INVITED PAPER
A viable systems perspective to knowledge management

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Abstract

Purpose – To provide the knowledge structure for an effective knowledge-based organization which integrates knowledge into organizational goals.

Design/methodology/approach – The structure, function, and process of a viable organization were discussed which provided a basis to construct a knowledge management (KM) framework and demonstrate knowledge structure in a knowledge-based organization. Based on systems view and viable systems model (VSM), a range of recently published KM practices were reviewed to position various knowledge content.

Findings – This study proposed a viable systems framework for organizational KM based on the VSM of Beer. Using the viable systems framework, organizational knowledge can be classified into four categories. Knowledge content was articulated based on the systems view. Thus, knowledge structure of various management hierarchies can be captured.

Originality/value – The result contributes to the practice of knowledge executive by supporting the diagnosis and design of an effective knowledge-based organization. The framework also provides a basis for future empirical studies on the relationships between KM strategies and organizational effectiveness. A specific KM strategy exists that can maximize the effectiveness of each of the four types of knowledge.

Keywords Knowledge management, Organizations, Systems analysis

Paper type Research paper

Introduction

The strategic use of knowledge management (KM) for retaining competitive advantage is well recognized (Senge, 1990; Nonaka and Takeuchi, 1995; Bollouju *et al.*, 2002; Hlupic *et al.*, 2002; Nemati *et al.*, 2002). It is generally believed that most of intellectual assets of a firm exist as knowledge in the minds of its employees (Horvath, 1999; Stenmark, 2001). Various practices, tools, and methodologies have been developed for promoting knowledge creation and sharing (Martensson, 2000; Binney, 2001; Gray, 2001; Achterbergh and Vriens, 2002; Hlupic *et al.*, 2002; Desouza, 2003).

The wide application of information technology (IT) is the most important force to improve the transition of society (Drucker, 1968). According to IT progress in organization, management information systems (MIS) focused on efficient transaction processing and providing decision-relevant information (Davis and Olson, 1985). MIS provides the infrastructure necessary for organizational daily operations. To raise the IT applications at the organizational level, the concept of decision support systems

(DSS) emerged. DSS attempts to support semi-structured or non-structured decision tasks. Two main types of DSS have been developed: data oriented or model oriented (Alter, 1977). Early MIS and DSS successfully integrated organizational tasks and helped firm to achieve competitive advantage. While MIS and DSS capture the majority of explicit organizational knowledge (Beveren, 2002), the tacit nature of skilled experience, insight, and vision, which are the building blocks of KM, is critical to gain competitive advantage when organization confronting the more turbulent environment (Nonaka and Takeuchi, 1995).

Knowledge has multiple properties (Horvath, 1999). Knowledge is a resource that can help in problem-solving. Knowledge can also be an output that is embedded in products or services. There one success companies that integrate KM, information system, and core capabilities to facilitate competitive advantage (Parise and Henderson, 2001; MacSweeney, 2003). Nonaka provided the theoretical base about KM. There are two-dimensions of knowledge creation, four modes of knowledge conversion, and five-phase model of the organizational knowledge-creation process (Nonaka and Takeuchi, 1995). Based on the effort of Nonaka, numerous authors have investigated the relationship between KM dimensions and organizational effectiveness. Choi indicated that different KM styles are related to different performance. Moreover, performance can be improved by focusing on both tacit-oriented and explicit-oriented KM styles (Choi and Lee, 2003). Becerra-Fernandez and Sabherwal (2001) proposed that the context influences the suitability of a KM process. More specifically, the task characteristic is the moderating effects of the effectiveness of one specific KM process (Becerra-Fernandez and Sabherwal, 2001). Gray developed a categorization system for KM practices. The role of KM practices varies according to the problem-solving process and the type of problem being addressed (Gray, 2001). Apparently, due to the intricate characteristics of knowledge, only depend on IT cannot share knowledge effectively (Mcdermott, 1999; Lang, 2001a, b). KM processes, tools, and methodologies are not universally appropriate relating to various organizational contexts. There is no guarantee that KM project will be equally effective. Organizational supporting capabilities and a stimulus context are required (Gold *et al.*, 2001).

