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6-2011

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Abstract

This paper presents a multicriteria analysis approach for evaluating knowledge management (KM) effectiveness in the university's administration. A framework is presented for identifying important properties to be considered in the KM evaluation process. A fuzzy multicriteria analysis algorithm is developed for evaluating KM effectiveness in the university's administration. As a result, the KM effectiveness can be properly assessed in a simple manner and effective decisions can be made for improving the KM implementation in the university. An example is presented for demonstrating the applicability of the proposed multicriteria analysis approach for effectively addressing the KM problem in real world settings.

Keywords

Knowledge Management, Multicriteria Analysis, Framework, Effectiveness, and University Administration

1. Introduction

Knowledge management (KM) is the identification, creation, distribution, utilization, and maintenance of organizational knowledge for fulfilling organizational objectives (Pumareja & Sikkel 2005). Significant advances have been made in the developments of KM for the universities in recent years. This is because the application of KM has been recognized to improve the university's overall performance.

Numerous literatures have been published on the development and implementation of KM in universities (Kidwell et al. 2000; Wijetunge, 2002; Numprasertchai & Igel 2005). However, universities are finding it difficult to measure the effectiveness of their KM implementation. This is due to (a) the lack of a proper framework for assessing the current status of KM, and (b) the difficulties in evaluating the university's performance of their KM initiatives (Pumareja & Sikkel 2005). As a result, it is critical for universities to assess their KM effectiveness in order for them to remain competitive.

This paper formulates the KM evaluation in universities as a multicriteria problem, and presents a multicriteria analysis approach for effectively solving this problem. Linguistic variables approximated by fuzzy numbers are used to represent the decision maker's subjective assessments so that the uncertainty and imprecision in the selection process are adequately handled in a less cognitively demanding manner. The degree of optimality is used to defuzzify the weighted fuzzy performance matrix so that the complex and unreliable process of comparing fuzzy utilities often required in fuzzy multicriteria analysis (Yeh et al. 2000) is avoided. The concept of the ideal solution (Zeleny, 1998) is applied for calculating the overall performance index for each KM alternative across all criteria. As a result, effective decisions can be made. In what follows, we first present a review of issues relating to KM in the university's administration. We then present a framework for identifying important properties to be considered in the evaluation process. This is followed by the development of a multicriteria analysis approach for evaluating the effectiveness of KM in the university's administration. Finally we present an example for demonstrating the applicability of the proposed multicriteria analysis approach for evaluating the effectiveness of KM in the university's administration.

2. Issues Relating to Knowledge Management in University's Administration

KM has been widely practiced by many universities as one of the most promising ways of achieving success in the information age (Malone, 2002). In fact, the adoption of KM in universities is becoming a necessity in order for them to remain competitive in a knowledge society characterized by the emergence of new knowledge markets and the entrance of new market players (Tortora et al. 2002). Besides the application of KM to intra-organizational processes and strategy (Pornchulee, 2001), the university's academic and administrative processes represent key areas which can be enhanced through the application of KM (Kidwell et al. 2000). However, to reap the benefits from the application of KM, there are issues and challenges that need to be addressed which include (a) creating and maintaining knowledge repositories, (b) improving knowledge access, (c) enhancing the knowledge environment, and (d) valuing knowledge (Tortora et al. 2002).

Lim & Klobas (2000) further describe two key factors critical for good KM practices including (a) the extent that external knowledge changes the environment, and (b) the extent that internal knowledge affects organizational specific requirements. This is where organizations need to assess the type(s) of knowledge they want to distribute and to what extent. For example, smaller organizations generally have a larger focus on external knowledge due to less human resources generating quality internal knowledge, while larger organizations often emphasize more on internal knowledge (Lim & Klobas 2000).

By its nature, universities' environment is suitable for the application of KM. This is due to the fact that (a) universities usually possess modern information infrastructure, (b) knowledge sharing with others is natural for academics, and (c) the desire of students to acquire knowledge from accessible sources in an efficient and effective manner (Sallis & Jones 2001). Therefore, it is important that universities live up to expectation of the global society. In order for them to do so, they must adopt and adapt good practices that emanate from information technology and globalization.

