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Exploring Knowledge Strategy Dimensions Using Fuzzy AHP

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Abstract

Living in knowledge-based world and increasing competition between companies- especially in IT-based companies- in determining the best knowledge strategy lead to more attention to this concept. The purpose of this paper is to review previous studies on knowledge strategy and its dimensions. Then, after categorizing these dimensions, a popular multi-criteria decision-making (MCDM) method- AHP- in Fuzzy environment is used to evaluate dimensions of knowledge strategy (KS). The results show that knowledge sourcing, learning sourcing, learning speed are more effective dimensions of knowledge strategy. As every organization has a leading dimension in KS, IT-based companies should focus on these dimensions for better developing knowledge strategy.

Keywords: Knowledge Strategy (KS), Learning, Knowledge Sourcing, Fuzzy Set, AHP.

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Introduction

Nowadays, in the knowledge-based economy, companies are struggling to gain better competitiveness by deploying knowledge as their primary function (Grant 1996) because knowledge is as a strategic asset that is tied to the sustained growth and competitive positioning of the organization. Haggie & Kingston (2003) represent the importance of the process involving acquisition, sharing, using, employing, inventing, and producing knowledge to obtain strategic changes in the economic environment and also using rich information services, advanced technological applications, and applying the human mind as a rich knowledge capital to enhance the value of all facets of life.

Despite the active implementation of knowledge management projects, many companies have failed to understand the expected benefits of knowledge (Kim et al., 2003). Then, managers should seek ways to face the challenges of creating, sharing and utilizing knowledge to help their companies thrive. So, it is vital to create new in knowledge management area that is more compatible with knowledge economy. One of these concepts is knowledge strategy (KS) (von Krogh et al., 2001; Zack et al., 2009). To manage organizational knowledge effectively, a defined knowledge strategy is regarded as important (Bierly & Chakrabarti, 1996; Asoh, 2004). According to Zack (1999), KS is a general approach that helps companies to fill the gap between an organization's current and future intellectual requirements in pursuing competitive advantage.

Knowledge strategies express the basic guidelines on how to approach and manage knowledge in concrete company. An extensive review of the literature revealed that there is no general agreement on the concept of KS and its dimensions.

In this regard, special focus of this work is to examine the comprehensive literature review of knowledge strategy topic and determine its dimensions. The second objective of this study is to determine more effective dimensions of KS in an IT-based company by using Fuzzy AHP method and experts' judgments. In other words, the weights of dimensions indicate the preference and importance of each dimension for selecting knowledge strategy type in an organization. This paper is organized as follows: In the next section, the literature review on knowledge strategy and knowledge strategy types and related work is presented. Then, in Section 3, the research methodology and Fuzzy AHP method is described. Section 4 and 5 assign the case study and related findings. Finally, the paper finishes with a brief conclusion that summarizes the objective of this work.

Literature Review

The concept of Knowledge Strategy and related works

Compared to the notion of strategy, that of knowledge strategy is a relatively new topic in business literature, even though the concept of using knowledge as a strategic tool to obtain competitive advantage has been recognized since the dawn of organized business (Abdollahi et al., 2008; Zack, 2005). The relationship between the two terms "knowledge" and "strategy" has been stressed in the literature since more than two decades ago (Kogut and Zander 1992) because knowledge has been increasingly seen as a strategic weapon and a competitive element (Kasten 2011). Later, the development of the so-called “knowledge-based view of the firm” (Grant 1996; Sveiby 2001) and the growing interest in KM have made knowledge strategy a key topic of analysis (Bratianu and Bolisani, 2015).

According to knowledge-based view of the firm, knowledge strategy concept is a bridge between knowledge management and strategic management. The knowledge-based view believes that a company’s unique knowledge is the key source of competitive advantage, allowing it to integrate conventional resources in different ways and create superior value to customers. Knowledge strategy is a tool to identify this unique knowledge, either existing in the company or required for a projected situation, and draft ways to develop and/or capitalize on it (Mintzberg, 1979; Barney and Hesterly, 2010; Acur et al., 2012).

Donate & Canales (2012) believed that KS is like a road map for companies to explore and exploit organizational knowledge. The main purpose of this road map is to gain strategic goals that arise from corporate and business strategies. So, the development of KS should contain all the operations that are referred to in the creation, transfer and application of knowledge (Conner and Prahalad, 1996; Grant, 1996; Nonaka, 1994; Spender, 1996). All of these can contribute to following competitive advantage through innovation and enhancing efficiency (von Krogh et al., 2001). In turn, a firm can achieve superior performance from its ability to outperform competitors in generating new knowledge and using its current knowledge-base more effectively (Almeida et al., 2003; De Carolis and Deeds, 1998).

