KEM_{KFM}: A Conceptual Model of Knowledge Evaluation via Knowledge Flow Manipulation

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Abstract

Despite that knowledge management system has been extensively studied to attain potential solutions for business use, there has been less work in dealing with the knowledge evaluation. The knowledge evaluation is one of the most important tasks to ensure that a specific knowledge object is substantially valuable to an organization. In this paper, based on knowledge flow manipulation we propose a conceptual model for knowledge evaluation (KEM_{KFM}). The model adopts a mechanism tracing and keeping information that a specific knowledge object is created, acquired, stored, shared, and implemented. Value that it performs is also considered. The conceptual model produces ultimately a result for the importance of each knowledge object to the organization, and core knowledge may be defined accordingly.
Keywords: knowledge evaluation, knowledge object, knowledge flow

1. Research Background

It has been seen that the advent of knowledge economy is facilitating the extensive research on knowledge management (KM). Generally, there are two main facets for the KM research trend. One is management and organization, and another is knowledge technology. The former focuses on how to find a management model that can match the development requirements of knowledge management system (KMS), such as knowledge creation management, organization culture, and learning organization. Based on the knowledge characteristics, the later aims mainly at how to employ information technology to develop KMS, such as knowledge capture technology and knowledge base development methodology. Ultimately, the goal for these two facets is to help an organization build a KMS as the most competitive strategy [1].

For the past decades, researchers, as well as business management, have devoted much effort on the exploration of KMS related solutions, such as What type of organization culture is best to help develop KMS? What is the relationship between KM and organization learning? How can IT be used in helping knowledge creation, acquisition, and sharing? How to evaluate the organizational knowledge to ensure the management of knowledge is valuable to the organization? For example, there are 100 knowledge objects in a knowledge base. However, there are only 3 objects that were used in the past half year, and no substantial value is aided to the organization. In this case, the knowledge base may be regarded as useless even it maintains plentiful. As Cohen [2] indicated that “management ignored the questions of how much of that knowledge was actually used to benefit the organization and whether efforts to capture and share knowledge put more of it to profitable use,” it is believed that a knowledge evaluation would be benefiting the KM performance.

Generally, from the stand viewpoint of KMS life cycle, it is found that there are six major steps to implement a KM management program: knowledge creation management, knowledge acquisition management, knowledge standardization, knowledge storage/sharing management, knowledge adoption management, and knowledge evaluation [3][4][5][6][7][8][9][10][11]. Basically, the life cycle leads an organization to KMS development and implementation, and subsequently makes an organization a knowledgeable body to adjust itself with changes. Furthermore, from the knowledge value point of view, it is generally believed that the knowledge evaluation management directly is to examine the KMS performance for an organization. Some literatures have shown the principles of knowledge performance evaluation [13][5][11]. For example, particularly, Housel [11] proposed a metrics to look at organization performance with respect to KM implementation. Nonaka & Takeuchi [13] has also introduced a model to describe knowledge socialization, externalization,

combination, and internalization in terms that knowledge flows among people to accumulate its life value. Based on these principles, it is believed that knowledge value can be better analyzed if knowledge life profile that describes knowledge flows is considered in developing knowledge evaluation model. For example, Is it obvious that design knowledge transferred from customers' complaints is adopted in new products frequently, What benefits does it produce? What are the incentives for knowledge creation? What is the core knowledge in this organization? For this, it is believed that building a knowledge evaluation model that examines organizational knowledge in terms of its value could be advantageous to an organization. Accordingly, not directly go into the KMS evaluation because the KMS implementation and the factors used in KMS evaluation are still at the stage of understanding and trying, this current study starts from the analysis of knowledge life profile to develop a conceptual knowledge evaluation model.

However, it is a complex task to trace and keep information for a knowledge object. According to the Arthur Anderson Knowledge Management Assessment, Probst & Romhardt [14] proposed some regulations for organizational knowledge, such as the relationship between KM and finance, the core knowledge used in creation, source allocation used in knowledge base improvement, etc. However, detail remains unknown when practical use is concerned. Ahn & Chang [5] also proposed an evaluation model (KP^3) for knowledge contribution in financial performance, such as technology knowledge of product development, operation processes, and marketing. However, answers of how technology knowledge is directly related to product development are still unknown, and therefore needs in more depth a qualitative and quantitative analysis. Moreover, it is believed that when assessing a knowledge object, it will be more effective if concern can be reached to knowledge elements of that object. For example, when assessing the knowledge of "culture marketing" in a knowledge base, information including people who deliver this knowledge, place the knowledge arrives, frequency the knowledge is shared and implemented, and the value the knowledge creates should be maintained meticulously. To do so, knowledge attributes (e.g. context, application area) becomes essential when constructing an evaluation model.

