Identification and prioritization of the barriers of knowledge management implementation using fuzzy analytical network process

A case study of the Iranian context

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Abstract

Purpose – The purpose of this paper is to identify the barriers of knowledge management (KM) implementation in Alborz Province industrial Parks Corporation and prioritize them using fuzzy analytical network process (FANP).

Design/methodology/approach – Through an in-depth review of the literature on KM and researcher findings from observations and interviews with experts, the main barriers of KM implementation, namely, organizational culture, organizational structure, human resource, technology and miscellaneous factors along with their related factors in the surveyed organization were identified. Then, based on the information gathered, an expert questionnaire was developed. Finally, the priority of each main barrier and their sub-factors were determined using FANP.

Findings – The results show that human resource and organizational culture factors with the weights of 0.66 and 0.22, respectively, have the highest ranking and therefore are the most important barriers. The technology factor with the weight of 0.00002 is the least important barrier in implementing KM in the surveyed corporation.

Research limitations/implications – One of the limitations of this study is the generalizability of the findings, which may be limited by the single case study method used.

Originality/value – There are fewer studies about KM barriers specifically with a focus on prioritizing them in organizations, especially in the context of Iran as a developing country. This study develops a comprehensive and solid mathematical technique to prioritize the identified barriers of KM implementation in the context of Iran.

Keywords Iran, Barriers, Knowledge management (KM), Case study, Fuzzy analytical network process (FANP)

Paper type Case study

1. Introduction

Scholars have argued for the relevance of knowledge management (KM) in increasing organizational effectiveness across industrial sectors in developing and developed

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countries (Jain and Jeppesen, 2013). Iran with a population of more than 70 million and the gross domestic product of about US$270 bn is the second largest economy in the Middle East. With a relatively strong economic growth (about 4.8 per cent) and diverse industries (Valmohammadi and Dashti, 2016). On the other hand Iran as a developing country during the past couple years has witnessed a growing interest toward KM implementation. Which as Valmohammadi and Ahmadi (2015) argue could be attributed to the implementation of deregulation policy by the Iranian government and the increase of competition among various manufacturing and services organizations. The importance of KM cannot be neglected in today's complex and universal environment. The organizations who know how to effectively achieve, distribute and manage information would be the leaders of their industry. Currently, organizations are faced with increasing global competitions and more complex customers; thus, such organizations have to make innovations in reducing costs, expanding markets and increase efficiency of their processes. Singh and Kant (2008) by literature note KM effort is no longer merely an option but rather a core necessity for organizations anywhere in the world, if they have to compete successfully.

Today's more complex and changing competitive conditions urge organizations to implement KM to achieve competitive advantages. But, according to Roth's research (2003) 40 to 60 per cent of KM projects fail. To date, well-known models such as "Knowledge Spiral" of Nonaka & Takeuchi, "Building Blocks of Knowledge Management" by Probst & his colleagues, "Munich Model" presented by Reinemann & Rothmeier do not provide answers to this extraordinary rate of failure (Roth, 2003).

To successfully implement KM in companies, it is helpful to deal with barriers which impede the successful implementation of KM. Barriers, which hinder organizations to implement KM, have been identified from various authors who have researched and written directly on this issue (Singh and Kant, 2008). The conducted literature review shows that technical terms are not used uniformly and the importance and influence of critical barriers seems manifold. Only scarce authors such as (Singh and Kant, 2008; Alazmy and Zairy, 2003) define the evaluation of suspected factors in addition to a ranking of barriers. However, it seems that for a successful implementation of KM, in addition to the determination of KM barriers, the identification of the priorities of these barriers which are correspondent to the context of the surveyed organization could help the management of organizations to focus and prioritize their resources and efforts toward removal of these specific barriers. Indeed, failure to identify and remove the barriers before and during the KM implementation would lead to the failure of KM project.

Due to the high probability of such failures, organizations should predict forthcoming conditions by scientific and certain methods to succeed in their KM implementation. Despite the widespread literature of KM, there are fewer studies about KM barriers in organizations, especially in this context of Iran as a developing country. Therefore, the main objectives of this study are to help the top management of the surveyed company to acquaint with the barriers of successful KM implementation and also determine the importance and priority of each barrier identified using a robust quantitative approach, i.e. fuzzy analytic network process (FANP).

Accordingly, to accomplish our objective in this paper, we used a combination of two separate processes (Matlab & Super Decision) to simplify data analysis. This allows considering complex interrelationships among decision levels and attributes and helps

researchers to analyze data very quickly and with high precision. Also, in this study, a fuzzy logic is introduced for the pair-wise comparison of analytic network process (ANP) to remove the deficiency of the conventional ANP, referred to as FANP. We propose a fuzzy extension of the ANP that uses uncertain human preferences as input information in the decision-making process. Instead of the classical eigenvector prioritization method, used in the prioritization stage of the ANP, a new fuzzy preference programming method, which obtains crisp priorities from inconsistent interval and fuzzy judgment, is applied.

In this way, the company and organizations in general will be able to increase the possibility of successful implementation of KM through focusing on these barriers.

2. Literature review of knowledge management

An interesting question which has engaged managers in recent years is that which factors lead to the success or failure of KM implementation. While organizations try to start KM, one of the major concerns that emerge is how to accomplish it. Many companies that are attempting to initiate KM are unsure of the best approach to adopt. There seems to be general agreement in the literature that a combined social and technological approach is ideal.

So the way forward will be paved if organizations are aware of the key factors that will make its adoption successful (Wong and Aspinwall, 2005). For instance, Valmohammadi (2010a, 2010b) suggests 12 factors, namely, top management support, organizational infrastructure, human resource management, organizational culture, information technology, KM strategy, rewarding and motivation, processes and activities, training and education, removal of resource constraints and benchmarking for successful implementation of KM in Iranian small to medium-sized enterprises (SMEs).

Karabag (2010) mentions that due to the complexity of KM, lack of practical plan and especially not considering success factors, KM implementation would not be successful. Therefore, success or failure of KM implementation depends on considering determinant factors. As a result, success or failure factors should be taken into consideration simultaneously. Also, Wendling *et al.* (2013) argue some factors depending on the existing context potentially could play the role of a critical success factor (CSFs) or critical failure factors. So based on the study of two companies, these scholars mention that these factors depending on the context and situation, like cultural differences can be a barrier or an enabler for knowledge sharing.