KM should align with organizational goals for developing an advantage over competitors. Organizational goals were accomplished through tasks design (Drucker, 1955). Organizational design is a complex process in integrating knowledge capabilities. To clarify the required knowledge capabilities, focus on individual function or department is inadequate. We need a macro framework to investigate the role and mission among various organizational components as a whole. While the traditional orthodox organizational structure is inadequate for knowledge-based organization (Nonaka and Takeuchi, 1995), a new organic organization structure that encourages effective and efficient communication is required to foster knowledge creation and sharing. Systems thinking provides a new sight to design a new organic organization. In the systems approach that satisfies the tenets of systems thinking, cybernetics is related to organizational effectiveness. Wiener defined cybernetics as the science of control and communication involving animals and the machines (Weiner, 1948). The universal principles of cybernetics apply not only to engineering systems but also to living systems, which Beer called the science of effective organization. Beer integrated cybernetics in relation to the principles governing the human nervous system, with a particular emphasis on its application to organizational management (Beer, 1979, 1981, 1985). Beer indicated organization behavior is conducted to survive,

that is, competitive advantage (Porter, 1985). Human nervous system is a rich and flexible control system – a viable system. Viable means "Able to maintain a separate existence." The central thesis of the viable systems model (VSM) is self-organization and self-regulation, actualized by autonomous management and consciousness adaptation ability. The regulatory mechanism of VSM provided a theoretical basis for designing the structure, process, and function of organizational tasks that integrate knowledge into organization value, thus improving organizational viability.

This study proposed a viable systems framework for organizational KM. Using the viable systems framework, organizational knowledge can be classified into four categories: constructive, bureaucratic, entrepreneurial, and transactive. Knowledge content was articulated based on the systems view. Thus, knowledge structure of various management hierarchies can be captured. This framework provides a basis for future empirical studies on the relationships between KM strategies and organizational effectiveness. A specific KM strategy exists that can maximize the effectiveness of each of the four knowledge types.

Conceptual foundations of knowledge management

KM is about leveraging knowledge into organizational value. This study reviews this subject from two angles. First, this study discusses the concept of knowledge from the organizational perspective. Second, this study reviews the theory of organizational knowledge creation. The KM related thesis below is the conceptual foundations of the proposed framework that is discussed in the latter sections of this paper.

Knowledge and organization

Some studies have considered knowledge from an IT perspective. A hierarchical relationship exists among data, information, and knowledge (Van der Spek and Spijkervet, 1997; Arthur Andersen Business Consulting, 2000; Rouse, 2002). Data are still uninterpreted symbols. Data are records of events or structured transaction records. Moreover, information is data that has been assigned a meaning. Methods of contextualizing, categorizing, calculating, correcting, and condensing are used to invest data with meaning. Information is generally transferred via documents or other media that aims to influence the perception of receiver and to alter their decisions and behavior. Knowledge enables people to assign meaning to data and thus generate information. Knowledge is the whole set of insights, experiences, and procedures which are considered correct and true, and which consequently guide human thoughts, behavior, and communication. The existence of a hierarchy is assumed from data to information to knowledge.

However, the hierarchical view of knowledge cannot effectively capture the essence of leveraging organizational knowledge. McDermott outlines six characteristics of knowledge that differentiate it from information (Mcdermott, 1999):

(1) Knowledge always involves a person who knows; knowing is a human act.
(2) Knowledge is the residue of thinking.
(3) Knowledge is created in the present moment.
(4) Knowledge belongs to communities.
(5) Knowledge circulates through communities in many ways.
(6) New knowledge is created at the boundaries of old.

Lang elaborated these six characteristics of knowledge and discussed each in detail (Lang, 2001a, b). Furthermore, Lang indicated that organizational knowledge has a social character. From the organization perspective, valuable knowledge is context-dependent. Human dimensions of organizing are central to effective knowledge work. Important functions of KM were to connect people and enable them to think together and share mental information, which they know will be useful to their community. However, knowledge representation has limits, IT inspired but only depend on IT cannot deliver knowledge effectively. Consequently, KM must breakthrough the barriers regarding creation, archiving and recovery of knowledge in relation to actual fuzzy contextualized activities.