For successful knowledge transfer, a university must support a knowledge sharing culture (Lim & Klobas 2000). However, the dissemination of knowledge through the university has many difficulties. Firstly, how do the users know where and how to locate the knowledge or information they desire? Secondly, how does the receiver of the knowledge know if the information is reliable and of a high quality? These problems impact upon universities that are trying to provide relevant and reliable knowledge to its employees. For example, Siegel et al. (2003) express a concern that universities need to be cautious about not overloading users with masses of information.

To successfully manage KM initiatives in universities, it is critical for the management to consciously and properly manage the processes associated with the creation of their knowledge assets (Rowley, 2000). Placing a strong emphasis on the technical side alone, such as providing adequate computer facilities and information and communication infrastructure will not ensure the success of the KM initiatives. Here, the management also needs to overcome the more difficult and challenging problems relating to social and cultural issues in university-wide KM.
The developments of (a) a framework for addressing these main issues stated above and (b) a multicriteria analysis approach for evaluating the KM effectiveness in the university's administration are therefore desirable.

3. The Framework

This section presents the framework for identifying important properties to be considered in evaluating the effectiveness of KM in the university's administration. In defining the framework, we adopted the concept from various e-readiness frameworks (Mutula & Van Brakel 2006; Hanafizadeh et al. 2009), extant literature on KM and research in universities business practices.
Based on the discussion in the previous section, we argue that there are five important properties to be considered in assessing the effectiveness of KM in the university's administration environment. They include (a) attitude, (b) policy, (c) practice, (d) technology, and (e) governance as shown in Figure 1.

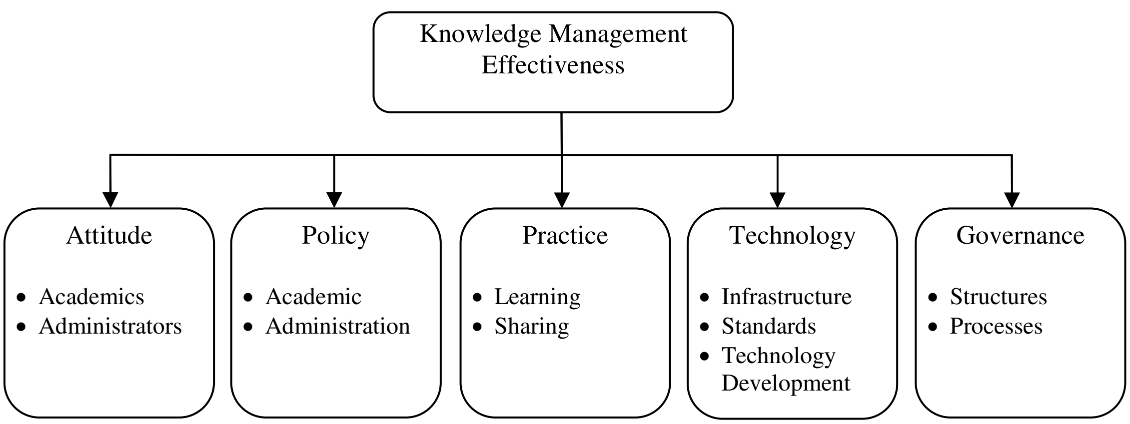

Figure 1: A Framework for Evaluating Knowledge Management Effectiveness

Attitude

Attitude reflects on the characteristics of both the academics and the administrators in performing their tasks. It measures the extent to which both the academics and the administrators are aware of the strategic, economical, regulatory, financial, and social concerns relating to the KM issues. On this basis, whether or not an employee in the university takes KM issues seriously will be dependent on the attitude of the employee towards KM. Existing surveys indicate that not only could opinions for KM adoption might vary from one university to another university (Corbitt et al. 2005). Measuring the attitudes of both the academics and the administrators therefore helps to understand the motivation and capability of KM.

Policy

Policy measures the extent to which KM policies are developed and implemented throughout the university. Several surveys found that most universities do not to have any policy supporting the philosophy of KM (Siegel et al. 2003). It is therefore important for universities to consider implementing policies to make KM processes formal (Storey & Barnett 2000).

