Research Paper

Identification and Ranking of Factors affecting the implementation of Knowledge Management by using ISM model

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Abstract

Nowadays, knowledge has essential role in achieving strategic objectives and gain competitive advantage. Knowledge should be managed like any other organizational resource. Therefore, one of the most important considerations in order properly implement the knowledge management process, is the identification and Ranking of the factors affecting the implementation of knowledge management. In this research, to identify organizational factors affecting the proper implementation of knowledge management, review of the literature was performed and then interpretive structural modeling was used for defining the relations between dimensions and Indicators of effective on implementation of Knowledge Management. The results show that the model contains seven elements: organizational culture, technology, organizational structure, strategy, human resources, leadership and benchmarking. Benchmarking and then technology have the highest driving power, and there are also less dependent on other factors, so it is necessary for the successful implementation of knowledge management, they should be given the utmost attention. After that, strategy, structure and leadership have higher driving power and dependence. On The fourth level, culture and human resources are, that have the least driving power and highest dependence.

Keywords: Knowledge Management, ISM model.

Introduction

Economy at the era of knowledge-based economy is dependent on creating, distributing and using knowledge which results in the growth of and creating security in organizations. Therefore, knowledge is considered a crucial issue and powerful factor to reach success in organizations (Aujirapongpan et al., 2010). Today, information and knowledge has become an important source and has actually made the capital of organization so that it can be claimed that today's organizations cannot respond actively to their environmental changes and in spite of massive investments in technical and technological infrastructures and also on professionals in a competitive changing environment they will fail (Peachey, 2006). To succeed in this issue, organizations should acquire necessary and appropriate information from internal (intellectual resources) and external resources of organization and provide them for the appropriate individuals and that necessitates the implementing of knowledge management process. In these circumstances only those organizations can act successfully that can make use of knowledge as a stable competitive advantage.

The most important misconception among organizations is that they think the effectiveness of knowledge management is only contingent upon technology. Knowledge management is not just a technology. Actually, using the best technologies in organization without considering the influential factors on the process of knowledge management will end in failure (Peachey, 2006). It means it should be considered that information technology is just a part of knowledge management and the successful implementation of this strategy necessitates paying attention to different factors in an organization including technology, culture and so on. Gap and inconsistency between these factors prevent successful implementation and execution of knowledge management. So, it is necessary to know how

these factors are related to each other. The current study is going to identify and Ranking the influential factors on implementing knowledge management.

Theoretical Bases of Research
Data, Information, Knowledge, Knowledge Management

Data are a group of separated and meaningless symbols, words, numbers, figures and facts which represent events (Davis, 1989). When the existing data in organization are interpreted and assessed, they are changed into information. In other words, information expresses related and meaningful data (Jafary et al., 2010). Knowledge develops from information and information develops from data (Hicks et al., 2006; Jafary et al., 2010). Practically, changing information into knowledge is the responsibility of human. Knowledge is not simple and explicit; it is a mixture of experiences, values and new information (Davis, 1989). Nonaka believes that information is changed into knowledge when it is interpreted by the people in organization and intermingled with their beliefs and commitments and received meaning (Nonaka, 1989). As for differences between data, information and knowledge, researchers are presented two types of knowledge in the form of tacit knowledge and explicit knowledge (Jafary et al., 2010). Implicit knowledge is subjective, hidden, informal and personal knowledge which is not easily transferred, shared and encoded; this intangible advantage can create abundant added value in organization (Nonaka, 1989; Lee, 2001; Nayir et al., 2008; Carter, 2009; Jafary et al., 2010). Explicit knowledge is objective, obvious, formal knowledge which can be provided in an organized and documented form; it is also easy to state and transfer them to others (Lee, 2001; Mohamed, 2006; Carter, 2009; Jafary et al., 2010). Today, knowledge is a crucial issue and powerful factor to reach success in organizations. Many managers have understood the major role of knowledge in acquiring competitive advantage and pursuing strategic goals of organization. To succeed in this issue, organizations should

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Manuscript No: IJSMD-KINA-2014-373

acquire necessary and appropriate information from internal (intellectual resources) and external resources of organization and provide them for the appropriate individuals and that necessitates the process of knowledge management. Robbins (2003) defines knowledge management as: the process of organizing and distributing the collected knowledge so that organization can give the information to the people in appropriate time (Ray, 2008). Magnier et al. (2010) defines knowledge management as the process of acquiring, creating, saving and using explicit and implicit knowledge, inside and outside of the borders of organization for reaching the goals of organization in the most efficient way.