Theory of organizational knowledge creation
From the organization perspective, knowledge as a resource aims to improve organizational effectiveness and efficiency. Simply stated, the objective of KM is to build, organize, and make good use of knowledge assets to make the enterprise act as intelligently as possible and thus secure its viability and overall success (Wiig, 1997). Authors have been advocated numerous prescriptive or descriptive frameworks to facilitate the sharing and integration of knowledge in organizational activities (Rubenstein-Montano *et al.*, 2001; Satyadas *et al.*, 2001). Since, organizational knowledge is derived from individual knowledge, knowledge creation process plays a key role in integrating all another KM practice. Nonaka develops a framework of knowledge creation that integrates both traditional and nontraditional views of knowledge (Nonaka and Takeuchi, 1995). The framework contains two dimensions, epistemological and ontological, as shown in Figure 1. The ontological dimension involves knowledge level. Knowledge is created by individuals, and then spreads to intra-organization, ultimately to inter-organization. As for the epistemological, Nonaka draw on Michael Polanyi's distinction between tacit knowledge and explicit knowledge. Tacit knowledge is personal, context-specific, and consequently difficult
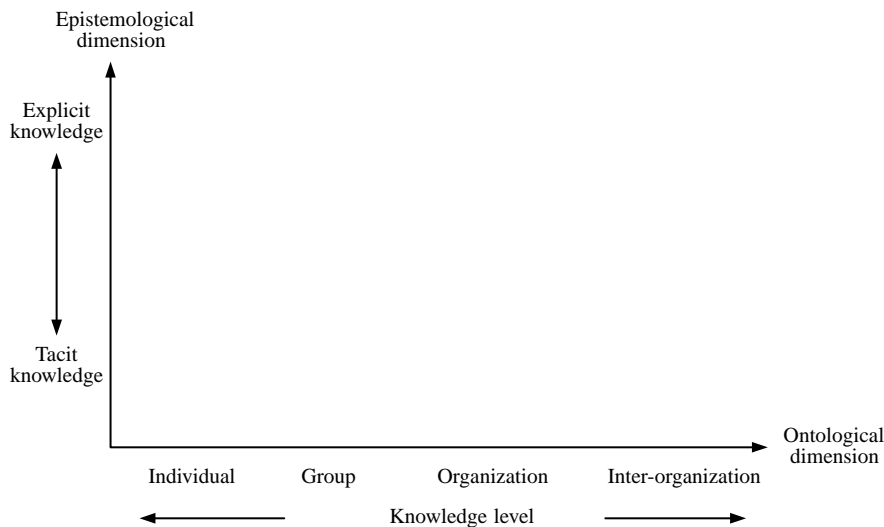
Figure 1.
Knowledge creation plane

to formalize and communicate. Tacit knowledge contains cognitive and technical elements. The cognitive elements center on the "mental model" of individual, which consist the schemata, paradigms, perspectives, beliefs, and viewpoints. Meanwhile, the technical elements of tacit knowledge include concrete know-how, crafts, and skills. On the other hand, explicit knowledge refers to knowledge that can be transmitted using formal, systematic language. The tacit and explicit dimensions are not mutually exclusive. Instead, these two dimensions are simply different to various degrees and constitute knowledge spectrum. In fact, Figure 1 shows the knowledge creation plane that will be used in fourth section to position various knowledge contents in an organization.

Both Nonaka and others emphasize the importance of tacit knowledge (Nonaka and Takeuchi, 1995; Beveren, 2002). Nonaka considers tacit knowledge to be more valuable than explicit knowledge. However, Alavi and Leidner indicated that these two types of knowledge are not dichotomous knowledge states; but rather are mutually dependent and reinforcing knowledge qualities. Focus excessively on one or the other may lead to the point being missed (Alavi and Leidner, 2001).

Assuming that knowledge is created via the interaction between tacit and explicit knowledge, Nonaka devised four modes of knowledge conversion, as shown in Figure 2 (Nonaka and Takeuchi, 1995):

(1) *Socialization: from tacit to tacit.* Socialization is a process of sharing experiences and thereby creating tacit knowledge, such as shared mental models and technical skills.

(2) *Externalization: from tacit to explicit.* Externalization is a process of articulating tacit knowledge into explicit concepts. It is a quintessential knowledge-creation process in that tacit knowledge becomes explicit, taking the shapes of metaphors, analogies, concepts, hypotheses, or models.

