Knowledge, management, and knowledge management in business operations

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Abstract

Purpose – *The purpose of this research is to help knowledge managers systematically grasp ''knowledge about management knowledge'' and get a ''deep and full'' understanding of the nature, scope and methodologies of knowledge management.*

Design/methodology/approach – *Through presenting a variety of perspectives on knowledge, management, and knowledge management, the article explores the essence of knowledge management in organizations from a perspective of critical systems thinking.*

Findings – *Knowledge management in business organizations has the task of managing the activities of knowledge workers or the transformation and interaction of organizational ''static substance knowledge'' and ''dynamic process knowledge'' for ''products, services, and practical process innovation'' and, at the same time, ''creating new or justifying existing organizational systematic knowledge''. Knowledge management is not simply about recording and manipulating explicit knowledge, but needs to address that which is implicit, and from which benefit can therefore be derived only through process rather than content.*

Originality/value – *The comprehensive review and classification of various management theories will expand both knowledge managers' and knowledge workers' understanding of the subject and provide a foundation for building a knowledge management toolkit in practice.*

Keywords *Knowledge management, Critical thinking, Organizations*

Paper type *Research paper*

1. Background: differing perspectives on knowledge management in business

Knowledge is an important issue for business organisations. There have been a number of different perspectives from which researchers and practitioners have approached the management of knowledge. While the acquisition, transmission, and use of knowledge has always been an important part of human affairs (hence the well-established domain of epistemology), Penrose (1959), Bell (1973) and Drucker (1993a) provide us with a good basis for relating knowledge to twenty-first century business organisations. Drucker symbolically declares knowledge, as we move into the ''knowledge society'' (Drucker, 1993b), as the key resource for individual firms and the key driver of competitive advantage for developed nations, competing in knowledge-based industries, living with knowledge communities and societies.

Penrose, acknowledged as one of the first scholars to recognize the role of knowledge in business organisations, saw acquiring knowledge as a social learning process:

> This increase in knowledge not only causes the productive opportunity of a firm to change in ways unrelated to changes in the environment, but also contributes to the ''uniqueness'' of the opportunity of each individual firm (Penrose, 1959).

As did Bell, Drucker proposed the concepts of knowledge worker and knowledge work arguing that the first knowledge workers, Taylor's industrial engineers, increased the productivity of manual workers (Drucker, 2001, 1993):

> **"Business organizations have an inherent interest in using both the business knowledge owned by the organization, and personal knowledge of their employees."**

> The basic capital resource, the fundamental investment, but also the cost centre of a developed economy, is the knowledge worker who puts to work what he has learned in systematic education, that is, concepts, ideas, and theories . . . (Drucker, 1993).

Drucker further suggests the productivity of knowledge as the determining factor in the competitive position of a company, an industry, or an entire country, but:

> . . .making knowledge productive is a management responsibility. It cannot be discharged by government; but it also cannot be done by market forces. It requires systematic, organized application of knowledge to knowledge (Drucker, 1993).

The increased concentration in recent years on the ''knowledge management'' practices of organisations can be seen in the work of Petrash (1996) on ''intellectual asset management'' in the Dow Chemical Company, and the management practice of ''intellectual capital'' in Scandia Inc. (Edvinsson and Malone, 1997). Critically, these efforts can best be treated as ''explicit knowledge management'' such as R&D management or the reuse or obsolescence of existing technological knowledge, rather than knowledge management by today's practical definitions, and cannot be compared to knowledge initiatives in large companies such as GE, GM, IBM and Fuji Xerox (Takeuchi and Nonaka, 2004; Barclay, 2005 website; Bushell, 2004; Barabba *et al.*, 2002; Gongla and Rizzuto, 2001; Nonaka and Takeuchi, 1995). These exemplary cases triggered a movement towards an active discussion of knowledge and its management, and created a cadre of knowledge management gurus and consulting experts in this specific domain, including Nonaka, Takeuchi, Leonard, Davenport, Prusak, Sveiby, etc., and their books were among bestsellers of their day (Nonaka and Takeuchi, 1995; Leonard, 1995; Davenport, 1993; Sveiby, 1997; Davenport and Prusak, 1998).

