

Ranking the Effective Factors in Knowledge Management Implementation Using Fuzzy Topsis Technique

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Abstract: Revolution in information technology and emergence of information community posed knowledge as the most efficient means to win competitions in both national and global levels. Nowadays, the most successful organizations are those which make the best use of this intangible capital. This paper aims at studying and ranking the factors which may affect the execution of management of knowledge in Behnoush Company. Aspects of this management in this research include: strategic, institutional, infrastructure, structural - social as well as social capital. Sub-criteria of execution of this process were ranked using fuzzy Topsis technique. “Brilliant strategic perspective”, “knowledge promotion” and “committed leadership” turned out to be ranked first to three, respectively.

Key words: Management of knowledge • Strategic aspect • Institutional aspect • Infrastructure aspect • Cultural-social aspect • Social capital aspect

INTRODUCTION

In data technology, knowledge is different from data and information. While data is a collection of realities and sizes, information is a sort of organized or processes data which has expiry data and great precision. Knowledge is a type of information which can influence “action”. Being actionable here means relationship with certain matters. For this purpose, relevant information must be put in its proper place and must have appropriate time and context so that everybody can make use of it in decision-making [1].

Knowledge is a key source in an intelligent decision making, forecasting, designing, planning, trouble shooting, analyzing, evaluating and intuition judgment [2] and success organizations compete to each other by their knowledge [3].

That is, knowledge does not do a particular deed, but it has the capability to interpret and utilizes information and experience which may influence decisions [4].

Management of Knowledge: Management of knowledge is a process which helps organizations identify, choose, organize and transfer important information and specialties within the organization which constitute part

of the organizational memory and mainly occur without a specific arrangements [5]. Another definition states that management of knowledge is an existing knowledge which can be used to create, distribute and transfer of knowledge, utilization of existing knowledge, acquisition of new knowledge and saving it within organization. Organizing the existing knowledge improves the efficiency of such knowledge in problem-solving, dynamic learning, strategic planning an effective decision making. Management of knowledge focuses on knowledge, interpretation and adding to it through reutilizations. Management of knowledge is a concept which has frequently been used in various areas particularly in knowledge engineering [6] and artificial intelligence [7].

Knowledge management includes the activities and processes which search synergic combination of data processing capacity and information [8].

Advancements in data processing and network technologies have improved accessibility to data and information through internet at any time and place worldwide. Increased demand in market for obtaining innovative products with more flexibility and better quality and lower cost at the soonest possible play an important role in new areas of management of knowledge [9].

Aspects of Management of Knowledge: In a knowledge-based economy, knowledge plays central role in production of wealth which if can be managed properly it can improve fundamental parts of the economy. Therefore, many companies and organizations search for a system by which they can manage their knowledge in organizational level [10-13].

There are some barriers to a successful execution of such management. If this process can be executed successfully, its results may reasonably guarantee the success of organization. In fact, such processes have been defined as key factors of success for organizations. They are useful for environmental analysis because there is a decisive relationship between environment and the factor which guarantee success of organization [14]. Analyzing and evaluating such key factors through identifying central areas which are vital for execution of management of knowledge can provide important sight. Hence management of knowledge needs to identify and evaluate such central areas in order to be able to measure the potential of its success [15].

Key factors in execution of management of knowledge in organizational level are; strategic factor, institutional aspect, infrastructure aspect, cultural and social aspects as well as social factors.

Strategic Factor: One way to execute management of knowledge successfully is to have a transparent and well-planned strategy. It is a key factor for organizing sources and ability to achieve the goals of management of knowledge. Strategic management and its related matters have been paid serious attention both in organizational and macro (national) levels.

Institutional Aspect: When we consider institutional theory, we see that sometimes actions and efforts may be repeated because there are sufficient laws and regulations for their repetition. Authors distinct the three above institutional pressure. On some occasions, action models may be supported by norms, values and expectations. According to Scott, the aspects of environment through such conditions may take place are: legislative entities, governmental authorities, regulations and organs, professions, interested groups and public opinion.