Albeit, the relevant literature can only provide publications that have examined the factors of success or failure and only a few authors such as Martini and Pellegrini (2005) have covered both areas. Most of studies have focused on key factors of KM success. Barriers which hinder organizations to implement KM have been identified through various authors who have researched and written directly on this issue. According to some studies, scarcity of time and lack of awareness about KM were the most important barriers to implement KM. For instance, Wendling *et al.* (2013) by literature note that time is a main barrier in knowledge sharing among employees.

Also, Shokri-Ghasabeh and Chileshe (2014) performed a study at the University of South Australia to introduce application of lessons learned process in construction contractors' bidding process in the context of KM. In this research study, they found that the top-three barriers to the effective capturing of lessons learned were "lack of employee

time", "lack of resources" and "lack of clear guidelines", whereas "lack of management support" was the least ranked barrier.

The Delphi study has proposed three barriers, among which culture was the top most barrier and immature technology and lack of need of KM were the minor barriers (D.D.C. Group, 1997). Also, Wendling *et al.* (2013) in their study found that cultural differences not only is a barrier among employees but also influence the other barriers. They state that cultural inferences such as language and customs can impede both the absorptive capacity and the relationship of the organizations.

A survey of Indian engineering industries has proposed 20 barriers, amongst them, lack of understanding of KM and lack of top management commitment have been identified as top most barriers. According to this survey, there is a need for KM strategy which must be supported by top management and requires a good KM infrastructure, staff retention and incentives to encourage knowledge sharing (Singh and Kant, 2008).

Oliva (2014), based on the answers obtained from the survey with managers of large Brazilian companies, identified the barriers associated with each stage o the process of KM implementation. The types of the barriers were classified as follows: environmental barriers, organizational barriers and human barriers. Also, in this study, five main barriers based on the interview with managers of the survey company were determined as follows: lack of interest from employees, inefficient communication, lack of culture of sharing, lack of competence of staff and lack of incentive. Akhavan *et al.* (2014) in their study in an Iranian project-based company based on the related literature review identified, grouped and finally prioritized KM barriers using a questionnaire. The five categories of KM's barriers determined in this study were as follows: individual, organizational, technological, contextual and inter-project. And finally, a conceptual framework has been presented in order to successfully tackle the KM barriers.

Sensky (2002) showed culture as a main barrier and lack of time, and lack of ownership of problem as two other barriers. Riege (2005) classifies barriers into three categories, namely, organizational, individual and technological barriers. Organizational barriers are lack of leadership, organizational structure and processes. Individual barriers are lack of time to share knowledge, job security, benefit of KM, low awareness and realization of the value. And technological barriers are lack of integration of information technology system, unrealistic expectation of employees and lack of training.

Dixon (2000) argues that the community of practice model allows organizations to overcome barriers to sharing information that conventional, technology-based KM systems often encounter. For example, people who are reluctant to contribute when asked to write something up for a database are willing to share information when asked informally by their colleagues. Hase *et al.*, (2006) in their research indicated that there could be numerous reasons that cause individuals to incline to share their knowledge with other members of a corporation, including self-esteem boosting to altruistic and conformist considerations. Furthermore, Osterloh and Frey's (2002) research on intrinsic and extrinsic motivation for knowledge sharing suggests that intrinsic motives are much more powerful enablers of such sharing than extrinsic, e.g. monetary or administrative stimuli.

Abtahi and Salavati (2007) in their study identified "culture" as the main barrier in KM implementation. Vaezi and Moslemi (2009) have considered "culture" and "organizational structure" as the most important factors in implementing KM and state that KM is more cultural issue than technology related and gaining people's trust is the

most important factor in successful KM implementation. If organizational culture doesn't support confidence and relationship between affairs, no technology can have desired outcomes.

Wong and Aspinwall (2005) mentions that the efforts of organizations which are trying to be knowledge-based are successful if required cultural factors for KM implementation exist in organizations. Thus, attitudes, beliefs and values of the people are determinant and this barrier is so hard.

Singh and Kant (2008) have categorized KM barriers. They have concluded that the level of each barrier is important for successful implementation of KM. Using interpretive structure model lack of top management commitment has identified as the most important barrier in their study. They have stated that in the fast changing global business, KM has emerged as an integral part of business strategy. Many business organizations have implemented KM and many are in the process of its implementation. KM implementation is adversely affected by few factors which are known as KM barriers.

Zyngier (2002) stated that there are several factors that have negative effect on the implementation of KM in organizations. Such factors are identified as KM barriers and might be resulted from internal or external barriers. Internal factors result from culture, organizational structure, etc., and external factors are out of control of organization. Marican and Abdullah (2008) pointed out that among the human behavior barriers to KM is "sexual harassment" that is unwanted and unwelcome. It occurs in the form of verbal, non-verbal or physical actions between employees at workplace. While the KM requires a good and healthy relationship between male and female employees in workplace, and on the contrary, one of the common problems in communication due to misperception of sexual harassment can occur between men and women.

Also, Ben Moussa (2009) argue that organizations have invested seriously in KM aiming to create a knowledge ability that might be helpful to achieve a competitive advantage. Studies have shown that not all KM projects are successful. In some studies, it is reported that about 84 per cent of KM projects fail. It can be concluded that the gap between users and management in conditions and goals of KM leads to failure. Daneshfard and Shahabinia (2013) noted that "understanding KM and how to implementing it" is one of the main challenges of organizations. Generally, it can be stated that human resources and KM have a close relationship. They continue that several KM projects have failed due to not paying necessary attention to human resources factor.

All in all, only a few numbers of scholars such as Alazmy and Zairy (2003) and Singh and Kant (2008) have provided a ranking of the factors, along with their assessed potential determinant. And the four identified critical success factors (top management support, motivation, measurement and content quality and KM system quality) are distributed across all three sectors or dimensions of KM (technique, organization and people). Despite the widespread literature of KM which was mentioned above, there are fewer studies about KM barriers specifically with a focus on prioritizing them in organizations, especially in this context of Iran as a developing country. As mentioned before, most of these studies only mention barriers without prioritizing them.