Kasten (2011) believed that knowledge strategy is as a component of the business strategy that provides a link between the organization’s strategic decisions and its knowledge structures and activities. These structures and activities often contain knowledge management systems, which places KS as the guiding principle of the knowledge management system.

According to Jennex and Olfman (2005, 2006) and also Jennex (2012), Knowledge Strategy is one of the main KM critical success factors (CSFs) which identifies users, sources, processes, storage strategy, knowledge, and links to knowledge for the KMS.

In the following, researchers focus on related works in the KS area to determine dimensions of KS. The first exploratory study in the context of knowledge strategies is conducted by Bierly & Chakrabarti (1996). They defined KS as "The set of collective responses of managers to the strategic learning needs of organization". These researchers examined knowledge strategy of 21 U.S. pharmaceutical industries from 1977 to 1991. The identified four knowledge strategy dimensions: knowledge source, radicalness of learning, speed of learning, and scope (breadth in the original study) of knowledge. Based on cluster analyzing, four generic knowledge strategy groups identified: loners, explorers, exploiters, and innovators.

Zack (2002) applied examples from 25 companies and presented a framework to evaluate an organization’s competitive position regarding its intellectual resources and capabilities. This framework recommends that organizations carry out a knowledge-based

SWOT (strengths, weaknesses, opportunities, and threats) analysis, compare their knowledge to their competitors and to the knowledge required to operate their own strategy. It provides a framework for characterizing the degree of aggressiveness of a knowledge strategy for closing strategic knowledge gaps.

In another work, Skyrme (2000) proposed hypotheses about KS. He determined two types of strategy: 1)make better use of the knowledge that already exists within the firm (He believed that very often people in one part of the company fail to solve customer's problems because the knowledge they need is elsewhere in the company but not known or accessible to them); 2) better innovation. It means creation of new knowledge and turning ideas into valuable products and services. Although category of KS types that presented by Bierly & Chakrabarti (1996) and Zack (1999) have validity and attractiveness between knowledge management researchers, but operationalizing of them is so difficult, especially for exploratory studies. For this reason, there is a little research based on these categories of KS (Asoh, 2004). For example, de Pablos (2002) used Bierly and Chakrabarty's typology of knowledge strategies in 123 Spanish companies and classified them to four groups.

The main result of this study is that knowledge strategy effects on organizational performance. Given some theoretical studies, Bierly & Daly (2002) presented a definition of KS as a firm's set of strategic choices regarding two knowledge domains: 1) the creation or acquisition of new knowledge; and (2) the ability to leverage existing knowledge to create new organizational products and processes. They mentioned that knowledge strategy of an organization demonstrates guidelines about how to allocate its knowledge sources. Also, in another large-scale study that conducted by Kasten (2006), the concept of knowledge strategy and its impact on the manner in which companies manipulate their organization's knowledge organized. From the viewpoint of Kasten, Knowledge strategy as a set of guidelines that shape organization's decision making regarding the acquisition, storage, manipulation, and application of its knowledge base. In this exploratory study, various industries such as healthcare, financial services and insurance were examined. According to the results of this study 1) knowledge strategy defines an informal set of guidelines rather than a formal set of rules; 2) there is a recognizable relationship between a company's business strategy type and the characteristics of its knowledge strategy; 3) knowledge strategies can be classified along a number of dimensions, including the organization's tendency to set knowledge in humans or technology, the propensity of a company to be proactive or reactive in its knowledge development or gathering, and the breadth with which it examines and develops knowledge.

Denford & Chan (2011) emphasized on two existing knowledge strategy typologies: the typology of Bierly & Chakrabarti (1996) including Loners, Explorers, Exploiters and Innovators and the typology of von Kroghet al. (2001) including Leveraging, Expanding, Appropriating, and Probing. They compared these typologies and mapped onto knowledge strategy dimensions, creating a set of eight ideal knowledge strategy profiles. Then, these profiles used to eight case studies to develop a better understanding of knowledge strategies by showing how the two typologies are related. Key results showed that there is a hierarchy between the two knowledge strategy typologies: the typology of Bierly & Chakrabarti (1996) executes at the grand strategy level, while the second typology (von Kroghet al., 2001) operates at the operational strategy level. Also, other findings of this study recommended that consistent portfolios of operational knowledge strategies can support an organization's grand knowledge strategy.