Hence, a proper legislative framework to support the execution of management of knowledge within organizations and commitment of leadership to execute management of knowledge as well as governmental

supports for such process can be considered as the most important institutional factors for execution of management of knowledge within organization.

Infrastructure Factor: This is a factor which has been cited in managerial literature and sources as an important factor in modern management. It includes efficient information technology, personnel familiar with advanced technologies in areas related to management, publications, seminars, conferences and management of knowledge, development of organizational learning and personnel access to knowledge through efficient and systematic methods.

Cultural and Social Aspect: Two authors who have carried out many researches on management of knowledge consider the existence of a broad network of organizational relations as a social factor which influences management of knowledge in micro level.

Social Capital: Theoretical principals of management of knowledge and social capital demonstrate the fact that social capital, as a key factor, can facilitate success of management of knowledge [16-20].

We can consider the social capital from three points of view: first, we can consider it a personal capital. Second, we can regard it as an organizational capital. Third, we can take it as a social capital of a community of country [21]. Because this paper deals with organizational level, so we can judge that the second point of view here prevails [22].

Social capital can improve and facilitate the execution of management of knowledge in organizational level through organizational trust and common norms [23].

Research Methodology: Statistical population of the research is composed of 42 managers from different managerial levels of Behnoush Co. because our statistical population is small- size; we used no special method for sampling.

For data gathering from literature and previous researches we used library method. Having studied different books, papers and researches as well as searching in internet we could gather the data which we needed. Since our research was descriptive, we used questionnaires for gathering the data which we needed to test our hypothesis, just like any other descriptive researches. We used SPSS software to test our hypothesis and validity of the research.

Reliability and Validity of Questionnaires: To ensure the reliability of our questionnaire we used content reliability. For this purpose, questionnaires were distributed to a group of university professors and professionals of management field of study and then we applied their comments in the questionnaires.

For the purpose of validity, we used Cronbach alpha. To this end, we chose 30 individuals from statistical population randomly and the questionnaires were distributed among them. The Cronbach alpha was obtained from them to be 0.81 indicating that the questionnaires had high validity.

Fuzzy Multivariate Decision Making Methods: Decision making means finding best alternative from among different ones which do exist. Existence of great many criteria for decision making may trouble decision maker. Therefore, in most cases, decision maker may intend to achieve more than one goal in deciding what method to be chosen.

Fuzzy theory was devised by Prof. Lotfizadeh in 1965. The theory is valuable in variable conditions and the conditions in which no comparison can be made. People's judgment is orally and always obscure. So this theory can clear such obscurity [25]. Acceptability of alternatives based on the criteria is mentioned numerically which is called Fuzzy Acceptability. it is measured through Fuzzy decision making methods. Ranking the alternatives is carried out by comparing the Fuzzy Acceptability [25].

Topsis (prioritizing method based on similarity with positive ideal solution) is regarded as a classic method of MCDM. Hwang and Yoon in 1981 expanded MCDM for problem solving which was based on determination of ideals. The chosen alternative must have smallest difference from positive ideal and had to have biggest difference from negative ideal. The application of Topsis in Iran traces back to 1990s. This application was initially very limited and only recently the Fuzzy condition was utilized in Iran.

Stages of decision making using Fuzzy Topsis technique is as follows:

Stage 1: Obtaining weights vector $w \sim j$.

Stage 2: Normalizing the matrix obtained through comments by the experts in relation to strategies:

$$\tilde{R} = [\tilde{r}_{ij}]_{m \times n}$$

- $B \subseteq \{1, \dots, n\}$ represents the indices which influence profit (equation 2)

- $C \subseteq \{1, \dots, n\}$ represents indices relating to cost (equation 3)

$$\tilde{r}_{ij} = \left(\frac{a_{ij}}{d_j^*}, \frac{b_{ij}}{d_j^*}, \frac{c_{ij}}{d_j^*}, \frac{d_{ij}}{d_j^*} \right), j \in B$$

$$\tilde{r}_{ij} = \left(\frac{a_j^-}{d_{ij}^-}, \frac{a_j^-}{c_{ij}^-}, \frac{a_j^-}{b_{ij}^-}, \frac{a_j^-}{a_{ij}^-} \right), j \in C$$