The effectiveness of KM in terms of policies can be assessed on the basis of the extent to which academic and administration policies are developed and implemented. Simatupang & White (1998) argue for the need for senior managers to develop policies that enable employees to (a) capture and disseminate knowledge that corresponds to competitive edge and (b) provide a formal, documented KM practice.

Both academic and administration policies provide individuals in the university's community, including partner organizations, with information about the university's approach, attitude and procedures for a range of academic and student administration matters (Chen & Burstein 2006). A rigorous and systematic approach to program development and review ensures the quality and currency of academic programs, and the capacity to adapt to market trends. Assessment principles and procedures help to optimize student progress, ensure students are treated fairly, and ensure a robust approach to academic integrity. Some of the policy considerations include student enrolment, policy on credit transfer application, and student e-mail policy.

Practice

The practice dimension focuses on the intellectual dimension of KM in universities. However, not all policies are implemented smoothly and universities might vary in the actual implementation of their policies. This practice dimension measures to what extent the university has translated its concerns and policies into actions through KM learning and sharing practices.

KM learning and sharing practices capture the extent to which best practices are adopted in the university. It is fully recognized that successful KM relies heavily on communities of practice, or groups of people who work on business-relevant topics across organisational boundaries (Lave & Wenger 1991). For example, The Bank of Montreal has used a technique called Social Network Analysis to determine who shares information and point out likely interventions. Cross-functional teams are formed to address new project demands, and leadership forums are initiated to encourage greater sharing among team leaders (Rao, 2002).

One of the main challenges faced by universities lies in the absence or limited participation and cooperation of employees in the university. This may be attributed to (a) ignorance of the employee on the functioning of the university or (b) the perception of the employee that KM learning and sharing practices are not part of his/her responsibility (Siegel et al. 2003). For example, in Harvard University, relatively few faculty members are willing to dedicate time in order to participate in decisions regarding organizational issues for the promotion of KM (Corbitt et al. 2005). For the enforcement of participation, an increase in the provision of information for relevant issues and the creation of opportunities enhancing individuals' involvement is essential.

The following indicators can be used to measure the practice dimension of KM effectiveness:

- Evidence of a collaborative culture in the university
- The extent of the desire and commitment to innovate
- Existence of individual learning responsibility

Technology

Technology is viewed as a support tool for individuals to achieve the overall strategic goals of the university (Robert-Witt, 2003). A key driver to measure the effectiveness of KM initiative in the area of technology is to have a sound KM technological infrastructure. This is because technological infrastructure has the potential to enable or facilitate knowledge processes by providing a platform for knowledge capture or sharing (Rowley, 2000). Some examples where technology can be successfully used to facilitate knowledge processes include (a) linking all employees of the university to one another and to all relevant external parties, (b) creating an institutional memory that is accessible to the entire university, (c) linking the university with its customers and partners, and (d) supporting collaboration amongst employees (Liebowitz & Wilcox 1997).

In the area of knowledge access, Rowley (2000) found that universities generally have well-established access to published knowledge sources across and within the university community. The Internet connectivity has been an invaluable resource where academic staffs are able to access public knowledge including a host of electronic documents (Raol et al. 2002). Within universities, networks based on intranet technology are usually utilized for supporting internal communication through e-mail and accessing databases and electronic documents. Therefore, it is important for universities to be proactive in the management of explicit and public knowledge. This is demonstrated by Peking University Guanghua School of Management, which uses information system to support its KM initiative. The system is capable of (a) improving the efficiency of research and teaching; (b) assisting research teams to adjust research methods and strategy in a timely manner, and (c) expanding the influence of the university at home and abroad (Schroeder & Pauleen 2005).

To measure the effectiveness of KM with regard to the technology dimension, universities can look at the following indicators:

- The extent of KM infrastructure in the university
- The development of KM standards across the university
- The extent of technology development to support university-wide KM initiatives

Governance

Governance includes structures and processes which have been developed to undertake, coordinate and control KM activities in the university (Schroeder & Pauleen 2005). More specifically, KM governance describes the structuring of the KM function, the distribution of KM decision making rights, and responsibilities among individuals, as well as the structures and processes for making and monitoring strategic decisions in relation to KM.