3. Research methodology

In our research, case study is suitable as it enables us to understand the paths leading to a certain outcome that could hardly be identified by testing the significance of a set of variables (Božic and Ozretic-Došen, 2015). Yin suggests that case studies are epistemologically justifiable when research questions focus on reasons behind observed phenomena, when behavioral events are not controlled, and when the emphasis is on contemporary events (Kshetri, 2007). Valmohammadi and Servati (2011) by literature mention that a case study methodology is best option when the objective is to build theory in the preliminary phases of a research study or to add new perspectives to previous research. The objective of a case study is not statistical generalization, but an analytical one. This methodology tries to generalize from case to theory; it does not attempt to extrapolate facts from the sample to the population. Also, according to Kshetri (2007), researchers argue that case method is "appropriate and essential where theory exists but the environmental context is different or where cause and effect are in doubt or involve time lags". This research satisfies these criteria. Accordingly, based upon suggestion of Eisenhardt (1989) who argues that best practices models provide good candidates for a case research methodology, in this study a leading industrial Parks Corporation located in the Iran 's Alborz Province which is involved in implementation of KM was selected which as previously noted, is called Alborz Province Industrial Parks Corporation (APIPC).

3.1 Analytic network process approach

Many decision-making problems cannot be considered hierarchically because they have interactions at various levels. The ANP allows for complex interrelationships among decision levels and attributes. The ANP feedback approach replaces hierarchies with networks in which the relationships between dimensions are not easily represented as higher or lower, dominant or subordinate, direct or indirect (Valmohammadi and Dashti, 2016). For instance, not only does the importance of the criteria determine the importance of the attributes, as in a hierarchy, but also the importance of the attributes may have impact on the importance of the criteria. A hierarchical structure with a linear top to bottom form is not suitable for a complex system.

ANP is used in many kinds of decision-making and priority setting problems (Valmohammadi, 2010a, 2010b). The ANP, introduced by Thomas L. Saaty, is a generalization of the analytic hierarchy process (AHP). ANP is the first mathematical theory that makes it possible to deal with all kinds of dependences and feedbacks (Saaty, 2001).

Figure 1 shows the structural difference between hierarchy and network. Indeed, the elements within the hierarchy are often interdependent. The computation of local weights in ANP is exactly the same as AHP method pair-wise comparisons among elements that need to be constructed. The result of computations or weights in ANP approach forms a supermatrix. By using initial supermatrix, it is possible to derive the weights of priorities (Valmohammadi and Dashti, 2016).

Actually, some researchers have focused on decision-making based on FANP (Promentilla *et al.*, 2013; Ayag and Özdemir, 2011; Boran and Goztepe, 2010; Valmohammadi, 2010a, 2010b). However, due to the vagueness and uncertainty on the judgments of decision makers, the crisp pair-wise comparison in the conventional ANP seems insufficient and imprecise to capture the right judgments of decision makers.

In this study, a fuzzy logic is introduced for the pair wise comparison of ANP to remove the deficiency of the conventional ANP, referred to as FANP. We propose a fuzzy extension of the ANP that uses uncertain human preferences as input information in the decision-making process. Instead of the classical eigenvector prioritization method, used in the prioritization stage of the ANP, a new fuzzy preference programming method, which obtains crisp priorities from inconsistent interval and fuzzy judgment, is applied. The resulting FANP enhances the potential of the ANP for dealing with imprecise and uncertain human comparison judgments.

It allows for multiple representations of uncertain human preferences, as crisp, interval and fuzzy judgment and can find a solution from incomplete sets of pair-wise comparisons. An important feature of the proposed method is that it measures the inconsistency of the uncertain human preferences by an appropriate consistency index.

In this study, a FANP-based approach for prioritization of the barriers of KM implementation using bell-shape fuzzy numbers is presented in first step. According to the fuzzy preference method, local weights of fuzzy pair-wise comparison matrices can be achieved. Then, an un-weighted and weighted super matrix based on its network structure can be formed, and finally these results must be defuzzified. For ANP, the key steps are to calculate the local weights and the limit super matrix.

3.2 Data collection and analysis

Mainly the statistical method is used for data analysis. In most of organizational studies, the researcher is interested on knowing how frequently a phenomenon happens or what is mean of a collection of number. In the present study, such descriptive statistics (mean, variation, etc.) is not used for data analysis. Instead, data were analyzed using FANP process which is a structured method of multi-criteria decision-making.

In this study through an in-depth study of extant literature on the barriers of KM implementation and interview with the managers and experts of the company, whom were involved with KM implementation, we proceeded to prepare an inventory, collecting expert's and manager's viewpoints on the barriers and challenges along with their relationships in KM implementation. So, we achieved a good perspective of the studied organization's conditions.

In the next step, using Matlab software, the collected data (through the questionnaire) were converted to bell-shape fuzzy numbers (due to a better approximation) as shown in Figure 2, and were analyzed by Super Decision software.