Stage 3: Now the matrix has been weighted taking the form of equation 4.

$$\tilde{V} = [\tilde{v}_{ij}]_{m \times n}, i = 1, 2, \dots, m, j = 1, 2, \dots, n$$

$$\tilde{v}_{ij} = \tilde{r}_{ij} \otimes \tilde{w}_j$$

Stage 4: To determine Fuzzy positive ideal solution (FPIS) and Fuzzy negative ideal solution (FNIS) (equations 5 and 6):

$$\tilde{v}_j^* = \begin{cases} \max_{i=1, \dots, m} \tilde{v}_{ij}; j \in B \\ \min_{i=1, \dots, m} \tilde{v}_{ij}; j \in C \end{cases} \quad \tilde{v}_j^- = \begin{cases} \min_{i=1, \dots, m} \tilde{v}_{ij}; j \in B \\ \max_{i=1, \dots, m} \tilde{v}_{ij}; j \in C \end{cases}$$

$$FPIS = \{\tilde{v}_j^* \mid j = 1, \dots, n\}$$

$$FNIS = \{\tilde{v}_j^- \mid j = 1, \dots, n\}$$

Stage 5: Calculation of sizes using Euclid distance.

$$\frac{1}{4} \left[(a_1 - b_1)^2 + (a_3 - b_2)^2 + (a_3 - b_3)^2 + (a_4 - b_4)^2 \right]$$

- The distance of each strategy from positive ideal can be calculated through equation 8.

$$d_i^* = \sum_{j=1}^n d(\tilde{v}_{ij}, \tilde{v}_j^*), i = 1, \dots, m$$

- And the distance of each strategy from negative ideal can be calculated through equation 9.

$$d_i^- = \sum_{j=1}^n d(\tilde{v}_{ij}, \tilde{v}_j^-), i = 1, \dots, m$$

Stage 6: Calculation of relative closeness to ideal and relevant ranking (equation 10)

$$CI_i = \frac{d_i^-}{d_i^- + d_i^*},$$

Prioritizing the aspects which influence the execution of management of knowledge using Fuzzy Topsis technique.

Table 1: lingual variables for weighting the criteria [26]

Very low	VL	(0,0,1,2)
Low	L	(1,2,2,3)
Less than average	ML	(2,3,4,5)
Average	M	(4,5,5,6)
More than average	MH	(5,6,7,8)
High	H	(7,8,8,9)
Very high	VH	(8,9,9,10)

