

Evaluation success of knowledge management in supply chain using fuzzy DEMATEL method

Ali Javidi

Department of Executive Management, Science and Research Branch, Islamic Azad University, Qazvin, Iran

Abstract: Knowledge management has a relatively short history since it is a new discipline. It has been developed as a conscious discipline by means of the published works of the academics and pioneers. The aim of this paper is Evaluation success of knowledge management in supply chain using fuzzy DEMATEL method. We can observe general clusters into cause and effect groups. Generally the criteria that are part of the effect cluster include 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13 and 14; the cause cluster includes 15, 16, 17, 18, 19, 20, 21, 22, 23, 24 and 25. The causal relationships among criteria can be depicted as the causal diagram (Fig. 1). this figure is shown that Willingness and Attitude is the most influence and the strongest connection to other criteria. This prominent advantage can be considered as one of the contribution of this paper. This proposed approach demonstrated with empirical case of an Iran Khodro Industrial Group (IKCO.CO) & SAPCO (Supplying Automotive Parts Company of Iran Khodro) in Iran.

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1. Introduction

In the new economy of the new millennium, knowledge has emerged as an asset to be valued, developed and managed. Several authors argue that knowledge has become a direct competitive advantage for companies, or that it is certainly the best resource and the only sustainable competitive advantage (Armstrong, 2006; Ishak, Eze, & Ling, 2010; Sumi, 2011; Ulrich, 1998). Knowledge is defined as the ability to sustain the coordinated deployment of assets and capabilities in a way that helps the firm achieve its goals (Soliman, 2000). To the organization, knowledge is defined as what people know about customers, products, processes, mistakes and success (Bollinger & Smith, 2001; Ishak, Eze, & Ling, 2010). Just like knowledge itself, knowledge management is difficult to define. The working definition of knowledge is that Knowledge must involve an agent, who uses knowledge to perform actions necessary to reach a goal. Knowledge can and should be evaluated by the decisions or actions to which it leads. However, defining what knowledge management understands may be somewhat simpler than defining knowledge on its own. The idea of 'management' gives us a starting point when considering, for example, the activities that make it up, explaining the processes of creation and transfer or showing its main goals and objectives without the need to define what is understood by knowledge. Consequently, in literature there are more ideas and definitions on knowledge management than just on knowledge, although these are not always clear

as there are numerous terms connected with the concept (Lloria, 2008). To give an example, Peter Drucker and Strassman observed in their studies published in 1970s that information and available information were perceived as a valuable asset in the organizations. In addition, Senge focused on cultural elements in knowledge management in his study entitled "learning organizations".

The SC has some difficulties and challenges to promote KM such as KM is not integrated into business processes; the performance of KM is difficult to assess; the participation level of KM is low; and the funds of KM are insufficient (Zhao et al., 2012). If top management is not committed to KM adoption in SC, it seems to have led to a situation where a common understanding concerning organizational vision, strategies and supplier/customer relationship management was not present (Natti & Ojaslo, 2008). The development of knowledge-based SC depends on the nature of knowledge flow in the entire chain. SC partners will find it very useful to share decision knowledge on a timely basis. However managerial mindsets and corporate culture are the main hurdle for it (Shih, Hsu, Zhu, & Balasubramanian, 2012).

2. Evaluation criteria's of KM adoption in SC

Based on the previous literatures, we focus on Twenty-five Effective factors in success of knowledge management in supply chain. The factors used in relevant literatures are listed in Table 1.

Table 1. Evaluation criteria's of KM adoption in SC

	Code	No
Knowledge exchange and value addition in SC	C ₁	1
Virtual teaming	C ₂	2
Knowledge capture	C ₃	3
Capacity to develop knowledge within SC	C ₄	4
Employee involvement	C ₅	5
Employee training and education	C ₆	6
Mining customer knowledge	C ₇	7
Top management support	C ₈	8
Organization structure	C ₉	9
Defined roles and responsibilities of SC members	C ₁₀	10
Trustworthy teamwork to exchange knowledge within SC	C ₁₁	11
Communication among the SC members	C ₁₂	12
Ethics and culture	C ₁₃	13
Mutual confidence among supply chain members	C ₁₄	14
Learning chain	C ₁₅	15
Networking techniques	C ₁₆	16
Communication and collaboration techniques	C ₁₇	17
Service exchange	C ₁₈	18
Supplier development (SD) program	C ₁₉	19
Data and information Security	C ₂₀	20
Decision knowledge sharing	C ₂₁	21
Knowledge redundancy	C ₂₂	22
Integration of knowledge and information flow	C ₂₃	23
Incentive alignment	C ₂₄	24
Employee empowerment	C ₂₅	25

3. Fuzzy DEMATEL

DEMATEL a variety of methods to make decisions based on paired comparisons is the benefit of the judgment of experts in extracting and structuring of a system by systematically applying the principles of graph theory, a hierarchical structure of agents in the system, along with the impact and influence relations between the elements is obtained, so that the intensity of these relationships and their importance will be given a numerical score.