Business organisations have an inherent interest in using both the business knowledge owned by the organisation, and the personal knowledge of their employees. What we are talking about here as business knowledge is practical knowledge, or useful knowledge for management, production, service and innovation in industries, rather than broader social and scientific knowledge.

This brief review highlights the different views, perspectives on, and approaches to knowledge management. Having looked at these issues, we can now move on to developing a deeper definition of the concept of knowledge in the business context.

2. Knowledge

The meaning of the word ''knowledge'' is subject to a number of different interpretations. In the past it has been linked with terms such as data, information, intelligence, skill, experience, expertise, ideas, intuition, or insight, which all depend on the context in which the words are used. Plato views knowledge as ''justified true belief'', which was later modified by Nonaka and Takeuchi (1995) to: ''a dynamic human process of justifying personal belief toward the truth'' at the organisational level. Bell defines knowledge in a broader sense as ''a set of organized statements of facts or ideas, presenting a reasoned judgment or an experimental result, which is transmitted to others through some communication medium in some systematic form'' or in general meaning as ''{that} which is objectively known, an intellectual property, attached to a name and a group of names and certified by copyright or some other form of social recognition'' (Bell, 1973). For Davenport and Prusak (1998), knowledge is ''a fluid mix of framed experiences, values, contextual information and expert insight''. Boisot (1998) defines knowledge as ''a capacity that builds

on information extracted from data or the set of expectations that an observer hold with respect to an event''.

In Drucker's opinion, knowledge is information that ''changes something or somebody either by becoming grounds for action, or by making an individual or an institution capable of different and more effective action'', or more simply termed, ''specialized knowledge''. When Drucker talks about knowledge work or knowledge workers, he emphasizes that only in or through systematic learning, that is, in and through formal schooling can the knowledge required for knowledge work be acquired; the knowledge for knowledge work cannot be acquired through apprenticeship (Drucker, 1993a). He focuses on the utility of knowledge, i.e. its application to businesses, in sharp contrast to traditional intellectuals who prided themselves on not considering utility. He also differs from Nonaka regarding who should be the key players in organisations. Both Drucker and Nonaka strongly believe that knowledge should relate to action. However, Drucker emphasizes the knowledge work done by knowledge workers and their productivity, while Nonaka argues that everyone in the organization should be involved in knowledge-creating activities. The difference mainly comes from the different types of organization they addressed when they discussed knowledge management and knowledge creation.

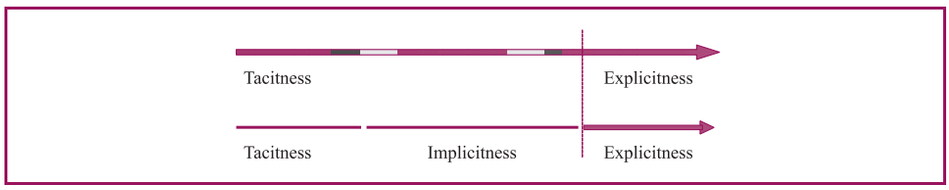
Knowledge can be further defined as subjective or objective; or explicit or tacit/implicit. Polanyi (1966) first divided human knowledge into two dimensions: explicit knowledge (formalized and written knowledge, expressed in the form of data, scientific formulae, specifications, manuals, or textbooks) and tacit knowledge (action-based and unformulated, highly personal and hard to transfer). He insists that knowledge is not gained by an objective flow of events and the necessary outcome of a determined scientific endeavour, but is grounded in such human conditions as the sense of beauty and passion (Polanyi, 1962, 1966). This insight helps uncover the mystery of discovery, invention, and creation by knowledge agents and emphasizes the agents' thinking, experiencing and acting capabilities. Recognizing the importance of new ways and processes of thinking and doing is the key to acquiring existing knowledge and generating new knowledge (Gao *et al.*, 2002, 2003). Implicit knowledge, another form of tacit knowledge, is the kind of knowledge that is shared or understood by people or groups who are either unwilling, or unable to express it explicitly (for example, due to cultural factors) without a proper atmosphere (Li and Gao, 2003). Tacit knowledge and implicit knowledge are not, however, mutually exclusive; efforts to bring them out in an organisation will require the allocation of organisational resources and can produce unexpected outcomes. The continuum of explicit knowledge, tacit knowledge and implicit knowledge is shown in Figure 1.