Table 2: Fuzzy weighted normalized matrix

Fuzzy decision making matrix and fuzzy weights	8	9	10	10	4	5	5	6	5	6	7	8	2	3	4	5	7	8	8	9
Sub-criteria	Strategic aspect				Institutional aspect				Infrastructure aspect				Social and cultural				Social capital aspect			
Brilliant strategic perspective	8	9	10	10	8	9	10	1	4	5	5	6	2	3	4	5	7	8	8	9
Goals	0	0	1	2	2	3	4	5	2	3	4	5	4	5	5	6	4	5	5	6
Measures	4	5	5	6	5	6	7	8	2	3	4	5	4	5	5	6	5	6	7	8
Political want	2	3	4	5	4	5	5	6	0	0	1	2	2	0	4	5	4	5	5	6
Comprehensive project of change management	0	0	1	2	1	2	2	3	4	5	5	6	2	3	4	5	2	3	4	5
RA (resources allocation) in network expansion	7	8	8	9	7	8	8	9	7	8	8	9	2	3	4	5	4	5	5	6
Committed leadership	8	9	10	10	7	8	8	9	8	9	1	1	4	5	5	6	5	6	7	8
Governmental support	2	3	4	5	7	8	8	9	4	5	5	6	2	3	4	5	7	8	8	9
Legal base	5	6	7	8	8	9	10	1	4	5	5	6	2	3	4	5	8	9	1	1
IT infrastructure	2	3	4	5	4	5	5	6	8	9	1	1	2	3	4	5	4	5	5	6
Personnel familiar with IT	0	3	1	2	2	3	4	5	7	8	8	9	0	0	1	2	2	3	4	5
Proper investment	2	3	4	5	7	8	8	9	8	9	1	1	0	0	1	2	4	5	5	6
Access to knowledge	8	9	10	10	7	8	8	9	7	8	8	9	2	3	4	5	2	3	4	5
Common reference model	5	6	7	8	8	9	10	1	8	9	1	1	2	3	4	5	2	3	4	5
Academic researches	0	0	1	2	4	5	5	6	5	6	7	8	0	0	1	2	0	0	1	2
Conferences and seminars	2	3	4	5	2	3	4	5	0	0	1	2	2	3	4	5	4	5	5	6
modeling	7	8	8	9	5	6	7	8	5	6	7	8	8	9	1	1	2	3	4	5
Horizontal structure	2	3	4	5	2	3	4	5	4	5	5	6	8	9	1	1	7	8	8	9
Appropriate pilot	7	8	8	9	4	5	5	6	2	3	4	5	2	3	4	5	0	0	1	2
Organizational learning improvement	7	8	8	9	0	0	1	2	8	9	1	1	5	6	7	8	5	6	7	8
Knowledge promotion	8	9	10	10	8	9	10	1	0	0	1	2	8	9	1	1	2	3	4	5
Support culture	0	0	1	2	8	9	10	1	2	3	4	5	4	5	5	6	8	9	1	1
Committed private sector	5	6	7	8	5	6	7	8	2	3	4	5	0	0	1	2	7	8	8	9
International network	2	3	4	5	4	5	5	6	2	3	4	5	7	8	8	9	5	6	7	8
Specialty networks	3	0	1	2	1	2	2	3	7	8	8	9	2	3	4	5	4	5	5	6
Due consideration of HR	7	8	8	9	7	8	8	9	5	9	1	1	5	6	7	8	0	0	1	2
High level training	8	9	10	10	7	8	8	9	7	6	7	8	8	9	1	1	7	8	8	9
Public awareness	2	3	4	5	7	8	8	9	0	0	1	2	4	5	5	6	2	3	4	5
Communicational learning	5	6	7	8	8	9	10	1	0	0	1	2	0	0	1	2	4	5	5	6
Social learning	2	3	4	5	4	5	5	6	7	8	8	9	2	3	4	5	8	9	1	1
Common values	0	0	1	2	2	3	4	5	8	9	1	1	7	8	8	9	5	6	7	8
Vast relations	2	3	4	5	7	8	8	9	7	8	8	9	8	9	1	1	0	0	1	2
Public trust	4	5	5	6	7	8	8	9	7	8	8	9	5	6	7	8	7	8	8	9

In real world, due to lack of sufficient information and/or inaccessibility of information, data are always in the form of fuzzy. Hence, we make attempt to use Topsis method with fuzzy data to prioritize the factors which may influence execution of management knowledge. The fuzzy values of lingual variables for acceptability of each strategy have been indicated in Table 1.

Fuzzy decision making matrix and weights of fuzzy aspects of management of knowledge were obtained through comments by the managers of Human Resources Department of Behnouth Co., as follows:

The normalized fuzzy matrix has been indicated in Table 2.

Table 2 Fuzzy weighted normalized matrix.

- Aspects
- Sub-criteria

Table 3 indicates the results of prioritizing sub-criteria using fuzzy Topsis technique in which di+ and di- represent the distance of each alternative from positive/negative ideal. Cli index for ranking the sub-criteria were used with due consideration of di+/di-.

Higher the value of Cli leads to higher priority for the related strategy.

Final matrix for ranking the indices can be seen in Table 3.