(3) *Combination: from explicit to explicit.* Combination is a process of systemizing concepts into a knowledge system. This mode of knowledge conversion involves combining different bodies of explicit knowledge.

Figure 2.
Four modes of knowledge conversion

(4) *Internalization: from explicit to tacit.* Internalization is a process of embodying explicit knowledge into tacit knowledge. It is closely related to "learning by doing." When experiences through socialization, externalization, and combination are internalized into individuals' tacit knowledge bases in the form of shared mental models or technical know-how, they become valuable assets.

The viable systems model

To identify the relationship between organizational goals and KM that supports organizational viability, this study first elaborates the concept of the VSM. Beer indicated that the human nervous system is a rich and flexible control system. The control essence of the human nervous system was integrated into the VSM. If organization can be designed similarly to the human nervous system, the regulating relationship of the two isomorphic systems can be obtained. Thus, the concept of human nervous system is important when discussing the thesis of VSM.

According to physiology, organs and function systems constitute the body organization (Best and Tayler, 1948; Martin, 1881). Human body exchanges energy between inside and outside environment continually. Each component uses various negative feedback systems to avoid huge status change and to maintain their homeostasis. The human nervous system composes two regulating mechanisms to maintain the internal stability and to direct consciousness movement of human body. First, the components of human body rely on mutual interaction to detect external change and self-regulated to maintain the internal stability. Secondly, human brain and sensory organs detect environment oscillation, handling crisis, direct the movement of body, and integrate local activity into an organic balance. Self-regulation and consciousness adaptation abilities are the essence of human nervous systems for designing an effective organization. Figure 3 shows the structure similarity between organizational architecture and nervous system. The functions and processes of each subsystem in a VSM-based organization and analogy to human nervous system are shown in Tables I and II.

The term "viable organization" means that the organization has the characteristics or capabilities of a VSM. A viable organization that bases on nervous system's regulating mechanism also comprises five subsystems. For simplification, this study labels the five subsystems as S1, S2, S3, S4, and S5, respectively. Similarly to nervous system, the regulating mechanisms of a viable organization also involves two dimensions: the subsystems S1-S3 perform autonomic management to achieve predefined objectives. The subsystems S3-S5 perform consciousness adaptation to environment. In terms of management, subsystems S3-S5 are the strategic function. S3 is the gateway between two regulation mechanisms.

The difference of a viable organization from human nervous system is that the total system contains two subsystems, which are identical with it (Figure 3). The labeled subsystem one (S1) likes organ's function. Usually S1 is a division or department and is producer of the organization. But S1 has the full function of a whole viable system. In management vocabulary, this means a division not only take orders from superior. A division has the autonomous and ability to determine which means to attain its goals. Thus, the VSM is a recursive model. To be a viable system, organization must comprise a collection of viable systems. Therefore, a viable
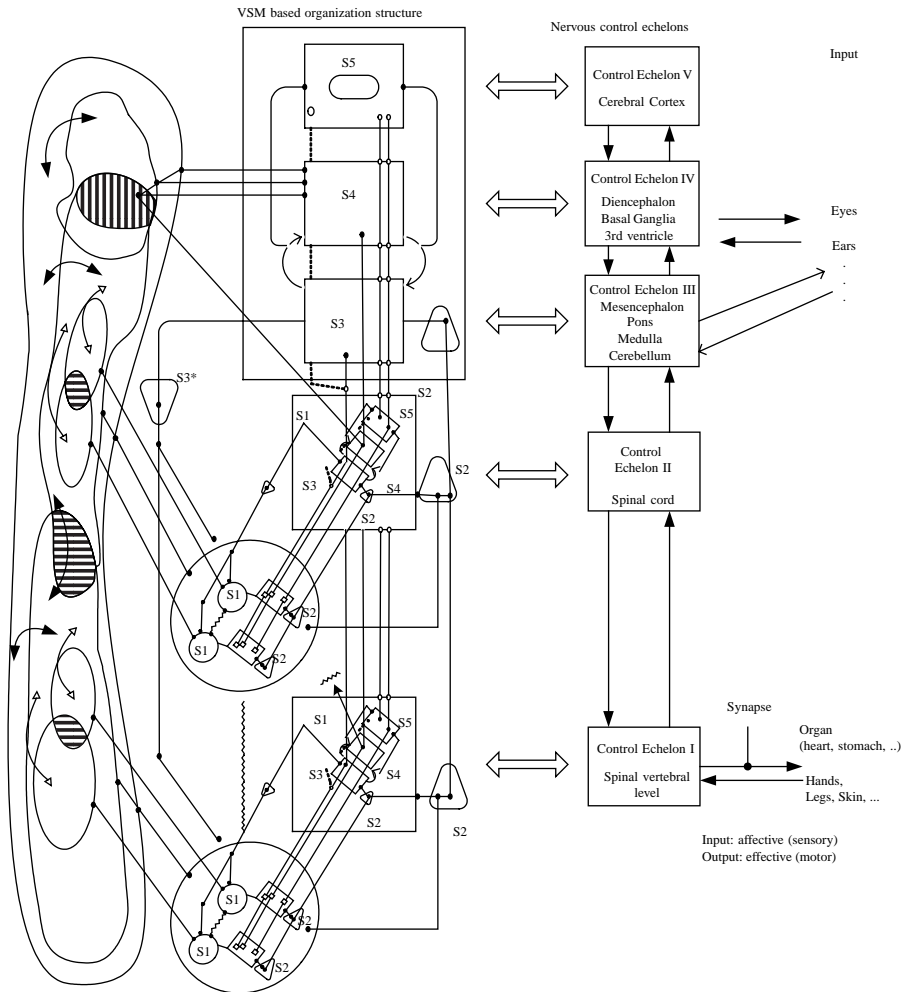
Figure 3.
VSM-based organization structure and isomorphic relationships to human nervous system