Donate & Canales (2012) used a cluster analysis to study the effect of KS on business performance and innovation based on a cross-sectional sample of Spanish companies. Based on empirical analysis, four types of KS determined: proactive, moderate, passive and inconsistent, each of them having various effects on business performance and innovation. Donate-Manzanares, M., & Guadamillas-Gomez (2007) focused on the relationship between innovation strategy, KS and firm performance. They established four types of KSs: proactive, moderate, passive and inconsistent. By using multiple regression analysis with interaction effects, they found that KS moderates the relationship between innovation strategy and firm performance. Hung (2015) focused on influence of knowledge strategy (i.e. knowing) on innovation through knowledge networking. He explained that knowledge networking influences on innovation capability directly and indirectly. The direct influence of knowledge networking is through alliances and interactions to bridge the emerging gaps between market and technology. Also, its indirect influences on innovation are in two ways: 1) it facilitates the influence of knowledge base (human capital and organizational capital) on innovation through determining opportunities and exchanging knowledge; and 2) creates a conduit for knowledge exploration and exploitation strategies.

Bagnoli & Giachetti (2015) performed both qualitative/quantitative analysis on a sample of small firms in northeast Italy to examine the alignment between knowledge strategies and competitive strategies. They specified two types of internal/external knowledge strategy: exploitation and exploration. Exploration means the generation of radical new knowledge by investing in R&D activities and challenging the existing frame of reference. It contains activities captured by terms like search, variation, risk-taking, experimentation, discovery and innovation. In contrast, exploitation stresses the incremental enhancement of the existing knowledge, typically done within an existing frame of reference. Exploitation strategy includes activities like refinement, improvement, static efficiency, enhancement and amelioration. According to Spender (1992) exploration strategy needs higher costs and increased risk for a company because it may disrupt the rules and routines within the firm, but is more likely to lead to a sustainable competitive advantage. While, exploitation strategy is more likely to maximize profits in the short term because its returns are less remote in time, less distant from the initial status quo of the firm, and more certain (Spender, 1992).

As mentioned above, studies and researches presented different meanings and dimensions of knowledge strategy. To summarize, Table 1 shows these definitions and dimensions of KS with appropriate references.

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Table 1 Definition and Dimensions of KS

Definition	Dimensions	References
The collective response of managers to the strategic learning needs of the firm	✓ learning (internal/external-radical/incremental) ✓ learning speed (slow/ fast) ✓ Breath of knowledge base (board/ narrow)	Bierly and Chakrabarti (1996)
Balancing knowledge-based resources and capabilities to the knowledge required for providing products or services in ways superior to those of competitors.	✓ Knowledge sourcing (internal/external) ✓ Exploration/exploitation	Zack (1999)
	✓ learning (internal/external-radical/incremental) ✓ learning speed (slow/ fast) ✓ Breath of knowledge base (board/ narrow)	de Pablos (2002)
Integrated set of strategic choices an organization makes and excuses to orientate its knowledge-related resources so as to ensure organizational goals	✓ Knowledge sourcing (internal/external) ✓ Learning type (individual/collective) ✓ learning speed, learning breath ✓ knowledge base (board/ deep) ✓ Exploration/exploitation	Asoh (2004)
The set of guidelines that shape the decisions that an organization makes regarding the acquisition, storage, manipulation and application of its knowledge base.	✓ Knowledge scope (board/deep) ✓ Approach to knowledge seeking and development (proactive/reactive) ✓ Knowledge storage (in people/in technology)	Kasten (2006)
Strategies that companies adopt to maximize the returns on their knowledge asset	-----------	Skyrem (2000)
A firm's set of strategic choices regarding two knowledge domains: exploration and exploitation	✓ Exploration and exploitation	Bierly and Daly (2002)
A road map for companies to explore and exploit organizational knowledge. The main purpose is to gain strategic goals that arise from corporate and business strategies	✓ proactive, moderate, passive and inconsistent	Donate & Canales (2012)
	✓ Exploration and exploitation	Bagnoli & Giachetti (2015)

Based on findings that are presented in Table 1, KS dimensions are categorized in two main groups: knowledge-oriented dimensions and learning-oriented dimensions. These groups are shown in Table 2. In addition, definition of each dimension is specified in Table 2.

Table 2 Categorization of KS dimensions

Groups	Dimensions	Definition
Knowledge-oriented	Knowledge sourcing	Knowledge sources within organization's boundary (internal) or outside organization's boundary (external)
	Knowledge scope	Generic knowledge (board) or specialized knowledge (deep)
	Knowledge storage	Storing and sharing knowledge via technology(in technology) or via person (in people)
	Knowledge seeking and development	Generating and experimenting new knowledge (exploration) or refining and using existing knowledge (exploitation)
Learning-oriented	Learning source	Learning sources within organization's boundary (internal) or outside organization's boundary (external)
	Learning speed	How fast the firm rotates around it's learning cycle (fast or slow)
	Learning type	Individual learning practices (individual) or group learning practices (collective)

Attending to the literature review (Bierly & Chakrabarti, 1996; Zack, 1999; Asoh, 2004; Bierly & Daly, 2007), and expert's opinions, three knowledge strategy types namely *innovator, exploiter, and explorer* are identified in this study.