So far knowledge attributes are not identified completely. Literature review in this study has collected some attributes that scholars proposed for the use of knowledge description (see Table 1). However, when the knowledge evaluation is concerned, it is found that most attributes are used to describe a knowledge (or knowledge object) without saying what can be used to describe information that this knowledge creates value. For example, culture marketing is one of the marketing strategies that a company is using. Therefore, information about who introduces it, whom it is introduced to, impact that it brings, and result it is performed should be taken into account. Moreover, knowledge of "culture marketing" may contain the context of the knowledge, the creator, the deliver, the place it arrives, the receiver, the user, the performance of its use. These are all items on which the evaluation operation should rely. To do so, this study aims at this part to propose a model, KEM_{KFM} that would help to evaluate organizational knowledge and would therefore disclose the knowledge that is likely frequently used in knowledge base.

Table 1: Potential attributes of knowledge

No.	Attributes	Literature
1	Conceptual level – Cognitive level of knowledge; automatic, pragmatic, systematic, goalsetting/idealistic	[8]
2	Degree of abstraction — Ranging from concrete to abstract.	[8]
3	Mode -- (Ranges from tacit to explicit.)	[8]
4	Content and application—knowledge about a certain subject (e.g., customers, suppliers, markets) and problem domain where the knowledge can be used (e.g., marketing, production, logistics)	[8]
5	Subprocess in decision making/application	[8, 15]
6	Technical Skills --- Accounting/tax/math/research skills	[15]
7	Degree of applicability – how broadly the knowledge	[8]

	can be applied (local or global)	
8	Adaptability – Adaptable , flexible	[15]
9	Observation, openness and interaction with the (uncertain) environment	[8]
10	Ability to adapt sales style from situation to situation	[8]
11	Degree of certainty – level of confidence in validity of knowledge	[8]
13	Control variables	[18]

Accordingly, there are two tasks that need to be done to construct the KEM_{KFM}. One is to analyze the knowledge profile (stop-by-stop) in terms of its career, and the other is to obtain the importance in each stop it reaches. The outputs of the KEM_{KFM} therefore are (1) parameters to describe the value of a knowledge and (2) importance of each parameter, and (3) total value that a specific knowledge creates. We first describe the KEM_{KFM} including a framework and its description. We then propose an evaluation mechanism used to derive the result of KEM_{KFM}.

2. Knowledge Evaluation Model (KEM_{KFM})

2.1 Knowledge life profile

It is believed that in an organization, knowledge source can be both tacit (in people) and explicit (in knowledge base). For the tacit knowledge in particular, the knowledge value could be the level of knowledge, the frequency of innovation, the amount of knowledge transfer, the result that knowledge brings. Obviously, the profile of knowledge flow may cover several items, regarded as its career, from generation, distribution, to application (in product and/or service). These items can be used as the basis of the evaluation of the tacit knowledge. Figure 1 illustrates a knowledge profile with respect to its flow in an organization. Starting from a tacit knowledge, there are two knowledge objects, K_0 and K_1. The K_0 is created by the organization itself while the K_1 from outside. It should be noted that basically every explicit knowledge object comes from tacit knowledge object. In other words, every explicit knowledge object is a result of an externalization process of tacit knowledge object. When K_0 is produced, on the one hand, there are two things happened. One is the K_0 is transferred into the receiver's tacit knowledge (K_{0t}), another is transformed into an explicit knowledge object (K_{0e}). The K_{0t} would repeat to be K_{0tt}, and so on so forth. Furthermore, the K_{0e} can be also expanded to be K_{0et} via internalization. On the other hand, the K_1 is initially regarded as a tacit knowledge object. It then can be shared as another tacit knowledge object (K_{1t}) or transferred into an explicit knowledge object (K_{1e}).

In the process of knowledge flow, like K_0, K_1, K_{0e}, K_{0t}, K_{0et}, K_{0tt}, K_{1e}, K_{1et}, some of then may be applied in the improvement of management or technology, and thereafter their performance is evaluated. This situation is quite complex and very difficult to trace the profile of their flows, and therefore difficult to reveal their contribution to the final value. Among the tactics used in evaluate the knowledge in an organization is the knowledge life profile that keep details of its flow. These details are used as the basis of performance evaluation.