The adoption and implementation of KM requires a sound management infrastructure in order to understand impacts, prioritise actions and manage the university's responses (Johannessen & Olsen 2003). Roles, responsibilities, accountability and control for KM initiatives need to be clearly established and strong governance is an important factor for the success of KM initiatives (Chourides et al. 2003). Several open questions can be adopted to find out the governance dimension of KM initiatives. For example, should the university appoint and assign the responsibility for KM initiatives to a Chief KM Officer? How is KM governed in the participating university?

The following indicators can be used to measure the governance dimension of KM effectiveness:

- Clearly defined roles, responsibilities, accountability and control for KM initiatives
- Existence of standard academic and administrative processes for developing KM initiatives

- Establishment of metrics for assessing the impact of KM initiatives
- Allocation of budgetary and other resources for KM
- The responsibility of specific individuals in KM adoption

4. Multicriteria Analysis Approach

Evaluating the effectiveness of KM alternatives usually involves in (a) assessing the performance ratings of KM alternatives with respect to each criterion, and the relative importance of the selection criteria, (b) calculating the criteria weighting and performance rating of KM alternatives, (c) aggregating the fuzzy criteria weightings and performance ratings for producing a weighted fuzzy performance matrix, and (d) calculating an overall performance index for each KM alternative across all criteria.

To model the uncertainty and imprecision present in the multicriteria decision making problem, linguistic terms are used to facilitate the subjective assessment to be made by the decision maker. These linguistic terms are represented by triangular fuzzy numbers as their approximate value ranged between 1 and 9, denoted as (a_1, a_2, a_3), where $1 < a_1 < a_2 < a_3 < 9$. For a linguistic term represented as (a_1, a_2, a_3), a_2 is the most possible value of the term, and a_1 and a_3 are the lower and upper bounds respectively used to reflect the fuzziness of the term. Table 1 shows the linguistic terms given as in Row 1 and their corresponding triangular fuzzy number given as in Row 3 for the decision maker to make qualitative assessments about the performance rating of each alternative with respect to a given criterion. To assess the relative importance of the evaluation criteria, the decision maker can use the linguistic terms given in Row 2 of Table 1, which are characterized by triangular fuzzy numbers as given in Row 3 of Table 1.

Linguistic Terms	Very Poor (VP)	Poor (P)	Fair (F)	Good (G)	Very Good (VG)
	Very Low (VL)	Low (L)	Medium (M)	High (H)	Very High (VH)
Membership Function	(1, 1, 3)	(1, 3, 5)	(3, 5, 7)	(5, 7, 9)	(7, 9, 9)

Table 1: Linguistic Variables used by the Decision Matrix

The evaluation process starts with the determination of the performance of KM alternatives A_i ($i = 1, 2, \ldots, n$) with respect to each criterion C_j ($j = 1, 2, \ldots, m$). As a result, the fuzzy decision matrix for the alternatives and the fuzzy weighting vector for the criteria can be expressed as follows

$$X = \begin{bmatrix} x_{11} & x_{12} & \cdots & x_{1m} \\ x_{21} & x_{22} & \cdots & x_{2m} \\ \cdots & \cdots & \cdots & \cdots \\ x_{n1} & x_{n2} & \cdots & x_{nm} \end{bmatrix} \quad (1)$$

$$W = (w_1, w_2, \ldots, w_m) \quad (2)$$

With the use of interval arithmetic (Kaufmann & Gupta 1991), the weighted fuzzy performance matrix for representing the overall performance of all alternatives in regard to each criterion can then be determined by multiplying the criteria weights (w_j) and the alternative performance ratings (x_{ij}), given as follows:

$$Z = \begin{bmatrix} w_1 x_{11} & w_2 x_{12} & . & w_m x_{1m} \\ w_1 x_{21} & w_2 x_{22} & . & w_m x_{2m} \\ . & . & . & . \\ w_1 x_{n1} & w_1 x_{n2} & . & w_m x_{nm} \end{bmatrix} \quad (3)$$

To reflect on the decision maker's attitude towards risk in the decision making process, the idea of incorporating the risk involved in the decision maker's subjective assessments is introduced. This is beneficial towards the decision making process as the ability of decision maker to (a) adequately deal with uncertainty and imprecision and (b) handle the risk inherent in the decision making process will help increase the confidence of the decision maker which will have an impact on the final outcome of the decision making process (Deng & Wibowo 2008).