On the other hand, Hayek's thoughts on knowledge bring out the importance of knowledge as contextual, and widely distributed throughout communities and societies:

> The knowledge of the circumstances of which we must make use never exists in concentrated or integrated form but solely as the dispersed bit of incomplete and frequently contradictory knowledge which all the separate individuals possess (Hayek, 1945, pp. 519).

For this reason, the fundamental issue in managing knowledge in an organisational context is to identify features of contexts and enable the processes that can facilitate the flow of knowledge of individuals in organisations, communities and societies for particular purposes, to make distributed components into a complete whole that will be useful for a purposeful objective. That issue drives managers or CKOs to think about using the

Figure 1 Continuum of explicit and tacit knowledge



synthesizing capability of knowledge workers and those individuals specialized in synthesis, as well as systems to help the process in an organisation.

In Gao's (Gao *et al.*, 2003) early work, organisational knowledge is considered at two levels: the individual level and the organisational level. Personal knowledge refers to Drucker's specialised knowledge and Polanyi's tacit knowledge as well as the person's values – professional ethics and morals. Personal knowledge belongs to the person who possesses it rather than the organisation s/he works for, but it can be used by the organisation.

At the organisational level, organisational knowledge is divided into organisational static substance knowledge and organisational dynamic process knowledge. Static substance knowledge refers to explicit knowledge or the bodies of knowledge in terms of mission and vision, science, technology, management theory, as well as the information and data upon which knowledge is based or from which it is drawn out. It can be classified into visionary knowledge (organisational vision, mission, ethics, and morals), objective and/or subjective knowledge (science, technology, and management in the form of hard aspects like technological equipment and products or soft aspects like research laboratories, qualified employees, patents, copyrights, services, and the ways of practicing management), and generic knowledge (information and data), which the organisation owns. Organisational dynamic process knowledge relates to human actions or the activities of organisational operation, called the organisational human activity system. These are categorized into autonomous human activity system (activity of distinct mission), semi-autonomous human activity system (activity of clear goals), and general human activity system (activity of defined problems) (see Table I).

The relationship between static substance knowledge and dynamic process knowledge is like that of ''cookbook'' and ''cooking''. Substance knowledge like book knowledge is clearly formed and can be communicated, codified, and exchanged. Some, in the form of patents or copyrights, can be bought or sold (such as the knowledge management practice in Dow Chemical Company mentioned above). On the other hand, dynamic process knowledge is like cooking. It is an activity or an operational process. It needs the technical knowledge embedded in knowledge agents and their personal skills and subjective judgment. Process knowledge can be realized only through knowledge agents engaging in activity. Without practices, the economic value of both substance knowledge and process knowledge cannot be obtained. Any organisation needs both static substance knowledge, like ''cookbooks'', and dynamic process knowledge, like ''cooking'', to realize its vision and mission.

Table I A framework of orgganisational knowledge

	Knowledge		*Criteria*
Static substance knowledge	Visionary knowledge	Vision; mission; ethics; moral	Humanity; justice; fairness; honesty
	Objective and/or subjective knowledge; generic knowledge	Science	Justification;falsification
		Technology	Advancement; novelty; applicability
		Management	Performance; applicability
		Information	Reliability; simplicity; timeliness
		Data	Objectivity; accuracy; reliability
Dynamic Process Knowledge or Human Activity System (HAS)	Autonomous (HAS) distinct mission		Publications; copyrights; patents; new products and service
	Semi-autonomous (HAS) (defined goals)		As above
	General (HAS) (defined problems)		New products and service; patents; patents publications copyrights