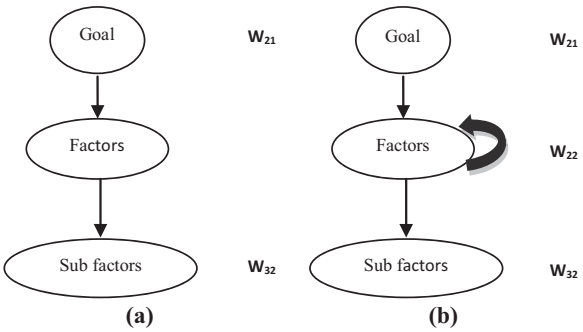

Figure 1.
(a) Hierarchy; and (b) Network

```
>> u = [1 2 3 4 5 6 7 8 9]
u =    1    2    3    4    5    6    7    8    9
>> a = fuzzifys(u,1)
a =
Column 1       2         3         4         5         6         7         8      Column 9
   1.0000   0.5000   0.2000   0.1000   0.0588   0.0385   0.0270   0.0200   0.0154
 >> a1 = defuzzyg(u,a)
a1 =    2.0475
>> b = fuzzifys(u,2)
b =
 Column 1       2         3         4         5         6         7         8      Column 9
   0.5000   1.0000   0.5000   0.2000   0.1000   0.0588   0.0385   0.0270   0.0200
>> b1 = defuzzyg(u,b)
b1 =    2.5849
>> c = fuzzifys(u,3)
c =
 Column 1       2         3         4         5         6         7         8      Column 9
   0.2000   0.5000   1.0000   0.5000   0.2000   0.1000   0.0588   0.0385   0.0270
>> c1 = defuzzyg(u,c)
c1 =    3.3390
>> d = fuzzifys(u,4)
d =
 Column 1       2         3         4         5         6         7         8      Column 9
   0.1000   0.2000   0.5000   1.0000   0.5000   0.2000   0.1000   0.0588   0.0385
>> d1 = defuzzyg(u,d)
d1 =    4.1585
>> e = fuzzifys(u,5)
e =
 Column 1       2         3         4         5         6         7         8      Column 9
   0.0588   0.1000   0.2000   0.5000   1.0000   0.5000   0.2000   0.1000   0.0588
>> e1 = defuzzyg(u,e)
e1 =    5
>> f = fuzzifys(u,6)
f =
 Column 1       2         3         4         5         6         7         8      Column 9
   0.0385   0.0588   0.1000   0.2000   0.5000   1.0000   0.5000   0.2000   0.1000
>> f1 = defuzzyg(u,f)
f1 =    5.8415
>> g = fuzzifys(u,7)
g =
Column 1       2         3         4         5         6         7         8      Column 9
   0.0270   0.0385   0.0588   0.1000   0.2000   0.5000   1.0000   0.5000   0.2000
>> g1 = defuzzyg(u,g)
g1 =    6.6610
>> h = fuzzifys(u,8)
h =
Column 1       2         3         4         5         6         7         8      Column 9
   0.0200   0.0270   0.0385   0.0588   0.1000   0.2000   0.5000   1.0000   0.5000
>> h1 = defuzzyg(u,h)
h1 = 7.4151
>> i = fuzzifys(u,9)
i =
 Column 1       2         3         4         5         6         7         8      Column 9
   0.0154   0.0200   0.0270   0.0385   0.0588   0.1000   0.2000   0.5000   1.0000
>> i1 = defuzzyg(u,i)
i1 = 7.9525
```

Figure 2.
The process of converting collected data to bell-shaped fuzzy numbers using Matlab software

We made the network model and then related Super-Matrix was composed according to the relationship between the criteria, and then the weight of each criterion was determined which in fact is the priority of KM barriers. Finally, these results were defuzzified. Figure 3 illustrates an overview of the steps of the research.

Expert questionnaire was prepared based on the main barriers of KM cited in various studied of scholars such as Wendling *et al.* (2013), Shokri-Ghasabeh and Chileshe (2014), Oliva (2014), Singh and Kant (2008) Vaezi and Moslemi (2009) and Akhavan *et al.* (2014) to collect data. It should be noted that to be assured on the content validity of the questionnaire, it was studied by three academics and managers of the company, and some refinements and changes were applied about some factors of the main barriers before finalizing and distributing the questionnaire. In this study, our sample was included 13 experts (managers and staffs) of APIPC in Iran who answered the questionnaire. In the designed questionnaire, respondents were asked to determine the importance and priority of each criterion. Table I shows demographics of the respondents.

To make comparisons, we need a scale of numbers that indicates how many times more important or dominant one element is over another element with respect to the criterion or property with respect to which they are compared.

Data were collected through expert questionnaire that relative importance between two criteria was measured according to a numerical scale from 1 to 9, as shown in Table II, where it is assumed that the **i** criterion is equally or more important than the **j** criterion. The phrases in the "Interpretation" column of Table I are only suggestive and may be used to translate the decision maker's qualitative evaluations of the relative importance between two criteria into numbers. It is also possible to assign intermediate values which do not correspond to a precise interpretation.

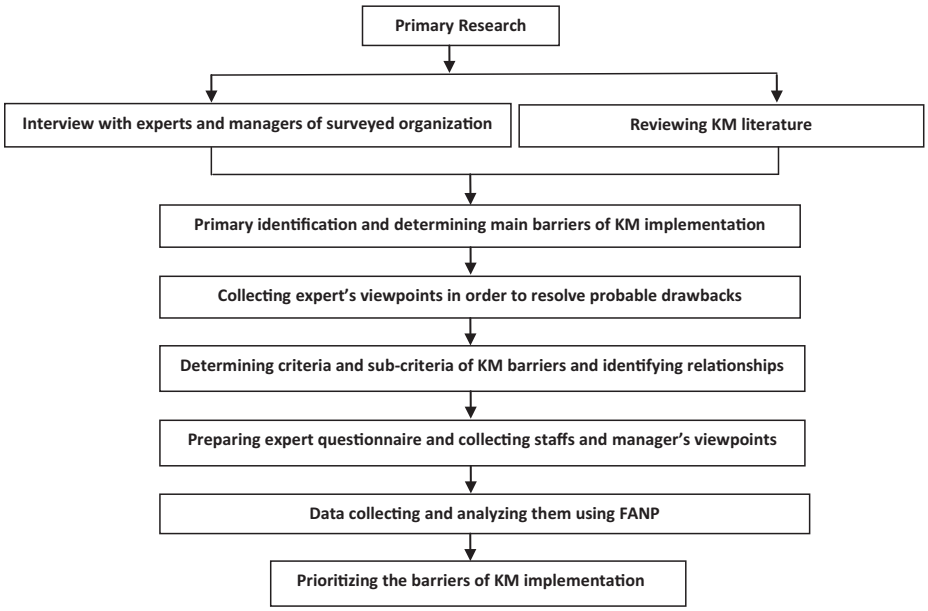

Figure 3.
Overview of the research

Demographics variables	Level	Frequency
Gender	Male	0.7
	Female	0.3
Educational background (%)	Under graduate	30.9
	Graduate	46.1
	PhD	23
Position (%)	Expert	23.1
	Master expert	23.1
	Manger	53. 8
Age (%)	25-35	15.2
	36-45	53.8
	Above 46	31
Work experience (year) (%)	7-10	23.1
	10-15	76.9