To address this issue, the concept based on $\lambda\,(0 \le \lambda \le 1)$ is therefore introduced for reflecting the decision maker's attitude towards risk in approximating their subjective assessments. A larger λ value indicates that the decision maker's assessments are closer to the most possible value a_2 of the triangular fuzzy numbers (a_1, a_2, a_3). Based on this concept, the refined assessment of the decision maker in regards to his/her attitude towards risk is defined as

$$z_{ij}^{k\lambda} = (a_1 + \lambda(a_2 - a_1), a_2, a_3 - \lambda(a_3 - a_2)) \quad (4)$$

where a_1, a_2, and a_3 are the lower bound, middle bound, and upper bound of individual decision maker's assessments about the performance rating of alternative A_i with respect to criterion C_j respectively.

In practical applications, λ = 1, 0.5, or 0 can be used respectively to indicate that the decision maker involved has an optimistic, moderate, or pessimistic view in the selection process (Yeh et al. 2000; Wibowo & Deng 2009). An optimistic decision maker is apt to prefer higher values of his/her fuzzy assessments, while a pessimistic decision maker tends to favor lower values (Yeh et al. 2000).

Having already incorporated the decision maker's attitude towards risk as in (4), the fuzzy performance matrix for the decision maker can be obtained as

$$Z^\lambda = \begin{bmatrix} z_{11}^\lambda & z_{12}^\lambda & \cdots & z_{1m}^\lambda \\ z_{21}^\lambda & z_{22}^\lambda & \cdots & z_{2m}^\lambda \\ \cdots & \cdots & \cdots & \cdots \\ z_{n1}^\lambda & z_{n2}^\lambda & \cdots & z_{nm}^\lambda \end{bmatrix}, \quad (5)$$

Given the fuzzy vector of the performance matrix for criterion C_j, a fuzzy maximum ($M_{\max}^j$) and a fuzzy minimum ($M_{\min}^j$) (Chen, 1985) can be determined as in (6)-(7) which represent respectively the best and the worst fuzzy performance ratings among all the alternatives with respect to criterion C_j (Zadeh, 1973; Chen, 1985).

$$\mu_{M_{\max}^j}(z^\lambda) = \begin{cases} \dfrac{z^\lambda - z_{\min}^{\lambda j}}{z_{\max}^{\lambda j} - z_{\min}^{\lambda j}}, \\ 0, \end{cases} \quad (6)$$

$$\mu_{M^{j}_{\min}}(z^{\lambda}) = \begin{cases} \dfrac{z^{\lambda j}_{\max} - z^{\lambda}}{z^{\lambda j}_{\max} - z^{\lambda j}_{\min}}, \\ 0, \end{cases} \tag{7}$$

where $i = 1, 2,\ldots, n$; $j = 1, 2,\ldots, m$.

$$z^{\lambda j}_{\max} = \sup \bigcup_{i=1}^{n} (z^{\lambda}_{ij}), \tag{8}$$

$$z^{\lambda j}_{\min} = \inf \bigcup_{i=1}^{n} (z^{\lambda}_{ij}). \tag{9}$$

The degree to which alternative A_i is the best alternative with respect to criterion C_j can then be calculated by comparing its weighted fuzzy performance (z^{λ}_{ij}) with the fuzzy maximum ($M^{j}_{\max}$), given as in (10). u_{Rj} (i) represents the highest degree of approximation of alternative A_i's weighted performance on criterion C_j to the fuzzy maximum. This setting is in line with the optimal decision of Zadeh (1973) who states that "in a fuzzy environment, objective and constraints formally have the same nature and their confluence can be represented by the intersection of fuzzy sets".