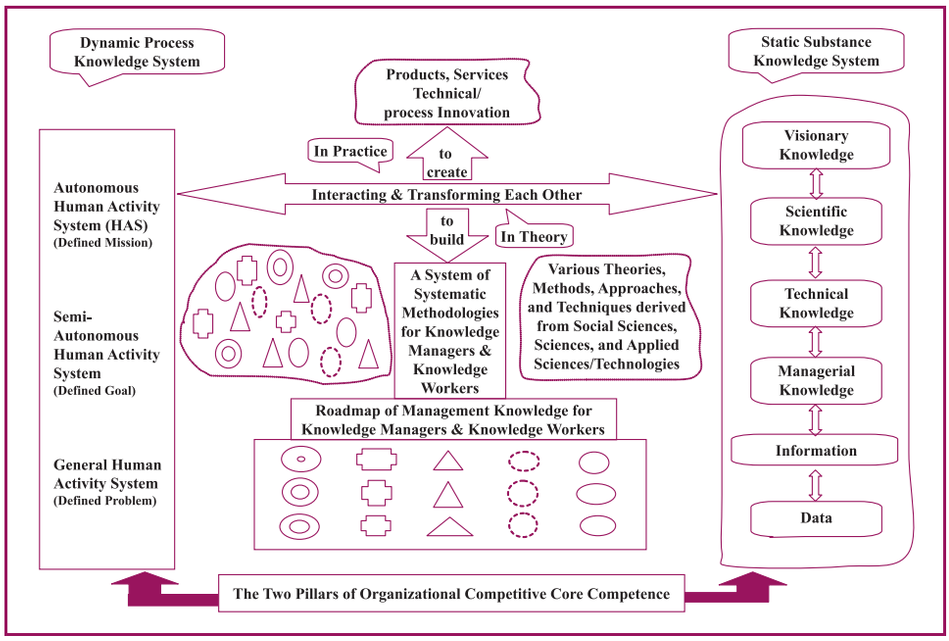
Source: Simplified from (Gao *et al.*, 2002)

The different kinds of static substance knowledge have different characteristics, play different roles, and therefore require different approaches to management. The different human activity systems focus on coping with different levels of organisational issues such as basic research, middle-term R&D, or short-term product/service development. The different characteristics of different kinds of knowledge need different criteria for evaluation. It is easy to understand the criteria of static substance knowledge (see Gao *et al.*, 2003). As for dynamic process knowledge or a human activity system, the criteria have to be the outcomes such as copyrights, patents, publications, new products or services, because knowledge agents have more knowledge about their work than their managers have (unless the manager himself/herself is also a knowledge agent in the same field); therefore, the process of knowledge work cannot be ''managed'' through process or work design. Organisations have to treat it as a black-box and exercise ''control'' through motivating professionals or knowledge workers and integrating the goals of individuals and the organisation, as well as society, to get the desired results through allocating the input and evaluating the output. Clearly each organisation has its unique static substance knowledge and dynamic process knowledge. Seeing them as a whole gives us an architecture of organisational knowledge that can be addressed with different perspectives through shifting social paradigms, based on different hypotheses and the characteristics of different kinds of knowledge. These are the two pillars of organizational competitive core competence. The interaction and transformation of them create new products, services, and technical and processes innovation in practice and generate new managerial knowledge for future use in theory (see Figure 2). In this sense, creative holism offers an insightful approach for ''managing'' organisational knowledge in a comprehensive and systematic manner (Jackson, 2003; Gao *et al.*, 2003; Gao and Li, 2003, 2006).

3. Management

Peter F. Drucker was the first to identify management as an independent discipline authoring the concept of the corporation (1946) and the practice of management (1954). The term ''management'' generally means the act of organizing and controlling a business or similar organisation. It includes two parts: responsibility and control. The first purposeful efforts at rational thinking about management began with Taylor, Fayol, and Weber. Ever since then, scholars, experts, and practitioners in various fields from different perspectives have

Figure 2 A perspective of creative holism on organizational knowledge management



studied the two domains and introduced concepts from science, technology, psychology, social psychology, sociology, biology, cybernetics, or complexity theory to address the issues.