Table I.
Demographics of the respondents

Intensity of importance	Definition	Explanation
1	Equal importance	Two activities contribute equally to the objectives
2	Weak or slight	
3	Moderate importance	Experience and judgment slightly favor one activity over another
4	Moderate plus	
5	Strong importance	Experience and judgment strongly favor one activity over another
6	Strong plus	
7	Very strong or demonstrated importance	An activity is favor very strongly over another
8	Very, very strong	
9	Extreme importance	The evidence favoring one activity over another is of the highest possible order of affirmation
Reciprocals of above	If activity **i** has one of the above non-zero numbers assigned to it when compared activity **j**, then **i** has the reciprocal value when compared whit **j**	

Table II.
The fundamental scale of absolute numbers based on Saaty's scale

Therefore, the comparisons were pair-wised. For example, organizational culture and structure priority were compared to each other, and its importance was determined. Then, organizational culture was compared to human resource and its importance was determined, and forth.

An expert questionnaire's validity and reliability is proved if some experts verify it and its inconsistency ratio must be less than 0.1. As mentioned above, this questionnaire was verified by some KM experts, and its calculated inconsistency

ratio was less than 0.1. So, it could be claimed that this expert questionnaire is verified.

Due to the ability of fuzzy numbers to simulate decision-making processes in the human mind, we have used them (expressive variables that can be converted to fuzzy numbers) to convert the expert's qualitative responses to quantitative values. To combine the experts' opinions for paired comparisons and calculate the fuzzy average, we used experts' opinions' geometric mean.

3.3 The criteria's relationships

The criteria and the relationships among them are shown in Figure 4. Organizational culture, organizational structure, human resource, technology and miscellaneous factors are our criteria, and their sub-criteria have come in network model. Black vectors show the internal relationships between the sub-criteria and other vectors show the criteria's relationships.

For example, human resources and organizational culture have interaction together; human resources and organization structure have interaction together and so on. Likewise, their sub-factors have interaction together too. After determining criteria's relationships, using a set of criteria and sub-criteria relations, the network model determined and communications between cluster and nodes is established to consider interactions among the model elements and compose un-weighted super matrix and weighted super matrix. The weight of criteria was calculated based on the mentioned calculations and finally they were prioritized.

To start analysis process in super decision software, first we have to create the network model. To do this, the level of criteria is defined in one cluster. Then we determined relationships between network components and connect them together. This is the most important step in Super Decision software. The model and its connections based on criteria and sub-criteria interactions have been shown in Figure 5.

After creating network, we must input data. To do this, the fuzzy numbers (Matlab's Output) were entered to the network according to their relationships. One of these steps is shown in Figure 6.

In the next step, Un-Weighted Super Matrix needs to be developed after controlling inconsistency ratio. This step creates the un-weighted super matrix.

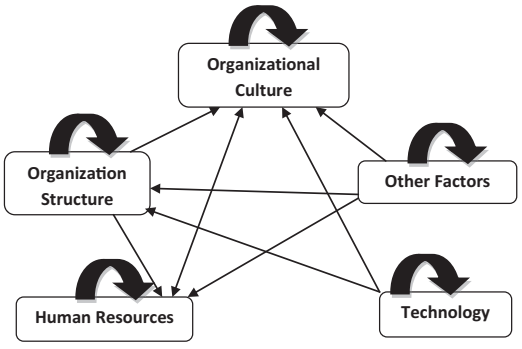

Figure 4.
Criteria's relationships

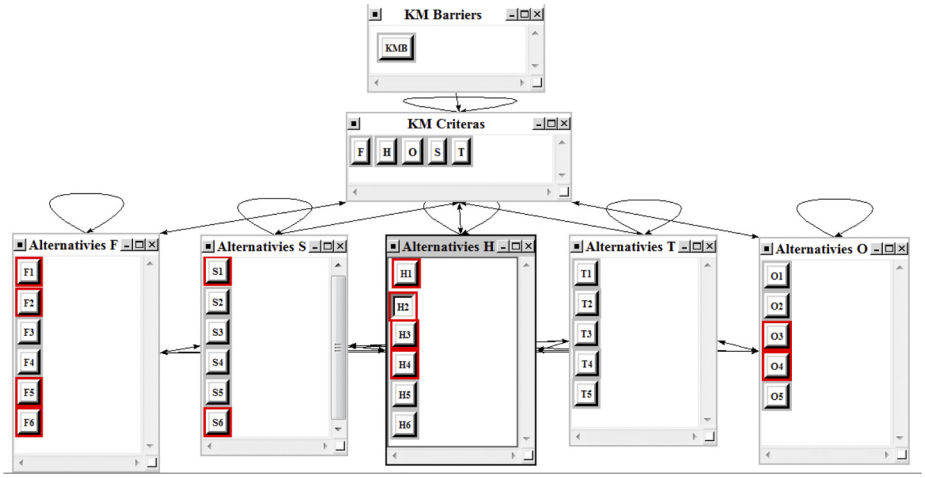

Figure 5.
Network model and connections

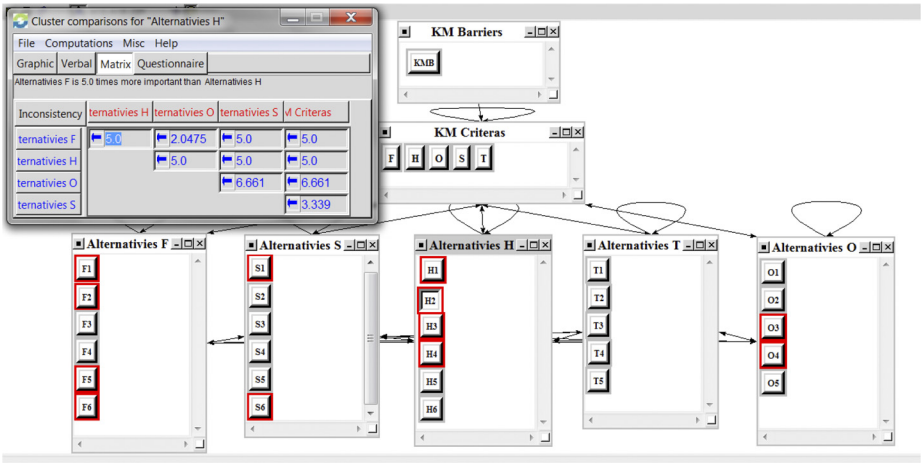

Figure 6.
Entering data

Now, the un-weighted super matrix needs to be converted to the weighted super matrix, i.e. a matrix that the sum of its column's components is 1 (what Saaty calls it a random matrix). This matrix is normalized according to the sum of columns, i.e. each element of the matrix is divided by sum of elements of that column. The result is called weighted super matrix.