Also, in order to compare each of the 5 criteria used included the following words and phrases equivalents of fuzzy values are shown in Table 2.

Table 2 - verbal expressions used in the values of R and equivalents

The fuzzy	Verbal Phrase
(1.0000 ,1.0000 ,1.0000)	No effect
(4.0000 ,3.0000 ,2.0000)	Very low impact
(6.0000 ,5.0000 ,4.0000)	Low impact
(8.0000 ,7.0000 ,6.0000)	High Impact
(9.0000 ,9.0000 ,8.0000)	Huge effect

The matrix can be $\tilde{x}_{ij} = (l_{ij}, m_{ij}, u_{ij})$ triangular fuzzy numbers $\tilde{x}_{ii} = (i = 1,2,3, \dots, n)$ and fuzzy numbers (0,0,0) are considered.

For consideration by all the experts take the arithmetic mean of the formula 1.

Formula (1)

$$\tilde{z} = \frac{\tilde{x}^1 \oplus \tilde{x}^2 \oplus \tilde{x}^3 \oplus \dots \oplus \tilde{x}^p}{p}$$

In this formula, p the number of experts and, respectively $\tilde{x}^1, \tilde{x}^2, \dots, \tilde{x}^p$ paired comparison matrix Expert 1, Expert 2 is a triangular fuzzy number and is a Certified p. \tilde{z} Is a triangular fuzzy number is $\tilde{z}_{ij} = (l'_{ij}, m'_{ij}, u'_{ij})$.

To normalize the matrix obtained from the use of formulas 2 and 3

Formulas (2)

$$\tilde{H}_{ij} = \frac{\tilde{z}_{ij}}{r} = \left(\frac{l'_{ij}}{r}, \frac{m'_{ij}}{r}, \frac{u'_{ij}}{r} \right) = (l''_{ij}, m''_{ij}, u''_{ij})$$

R is obtained by the following equation:

Formulas (3)

$$r = \max_{1 \leq i \leq n} \left(\sum_{j=1}^n u_{ij} \right)$$

After calculating the matrix, the matrix of fuzzy relations is obtained according to formulas 4 to 7.

Formulas (4)

$$T = \lim_{k \rightarrow +\infty} (\tilde{H}^1 \oplus \tilde{H}^2 \oplus \dots \oplus \tilde{H}^k)$$

Each element in the fuzzy number is $\tilde{t}_{ij} = (l_{ij}^t, m_{ij}^t, u_{ij}^t)$ And calculated as follows:

Formulas (5)

$$[l_{ij}^t] = H_l \times (I - H_l)^{-1}$$

Formulas (6)

$$[m_{ij}^t] = H_m \times (I - H_m)^{-1}$$

Formulas (7)

$$[u_{ij}^t] = H_u \times (I - H_u)^{-1}$$

In this formula **I** and the unit matrix, H_l, H_m, H_u and each $n \times n$ matrix that Elements it to the lower number, the number of middle and high number of matrix H is formed by triangular fuzzy numbers.

The next step is to obtain a matrix of rows and columns. Rows and columns according to formulas 8 and 9 to make.

Formulas(8)

$$\tilde{D} = (\tilde{D}_i)_{n \times 1} = [\sum_{j=1}^n \tilde{t}_{ij}]_{n \times 1}$$

Formulas(9)

$$\tilde{R} = (\tilde{R}_i)_{1 \times n} = [\sum_{i=1}^n \tilde{t}_{ij}]_{1 \times n}$$

\tilde{R}, \tilde{D} are respectively the matrix. $n \times 1$ and $1 \times n$
Next, the importance of each indicator $(\tilde{D}_i + \tilde{R}_i)$ and the relationship between the measure $(\tilde{D}_i - \tilde{R}_i)$ is specified. $\tilde{D}_i - \tilde{R}_i > 0$ if the measure is effective and if $\tilde{D}_i - \tilde{R}_i < 0$ the criterion is effectiveness.

