assessment	A9	3.23	3.68	2.35	4.07	3.76

Normalization of decision matrix

In this step, scales of decision matrix become scale-free; meaning that each value is divided by the same index based on vector value. Consequently, each entry rij is calculated from the relation below (Table 6):

$$r_{ij} = \frac{x_{ij}}{\sqrt{\sum_{i=1}^{m} x_{ij}^{2}}}$$

Table 6- Normalized matrix of scoring nine alternatives based on five criteria

Alternatives	Accountability	Competency	Flexibility	Speed	Cost effectiveness
A1	0.015631	0.021968	0.035588	0.022258	0.038285
A2	0.03212	0.029616	0.029402	0.025516	0.039012
A3	0.024305	0.029841	0.03153	0.038979	0.0147
A4	0.051278	0.034639	0.020355	0.046471	0.020596
A5	0.03355	0.03314	0.027672	0.035287	0.043212
A6	0.026974	0.028191	0.028736	0.031813	0.017689
A7	0.044606	0.026767	0.015632	0.030293	0.03037
A8	0.015631	0.026017	0.032129	0.030076	0.020596
A9	0.030786	0.027592	0.015632	0.044191	0.03037

Effect of weight on decision making matrix

In this step, the normalized matrix (Table 6) is multiplied by fuzzy weighted matrix (Table 1) to elucidate weighting effect of criteria in rating.

Table 7- Schematic presentation of weighted matrix multiplied by normalized matrix

W	0. 27	0.09	0.21	0.25	0.18
Alternatives	**Accountability**	**Competency**	**Flexibility**	**Speed**	**Cost effectiveness**
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A3	0.024305	0.029841	0.03153	0.038979	0.0147
A4	0.051278	0.034639	0.020355	0.046471	0.020596
A5	0.03355	0.03314	0.027672	0.035287	0.043212
A6	0.026974	0.028191	0.028736	0.031813	0.017689
A7	0.044606	0.026767	0.015632	0.030293	0.03037
A8	0.015631	0.026017	0.032129	0.030076	0.020596
A9	0.030786	0.027592	0.015632	0.044191	0.03037

After performing necessary calculation in Table 7, the results are presented in Table6.

Table 8- Product of multiplication of normalized matrix by weighted matrix

Alternatives	**Accountability**	**Competency**	**Flexibility**	**Speed**	**Cost effectiveness**
A1	0.00422	0.001977	0.007473	0.005565	0.006891
A2	0.008673	0.002665	0.006174	0.006379	0.007022
A3	0.006562	0.002686	0.006621	0.009745	0.002646
A4	0.013845	0.003118	0.004275	0.011618	0.003707
A5	0.009059	0.002983	0.005811	0.008822	0.007778
A6	0.007283	0.002537	0.006035	0.007953	0.003184
A7	0.012044	0.002409	0.003283	0.007573	0.005467
A8	0.00422	0.002342	0.006747	0.007519	0.003707
A9	0.008312	0.002483	0.003283	0.011048	0.005467

Determining positive ideal solution and negative ideal solution

Table 9 shows the maximum and minimum of each column of Table 8.

Table 9- Positive and negative ideal items of each column of Table 8

MAX	0.01384515	0.003118	0.007473	0.011618	0.007778
MIN	0.00422045	0.001977	0.003283	0.005565	0.002646

After determining positive and negative ideal solutions, distance of each n-dimension item is assessed using Euclidean method, meaning that distance of solution i from positive and negative ideal solutions (di- and di+) is estimated. Then closeness to ideal solution (CLi) is calculated. The results are presented in Table 10

Table10- Results of calculating positive and negative ideal items and closeness to ideal solution

d1+	0.01146135	d1_	0.005965		CL1	0.342298
d2+	0.00752762	d2_	0.006962		CL2	0.480482
d3+	0.00915421	d3_	0.005883		CL3	0.391229
d4+	0.00517733	d4_	0.011519		CL4	0.689912
d5+	0.00578878	d5_	0.008232		CL5	0.587129
d6+	0.0089446	d6_	0.004823		CL6	0.350315
d7+	0.00655826	d7_	0.008566		CL7	0.566375
d8+	0.01127547	d8_	0.004133		CL8	0.268229
d9+	0.00736521	d9_	0.007417		CL9	0.501752

Rating of nine factors of organizational readiness is presented in Table 11.

Table 11- Final ranking of nine organizational readiness factors using integrated method

9S factors of organizational readiness		rank
Style	A1	**8**
Shared values	A2	**5**
Skills	A3	**6**
Supporting factors	A4	**1**
Systems	A5	**2**
Staffs	A6	**7**
Strategy	A7	**3**
Structure	A8	**9**
Self-assessment	A9	**4**

As can be seen from Table11, supportive factors, systems and strategy were rated the first, second and third places. The lowest rate belongs to style, staff and structure; and self-evaluation, shared values and skills are rated in median places.

Conclusion

The present study was carried out to identify and rank organizational readiness factors for implementing ERP based on agility and by extending McKinsey 7S model approach. So in this research by reviewing organizational readiness models (Razmi et al model, BEST model, Sosia and Nanayakkara model and McKinsey 7S model), organizational readiness dimensions for implementing ERP were analyzed and finally it was revealed that McKinsey 7S model is more comprehensive and complete. According to literature review from other references (rather than aforementioned models), it seemed that self-evaluation (Hauswald et al., 2011; Pinheiro et al., 2013; Boehm et al., 2013; Hidayanto et al., 2013; González-Villar et al., 2014) and supportive factors (Jarrar et al., 2000; Somer et al., 2001; Nah et al., 2001; Zhang et al., 2002; Soh et al., 2003; Finney et al., 2007; Dezdar et al., 2009; Rahmati, 2010; Nasir & Sahibuddin, 2011; Alaskari et al., 2013; Saleh et al., 2013) are important factors that can play role in extending McKinsey 7S model. Therefore, 9S model was used in next steps. Furthermore, by evaluating agility and its criteria, five criteria as responsibility, flexibility, competency, speed and cost effectiveness were identified as the main criteria of agility (cho et al.,1996; Yusuf et al.,1999; Sharp et al.,1999; Menor et al., 2001; Mathiyakalan et al., 2005; Lin, et al., 2006a; Lin, et al., 2006b; Swafford et al., 2006; Sherehiy et al., 2007; Bottani, 2009; Tseng and Lin, 2011; Avazpour et al., 2014).

Therefore, the nine organizational readiness factors (McKinsey extended model) were considered as alternatives and five factors of organizational agility were considered as criteria. In this study, criteria (based on pairwise comparisons) and alternatives (based on 5 criteria) were weighted by five experts. By calculating compatibility rate (0.06<0.1), weight of each criterion was determined by fuzzy AHP approach. Then, by including weight coefficients of criteria in alternatives scores, organizational readiness factors (as alternatives) were prioritized using TOPSIS technique. Results obtained in this study indicate that the highest weight belongs to responsibility and the lowest weight belongs to competency. Moreover, in alternatives ranking, supportive and self-evaluation factors (added to McKinsey model) are ranked the first and fourth places. Therefore it can be claimed that McKinsey 7S model can be extended to 9S model. It is a unique research. So far in the field of ERP, only its key factors have been rated by researchers but it was for the first time that organizational readiness factors were prioritized. The results achieved in this research can be used as reference and guideline by researchers and industrialists.

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