Figure 1: Knowledge flow profile

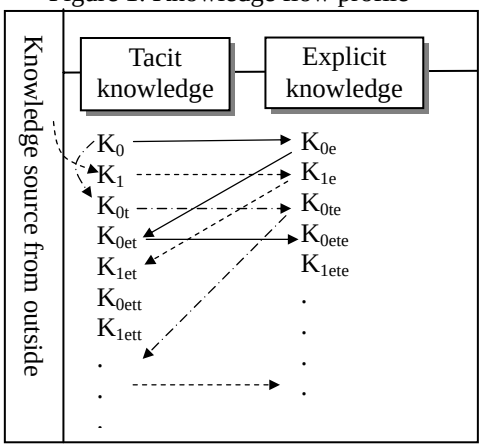

Table 2: Stages of knowledge profile

Stage	Description
1	Creator/Producer
2	Being read/listened,
3	3) Being transferred/distributed /expanded/shared
4	Being applied/implemented

2.1 Framework of KEM $_{KFM}$

Apparently, to define the details mentioned above is quite complex. Evaluation factors, knowledge attributes, approaches to obtain these factors and attributes are all issues that need to be overcome. This study then proposes a framework (KEM $_{KFM}$) that is illustrated in Figure 1. Basically, knowledge is quite different from data or information. It may be composed of a set of knowledge elements, in addition to its attributes. First, because there are no sufficient evidences that can be relied on to derive the information used to evaluate a specific knowledge. Analysis of literature review may be used. The output of the integration operation is parameters of life profile. Basically, literature has addressed some concepts of knowledge evaluation, such as extendibility, integration degree, transformation degree and the creativeness of an employee [22]. The main idea for the KEM $_{KFM}$ therefore is to define parameters of every node of the profile for a specific knowledge, and to keep all possible information about its sharing, application, and performance. In addition, the final value of each knowledge object would be the sum of the value performing in each node. Furthermore, information about knowledge use can be also retrieved, such as contribution to the product design, managerial regulations.