The limit matrix can be calculated from weighted matrix, i.e. using normalized amount of matrix in previous steps that limit matrix can be extract. Limit matrix indicates final result for the weights of the criteria and sub-criteria (KM barriers).

In the next step, we must develop limit matrix. The aim of limiting weighted super matrix is to obtain relative long-term effect of each element on each other to diverge the importance index of each element of weighted super matrix which we powered it to **k** (**k** is a large optional number) to make all elements of super matrix

alike. We should repeat this step, in this way, limit matrix is calculated. Limit matrix is a matrix that all elements of each row are equal to each other and shows the final weight of the index of that row.

Finally, we defuzzified the results using Matlab software. After these steps, we can proceed to prioritize KM barriers. Table III shows the KM barriers priority based on our findings extracted from super decision software. In this table, priorities (the final weight) of KM barriers in comparison with each other have been shown.

3.4 Practical implications

Understanding the barriers to the implementation of KM and the relationship between these barriers can lead into better recognition of complexity of system implementation and subsequently, result in the rise of KM implementation in all organizations particularly, large industries such as APCIP. Despite extensive studies done on the classification and prioritization of the problems facing implementation and adoption of KM, most of these research studies are just limited to the identification of barriers to KM implementation, and to the best knowledge of the authors, this is the first attempt to study the interactions of barriers to KM implementation and prioritize them using a novel model and useful application of the specific analytic technique. Classification of the elements of barriers along with determination of priorities and ranking of the barriers can be of great value for companies to prioritize their efforts and resources on removing the most important barriers and challenges toward successful implementation of KM.

Considering the analysis of the relationships between criteria and sub-criteria in this study, we found that the main barriers in KM implementation project in the survey organization can be divided into five main barriers:

(1) human resources;
(2) organizational culture;
(3) organizational structure;
(4) technological factors; and
(5) miscellaneous factors.

In the survey organization, human resource (H = 0.66492) had the highest priority among the main barriers of KM. Human resource is one of the KM bases and a key to creativity and innovation. This high level of priority is consistent with the finding of Valmohammadi and Ahmadi (2015) where these scholars state organizations involved in KM implementation should pay more attention to this soft dimension of KM, i.e. human capital in order to increase the chances of successful KM implementation. This finding also is in congruent with the finding of Rynhardt (2008), where he noticed person-related barriers as the main barrier in KM implementation.

The second main barrier with the weight of 0.22 is organizational culture; this result also is consistent with the findings of Javidan *et al.* (2010) where they identified organizational culture as one of major barriers in KM and suggest that changing organizational culture is one of most difficult process in each KM system. Among its sub-factors, "improper cultural communications" has the highest priority. Also, in line with our findings, we could refer to Wong and Aspinwall (2005) discussion, where they argue that weak organizational culture restrains persons from sharing their knowledge

Table III. KM barriers priorities

Main barriers	Symbol	Priority (Final Weight)	Sub-criteria	Symbol	Priority
Organizational culture	C	0.22027	Neglecting knowledge workers	C1	0.24587
			Neglecting innovation	C2	0.14581
			Lack of trust	C3	0.14164
			Lack of knowledge sharing	C4	0.03812
			Improper connections	C5	0.38340
			Lack of team working	C6	0.04515
Organizational structure	S	0.07353	lack of knowledge-based and dynamic structure	S1	0.24438
			Bureaucratic structure	S2	0.03357
			Improper communications	S3	0.37904
			Poor job description	S4	0.04072
			lack of top management commitment	S5	0.00277
			Lack of delegation of authority	S6	0.29951
Human resource	H	0.66492	Lack of attention to knowledge workers	H1	0.08180
			Lack of motivation	H2	0.71259
			Lack of rewards	H3	0.06317
			Improper communications among employees	H4	0.13680
			paucity of training	H5	0.00133
			Lack of attention of expertise	H6	0.00432
Technological factors	T	0.00002	Paucity of data centers	T1	0.09524
			Lack of access to intranet	T2	0.04762
			Lack of access to internet	T3	0.28571
			Lack of IT infrastructure	T4	0.38095
			Lack of IT knowledge	T5	0.19048
Miscellaneous factors	O	0.04126	Political factors	O1	0.00100
			Socio–Economic factors	O2	0.00133
			People's sabotage	O3	0.49692
			Monopoly of knowledge	O4	0.50058
			External factors	O5	0.00017

and they try to keep their knowledge as a resource of power. "Lack of motivation" has the highest priority among sub-criteria in this group. It indicates that the highest priority belongs to human resources, who are the premise of KM, as it is knowledge workers who create knowledge.

The third priority goes to "Organizational Structure" with the weight of (S = 0.07353). This result is in line with the study of Aminibidokhti *et al.*, (2012) where they argue that hierarchical structure does not provide the required flexibility in the organization As a result, the people get accustomed to perform routine organizational processes and not willing to be innovative and share their knowledge to convert it to skills which might be effective for problem solving in the organization. Among its sub-criteria, "improper organizational communications" gained the first priority in this category.