- *Innovator* is the most aggressive and fastest learners, combining internal, external, radical, and incremental learning.
- *Explorer* is a creator or acquirer of the knowledge required to be competitive in its strategic position. This type of KS has high levels of radicalness but is similar to other groups in other characteristics.
- *Exploiter* has capabilities that exceed the requirements of its competitive position, allowing it to use its knowledge to deepen or broaden its position. Exploiters have low R&D expenditure and broad but shallow knowledge bases. An innovator integrates the best characteristics of an explorer and an exploiter.

Research Methodology

The purpose of this work is to determine which dimension of KS is more effective on selecting KS types in IT- based companies. So, a multi-criteria decision-making method- AHP- is used in Fuzzy environment.

Fuzzy analytic hierarchy process method

First time, Zadeh introduced the fuzzy set theory to deal with vagueness of human thought. A fuzzy set is a class of objects with a continuum of grades of membership. Such a set is characterized by a membership function which assigns to each object a grade of membership ranging between zero and one (Zadeh, 1965). This powerful method of multiple criteria decision-making (MCDM) proposed by Saaty (1980). Although the purpose of AHP is to capture the expert's knowledge, the conventional AHP approach still may not completely reflect the human thinking style (Kahraman et al. 2003). In fact, due to the fuzzy nature of the decision process, decision-makers are usually unable to explicit about their preferences. So, this tool helps them providing an ability of giving interval judgments instead of point judgments (Bozbura & Beskese, 2007). The pure AHP model is often criticized for some reasons: 1) it provides unbalanced scale of judgments (Deng, 1999); 2) it applies in nearly crisp-information decision (Yang & Chen, 2004); and 3) the ranking of this method is rather imprecise (Sun, 2010). To improve these problems, different researchers combine fuzzy theory with AHP. Van Laarhoven and Pedrycz (1983) were the first researchers and proposed fuzzy AHP (FAHP). Later on, Buckley (1985) develops Saaty's AHP method in which decision makers can express their preference using fuzzy ratios instead of crisp values. In 1996, Chang presented a new approach - a fuzzy extent analysis- for AHP, which has steps as the same as Saaty's crisp AHP. In this paper the extent fuzzy AHP is utilized, which was originally introduced by Chang (1996).

Let X = {x1, x2, x3... xn} an object set, and G = {g1, g2, g3..., gn} be a goal set. Then, each object is taken and extent analysis for each goal is carried out, respectively. So, m extent analysis values for each object can be obtained and shown as following symbols:

$$\tilde{M}_{g_i}^1, \tilde{M}_{g_i}^2, ..., \tilde{M}_{g_i}^m, \quad i=1, 2\ldots, n \tag{1}$$

$\tilde{M}_{g_i}^j$ (j=1, 2, 3, … , m) are all triangular fuzzy numbers (TFNs). The steps of the Chang's (1996) approach can be summarized as follows:

Step 1: The value of fuzzy synthetic extent with respect to the i-th object is defined as:

$$S_i = \sum_{j=1}^{m} \tilde{M}_{g_i}^j \otimes \left[\sum_{i=1}^{n} \sum_{j=1}^{m} \tilde{M}_{g_i}^j \right]^{-1} \tag{2}$$

Where $\otimes$ signifies the extended multiplication of two fuzzy numbers. In order to obtain $\sum_{j=1}^{m} \tilde{M}_{g_i}^j$, it carries out the addition of M extent analysis values for a particular matrix such that,

$$\sum_{j=1}^{m} \tilde{M}_{g_i}^j = \left(\sum_{j=1}^{m} l_j, \sum_{j=1}^{m} m_j, \sum_{j=1}^{m} u_j \right) \tag{3}$$

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And for obtain $\left[\sum_{i=1}^{n}\sum_{j=1}^{m}\tilde{M}_{g_i}^{j}\right]^{-1}$, it carries out the fuzzy addition operation of $\tilde{M}_{g_i}^{j}$ (j =1, 2, …, m) values such that,

$$\sum_{i=1}^{n}\sum_{j=1}^{m}\tilde{M}_{g_i}^{j} = \left(\sum_{i=1}^{n} l_i , \sum_{i=1}^{n} m_i , \sum_{i=1}^{n} u_i\right) \tag{4}$$