Factors affecting the implementation of Knowledge Management

Technology : Duffy (2000) expresses information technology as a tool for managing the sources of information and knowledge and facilitating access to the documents. Information technology usually preserves the data base and is considered as a tool for accessing the information which will ensure the survival of information and knowledge of organization. Information technology is referred to the technologies providing necessary facilities for collecting, saving, processing and distributing information. Alavi et al. (2001) state that technological communications are critical for all knowledge management processes. For having competitive advantage, organizations should be aware of important information of their business and prevent loss of information and knowledge which has been acquired based on skills and experiences of organization staffs. A lot of knowledge is located across organizational processes, best practices, Know-how, organizational culture and norms (Gupta et al., 2000). Unfortunately, this knowledge is scattered within the organization and cannot be recognized by individuals; however, employees must have quick and easy access to this information and use it to excel in a competitive position. But companies cannot adapt themselves to this trend unless managers create necessary requirements for storage, retrieval and access to knowledge; this requires the application of the best practices and an appropriate technology system (Ray, 2008). Also because of geographical distribution, technology is used to create knowledge distribution systems such as databases. Generally, technology contributes significantly to creating urgency, simplicity, transparency in access to information to solve problems just-in-time (Mohamed, 2006).

Cultural: The values, principles, norms, customs and organizational procedures are considered the cultural resources of knowledge in organization (Chen et al., 2005). Perhaps the greatest obstacle for the implementation of knowledge management, organizational culture is. Shaping culture is considered an important issue in creating necessary capability and capacity for knowledge management to be effective (Knapp et al., 1999; Gold et al., 2001; Peacy, 2006; Aujirapongpan et al., 2010). Most researchers believed that organizational culture change is difficult; however, it is considered a very important prerequisite for knowledge management process (Chen et al., 2005).

The culture of trust increases relationship and mutual trust among members of organization and has individuals to implement knowledge management more eagerly. Organizations also need an environment or a culture of continuous learning to have knowledge management successful so that learning can occur at all levels of the organization. In a learning culture individuals look for problems and are encouraged to learn (Holste et al., 2010).

Leadership : Leadership is at the peak of knowledge management pyramid. According to researchers, the role of leader in knowledge management process has changed from controller to facilitator to increase the power of knowledge workers (Esther, 2011). Because leaders are models for other individuals in organization, they have a direct effect on organizational culture and individuals' attitudes on how to apply knowledge in organization. Therefore, leadership plays a critical role in the success of other factors involved in the success of knowledge management programs in organization. The result of a study on 431American and European companies indicates that organizations cannot ignore the role played by leadership in the process of knowledge management. Without leadership support, knowledge management programs will be a fad and no serious attention will be devoted to them (DeTienne et al., 2004). Emphasizing the importance of the leadership role on the knowledge management process, researchers and scholars have defined many methods in accordance with knowledge management. Productivity of an organization depends largely on knowledge management through appropriate leadership styles. The leadership role in implementing knowledge management in organization is clearly highlighted by Cleveland (1985) in his book (Singh, 2004).

Structure : Organization is a combination of elements, relationships between elements and the structure of relationships as a whole which constitutes a unit (Peachey, 2006). The necessity of structural adaptation to organization strategy in line with better organizational strategy is the subject of most structural studies (Zheng et al., 2010). Management patterns are constantly evolving and the main evolution is organizational structure change. As the companies entered 1990's, knowledge became one of the most important strategic resources and knowledge management was recognized as a competitive advantage for organizations.

Accordingly, the organizational structure has evolved as internal and external needs increased and as we step in knowledge-based economy, it imposes new requirements on structural patterns (Peachey, 2006). Eliminating the limitations of traditional segmentation facilitates sharing knowledge in organization (Pierce, 2012).

Goals and strategy : Setting goals and creating strategy to implement knowledge management should originated from main goals of organization and at the strategic level it is important to consider creating organization based on knowledge (De pablos, 2002). Wong and Aspinwall state that one of important criteria for effective knowledge management is setting a clear strategy and goal. Rational strategy helps clarify business cases for the realization of knowledge management and directing organization towards becoming knowledge-based (Wong et al., 2005).