The forth priority is "Miscellaneous Factors" with the weight of M = 0.04126. Zyngier (2002) stated that there are numerous factors which have negative effect on KM implementation in organizations. They are called "KM barriers" and might result from internal or external barriers. Internal barriers result from culture, organizational structure, etc. and external ones are often out of the organization's control. Among this group's sub-criteria, "Monopoly of knowledge" obtained highest priority in the studied organization. And finally the least priority belongs to "Technological Factors" with the weight of (T = 0.0002), which is consistent with the argument of Fadaie *et al.*, (2012) whom state that neglecting human role and its related effects on KM implementation indicate a common belief that IT can be replaced with human factor. While KM system would not lead to success unless the role and importance of "knowledge manager" understood properly, and technology never can overcome human's mind. So, respondents have considered technology as the smallest barrier to KM implementation in their organizations. This finding also, is in line with the finding of Valmohammadi (2010a, 2010b) where he in his study regarding the CSFs of KM implementation in The Iranian SMEs found a low priority for IT. The participants did not recognize technology as a barrier in KM establishment although the studied organization lacks technological infrastructure. "Lack of technological infrastructure" had the highest priority among the sub-criteria of this factor.

4. Conclusions, limitations and suggestions

The main contribution of this study is the determination and prioritization of KM barriers through a solid and quantitative approach in the context Iran and to overcome the most important prioritized barriers, i.e. human resource and organizational culture in this study top management of organizations in general and the surveyed organization in particular should be informed, holding educational classes for all of staff in various levels could be very beneficial to familiarize employees with benefits and nature of KM system. And through designing and implementing a suitable reward scheme, which plays the role of support and necessary infrastructure for KM implementation, they should strive to foster an organizational culture which supports the collaboration and build confidence and trust among employees to accept and share their knowledge, thus paving the path for successful implementation of KM project.

Also, regarding the second most important barrier, namely, organizational culture, as the cultural changes take a long time and as Liebowitz (2006) argues sometimes between 10 and 14 years, to increase the chances of successful KM implementation, policy makers and managers of organizations should use a KM strategy that matches

their existing organizational culture, instead of using a force-fitting approach which is in contradiction with the macro-organizational culture.

One of the limitations of this study is the generalizability of the findings, which may be limited by the single case study method used. In this study, we tried to identify and consider all important barriers to KM implementation and use a comprehensive and solid approach to rank the barriers. While the application of the proposed approach led to the useful insights, the findings may not be directly translatable to other organizations. For instance, due to the cultural differences among various organizations and industries and also, the level of maturity of human resource systems of organizations, and technological factors employed, more studies are necessary to assess the validity and reliability of the proposed framework in the context of multiple organizations, particularly in the context of developed countries to provide the necessary ground for benchmarking purposes.

Finally, and as a direction for further research, it is recommended in future studies to increase the validity of the results obtained in this research the prioritization of KM barriers to be done using other MADM techniques and in other industries. Also, it is suggested that a coupled model comprising the main barriers and critical success factors of KM to be studied.

References

Abtahi, H. and Salavati, A. (2007), "Knowledge management in organizations", *Peyvand Now Journal (Persian)*, Vol. 3, pp. 25-46.

Akhavan, P., Zahedi, M.R. and Hosein, S.H. (2014), "A conceptual framework to address barriers to knowledge management in project-based organizations", *Education, Business and Society: Contemporary Middle Eastern Issues*, Vol. 7 Nos 2/3, pp. 98-119.

Alazmy, M. and Zairy, M. (2003), "Knowledge management critical success factors", *Total Quality Management and Business Excellence*, Vol. 14 No. 2, pp. 199-204.

Aminibidokhti, A., Mcvand, S. and Ehsani, Z. (2012), "The relationship between organizational culture and knowledge management", *Iranian Rahbord journal*, Vol. 59, pp. 191-216.

Ayag, Z. and Ozdemir, R.G. (2011), "An intelligent approach to machine tool selection through fuzzy analytic network process", *Journal of Intelligent Manufacturing*, Vol. 22 No. 2, pp. 163-177.

Ben Moussa, C. (2009), "Barriers to knowledge management: a theoretical framework and a review of industrial cases", *World Academy of Science, Engineering and Technology*, Vol. 3 No. 6, pp. 906-917.

Boran, S. and Goztepe, K. (2010), Development of a fuzzy decision support system for commodity acquisition using fuzzy analytic network process", *Expert Systems with Applications*, Vol. 37 No. 3, pp. 1939-1945.

Božic, L. and Ozretic-Došen, Đ. (2015), "Enabling innovation and creativity in market-oriented firms", *Baltic Journal of Management*, Vol. 10 No. 2, pp. 144-165.

D.D.C. Group. (1997), *Research & Perspectives on Today's Knowledge Landscape*, Delphi on Knowledge Management, Boston, MA.

Daneshfard, K. and Shahabinia, S. (2013), "Investigating relationship between organizational culture and knowledge management (Case Study: Power Distribution Executive VP North East Tehran)", *Management Journal*, Vol. 17, pp. 231-249.

Dixon, N. (2000), *Common Knowledge: How Companies Thrive by Sharing What They Know*, Harvard Business School Press, Boston, MA.

Eisenhardt, K.M. (1989), "Building theories from case study research", *Academy of Management Review*, Vol. 14 No. 4, pp. 532-550.

Fadaie, G., Hassannzadeh, M. and Zerati, M. (2012), Study of knowledge management system", *Ketabkhaneh Journal*, Vol. 17, pp. 553-580.

Hase, S., Sankaran, S. and Davies, A. (2006), "Overcoming barriers to knowledge management: visiting the dark side of organizations", *Act KM Online Journal of Knowledge Management*, Vol. 3 No. 1, pp. 35-44.

Jain, A.K. and Jeppesen, H.J. (2013), "Knowledge management practices in a public sector organization: the role of leaders cognitive styles", *Journal of Knowledge Management*, Vol. 17 No. 3, pp. 347-362.

Javidan, M., Dorfman, P.W., Howell, J.P. and Hanges, P.J. (2010), "Leadership and cultural context: a theoretical and empirical examination based on Project GLOBE", in Nohria, N. and Khurana, R. (Eds), *Handbook of Leadership Theory and Practice*, Harvard Business Press, Boston, MA.

Karabag, A. (2010), "Critical barrier and success factors for implementing knowledge management in organizations ", CEMS Doctoral Seminar, Preston, 22-25 June.

Kshetri, N. (2007), "Barriers to e-commerce and competitive business models in developing countries: a case study", *Electronic Commerce Research and Applications*, Vol. 6 No. 4, pp. 443-452.

Liebowitz, J. (2006), *Strategic Intelligence*, Auerbach Publications, Taylor & Francis Group.