Then, the inverse of the vector is computed as,

$$\left[\sum_{i=1}^{n}\sum_{j=1}^{m}\tilde{M}_{g_i}^{j}\right]^{-1} = \left(\frac{1}{\sum_{i=1}^{n} u_i}, \frac{1}{\sum_{i=1}^{n} m_i}, \frac{1}{\sum_{i=1}^{n} l_i}\right) \quad where \quad u_i , m_i , l_i > 0 \tag{5}$$

Finally, to calculate the S_j, it performs the following multiplication:

$$S_i = \sum_{j=1}^{m}\tilde{M}_{g_i}^{j} \otimes \left[\sum_{i=1}^{n}\sum_{j=1}^{m}\tilde{M}_{g_i}^{j}\right]^{-1} = \left(\sum_{j=1}^{m} l_j \otimes \sum_{i=1}^{n} l_i , \sum_{j=1}^{m} m_j \otimes \sum_{i=1}^{n} m_i , \sum_{j=1}^{m} u_j \otimes \sum_{i=1}^{n} u_i\right) \tag{6}$$

Step 2: The degree of possibility of $\tilde{M}_2 = (l_2, m_2, u_2) \geq \tilde{M}_1 = (l_1, m_1, u_1)$ is as follows:

$$V(\tilde{M}_2 \geq \tilde{M}_1) = \sup[\min(\tilde{M}_1(x), \tilde{M}_2(x))] \tag{7}$$

This can be equivalently expressed as:

$$V(\tilde{M}_2 \geq \tilde{M}_1) = hgt(\tilde{M}_1 \cap \tilde{M}_2) = \tilde{M}_2(d) = \begin{cases} 1 & if \ m_2 \geq m_1 \\ 0 & if \ l_1 \geq u_2 \\ \dfrac{l_1 - u_2}{(m_2 - u_2) - (m_1 - l_1)}, & otherwise \end{cases} \tag{8}$$

Fig. 1 describes $V(\tilde{M}_2 \geq \tilde{M}_1)$ for the case d for the case $m_1 < l_1 < u_2 < m_1$, where d is the abscissa value corresponding to the highest crossover point D between $\tilde{M}_1$ and $\tilde{M}_2$, to compare $\tilde{M}_1$ and $\tilde{M}_2$, it need both of the values $V(\tilde{M}_1 \geq \tilde{M}_2)$ and $V(\tilde{M}_2 \geq \tilde{M}_1)$.

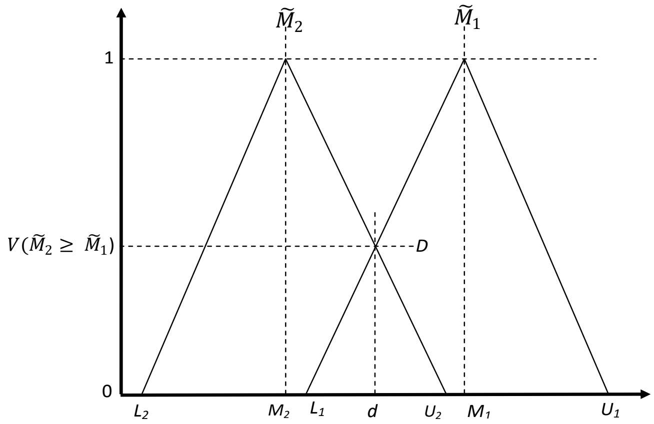

Figure 1 The intersection between M_1 and M_2 (Chang 1996)

Step 3: The degree of possibility for a convex fuzzy number to be greater than k convex fuzzy numbers M_i (i=1, 2, …, K) is computed as :

$$V(\widetilde{M} \geq \widetilde{M}_1, \widetilde{M}_2, \ldots, \widetilde{M}_k) = \min V(\widetilde{M} \geq \widetilde{M}_i), \quad i=1,2,\ldots,k \tag{9}$$

Step 4: $W = (\min V(s_1 \geq s_k), \min V(s_2 \geq s_k), \ldots, \min V(s_n \geq s_k))^T$, is the weight vector for

k = 1, . . . , n.

It is obvious that decision makers (Ds) from various backgrounds may define different weight vectors. Because of their imprecise evaluation and also serious persecution during decision process, a group decision making based on FAHP proposes. This can improve pair-wise comparisons. In this paper, to combine opinions of different decision makers and construct the group paired comparison matrix, geometric mean is used. It should be noted that, a linguistic scale has been developed to perform a pair-wise comparison among the parameters (Table 3).