Classical management focused on the use of scientific methods to define the best way for a job to be done, the flow of command and information or documentation, hierarchy, division of labour, and operation rules (Taylor, 1911; Fayol, 1949; Weber, 1947). Researchers specialized in both ''hard'' and ''soft'' individual production factors (such as capital, materials, or human resource), organisational structure and strategy (Chandler, 1962), decision-making (Simon, 1947), organisational competence (Hamel and Prahalad, 1990, 1994), and organisational competitiveness (Porter, 1979, 1980, 1985). They also identified the duties of managers as to what they should do and how they should do it (Barnard, 1938; Drucker, 1954, 1966, 1973; Mintzberg, 1973, 1975), as well as taking the organisation as a whole to qualitatively and quantitatively study its effectiveness and efficiency (Churchman *et al.*, 1957; Churchman, 1968, 1971, 1979; Ackoff, 1974, 1981, 1999a, 1999b; Beer, 1972, 1979; Checkland, 1981; Jackson, 1991, 2000, 2003). These studies and discussions not only make ''management'' legitimate as a discipline based on different schools with different concepts, principles, techniques, and practice to embrace a wider human perspectives in academic sense but also create a new profession – that of the professional manager with professional knowledge about organisational management, who is in charge of operational effectiveness and efficiency in an organisation, with a focus on realizing organisational mission and goals.

In contrast to scientific management, which emphasized organisational order, rationality, uniformity, and consistency, through viewing the organisation as a social system Mayo established human relations theory to improve the productivity of human resource (Mayo, 1930). This changed management attitudes toward the treatment of human labour. Later, Maslow built up his five-level hierarchy of human needs and Herzberg developed motivation-hygiene theory through the application of psychology and social psychology (Maslow, 1970; Herzberg *et al.*, 1959). McGregor called these soft management styles Theory ''Y'', as opposed to Theory ''X'' – authoritarian or hard management styles (McGregor, 1960). Ouchi summarized the Japanese management style as Theory ''Z'' (Ouchi, 1981). Nonaka and Takeuchi later interpreted the Japanese management system with their knowledge-creating theory (Nonaka and Takeuchi, 1995).

Whilst these studies focused on how to make human labour more effective at work, others were interested in the duty of managers. Barnard (1938) discussed formal organisations and the authority of executives, identified the responsibilities of managers, and pointed out that the main task of managers is decision-making. From a similar perspective, Simon (1947) developed bounded rational decision-making theory, using ''satisfying'' to replace ''maximizing'' under uncertainty. Drucker (1954, 1973, 1993a), however, emphasized objectives as the main means for management and later systematically discussed the tasks, responsibilities, and practice of management. On the other hand, Mintzberg (1973, 1975) discussed the tasks of managers and emphasized their intuition and the role of personal contact. Now leadership is viewed as an important task for managers and entrepreneurship as a unique characteristic of practitioners. Managers in the 21st century require not only entrepreneurship, leadership, and their personal abilities in decision-making and judgment, but also knowledge about management – what they should do and how to do it effectively and efficiently.

Following the soft trend on factors such as structure, in the 1920 s Du Pont's decentralised organisational structure replaced the traditional centralized organisation. Chandler defined corporate strategy, analyzed the relationship between structure and strategy, and pointed out that structure should follow strategy (Chandler, 1962). Andrews then amplified this concept and identified corporate strategy as the most important task of an executive (Andrews, 1965). Later, Porter analyzed how competitive forces and advantage shape organisational strategy and described competitive strategy as a roadmap towards sustainable competitive advantage (Porter, 1979, 1980, 1985). While Porter talked about competitive advantage, Hamel and Prahalad called for a focus on developing and

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maintaining corporate capabilities (Hamel and Prahalad, 1990, 1994). Similarly Collins and Porras concluded that a ''visionary'' company is contingent on preserving a fixed core ideology to ensure continuity and pointed out the key elements for longevity and success (Collins and Porras, 1994). The content on ''what to be'' and the formulation and implementation of ''how to do'' provided by different researchers demonstrates a special aspect of necessary managerial knowledge.