Human resources : Some features of human resources are required for implementing knowledge management. These requirements include creating equal opportunities for employees, creating creativity among individuals, and

evaluating performance and reward (DeTienne et al., 2004). Creating innovation and creativity in employees and empowering them and ultimately creating a learning organization are among the significant factors for implementing knowledge management program (Škerlavaj et al., 2010). To create knowledge and use it, all companies and organizations should exploit all their resources, including their human resources, based on knowledge-based programs. Human resource issues including mobilizing and sharing knowledge, knowledge culture and creating a set of human resource policies are in line with strategic objectives of knowledge management program (Iles et al., 2001). Motivating employees is another variable that may affect the implementation of knowledge management. People are in the heart of knowledge management. The employees create, store, transform, and use knowledge. They are considered as one of knowledge management infrastructure factors (Reinholt et al., 2011). One of the most important human resource factors that influence the effectiveness of knowledge management process is creating knowledge teams (Soliman et al., 2000).

Benchmarking : APQC defines benchmarking as the process of identifying, learning, and matching outstanding methods and procedures of each organization, anywhere in the world, to help improve the performance of organization or society (Sharma et al., 2012).

According to the definition, knowledge-based economy is the creation of value in society through wisdom, knowledge and technology. Knowing the experiences and ways used by others is not only considered a guide for future programs, but also indicates many starting points and supports in utilizing procedures, techniques and methods along with their weaknesses and strengths for implementing and establishing knowledge management. Understanding the ways by which companies have established and deployed knowledge management is achievable through benchmarking (Valmohammadi, 2010). Benchmarking contributes to the collection of implicit knowledge, techniques, and enablers for organization, therefore it is considered as a crucial factor in implementing effective knowledge management process (Sharma et al., 2012).

According to what mentioned earlier in literature review, it can be seen that extensive literature have been presented on identifying and reviewing factors affecting the implementation of knowledge management process in organizations. But so far, the relationship between these factors has not been provided in a comprehensive operational definition. Therefore, this research investigated the literature to identify these factors and indicators and by using interpretive structural modeling to define the relationship between these dimensions and indicators affecting the implementation of knowledge management.

Research Methodology

In this study, dimensions and indicators affecting the implementation of knowledge management process were identified through a literature review. Having applied the view of experts in this field on them, we presented them in Table No. 1 Then, to create the connection matrix; these dimensions were given in a 7x7 matrix to 15 experts in this field with over 10 years of experience in management.

Table No. 1: dimensions and indicators affecting the implementation of KM

dimensions	indicators
Cultural	Culture of partnership and Cooperation
	Culture of knowledge sharing and trust
	Creativity and innovation as an organizational value
Technology	Removing distance in time and place
	Assist in developing business
	Helping people interact and cooperate more
	Helping for acquiring new knowledge
Structure	Centralization and decentralization
	Organizational complexity
	Formality
	The ease of access to employees
Strategy	Clarity
	Convert competitive intelligence to practical designs
	Acquiring knowledge of supply chain and employees
	transferring organizational knowledge to individual knowledge
	Replacement of outdated knowledge
	Reforming strategies appropriate with acquiring knowledge
Human resources	using staff expertise completely and make a commitment
	Fitness Jobs with mood of staff
	Creating equal opportunities
	Motivate staff
Leadership	The role of facilitator rather than a controller
	To support the knowledge program, including creativity and innovation
	Belief in knowledge as a distinctive competitive advantage
	Protection of secret knowledge
	Proper performance evaluation and reward systems
	Valuing to staff as for their expertise

Benchmarking	Learn from previous mistakes
	Obtain feedback from ongoing projects
	Exchange knowledge with other organizations
	Acquisition of knowledge regarding New Products
	Comparative evaluation and selection of the best course of action