Table 3 Linguistic scale with corresponding triangular fuzzy numbers

Linguistic scale	Triangular fuzzy numbers			Inverse of triangular fuzzy numbers		
	l	m	u	l	m	u
Equal important	1	1	1	1	1	1
Weakly more important	1	3	5	1/5	1/3	1
More important	3	5	7	1/7	1/5	1/3
Strongly more important	5	7	9	1/9	1/7	1/5
Absolutely more important	7	9	11	1/11	1/9	1/7

Case Study

As previously mentioned, the purpose of this work is to determine the more effective dimensions of knowledge strategy in IT- based companies. Firstly, by reviewing the related literature comprehensively, these dimensions (hereafter, criteria) extracted. These criteria as shown in Table 2, are: Knowledge sourcing (C1), Knowledge scope (C2), Knowledge storage (C3), Knowledge seeking and development (C4), Learning source (C5), Learning speed (C6) and Learning type (C7). Researchers identified three important decision makers (Ds) in an IT-based company in Tehran who had good experience about knowledge management area to perform pair-wise comparisons in Fuzzy AHP technique.

Findings

In the first step, the experts are given the task of forming individual pair-wise comparison matrix by using the scale given in Table 3. Geometric means of these values are found to construct a group decision matrix (Table 4).

Table 4 Aggregated decision matrix

Aggregated	C1			C2			C3			C4			C5			C6			C7		
	L	m	u	l	m	u	l	m	u	l	m	u	L	m	u	l	m	u	l	m	u
C1	1	1	1	1	2.08	2.92	2.08	4.22	6.26	1	1	1	1	1	1	1	1	1	1	3	5
C2	0.34	0.48	1	1	1	1	1	3	5	0.34	0.48	1	1	1	1	0.58	0.69	1	1	1	1
C3	0.16	0.24	0.48	0.2	0.33	1	1	1	1	0.52	0.58	0.69	0.2	0.33	1	1	1	1	0.34	0.48	1
C4	1	1	1	1	2.08	2.92	1.44	1.71	1.91	1	1	1	3	5	7	1	1	1	1	1	1
C5	1	1	1	1	1	1	1	3	5	0.14	0.2	0.33	1	1	1	1	1	1	1	1	1
C6	1	1	1	1	1.44	1.7	1	1	1	1	1	1	1	1	1	1	1	1	4.22	6.26	8.28
C7	0.2	0.33	1	1	1	1	1	2.08	2.92	1	1	1	1	1	1	0.12	0.15	0.23	1	1	1

After forming group decision matrix, the weight of all criteria calculated. The weight calculation details are given below. Because of the other calculations are similar for each comparison matrix, these are not given here and can be done simply according the computations below. The value of fuzzy synthetic extent respect to the ith object (i= 1,2,...) is calculated as:

$S_1 = (8.08, 13.3, 18.18) \otimes (0.0118, 0.0153, 0.0208) = (0.0953, 0.2034, 0.378)$

$S_2 = (5.26, 7.56, 11) \otimes (0.0118, 0.0153, 0.0208) = (0.062, 0.1156, 0.228)$

$S_3 = (3.42, 3.96, 6.17) \otimes (0.0118, 0.0153, 0.0208) = (0.0403, 0.06, 0.128)$

$S_4 = (9.44, 12.79, 15.83) \otimes (0.0118, 0.0153, 0.0208) = (0.111, 0.195, 0.329)$

$S_5 = (6.14, 8.2, 10.33) \otimes (0.0118, 0.0153, 0.0208) = (0.072, 0.125, 0.214)$

$S_6 = (10.22, 12.7, 14.98) \otimes (0.0118, 0.0153, 0.0208) = (0.1205, 0.194, 0.311)$

S_7 = (5.32, 6.56, 8.15) ⊗ (0.0118, 0.0153, 0.0208) = (0.062, 0.1003, 0.17)

These values are shown in Table 5.

Table 5 Fuzzy synthetic extent of each criterion

S_i	l_k	m_k	u_k
S_1	0.095	0.203	0.380
S_2	0.062	0.117	0.230
S_3	0.04	0.061	0.129
S_4	0.112	0.196	0.331
S_5	0.073	0.126	0.216
S_6	0.121	0.195	0.313
S_7	0.063	0.101	0.170

Then V values (degree of possibility matrix) calculated using these vectors are shown in Table 6.