Table 3, $\tilde{D}_i + \tilde{R}_i$ and $\tilde{D}_i - \tilde{R}_i$ shows.

Influencing factors	$\tilde{D}_i + \tilde{R}_i$	$\tilde{D}_i - \tilde{R}_i$
Influencing factor 1	(4.1451,7.5423,12.2998)	(-4.5754,-0.4997,3.5793)
Influencing factor 2	(4.1137,7.4937,12.2517)	(-5.0202,-0.9800,3.1178)
Influencing factor 3	(4.1663,7.5749,12.3733)	(-4.9469,-0.8676,3.2602)
Influencing factor 4	(4.2119,7.6455,12.4873)	(-4.8736,-0.7459,3.4018)
Influencing factor 5	(4.1289,7.5173,12.2094)	(-4.9614,-0.9308,3.1191)
Influencing factor 6	(4.0516,7.3979,12.1642)	(-4.9383,-0.9205,3.1742)
Influencing factor 7	(4.1091,7.4868,12.2355)	(-4.6658,-0.6236,3.4606)
Influencing factor 8	(4.0158,7.3424,12.1212)	(-4.9868,-0.9739,3.1186)
Influencing factor 9	(4.1036,7.4783,12.2572)	(-4.5560,-0.5022,3.5976)
Influencing factor 10	(4.1097,7.4877,12.2621)	(-4.3083,-0.2472,3.8441)
Influencing factor 11	(4.0801,7.4420,12.1984)	(-4.4893,-0.4431,3.6290)
Influencing factor 12	(4.1279,7.5159,12.2877)	(-4.2544,-0.1941,3.9054)
Influencing factor 13	(4.0754,7.4348,12.1678)	(-4.2837,-0.2454,3.8087)
Influencing factor 14	(4.0535,7.4008,12.0986)	(-4.1688,-0.1656,3.8763)
Influencing factor 15	(4.0993,7.4716,12.2079)	(-3.7130,0.3512,4.3957)
Influencing factor 16	(4.0556,7.4043,12.1148)	(-3.8047,0.2114,4.2545)
Influencing factor 17	(4.1547,7.5572,12.2922)	(-3.6632,0.4112,4.4743)
Influencing factor 18	(4.1172,7.4993,12.2079)	(-3.4295,0.6515,4.6612)
Influencing factor 19	(4.1080,7.4851,12.1911)	(-3.5939,0.4436,4.4892)
Influencing factor 20	(4.1356,7.5276,12.2922)	(-3.5218,0.5594,4.6349)
Influencing factor 21	(4.1317,7.5216,12.2637)	(-3.4169,0.6791,4.7151)
Influencing factor 22	(4.0879,7.4540,12.1278)	(-2.8043,1.2802,5.2356)
Influencing factor 23	(4.1971,7.6227,12.3492)	(-3.1712,0.9327,4.9808)
Influencing factor 24	(4.1930,7.6162,12.2704)	(-2.6212,1.4850,5.4562)
Influencing factor 25	(4.2305,7.6741,12.3666)	(-2.7787,1.3340,5.3573)

In the next step, and the fuzzy numbers obtained from the previous step formula scoring 10 De fuzzy.

Formulas (10) $B = \frac{(a_1+a_3+2 \times a_2)}{4}$

B is the number Dyfuzzy $\tilde{A} = (a_1, a_2, a_3)$

The degree of central role $(Dx + Rx)$ in DEMATEL represents the strength of influences both dispatched and received. On the other hand, if $(Dx - Rx)$ is positive, then the evaluation criterion x dispatches the influence to other evaluation criteria more than it receives. If $(Dx - Rx)$ is negative, the

evaluation criterion x receives the influence from other evaluation criteria more than it dispatched. The (Dx - Rx) values are reported in Table 4. We can observe general clusters into cause and effect groups. Generally the criteria that are part of the effect cluster include 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13 and 14; the cause cluster includes 15, 16, 17, 18, 19, 20, 21, 22, 23, 24 and 25. The causal relationships among criteria can be

depicted as the causal diagram (Fig. 1). This figure is shown that Willingness and Attitude is the most influence and the strongest connection to other criteria. Figure 1 also shows the importance and impact and influence among the criteria. Horizontal axis and the vertical axis measures the impact or influence diagram shows the criteria.