In Jackson's recent research he takes a creative and holistic perspective, or in his words Creative Holism, using social theory to explore the underlying philosophies and hypotheses of various management theories to gain an insight into what management is and reach a new stage of knowledge management (i.e. the organisation and management of various ''knowledge about business knowledge'' in the form of system of systems methodologies and the practice of managing business knowledge). Operational research, generated from scientific management, was first summarized by Churchman (Churchman *et al.*, 1957) and later separated into hard groups, for an emphasis on modelling with mathematics and computers, and soft groups with a focus on solving management problems. Both hard OR and soft OR look at the organisation as an interrelated and interdependent set of elements functioning as a whole to improve its whole performance. Systems concepts and techniques developed from physics, biology, and cybernetics, quantitative approaches from mathematics, statistics, and engineering, and qualitative analysis from social sciences and social study have been introduced to expand the scope of the research from resource allocation to strategic planning and decision-making, and deepened the research to the philosophical and theoretical level. Jackson (2000, 2003) summarized these approaches into four groups: improving goal seeking and viability, exploring purposes, ensuring fairness, and promoting diversity, which made various systems approaches be easily understood by practitioners.

To improve goal seeking and viability, we can use hard OR, soft systems dynamics, and the viable systems model (Senge, 1990; Beer, 1972, 1979). Complexity theory is also introduced to study the disordered, irregular, and random aspects of organisations (Jackson, 2003). This research helps managers understand the unpredictable factors confronting organisations and find their hidden patterns. To explore purposes, we can use interactive planning (IP), soft systems methodology (SSM), and strategic assumption surfacing and testing (SAST) (Ackoff, 1981, 1999a; Checkland, 1999; Mason and Mitroff, 1981). All of these soft systems approaches emphasize the learning and participation of different parties with different interests and perspectives at all levels as crucial elements. They all focused on exploring hidden hypothesis and differences in values, interests, and perspectives. However, they are quite different in terms of means, techniques, and targets. To ensure fairness and promote diversity, we can use critical systems heuristics (CSH), team syntegrity (TS), and postmodern systems thinking (Ulrich, 1983; Beer, 1994). CSH makes the lack of comprehensiveness of planning and design transparent. TS provides a set of procedures with five stages to support democratic decision-making. In believing that functionalist, interpretive and emancipatory systems thinking suppresses differences and creativity, and rejecting the belief in rationality, truth, and progress, the postmodern systems approach emphasized the exceptional and made a space for suppressed voices to be heard by engaging people's emotions. Taket and White's Participatory Appraisal of Needs and the Development of Action (PANDA) is an example of the postmodern systems approach for

holistically and pragmatically addressing diversity and uncertainty in multi-agency settings in modern organisations (Taket and White, 2000).

From the above introduction it can be known that the systems strand takes the research object as an interconnected, open, adaptive complex system. Although all are labelled as systems approaches and have a holistic character, as Jackson described, each approach is based on a unique hypothesis, interprets reality from its own particular perspective, and focuses on different aspects of organisational issues. Jackson made use of Burrell and Morgan's classification of social paradigms and Morgan's enumeration of various metaphors or models of the organisation to highlight and illustrate the different characteristics of these systems approaches and their functions (Burrell and Morgan, 1979; Morgan, 1997).

From Taylor to Jackson, the concept of management has evolved from a ''scientific'' method for organisation and operation to more diverse approaches that embrace a wider human perspective. The objectives of management were expanded from ''things and procedures'' to ''persons and processes or human activity systems''. This does not mean that ''things and procedures'' are not important; rather that ''people and processes'' are more important. The latter is an extension, not exclusion in scope. Therefore, both should be considered and cannot be separated. They must be addressed as a whole. Having all of this in mind, let us move to the next topic, knowledge management.