Table 6 V values

V	S_1	S_2	S_3	S_4	S_5	S_6	S_7
S_1	-	0.608	0.19	0.968	0.606	0.96	0.421
S_2	1	-	0.541	1	1	1	0.867
S_3	1	1	-	1	1	1	1
S_4	1	0.6	0.114	-	0.597	0.993	0.382
S_5	1	0.949	0.465	1	-	1	0.797
S_6	1	0.585	0.058	1	0.597	-	0.346
S_7	1	1	0.623	1	1	1	-

After that, minimum value of each row in degree of possibility matrix calculates (Table 7). For example, minimum value for the first row (S_2) is:

Min (S_2) = Min (0.608, 1, 0.6, 0.949, 0.585, 1) = 0.585

Table 7 Minimum value of each row

S1	S2	S3	S4	S5	S6	S7
1	0.585	0.058	0.968	0.579	0.96	.346

Then these values are normalized as follows:

Sum (1, 0.585, 0.058, 0.968, 0.579, 0.96, 0.346) = 4.496

Weight of C1= 1/ 4.496= 0.222

So, final weights of all criteria are shown in Table 8.

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Table 8 Final weight of criteria

Criteria	**C_1**	**C_2**	**C_3**	**C_4**	**C_5**	**C_6**	**C_7**
Weight	0.222	0.130	0.013	0.215	0.129	0.213	0.077

According to the weights of criteria, knowledge sourcing (C1), Knowledge seeking and development (C4) and learning speed (C6) have the highest effect in knowledge strategy respectively.

Conclusion

According to Drucker (1969), knowledge is as the central energy of modern society. In today's competitive business environment, all companies want to get the most from their business' knowledge. They need to have a strategic approach to discover, collect and share it. It is done through a Knowledge Strategy (KS). In fact, KS is a new concept that shows the combination of knowledge management and strategic management. The aim of this semantic construct is to create new value through considering knowledge as a strategic resource in managerial decision making. Therefore, given the importance of KS, managers of the companies understand that knowledge strategy is necessary to measure which resources are needed to get the desired KS position. Identification of some factors can help companies to improve their efficiency.

Many researches and studies have focused on concept of KS, its dimensions, and also KS typology. One of the important elements for selecting the KS type in companies is identification of more effective dimensions of KS. Therefore, researchers tried to review all related literature and extract main dimensions of KS. The contribution of this work is to categorize these dimensions in two groups: knowledge-oriented and learning-oriented. Also, three KS types (innovator, explorer and exploiter) determined. By using Fuzzy AHP, the weight of each dimension is determined. As mentioned in finding part, three dimensions namely knowledge sourcing, Knowledge seeking and development, and learning speed allocated more weight. It means that IT-based companies should focus on these dimensions to better develop their knowledge strategy. Although, other dimensions like knowledge scope, knowledge storage, learning source and learning type should be considered in KS development.

References

Abdollahi, A., Rezaeian, A., & Mohseni, M. (2008). Knowledge strategy: linking knowledge resources to competitive strategy. *World Applied Sciences Journal*, 4(2), 08-11.

Almeida, P., Phene, A., & Grant, R. (2003). Innovation and knowledge management: Scanning, sourcing, and integration. *Handbook of organizational learning and knowledge management, 356-371*.

Asoh, D. A. (2004). Business and Knowledge Strategies: alignment and performance impact analysis (Doctoral dissertation, University at Albany, Doctoral Program in Information Science).

Bagnoli, C., & Giachetti, C. (2015). Aligning knowledge strategy and competitive strategy in small firms. *Journal of Business Economics and Management*, 16(3), 571-598.

Bierly, P. E., & Daly, P. (2002). Aligning human resource management practices and knowledge strategies. *The strategic management of intellectual capital and organizational knowledge*, 277-295.

Bierly, P., & Chakrabarti, A. (1996). Generic knowledge strategies in the US pharmaceutical industry. *Strategic management journal*, *17*(S2), 123-135.

Bierly, P., & Chakrabarti, A. (1996). Generic knowledge strategies in the US pharmaceutical industry. *Strategic management journal*, *17*(S2), 123-135.

Bozbura, F. T., & Beskese, A. (2007). Prioritization of organizational capital measurement indicators using fuzzy AHP. *International Journal of Approximate Reasoning*, 44(2), 124-147.

Bratianu, C., & Bolisani, E. (2015, September). Knowledge Strategy: An Integrated Approach for Managing Uncertainty. In *European Conference on Knowledge Management* (p. 169). Academic Conferences International Limited.

Chang, D. Y. (1996). Applications of the extent analysis method on fuzzy AHP. *European journal of operational research*, 95(3), 649-655.

Conner, K.R. & Prahalad, C.K. (1996). A resource-based theory of the firm: Knowledge versus portunism. *Organization Science*, 7(5), 477–501.

DeCarolis, D. M., & Deeds, D. L. (1999). The impact of stocks and flows of organizational knowledge on firm performance: An empirical investigation of the biotechnology industry. *Strategic management journal*, 953-968.