organization has hierarchical relationship between subsystems. But hierarchical principle in VSM is different from traditional orthodox concept. Hierarchy is thesis of general systems theory (GST) when big systems are becoming organized (Von Bertalanffy, 1973).

"Variety" is a key concept in the VSM. Organization is an extreme complex system. Effective organization concerned with management complexity. Variety is a cybernetic term that can be used to measure of the complexity deal with by management (Beer, 1959, 1966, 1975, 1976). Variety is the number of possible system states. The problems come from environment are called variety. Moreover, the alternatives that a viable organization possessed in dealing with outside environment are also called variety. The variety of alternatives must lager than the variety of problems to achieve effective management. The law of requisite variety describes that only variety can

Subsystem		Function		Knowledge level
S5	Policy	Define the future development of organization	Consciousness adaptation	Inter-organization organization
S4	Intelligence	Define the status in competitive industry		Inter-organization organization
		Alignment with environment development		
		Environment scanning		
S3	Control	Govern the stability of the internal environment of the organization		Organization
		Responsible for the internal resource allocation	Autonomous management	
		Communication gateway between S4 and S1's		
S2	Coordinate	Local regulatory between divisions		Group
		Anti-oscillation between divisions		
S1	Implementation	Producer of the organization		Individual
		Self-regulation		
		Pursue the predefined objectives to maintain internal environment's steady state		

Table I.
Functions of a viable organization

absorb variety (Ashby, 1956; Beer, 1976, 1979). Subsequently, the viable organization design is based upon the concept of requisite variety to accomplish the homeostasis regulation. Clearly, environmental variety significantly exceeds the operation centers'. Operation center's variety also significantly exceeds the management centre that regulates or controls it. High variety thus must be attenuated to the number of possible states that the receiving entity can handle. Additionally, low variety must be amplified to the number of possible states that the receiving entity requires to remain regulated. Hierarchical relationships among viable organization contributes to amplify alternative variety and to attenuate problem variety. Viable organization also called variety engineer. Integrating knowledge capability into task means organization possess more variety to handle management complexity (Leonard, 2000; Yolles, 2000; Achterbergh and Vriens, 2002). The form of variety is information. Therefore, in addition to structural consideration, the effectiveness of information flow must also be considered.