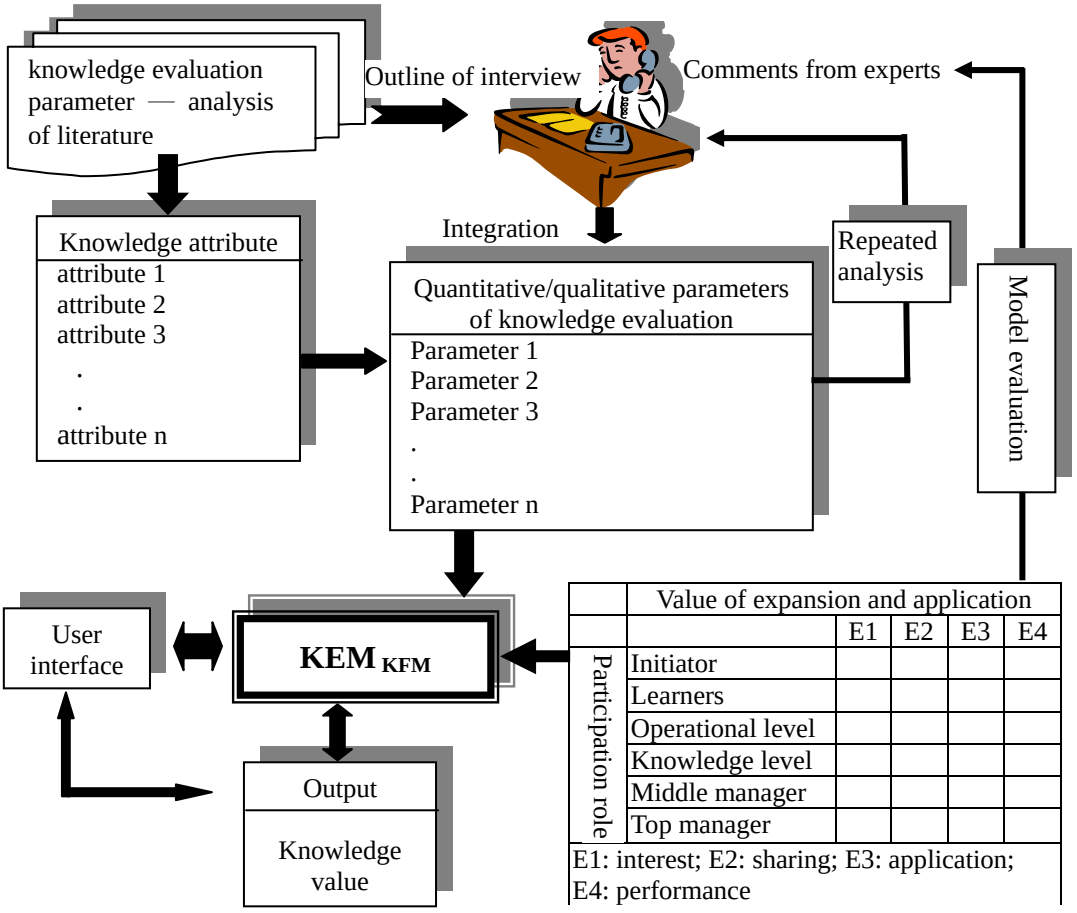

Figure 2: Framework of KEM $_{KFM}$

2.2 Evaluation mechanism

In Figure 2, so far to define the parameters of flow profile is quite complex. This study at present derives four main stages based on a review of literature for this: 1) creator/introducer, 2) being read/listened, 3) being transferred/distributed/expanded/shared, 4) applied/implemented. Parameters defined in each stage are 1) who (position) and where (place), 2) position of the reader of listener, activity (e.g. self-study, conference, training, speech), 3) distributor and position, activity, receiver and position, 4) implementer/applier and position, domain (management, technology, organization), performance (improvement, cost reduction, profit increase). The process of knowledge flow is as follows. First, when a knowledge object (denoted by K) enters into an organization, it is stored based on the predefined

attributes. It then is read or listened via an activity. At this moment, the K flows from creator/introducer to the receiver. After this, the K may be internalized and modified to be another knowledge object (K'), and distributed to next receivers or back to the creator. In this case, K' becomes another kind of K, and its flow profile starts also. Information about the person who performs this thing via an activity is stored. This process may be repeated for several times. Finally, the K may be applied in some areas. Information about these is also stored.

Although the mentioned above mechanism is to trace the knowledge flow as the basis of evaluation parameters, the regarded knowledge so far is the whole knowledge object. However, since it has been seen that a knowledge object may contain several knowledge elements (e.g. decision model). It is therefore believed that the way the ongoing knowledge base is stored is like this. Each knowledge element may very possibly flow in the organization and consequently creates its own element profile. In this case, contribution from a knowledge element may be added to it's the main knowledge it belongs to. To formulate this situation, the knowledge value can be expressed as follows. It should be noted that parameter x can be the importance of introducer's or creator's position, the importance of activity of knowledge sharing.

$$V(K) = \sum_{i=1}^{4} S_i(KE_1, KE_2, ... KE_n) * PA(x_1, x_2, ..., x_m)$$

Si : the i^{th} stage, i=1, 2, 3, 4
KEj : the j^{th} knowledge element.
j = 1, 2, … n
PA(x_r): participation importance of parameter x_r, r=1, 2…m)

3. An Illustrated Example

To further demonstrate how this model functions, this study uses an example to explain. This example contains three tables: 1) definition of profile stages (Table 2), 2) definition of importance of position, place, and performance (Table 3), 3) knowledge flow statement (Table 4). In particular, the Table 4 keeps the K's flow information at the time it is created/introduced. Assume there is a knowledge object (denoted by X). Taking the first record as an example, it is read that the X was introduced by a middle manager (PO3) in a discussion (PL3). Then there was a knowledge level person (PO2) who applied X. This application case finally produced a large benefit (PF7). It is noted that the concern of the Application is only the applicant's position. For the area it is applied in, this example does count for it because any area is fine, and therefore moves to the importance of performance. The total value for the Position, Place, Application, and Performance is therefore 30, 40, 21, 7, respectively. This implies that (1) (a) the value that K flows with respect to the generation by creator and transmission by users is 30, (b) the value that K flows in the places that generation and transmission occur is 40, (c) the value that K is applied with respect to different users is 21, and (d) the value with respect to K's performance is 7; (2) There are two negative value while using K.

4. Conclusion

In this paper, the importance of knowledge evaluation has been briefly addressed. Different from what has been studied for knowledge evaluation, this research focuses on the model of knowledge flow manipulation. Parameters used as the basis of evaluation mechanism in each stage are defined. An example presenting how to use the evaluation model is delineated. Further research focuses may have tow. One is to look for more comprehensive parameters, particularly the comments from knowledge management expertise, and another is to develop a system to facilitate the model capability.