ISM process
Identification of elements relevant to issue or problem
The select of Participants Group:
　Participants should possess the content knowledge in an acceptable level.
Producing a set of elements:
　In some cases, a set of elements, which should be structured, has already been defined. But in many cases, it is necessary for participants to produce the required elements.
Completing connection matrix of elements:
　The group will discuss the question and provide a consensus answer. If they cannot reach agreement about the answer, it can be achieved through a ballot. Four linguistic variables are used to express the relationship between the elements in the given answers. These four variables are:
　V: Only (i) leads to (j).
　A: Only (j) leads to (i).
　X: There is a two-way relationship between (i) and (j).
　O: There is not any relationship between (i) and (j).
　In this form of receiving answers, questioning the elements above diagonal is enough. The upper triangular matrix obtained from the above linguistic variables is called Structural Self-interaction Matrix (SSIM).
Completing reachability matrix:
　Then the linguistic variable matrix will be changed into reachability matrix.
　If the cell value (i,j) in SSIM is "V", then in reachability matrix assign value 1 to the cell (i,j) and 0 to the cell (j,i). If the cell value (i,j) in SSIM is "A", then in reachability matrix assign value 0 to the cell (i,j) and 1 to the cell (j,i). If the cell value (i,j) in SSIM is "x", then in reachability matrix (i,j) and (j,i) becomes 1. If (i,j) enters in form of "O", then (i,j) and (j,i) become 0. Reachability matrix can be used for structuring the elements. To do this it is necessary to modify reachability matrix. According to the given definition of reachability matrix, modified reachability matrix is defined as follow.
　In modified reachability matrix (represented by M) $m_{ij}=1$ if and only if element (s_j) is attainable through element (s_i) even via transitive relation in graphs.
　$M= (A+I)^n$
　"n" is determined in such a way that by adding it the number of none-zero elements of matrix M does not change. None-

zero elements are assigned 1. Then set R_i is defined by the title of an attainable (output) set for each element that $〖s〗_i \in S$. This set includes all the elements that are attainable through element that $〖s〗_i$. In other words, all the elements that row i from their modified reachability matrix is 1. It is also needed to define the prior (input) set; for every $〖s〗_j \in S$, set A_j is defined as all elements which can access to element s_j .In other words, all the elements that column j from their modified reachability matrix is 1. The union of a collection of sets which is shown by $A_i \cap R_i$ includes all distinct elements in both sets. When condition $A_i= A_i \cap R_i$ is true for one element s_i , it can be said that element s_i is not attainable from any other element in set S and therefore it is located at the lowest level of elements. After determining the lowest level, is it necessary to eliminate this element from matrix M and repeat the above process. After repeating it in the decreased system, the above calculations and table are calculated to determine the elements of the next level.
Drawing the graph:
　When the entire reachability matrix is built, it is possible to create a multilevel directed graph. The obtained matrix is a directed matrix with minimum edges that shows effectively and hierarchically both direct answers and rational inferences and tries to eliminate extra edges from graph.
Drawing the driver power and dependence matrix:
　Criteria under study can be divided in 4 categories according to the influence of each criterion on other criteria and the dependency of each one on others. The sum of columns and the sum of rows in modified reachability matrix are called dependency and driving power of that element, respectively.
　Autonomous: elements with minimum dependency of driving power on other criteria.
　Dependent: elements with low driving power but high dependency on other criteria.
　Connector: these elements have high driving power and also high dependency.
　Independent: the elements of this cluster have high driving power and low dependency (Warfield, 1973; Warfield, 1974).

Research Findings
　The result of experts' discussion about completing SSIM for the influencing criteria on implementing Knowledge management process in organization is given in Table No. 2.

Table No. 2: SSIM for the influencing criteria on implementing KM

i \ j	1.Cultural	2.Technology	3.Structure	4.Strategy	5. HR	6. Leadership	7.Benchmarking
1.Cultural	-	O	O	A	X	A	A
2.Technology	-	-	V	O	V	O	A
3.Structure	-	-	-	A	O	V	A
4.Strategy	-	-	-	-	O	A	A
5.HR	-	-	-	-	-	A	A
6.Leadership	-	-	-	-	-	-	A
7.Benchmarking	-	-	-	-	-	-	-

.

Then, linguistic variables matrix was changed to reachability matrix whose result is given in Table 3

Table No. 3: reachability matrix

i \ j	1.Cultural	2.Technology	3.Structure	4.Strategy	5. HR	6.Leadership	7.Benchmarking
1.Cultural	1	0	0	0	1	0	0
2.Technology	0	1	1	0	1	0	0
3.Structure	0	0	1	0	0	1	0
4.Strategy	1	0	1	1	0	0	0
5.HR	1	0	0	0	1	0	0
6.Leadership	1	0	0	1	1	1	0
7.Benchmarking	1	1	1	1	1	1	1

According to obtained reachability matrix and the stated formula, modified matrix is obtained for n=4. After calculating power 4 of reachability matrix, all none-zero elements will be considered 1. Modified reachability matrix is shown is Table 4.