$$u_{Rj}(i) = \sup\left(z^{\lambda}_{ij} \cap M^{\lambda j}_{\max}\right), \tag{10}$$

Similarly, the degree to which alternative A_i is not the worst alternative with respect to criterion C_j can be calculated by comparing the weighted fuzzy performance ($w_j x_{ij}$) of alternative A_i with the fuzzy minimum ($M^{j}_{\min}$), as

$$u_{Lj}(i) = 1 - \sup\left(z^{\lambda}_{ij} \cap M^{\lambda j}_{\min}\right), \tag{11}$$

The degree of optimality (or preferability) of alternative A_i over all other alternatives with respect to criterion C_j is thus determined by

$$r^{\lambda}_{ij} = \frac{u_{R_j}(i) + u_{L_j}(i)}{2} \tag{12}$$

A fuzzy singleton matrix (Zadeh, 1973) can be obtained from the weighted fuzzy performance matrix based on (6)-(12), given as

$$R^{\lambda} = \begin{bmatrix} r^{\lambda}_{11} & r^{\lambda}_{12} & \cdots & r^{\lambda}_{1m} \\ r^{\lambda}_{21} & r^{\lambda}_{22} & \cdots & r^{\lambda}_{2m} \\ \cdots & \cdots & \cdots & \cdots \\ r^{\lambda}_{n1} & r^{\lambda}_{n2} & \cdots & r^{\lambda}_{nm} \end{bmatrix} \tag{13}$$

To avoid the complicated and unreliable process of comparing and ranking fuzzy utilities often required in fuzzy multicriteria analysis, the concept of the ideal solution is introduced for calculating an overall performance index for each alternative across all criteria. This concept has since been widely used in developing various methodologies for solving different practical decision problems (Wibowo & Deng 2009). This is due to (a) its simplicity and comprehensibility in concept, (b) its computation efficiency, and (c) its ability to measure the relative performance of the decision alternatives in a simple mathematical form.

Based on the concept of the ideal solution above, the positive ideal solution $A^{\lambda+}$ and the negative ideal solution $A^{\lambda-}$ can be determined respectively from (13), shown as in (14) and (15).

$$A^{\lambda+}=(a_1^{\lambda+},\ a_2^{\lambda+},\ ...,\ a_m^{\lambda+})$$
$$A^{\lambda-}=(a_1^{\lambda-},\ a_2^{\lambda-},\ ...,\ a_m^{\lambda-}) \tag{14}$$

where

$$a_j^{\lambda+}=\sup(r_{1j}^{\lambda},\ r_{2j}^{\lambda},\ ...,\ r_{nj}^{\lambda})$$
$$a_j^{\lambda-}=\inf(r_{1j}^{\lambda},\ r_{2j}^{\lambda},\ ...,\ r_{nj}^{\lambda}) \tag{15}$$

Based on (14)-(15), the Hamming distance between each alternative and the positive ideal solution $S_i^{\lambda+}$ and between the alternative and the negative ideal solution $S_i^{\lambda-}$ can be respectively calculated as

$$S_i^{\lambda+}=\sum_{j=1}^{m}(a_j^{\lambda+}-r_{ij}^{\lambda}), \qquad S_i^{\lambda-}=\sum_{j=1}^{m}(r_{ij}^{\lambda}-a_j^{\lambda-}), \tag{16}$$

A preferred alternative should have a higher degree of similarity to the positive ideal solution, and a lower degree of similarity to the negative ideal solution (Hwang & Yoon 1981; Shipley et al. 1991). Based on this perception, an overall performance index for each alternative with the decision makers' λ degree of optimism towards risk can be calculated in a simple manner.

$$P_i^{\lambda}=\frac{S_i^{\lambda-}}{S_i^{\lambda+}+S_i^{\lambda-}}, \quad i=1,2,...,n. \tag{17}$$

The larger the performance index value, the more preferred the alternative A_i.