4. Knowledge management

''Knowledge management'' contains a much more complex meaning than the terms management and knowledge alone. Various topics in different contexts with different perspectives are discussed under the term ''knowledge management''. Briefly we divide them into two groups – the hard track and the soft track. Hard track theories, methodologies, approaches, and tools are those related to either hard technology (the application of science to industrial or commercial objectives, like industrial R&D) or soft technology (related to software, database, information, patents, or copyrights, which have clear objective criteria in their corresponding professional communities). To those associated with the hard group, knowledge management is an advanced level for discussing technology, R&D, or product/service innovation and development, data mining or knowledge discovery from databases, MIS, IT infrastructures or supporting software, expert systems, decision-support systems, or knowledge repositories (Boisot, 1995, 1998; Davenport, 1993; Davenport and Prusak, 1998; Stewart, 1997). Typical terms used by this group are ''capture'', ''abstract'', ''codify'', ''organize'', ''store'', ''diffuse'', ''reuse'', ''transfer'', or ''transform''. Hard technology or IT infrastructure and supporting software, is aimed at the management of existing explicit knowledge. The fundamental assumption in this perspective is based on the belief that knowledge comes from information, information comes from data, and data come from events. Creating knowledge implies a process of generating insights through extracting information from data. Thus, IT serves as a tool or enabler for turning knowledge into profitable industrial commodities. Financial investors treat a firm's IT investments and associated organisational assets as intangible assets that increase long-term output and profits (Brynjolfsson *et al.*, 2002), which may be a driver for linking IT with knowledge management. To the hard track, knowledge management is almost equal to an IT-based management system. The basic assumption is that information technologies can accelerate the flow of knowledge and offer ''modern'' systems to stockpile formal knowledge and support personal knowledge sharing.

On the other hand, the theories, methodologies, approaches, and tools related to the soft track, as represented by Nonaka, Takeuchi, Sveiby and Wenger, are people-focused and concentrate on facilitating or enabling a ''good'' space for knowledge creation like ''Ba (space)'', ''community of practice'' or a knowledge-creating/sharing culture (Nonaka and Takeuchi, 1995; Sveiby, 1997; Sveiby (n.d.) website; Wenger, 1998). Experts in this track place more emphasis on tacit/implicit knowledge or know-how, and consider that this huge part of the knowledge iceberg is something closely attached to body and mind and embodied in action. Nonaka noted that knowledge is ''a dynamic human process of justifying personal belief toward the truth''. Tacit knowledge is unarticulated and elusive;

let alone capable of being transferred through electronic systems. The soft track insists that knowledge is something different from information; knowledge is embedded in people and knowledge creation is associated with the processes of social interaction. We can also classify the theories, methodologies, approaches, and tools that deal with the soft management topics like vision/values creation, organisational learning, or culture into the soft track (Zack, 1999; Boisot, 1995; von Krogh and Roos, 1995; Edmondson and Sole, 2002; Long, 1997). For the soft track, knowledge movement is one kind of informal, collective learning; for observers, there is no major difference here from the learning organisation advocated by Chris Argyris, Donald Schon, Edgar Schein, and Peter Senge, except for a focused purpose on quality control or new product development (Argyris and Schon, 1978, 1996; Argyris, 1993a, 1993b; Schein, 1987, 1988; Senge, 1990). They strongly believe in the creation of new knowledge, not just the revisiting and reuse of existing knowledge possessed by an organisation. To soft track adherents, explicit knowledge is only the small tip of the iceberg of knowledge, and current IT tools are useful only in so far as they support communication and coordination. This is quite different from some hard views, which consider that knowledge management cannot be separated from computer-based technology (Holsapple, 2005). There also are some scholars who tackle specific professional issues (like information, information system or product/service innovation) from a knowledge management perspective by synthesising both hard and soft aspects (Boisot, 1998; Leonard and Sensiper, 1998) or who take knowledge management as the effectively integration of people, technology and processes (KM Advantage home, 2005) website.