Table No. 4: modified reachability matrix

i \ j	1.Cultural	2.Technology	3.Structure	4.Strategy	5. HR	6.Leadership	7.Benchmarking	driving power
1.Cultural	1	0	0	0	1	0	0	2
2.Technology	1	1	1	1	1	1	0	6
3.Structure	1	0	1	1	1	1	0	5
4.Strategy	1	0	1	1	1	1	0	5
5.HR	1	0	0	0	1	0	0	2
6.Leadership	1	0	1	1	1	1	0	5
7.Benchmarking	1	1	1	1	1	1	1	7
dependency	7	2	5	5	7	5	1	

Criteria ranking is done according to modified reachability matrix. Set R_i and set 〖 A〗_i , and also (A_i∩ R_i) are defined for every element in Table 5.

Table No. 5: sets related to ranking at the first repetition

i	R$_i$	A$_i$	A$_i$ ∩ R$_i$	Level NO.
1	1 , 5	1 , 2 , 3 , 4 , 5 , 6 , 7	1 , 5	-
2	1 , 2 , 3 , 4 , 5 , 6	7 , 2	2	-
3	1 , 3 , 4 , 5 , 6	2 , 3 , 4 , 6 , 7	3 , 4 , 6	-
4	1 , 3 , 4 , 5 , 6	2 , 3 , 4 , 6 , 7	3 , 4 , 6	-
5	1 , 5	1 , 2 , 3 , 4 , 5 , 6 , 7	1 , 5	-
6	1 , 3 , 4 , 5 , 6	2 , 3 , 4 , 6 , 7	3 , 4 , 6	-
7	1 , 2 , 3 , 4 , 5 , 6 , 7	7	7	**first**

Then, the seventh row which belongs to the first level is deleted from Table 5 and the above process is repeated. The results are given in Table 6.

Table No.6: sets related to ranking at the Second repetition

i	R$_i$	A$_i$	A$_i$ ∩ R$_i$	Level NO.
1	1 , 5	1 , 2 , 3 , 4 , 5 , 6	1 , 5	-
2	1 , 2 , 3 , 4 , 5 , 6	2	2	**Second**
3	1 , 3 , 4 , 5 , 6	2 , 3 , 4 , 6	3 , 4 , 6	-
4	1 , 3 , 4 , 5 , 6	2 , 3 , 4 , 6	3 , 4 , 6	-
5	1 , 5	1 , 2 , 3 , 4 , 5 , 6	1 , 5	-
6	1 , 3 , 4 , 5 , 6	2 , 3 , 4 , 6	3 , 4 , 6	-

Then, the second row which belongs to the second level is deleted from Table 6 and the above process is repeated. The results are given in Table 7.

Table No.7: sets related to ranking at the third repetition

i	R$_i$	A$_i$	A$_i$ ∩ R$_i$	Level NO.
1	1 , 5	1 , 3 , 4 , 5 , 6	1 , 5	-
3	1 , 3 , 4 , 5 , 6	3 , 4 , 6	3 , 4 , 6	**third**
4	1 , 3 , 4 , 5 , 6	3 , 4 , 6	3 , 4 , 6	**third**
5	1 , 5	1 , 3 , 4 , 5 , 6	1 , 5	-
6	1 , 3 , 4 , 5 , 6	3 , 4 , 6	3 , 4 , 6	**third**

Then, the third, Fourth and Fifth row is deleted from Table 7 and the above process is repeated. The results are given in Table 8.

Table No.8: sets related to ranking at the Fourth repetition

i	R$_i$	A$_i$	A$_i$ ∩ R$_i$	Level NO.
1	1 , 5	1 , 5	1 , 5	**Fourth**
5	1 , 5	1 , 5	1 , 5	**Fourth**