In the two dimensions of KM framework, Nonaka indicated that knowledge is created only by individuals (Nonaka and Takeuchi, 1995). Organization provides a "knowledge network" to amplify the knowledge creation from individuals to group, organization, and ultimately, inter-organization. From the viable systems perspective, knowledge ontology can be mapped onto the VSM hierarchical structure. In a viable organization, S1 generally comprises divisions. But "division" is a concept. Division cannot perform organizational tasks. Employee is proxy of division to perform required activity which to pursue organizational viability. Consequently, the knowledge created and retained in S1 is individual knowledge. However, from the organizational perspective, the activities performed by individual employees are part

Subsystem	Process/mechanism	Human nervous system
S5	Thinking centre of the organization	Brain (cerebral) cortex
	Define and conscious direct the function of divisions into an organic whole	Brain store and recall memory, think and learning
	Crisis handling	
S4	Catch outside environment information and internal operational performance to determine the competitive status and behavior of the total organization	Use eyes, ears, nose, tongue, and body to perceive outside environment Equilibriums the outside and inside environment's needs
S3	Translate organizational goals into goals of each S1's	Sympathetic nervous system regulates organ's function when body suffers from pressure
	Define the framework of S1's via three ways: legal and corporate requirements, resource bargain, and ...	
	Crisis information sent upward to S4	
	Define the framework of S1's via accountability	Parasympathetic nervous system relaxes organ's function
	Routine auditing to S1	
	Handles interdivisional interaction	Peripheral nervous system
S2	Formal communication systems between divisions, such as information system	Nerve that bring message between each organs
	Informal communication systems between divisions	Hormone secreted
	Building operation protocol between S1's	
S1	Error-controlled (negative) feedback systems	Autonomic reflex arc
	Operation within the intention of the whole organization	
	Operation within the coordinating framework of S2	
	Submit to the automatic control of S3	

Table II.
Processes/mechanism of viable organization and analogy to human nervous system

of the whole. Individual employees are fragment and sterile. Effective knowledge worker must consider who is going to use their output and what these others need to know about their works. Therefore, the knowledge of S2 about the interface between individuals that aims for anti-oscillation is group knowledge.

While specialist knowledge is spread from individuals throughout organization, the scope of knowledge vision changed. The knowledge in "organization" level comprises the whole set of vision, experience, or insight that investigates the organization as a whole. The "organization" level knowledge includes:

- governs internal stability of organization (S3 knowledge);
- alignment with environment competitiveness (S4 knowledge); and
- pursing future organizational development (S5 knowledge).

Organization pursues increased competitive advantage through continuous interactions with its environment. The general environment organization face includes economic, political, social, and cultural factors. These environmental factors would influence organization's competitiveness. Facing increasingly complex environment, organization

are pursuing a new business strategy of strategic alignment with industrial partner or competitors to pursue common goals, such as through developing industrial protocols to standardize product specifications (Porter, 1985; Lang, 2001a, b). These synergistic advantages cannot achieve by individual organization. Therefore, knowledge of S4 and S5 must include inter-organization knowledge.

A viable systems framework to knowledge management

This section develops a systematic framework that used to further analyze and discuss the potential role of KM for organization pursuing viability. From the VSM perspective, knowledge content can be classified into four categories: constructive, bureaucratic, entrepreneurial, and transactive (Figure 4). Table III summarized the systematic considerations regarding viable organization as a whole.

The key knowledge players in performing the consciousness adaptation function by viable organization are top managers and middle managers. Drucker (1955) described the task of top managers as follows:

> The chief executive (that is the top manager) thinks through the business the company is in. He develops and sets over-all objectives. He makes the basic decisions needed to reach these objectives. He communicates the objectives and the decisions to his management people. He educates these managers in seeing the business as a whole and helps them to develop their own objectives from those of the business. He measures performance and results against the objectives. He reviews and revises objectives as conditions demand.

According to GST, top manager can:

> ... direct the organizational growth by changing organizational goals, terminating certain activities, initiating new activities, engaging in research, continually searching its memory for vital information, modifying the value systems of its personnel, or changing the firm's operating patterns (Schoderbek *et al.*, 1975).