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References

[1] Liebowitz, J.(1999). Knowledge Management Handbook. New York: CRC press.
[2] Cohen, D. (2006) "What's Your Return on Knowledge?" http://harvardbusinessonline.hbsp.harvard.edu/hbsp/hbr/articles/article.jsp
[3] Awad, E.M. & Ghaziri, H.M. (2004), Knowled&ge Management, Upper Saddle River, NJ: Pearson Education Inc.
[4] Inkpen, A., (1998), " Learning, Knowledge Acquisition, and Strategic Alliances", European Management Journal, Vol. 16 No.2 , pp.

[5] Ahn, J.H. & Chang ,S.G.. (2004). Assessing the contribution of knowledge to business performance: the KP methodology. Decision Support Systems 36 403-416.
[6] Quinn, J.B. and Baily, M. “Information Technology,” Brookings Review (12:3), pp. 36-41.
[7] Gupta, A. K., & Govindarajan V. (2001). Knowledge flows within multinational corporations. Strategic Management Journal, 21, 473-496.
[8] Holsapple, C.W. & Joshi, K.D. (2001). Organizational knowledge resources. Decision Support Systems 31, 39–54
[9] Dixon, N.M. 著，李淑華譯。知識共享型組織：建置、保存、移轉企業知識庫的五種方法。北市：商周，2001。
[10] Bhatt, G. D. (2000). Organizing knowledge in the knowledge development cycle. Journal of Knowledge Management, 4(1), 15-26.
[11] Housel, T. & Bell, A.H. (2001), Measuring and managing knowledge, New York: McGraw-Hill.
[12] Hellstrom, T., & Jacob, M. (2003), Knowledge without goals? Evaluation of knowledge management programmes. Evaluation, 9(1), 55-72.
[13] Nonaka, I. and Takeuchi, H. The Knowledge Creating Company, Oxford University Press,New York, 1995.
[14] Probst, G..& Steffen, R. & Kai, R. (1999). Managing Knowledge: Building Blocks for Success. New York: John Wiley & Sons.
[15] M. J. Abdolmohammadi, D. G. Searfoss, J. Shanteau (2004), Behavioral Research in Accounting, 16, 1-17.
[16] Chiva-Gomez, R. (2003). The Facilitating Factors for Organizational Learning: Bringing Ideas from Complex Adaptive Systems. Knowledge and Process Management, 10(2), 99.
[17] Marshall, G.W. & Goebel, D.J. & Moncrief, W.C. (2003). Hiring for success at the buyer–seller interface. Journal of Business Research 56, 247– 255
[18] Zohar, A. (1999). Teachers’ metacognitive knowledge and the instruction of higher order thinking. Teaching and Teacher Education 15, 413-429
[19] 林東清，知識管理，2004，台北市：智勝文化

Table 3: Definition of importance position, place, application, and performance

Code	Position	Imp	Code	Place	Imp	Code	Performance	Imp
PO1	OpL	1	PL1	Self-Reading	1	PF1	-Very Large	- 7
PO2	KnL	3	PL2	Training	3	PF2	- Large	-5
PO3	MiM	5	PL3	Discussion	5	PF3	- Medium	-3
PO4	ToM	7	PL4	Conference	7	PF4	- Small	-1
			PL5	Decision-making	9	PF5	None	0
						PF5	Small	1
						PF6	Medium	3
						PF7	Large	5
						PF8	Very large	7

Imp: Importance
OpL: Operational Level; KnL: Knowledge Level; MiM: Middle Manager; ToM: Top Manager
PL1: Self-Reading place; PL2: Training place; PL3: Discussion place; PL4: Conference place; PL5: Decision-making place

Table 4: Flow statement of knowledge X

Stage	Position	Pt.	Place	Pt.	Application	Pt.	Performance	Pt.
1	PO3	5	PL3	5	PO2	3	PF7	5
2	PO1	1	PL1	1				
2	PO2	3	PL2	3	PO1	1	PF4	-1
2	PO4	7	PL4	7	PO3	5	PF6	3
3	PO3	5	PL2	3	PO2	3	PF5	0
3	PO1	1	PL3	5	PO2	3	PF4	-1
4	PO2	3	PL4	7	PO3	5	PF6	1
4	PO3	5	PL5	9	PO1	1	PF5	0
Total		30		40		21		7

1