According to the above results, the graph related to research factors based on ISM model are shown in Figure 1.
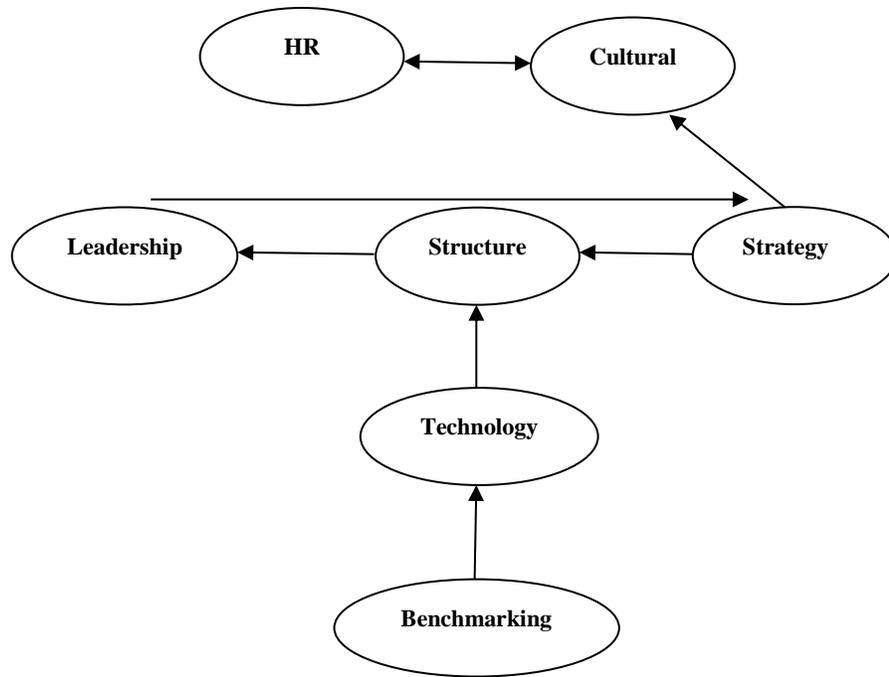
Figure No.1: Obtain model by the ISM method

   Segmentation of research criteria based on dependency and driving power as for the results of Table No. 4, are represented in Figure No.2.
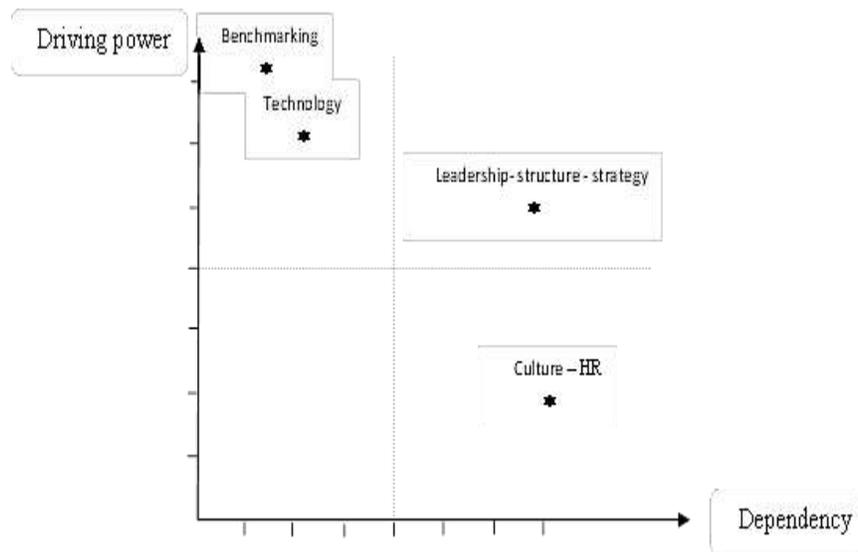

Figure No.2. Dependency and driving power

Conclusion

   In today's competitive world, organizations try hard to maintain and promote their position and deploy proper strategy for their development and survival. One of the most important steps in this regard is proper management of resources in organization. Today, knowledge is considered as the most important resource in organization. Therefore, knowledge has become one of interesting and challenging issues in management and has been the focus of many organizations. Thus, this study attempts to identify and rank factors affecting the implementation of knowledge management in organization. Research findings show that the seven factor of organizational

culture, technology, structure, strategy, human resources, leadership and benchmarking are among the factors affecting knowledge management. The results of interpretive structural modeling also show that benchmarking is the basis for the model, because it affects all other dimensions, and comes after the technology factor which will affect all factors other than benchmarking directly or indirectly. At the third level are organization, strategy and leadership factors. And finally at the fourth and last level are the criteria of rating human force which affect each other mutually.

Influential criteria on Knowledge Management implementation are divided into four parts according to the influence and dependency matrix and according to the influence of each factor on other factors and dependency of each one on others. This matrix shows that benchmarking and then technology have the highest influence and driving power on other factors and also have less dependency on other factors; therefore, they are at the lowest level of model and have the highest influence on other factors. Because of the effect of these factors on other factors, it is necessary to give them a considerable attention.

After that, strategy, structure and leadership have high driving power and dependency. Because of the influence of the previous two levels, these elements have high dependency; and because of their influence on the next two higher levels, they have high driving power. Therefore, any change in this category of elements will influence the elements of the higher level. So, this category of elements is very important. On the other hand, culture and human resources are factors which have the lowest driving power and the highest dependency; therefore, for changing them, other factors should be considered, too.

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