5. An Example

To demonstrate the applicability of the proposed multicriteria analysis approach above, an example for evaluating the effectiveness of KM alternatives in a university is presented in this section. As discussed in Section 3, five evaluation criteria including attitude (C_1), (b) policy (C_2), (c) practice (C_3), (d) technology (C_4), and (e) governance (C_5) are considered for evaluating six KM alternatives.

Using the linguistic terms defined in Table 1, the performance ratings of six KM alternatives with respect to the five criteria are assessed. Columns 2-7 of Table 2 show the assessment results, which constitute the fuzzy decision matrix as given in (1). Using the linguistics terms defined in Table 1, the importance of the five criteria is assessed by the decision maker. Column 8 of Table 2 shows the assessment results, which constitute the fuzzy weight vector as given in (2).

Using the membership functions defined in Table 1 for the linguistic terms used for the fuzzy decision matrix and the fuzzy weight vector, the weighted fuzzy performance matrix for the given multicriteria analysis problem can be calculated by (1) and (2) respectively. Table 3 shows the weighted fuzzy performance matrix that represents the overall performance of each alternative on each criterion.

Criteria	Alternatives						Criteria weights
	A_1	A_2	A_3	A_4	A_5	A_6	
C_1	F	G	P	G	F	VG	H
C_2	VG	VG	F	P	VG	G	M
C_3	G	G	F	P	G	F	VH
C_4	P	G	VG	F	G	F	M
C_5	F	G	G	VG	VG	P	VH

Table 2: Performance Assessments and Criteria Weights of KM Alternatives

Criteria	Alternatives					
	A_1	A_2	A_3	A_4	A_5	A_6
C_1	(15, 35, 63)	(25, 49, 81)	(5, 21, 45)	(25, 49, 81)	(15, 35, 63)	(35, 63, 81)
C_2	(21, 45, 63)	(21, 45, 63)	(9, 25, 49)	(3, 15, 35)	(21, 45, 63)	(15, 35, 63)
C_3	(35, 63, 81)	(35, 63, 81)	(21, 45, 63)	(7, 27, 45)	(35, 63, 81)	(21, 45, 63)
C_4	(3, 15, 35)	(15, 35, 63)	(21, 45, 63)	(9, 25, 49)	(15, 35, 63)	(9, 25, 49)
C_5	(21, 45, 63)	(35, 63, 81)	(35, 63, 81)	(49, 81, 81)	(49, 81, 81)	(7, 27, 45)

Table 3: The Weighted Fuzzy Performance Matrix of KM Alternatives

In this case, the decision maker is assumed to have a moderate attitude towards risk and applies λ = 0.5. From (6) – (16), the Hamming distance between each alternative and the positive ideal solution $s_i^{\lambda+}$ and between the alternative and the negative ideal solution $s_i^{\lambda-}$ can be calculated respectively. The results are shown in Table 4.

Alternatives	$s_i^{\lambda+}$	$s_i^{\lambda-}$
A_1	1.46	2.51
A_2	0.31	0.76
A_3	1.67	1.98
A_4	0.35	1.21
A_5	0.24	1.8
A_6	1.57	2.36

Table 4: The Hamming Distance between Each Alternative and the Ideal Solutions

The overall performance index for each KM alternative across all the criteria can be obtained by applying (17) to the data in Table 4. Table 5 shows the overall performance index of the KM alternatives and their corresponding rankings with respect to the decision maker's attitudes towards risk. A_5 is the most effective KM alternative as it has the highest value of 0.87.

Alternatives	Performance Index	Ranking
A_1	0.63	4
A_2	0.71	3
A_3	0.54	6
A_4	0.78	2
A_5	0.87	1
A_6	0.60	5

Table 5: The Overall Performance Index and Ranking of KM Alternatives

6. Conclusion

Effective implementation of KM is recognized as a source of competitive advantage and the prerequisite for successful outcome for universities. It is therefore critical for universities to evaluate their KM effectiveness in order for them to remain competitive. This paper has presented a framework for identifying important properties to be considered in the KM evaluation process and developed a multicriteria analysis approach for evaluating KM effectiveness in the university's administration. An example is presented which shows that the proposed approach provides an effective and useful way of solving the KM evaluation problem.

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