Essentially, top managers use positive feedbacks as regulation mechanism, a growth-prompting device, to enhance organizational competitiveness. Organizational
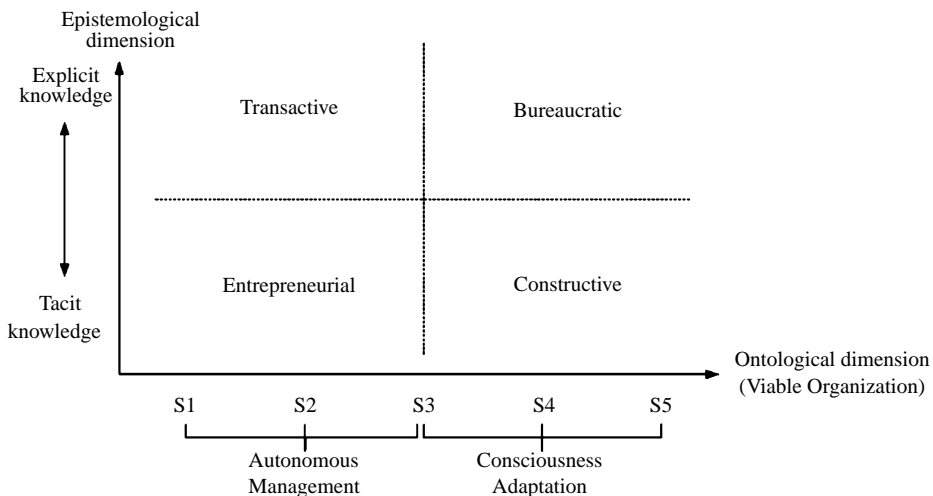
Figure 4.
A viable systems framework for KM

Knowledge characteristics	Functions of viable organization	1. Key knowledge players	2. Regulation mechanism	3. Input (knowledge base)	4. Process (skill for knowledge creation)	5. Output (form of knowledge created)	6. Environment (factors affect KM effectiveness)
Explicit knowledge	S4 + S5	Top managers	Positive feedback	1. Grand concept 2. knowledge vision	1. Conceptual skill	1. Writing data base	1. Intention 2. Consciousness
	S3	Middle managers	Negative feedback	1. Cognitive model	1. Integration skill	1. Decision rules	1. Interaction 2. Coordination 3. Communication
	S1 + S2	Front-line employees	Negative feedback	1. Professional, scientific, and head analysis 2. Quantifiable knowledge 3. Codiable knowledge	1. Technological skill 2. Human skill 3. Analytical skill	1. Menu 2. Standard operating procedure	1. Building operation protocol
Tacit knowledge	S4 + S5	Top managers	Positive feedback	1. Grand concept 2. Knowledge vision	1. Conceptual skill	1. Product/service innovation 2. Mental data base	1. Intention 2. Consciousness
	S3	Middle managers	Negative feedback	1. Cognitive model	1. Integration skill	1. Management practice	1. Interaction 2. Coordination 3. Communication
	S1 + S2	Front-line employees	Negative feedback	1. Experience-based bodily knowledge 2. Know-how 3. Congitive knowledge	1. Technological skill 2. Human skill 3. Analytical skill	1. Best practices	1. Autonomy

Table III.
A viable systems consideration for KM

intention and consciousness ability help top managers to create knowledge. Top managers based on grand concept and knowledge vision to create knowledge using conceptual skill. Meanwhile, middle managers physically implement strategic plans. Middle managers acquire and allocate resources, establishment and monitoring of budgets (Anthony, 1965). Negative feedbacks are used for control in that they are designed to minimize deviations between set standards and actual performance. As channels linking top managers and frontline employees, interaction, coordination, and communication affect the effectiveness of knowledge creation by middle managers. Middle managers based upon cognitive model to create knowledge using integration skill.

Environment and task complexity influence the explicitness of knowledge in the knowledge spectrum. Knowledge is more tacit in nature when there is more environment and task complexity. Tacit knowledge that aims to organizational consciousness adaptation is "constructive" knowledge. Such knowledge comprises two parts. The first part created by top managers is the form of product/service innovation, as well as human experience recorded in the mental database (Forrester, 1980). Meanwhile, the second part is created by middle managers and comprises management practice.

Explicit knowledge that aims to improve organizational consciousness adaptation is "bureaucratic" knowledge. This knowledge is "bureaucratic" in the sense that a definite procedure exists for handling repetitive and routine tasks. The explicit knowledge created by top managers is stored in writing database (Forrester, 1980). This data base records the history of decisions, and the rationale governing decisions. The explicit knowledge created by middle managers takes the form of decision rules.