Table 4 shows the numbers Dyfazy Table 3.

Table 4 - The importance and impact criteria (Absolute numbers)		
Influencing factors	$(\bar{D}_i + \bar{R}_i)^{def}$	$(\bar{D}_i - \bar{R}_i)^{def}$
Influencing factor 1	7.8824	-0.4989
Influencing factor 2	7.8382	-0.9656
Influencing factor 3	7.9224	-0.8555
Influencing factor 4	7.9975	-0.7409
Influencing factor 5	7.8432	-0.9260
Influencing factor 6	7.7529	-0.9013
Influencing factor 7	7.8295	-0.6131
Influencing factor 8	7.7055	-0.9540
Influencing factor 9	7.8293	-0.4907
Influencing factor 10	7.8368	-0.2397
Influencing factor 11	7.7906	-0.4366
Influencing factor 12	7.8619	-0.1843
Influencing factor 13	7.7782	-0.2415
Influencing factor 14	7.7384	-0.1559
Influencing factor 15	7.8126	0.3463
Influencing factor 16	7.7447	0.2182
Influencing factor 17	7.8903	0.4084
Influencing factor 18	7.8309	0.6337
Influencing factor 19	7.8173	0.4456
Influencing factor 20	7.8707	0.5580
Influencing factor 21	7.8597	0.6641
Influencing factor 22	7.7810	1.2479
Influencing factor 23	7.9479	0.9187
Influencing factor 24	7.9240	1.4513
Influencing factor 25	7.9863	1.3117

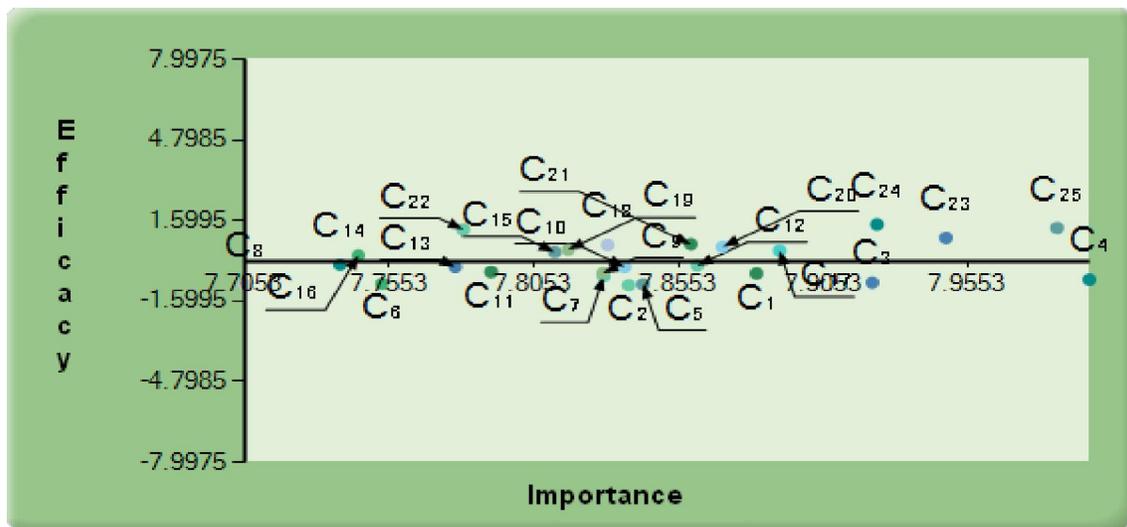


Figure 1. The importance and impact and influence among the criteria

4. Conclusion

Knowledge management systems are pervasive and spending on knowledge management services is growing steadily (Musico, 2009). Evidently not a fad, corporate attention and spending have been paralleled by rising academic interest, which has produced numerous investigations, ranging from the ontology of organizational knowledge and its transfer (Ringberg & Reihlen, 2008) to knowledge management system effectiveness within organizations (Zhao & Anand, 2009). Studies of KM (knowledge management) system effectiveness are important because the risks of inflated expectations are high given the volume of knowledge-based work today and the allure of technology to help eager managers craft higher performing organizations. The aim of this paper is Evaluation success of knowledge management in supply chain using fuzzy DEMATEL method. We can observe general clusters into cause and effect groups. Generally the criteria that are part of the effect cluster include 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13 and 14; the cause cluster includes 15, 16, 17, 18, 19, 20, 21, 22, 23, 24 and 25.

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