Denford, J. S., & Chan, Y. E. (2011). Knowledge strategy typologies: defining dimensions and relationships. *Knowledge Management Research & Practice*, 9(2), 102-119.

Donate, M. J., & Canales, J. I. (2012). A new approach to the concept of knowledge strategy. *Journal of Knowledge Management*, 16(1), 22-44.

Donate-Manzanares, M., & Guadamillas-Gomez, F. (2007). The relationship between innovation and knowledge strategies: Its impact on business performance. *International Journal of Knowledge Management Studies*, *1*(3-4), 388-422.

Grant, R. M. (1996). Toward a knowledge-based theory of the firm. *Strategic management journal*, 17(S2), 109-122.

Haggie, K., & Kingston, J. (2003). Choosing your knowledge management strategy. *Journal of Knowledge Management Practice*, 4(4).

Hung, H. M. (2015). Influence of knowledge networking, knowledge base, and knowledge strategy on innovation capability. *International Journal of Business and Systems Research*, *9*(2), 138-153.

Jennex, M.E. & Olfman, L., (2005). Assessing Knowledge Management Success. *International Journal of Knowledge Management*, 1(2), 33-49.

Jennex, M.E. & Olfman, L., (2006). A Model of Knowledge Management Success. *International Journal of Knowledge Management*, 2(3), 51-68.

Jennex, M.E. (2012). Identifying the components of a knowledge management strategy. *Proceedings of the Eighteenth Americas Conference on Information Systems, Seattle, Washington, August 9-12.*

Kahraman, C., Cebeci, U., & Ulukan, Z. (2003). Multi-criteria supplier selection using fuzzy AHP. *Logistics Information Management*, 16(6), 382-394.

Kasten, J. (2006). Knowledge strategy drivers: An exploratory study (Doctoral dissertation, Long Island University).

Kasten, J. (2011). Knowledge strategy and its influence on knowledge organization. *NASKO*, *1*(1), 100-104.

Kim, Y. G., Yu, S. H., & Lee, J. H. (2003). Knowledge strategy planning: methodology and case. *Expert systems with applications, 24*(3), 295-307.

Kogut, B. and Zander, U. (1992). Knowledge of the firm, combinative capabilities, and the replication of technology, *Organization Science*, 3(3), 383-97.

Mládková, L. (2014). Knowledge Strategy: Key Player or Relict of the Past? *Procedia-Social and Behavioral Sciences*, 150, 628-636.

Nonaka, I. (1994). A dynamic theory of organizational knowledge creation. *Organization Science*, 5(1), 14–37.

Pablos, P. O. D. (2002). Knowledge management and organizational learning: typologies of knowledge strategies in the Spanish manufacturing industry from 1995 to 1999. *Journal of Knowledge Management*, *6*(1), 52-62.

Saaty, T. 1980, The Analytic Hierarchy Process. *McGraw-Hill*, New York.

Skyrme, D. J. (2000). Developing a knowledge strategy: from management to leadership. *Knowledge management: Classic and contemporary works*, 61-84.

Spender, J. C. (1992). Limits to learning from the West: How Western management advice may prove limited in Eastern Europe. *The International Executive, 34*(5), 389-413.

Spender, J.C. (1996). Making knowledge the basis of a dynamic theory of the firm. *Strategic Management Journal*, 17, 45–62.

Sun, C. C. (2010). A performance evaluation model by integrating fuzzy AHP and fuzzy TOPSIS methods. *Expert systems with applications*, 37(12), 7745-7754.

Sveiby, K. E. (2001). A knowledge-based theory of the firm to guide in strategy formulation, *Intellectual Capital*, 2(4), 344-358.

Van Laarhoven, P. J. M., & Pedrycz, W. (1983). A fuzzy extension of Saaty's priority theory. *Fuzzy sets and Systems*, 11(1), 199-227.

Von Krogh, G., Nonaka, I., & Aben, M. (2001). Making the most of your company's knowledge: a strategic framework. *Long range planning*, *34*(4), 421-439.

Zack, M. H. (2002). Developing a Knowledge Strategy,[w:] The Strategic Management of Intellectual Capital and Organizational Knowledge, eds. CW Choo, N. Bontis.

Zack, M. H. (2005). The strategic advantage of knowledge and learning. *International Journal of Learning and Intellectual Capital*, *2*(1), 1-20.

Zack, M.H., 1999. Developing a knowledge Strategy. *California Manage. Rev.*, 14(3): 125-145.

Zadeh, L. A. (1965). Fuzzy sets. *Information and control*, 8(3), 338-353.