For autonomous management function of a viable organization, the key knowledge players are middle managers and frontline employees. The systematic consideration of KM relating middle managers was discussed above. For frontline employees, they worked under predefined objectives, effectively and efficiently used existing facilities and resources to carry out activities within budget constraints (Anthony, 1965). Negative feedbacks served as regulation mechanism, just as middle managers. Task content can be used to classify the frontline employees into two types: physical-flow incentive or information-flow incentive. The tacit knowledge that supports autonomous management is "entrepreneurial" knowledge. Relying on experience-based bodily knowledge and know-how, the physical-flow incentive employees use technological skill to create knowledge. Meanwhile, the information-flow incentive employees use human skill and analytical skill to create knowledge that based on cognitive knowledge. Autonomy is critical for facilitating the creation of "entrepreneurial" knowledge. Output knowledge takes the form of "best practices." On the other hand, the explicit knowledge that supports autonomous management is "transactive" knowledge. Operation protocol is the critical success factor. Frontline employees Using professional, scientific, and head analysis, quantifiable and codiable knowledge to create "describable" knowledge. Output knowledge takes the form of menu or standard operation procedure.

Discussion

While IT facilitates the internationalization trend, organization faces more complex and dynamic environment. Knowledge must integrate into routine operation to

improve competitiveness. From the proposed VSM-based KM framework, one can recognize that there exist different knowledge contents in an organization. Tacit and explicit knowledge spread out each functions and management hierarchies simultaneously. For an organization wish to leverage knowledge advantage, a total function of KM system may be inadequate. Various knowledge management systems (KMS) are needed, Such as operation-oriented KMS or strategic-oriented KMS.

Knowledge creation and sharing must across function and management hierarchy to accommodate competitive strategy. Based upon environment's opportunity and risk, top management evaluates organization's strength and weakness to determine the competitive strategy. Knowledge vision of top management directs the integration of cross-functional knowledge to develop core competence. Therefore, knowledge spreading in the same organization function indicates sharing professional knowledge to enhance individual capability. Knowledge spreading across organization functions and management hierarchies indicate communicating professional knowledge to enhance organizational competitive advantage. Consequently, knowledge creation and knowledge sharing do not limit in the same function or management level. The viable systems framework for KM provides managerial connotation to Nonaka's theory of knowledge creation. That is, knowledge creation and sharing that across function and management hierarchy are requisite. In the knowledge conversion process, individual recognizes his role and mission that takes organization as a whole.

Internet technology promotes knowledge sharing and strengthens KM. Based upon IT, MIS and DSS successfully integrate computerization activities and support management decision. MIS, DSS and KMS are three IT-based systems that progressed for helping different management practices. These systems are interdependent activities. Data and information processing methodology can integrate into KMS to enhance KM performance. For example, using file management methodology to manage "best practice" document, each employee whenever can access these knowledge resource via internet or intranet. Thus, a synergy can be created via holistic use of these three systems.

Conclusion
To leverage knowledge resource, one must catch the whole picture about organizational knowledge to facilitate viability. Environment complexity affects knowledge explicitness. Some knowledge can easily be articulated and stored by electronic media, while some tacit knowledge cannot. However, tacit knowledge can be transferred and learned through efficient communication networks. This study proposed a viable systems framework for organizational KM based on the VSM of Beer. The proposed framework classifies organizational knowledge into four categories: constructive, bureaucratic, entrepreneurial, and transactive. Knowledge content was articulated by key knowledge players, regulation mechanism, input (knowledge base), process (skill for knowledge creation), output (form of knowledge created), and environment (factors affect KM effectiveness). In other words, a KM system can be viewed as a framework of knowledge taxonomy. This taxonomy can be used to systematically explore the key components and environmental factors for various KMS. By exploring the structure, functions, and processes of a viable organization, one can affirm that KM plays a key role in facilitating an organization to pursue its viability. Consequently, knowledge structure of various organizational

function domains can be captured. The framework also provides a basis for future empirical studies on the relationships between KM strategies and organizational effectiveness. A specific KM strategy exists that can maximize the effectiveness of each of the four knowledge types.

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