Marican, S. and Abdullah, S.A. (2008), "Overcoming human barrier as a measure towards improved knowledge management", *Communications of the IBIMA*, Vol. 4 No. 19, pp. 148-160.

Martini, A. and Pellegrini, L. (2005), "Barriers and levers towards knowledge management configurations", *Journal of Manufacturing Technology Management*, Vol. 16 No. 6, pp. 670-681.

Oliva, F.L. (2014), "Knowledge management barriers, practices and maturity model", *Journal of Knowledge Management*, Vol. 18 No. 6, pp. 1053-1074.

Osterloh, M. and Frey, B.S. (2002), "The dynamics of motivation in new organizational forms", *International Journal of the Economics of Business*, Vol. 9 No. 1, pp. 61-77.

Promentilla, M.A.B., Tapia, J.F.D., Arcilla, C.A., Dugos, N.P., Gaspillo, P.D., Roces, S.A. and Tan, R.R. (2013), "Interdependent ranking of sources and sinks in CCS systems using analytical network process", *Proceedings of the 6th International Conference on Process Systems Engineering (PSEASIA)* 25-27 June 2013, *Kuala Lumpur*.

Riege, A. (2005), "Three-dozen knowledge-sharing barriers managers must be consider", *Journal of Knowledge Management*, Vol. 9 No. 3, pp. 18-35.

Roth, S. (2003), *Wissensvernetzung und lernende Organisationen in: Bsirske*, Wissensmanagement, VSA-Verlag, Hamburg, pp. 166-175.

Rynhardt, R. (2008), *Barriers and Facilitators to Knowledge Management in Multi-National Companies : The case of Nissan*, Gordon Institute of Business Science.

Saaty, T.L. (2001), *Decision Making with Dependence and Feedback: The Analytic Network Process*, 2nd ed., RWS Publications, Pittsburgh.

Sensky, T. (2002), "Knowledge management", *Advances in Psychiatric Treatment*, Vol. 8 No. 5, pp. 387-395.

Shokri-Ghasabeh, M. and Chileshe, N. (2014), "Knowledge management: barriers to capturing lessons learned from Australian construction contractors' perspective", *Construction Innovation*, Vol. 14 No. 1, pp. 108-134.

Singh, M.D. and Kant, R. (2008), "Knowledge management barriers: an interpretive structural modeling approach", *International Journal of Management Science and Engineering Management*, Vol. 3 No. 2, pp. 141-150.

Vaezi, R. and Moslemi, T. (2009), "Identifying organizational factors affecting the optimal performance of a knowledge management system (Case study: Tehran Hamkaran System)", *Journal of Management Development*, Vol. 1, pp. 7-19.

Valmohammadi, C. (2010a), "Identification and prioritization of critical success factors of knowledge management in Iranian SMEs: an experts' view", *African Journal of Business Management*, Vol. 4 No. 6, pp. 915-924.

Valmohammadi, C. (2010b), "Using analytic network process in business strategy selection: a case study", *Australian Journal of Basic and Applied Sciences*, Vol. 4 No. 10, pp. 5205-5213.

Valmohammadi, C. and Ahmadi, M. (2015), "The impact of knowledge management practices on organizational performance: a balanced scorecard approach", *Journal of Enterprise Information Management*, Vol. 28 No. 1, pp. 139-157.

Valmohammadi, C. and Dashti, S. (2016), " Using interpretive structural modeling and fuzzy analytical process to identify and prioritize the interactive barriers of e-commerce implementation", *Information & Management*, Vol. 53 No. 2, pp. 157-168.

Valmohammadi, C. Servati, A. (2011), "Performance measurement system implementation using Balanced Scorecard and statistical methods", *International Journal of Productivity and Performance Management*, Vol. 60 No. 5, pp. 493-511.

Wendling, M., Oliveira, M. and Maçada, M.A.G. (2013), "Knowledge sharing barriers in global teams", *Journal of Systems and Information Technology*, Vol. 15 No. 3, pp. 239-253.

Wong, K.Y. and Aspinwall, E. (2005), "An empirical study of the important factors for knowledge management adoption in the SME sector", *Journal of Knowledge Management*, Vol. 9 No. 3, pp. 64-82.

Zyngier, S. (2002), "Knowledge management obstacles in Australia", *Proceeding, of the 10th European Conference on Information Systems, Gdansk, June*, 6-8, pp. 919-928.

Further reading

duPlessis, M. (2008), "What bars organizations from managing knowledge successfully", *International Journal of Information Management*, Vol. 28 No. 4, pp. 285-292.

Lindner, F. and Wald, A. (2011), "Success factors of knowledge management in temporary organizations", *International Journal of Project Management*, Vol. 29 No. 7, pp. 877-888.

Probst, T.G., Raub, S. and Romhardt, K. (2000), *Managing Knowledge: Building Blocks for Success'*, Wiley.

Riger, S. (1991), "Gender dilemmas in sexual harassment policies and procedures", *American Psychologist*, Vol. 46 No. 5, pp. 497-505.

Sedjavadein, R., Emami, M. and Rastegar, A. (2011), "Investigating relationship between organizational culture and knowledge management (Case Study: National Iranian Oil Refining and Distribution Company)", *Management and Human Resource Journal*, Vol. 12, pp. 45-56.

Singh, M. and Kant, R. (2007), "Knowledge management as competitive edge for Indian engineering industries", *Proceeding of the International Conference on Quality and Reliability*, *Chiang Mai*, 5-7 *November*, pp. 398-403.

Sohrabi, B. and Darami, H. (2011), *Knowledge Management with MBA Approach*, SAMT publications in Tehran, Humanities Research and Development Center.

Tsung-Han, C. and Tien-Chin, W. (2009), "Using the fuzzy multi-criteria decision making approach for measuring the possibility of successful knowledge management", *Information Sciences*, Vol. 179 No. 4, pp. 355-370.

Wiig, K. (2007), "Effective social knowledge management", *Journal of Knowledge Management*, Vol. 11 No. 5, pp. 141-156.

Zack, M.H. (1999), "Developing a knowledge strategy", *California Management Review*, Vol. 41 No. 3, pp. 125-145.

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