Table 4: Positive/negative ideal points and final weights

Aspects	di+	di-	cli	Rank
Brilliant strategic perspective	1.32884149	1.701164082	0.561439259	1
Goals	2.518369993	0.576067539	0.186162278	27
Measures	1.985282844	1.090659885	0.354557436	10
Political want	2.372950484	0.708536781	0.229933342	24
Comprehensive project of change management	4.090229464	0.575447932	0.123336417	33
RA (resources allocation) in network expansion	2.847622107	1.714911257	0.375868212	7
Committed leadership	2.536981962	1.919596614	0.430733259	3
Governmental support	3.198168193	1.119332156	0.259254676	22
Legal base	2.788161955	1.454515456	0.342829*613	12
IT infrastructure	3.317641022	1.250023932	0.273668044	20
Personnel familiar with IT	3.928613529	0.855380273	0.178800456	29
Proper investment	3.268632539	1.40068552	0.299976464	15
Access to knowledge	2.886822669	1.835053777	0.38862808	6
Common reference model	2.969644683	1.735868819	0.368901039	9
Academic researches	4.164345323	0.835221301	0.16705874	31
Conferences and seminars	3.916673101	0.64317849	0.141052505	32
modeling	2.943552172	1.561517834	0.346613445	11
Horizontal structure	3.228711875	0.903312277	0.218612536	25
Appropriate pilot	3.606848907	1.284936935	0.262672361	21
Organizational learning improvement	2.920686644	1.449122901	0.331621524	14
Knowledge promotion	1.690283681	1.441030295	0.460199873	2
Support culture	2.238917555	0.85500825	0.276350599	19
Committed private sector	1.862126655	1.241216256	0.399961039	5
International network	2.196407401	0.886168361	0.287476588	16
Specialty networks	3.786907556	0.772258459	0.169385905	30
Due consideration of HR	3.01078077	1.799454094	0.374088614	8
High level training	2.441515569	1.749536514	0.417445663	4
Public awareness	3.369556474	0.859198369	0.185621922	28
Communicational learning	3.473507404	1.194381668	0.255871905	23
Social learning	3.071625298	1.165481095	0.275065336	18
Common values	3.381553875	0.33992311	0.217500432	26
Vast relations	3.390745112	1.316142683	0.279620977	17
Public trust	2.776060938	1.437848779	0.341214899	13

CONCLUSION AND RECOMMENDATIONS

This paper dealt with the factors which influence the execution of management of knowledge in organizational level. After a review on the research history, we designed the effective elements which may have influence on the execution process. Questionnaires comprised of 5 main criteria which were “strategic”, “institutional” and “infrastructure”, cultural and social” and “social capital. Also we had 33 sub-criteria (including 33 aspects of management of knowledge). The questionnaires were distributed among 42 managers of Behnouth Co.

Using fuzzy Topsis technique, we prioritized sub-criteria of management of knowledge: “brilliant strategic perspective” was ranked first and “knowledge promotion”, “committed leadership”, “high level training to personnel” and “participation of private sector” were ranked second to five, respectively.

“Communicational learning”, “comprehensive project for change management” as well as “academic researches” were ranked lower. Because this research indicates the existing conditions of the organization and shows its preparedness to engage in execution of management of knowledge, also taking data which were obtained into account, we recommend that:

As once mentioned earlier, academic education and researches have very low ranks, so we recommend that the organization must pay serious attention when recruiting and employing persons for its positions. It must employ those who have higher education and have good capabilities in different capacities. Also it must be paid attention that high level training to personnel has a high rank and communicational learning ranks low. So it can be said that the trainings already given had not been efficient and applied enough. Therefore another recommendation is that the organization must give more efficient and more applied trainings to its personnel.

Concerning the “brilliant strategic perspective”, “committed leadership” and “access to knowledge” in organization, it is clear that the organization has a satisfactory position in terms of leadership and strategic decision. Leaders of the organization have good skills and capabilities as to execution of the strategies and rapid changes in managerial and leadership posts shall, by no means, be in the interest of the organization.

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