Those who believing in critical systems thinking and critical systems practice, view any existing theory, methodology, approach, and tool as the outcome of the human mind, reflecting some actual situation from different perspectives based on different value systems. Therefore, they focus on different aspects of reality, concentrate on different issues, tackle problems with different techniques, and obtain different outcomes. In order to take advantage of these different theories and approaches, we should approach reality from as many perspectives as possible (as Jackson named it, ''creative holism''), and draw a whole picture of the development of knowledge management, to build a toolkit based on organisational static substance knowledge and dynamic process knowledge (Gao *et al.*, 2003; Gao and Li, 2003, Jackson, 2005). Considering the concepts of knowledge and management reviewed earlier in this paper, keeping to the commitments of critical awareness, pluralism (at both the theoretical and methodological levels), and improvement of critical systems thinking in mind, and following the method of matching problems with suitable approaches from critical systems practice, we will now briefly analyse knowledge management in the following sections.

For knowledge management in business, organisations must have clear objectives: the effective and efficient management of existing organisational knowledge and the mobilization of personal knowledge for achieving organisational goals. In this way, companies generate, communicate, and leverage their intellectual assets. To achieve this, we now return to the concept of static substance knowledge and dynamic process knowledge, and a framework for organisational knowledge (Table I). Management here has two facets: administrative efforts in relation to existing explicit, ''subjective'' or ''objective'' knowledge (e.g. static substance knowledge); and facilitative initiatives to enable the dynamic process of tacit or implicit knowledge flow among knowledge workers for the effectiveness and efficiency of the human activity system (e.g. dynamic process knowledge).

To manage organisational knowledge is to manage both substance knowledge and process knowledge. Managing substance knowledge means managing the activities of developing, creating, capturing, codifying, mining, organizing, distributing, diffusing, protecting, and utilizing substance knowledge, which are generally carried out by knowledge workers or professionals. In knowledge-based organisations such as high-tech companies, software companies, consultants, pharmaceutical companies, or law firms, managers usually have less knowledge about the detailed processes of ''manufacturing'', or the nature of products or services than the employees (i.e. knowledge workers) who actually engage in the work.

Therefore, to manage substance knowledge actually means to manage the activity of knowledge workers who are engaged in knowledge related work, that is, a human activity system. As dynamic process knowledge is viewed as a human activity system, therefore, knowledge management in essence means to manage organisational human activity systems; in other words, to manage organisational knowledge is to manage the process or the activities of knowledge workers. Once this is recognized as the main concern, our attention should be focused on identifying and analysing the nature, characteristics, and meaning of knowledge work. Based on the nature and characteristics of knowledge work, managers or CKOs decide how to design the organisational structure and how to manage knowledge related activities.

Management, as discussed earlier, means interactive planning or corporate/organisational strategy, facilitating participators, building or nurturing ''good'' configuration of various Bas, and empowering, supporting and motivating professionals. Consequently, various approaches, techniques, and tools developed in different strands of management for managing process, activities, and human resources are the potential available tools for organisational knowledge management. But this does not mean they can simply be picked up and put into use. Before applying an approach, we must find out its theoretical background and its original context and gain an in-depth understanding of its strengths and weaknesses. This is another form of knowledge management, which will lead to a picture of the state-of-the-art development of knowledge management accompanied by a detailed analysis of each examination for every particular approach and theory.

Jackson's modified Ideal Problem-Context offers an alternative perspective for the analysis of knowledge management approaches. Issues and associated problem-solving tools can be grouped into six sets: simple-unitary, simple-pluralist, simple-coercive, complex-unitary, complex-pluralist and complex-coercive context (Jackson, 2003). Because of specific issues and contexts, the required methods in each set will be different. An approach quite suitable for a simple-pluralist situation could be unproductive in a complex-coercive context. This necessitates a careful examination of the approaches to and participants in knowledge management in each set. For example, in a simple-pluralist case, such as a quality control cycle, knowledge activities cannot be as complex as simple sharing of information and experiences of frequent troubleshooting. However, in a complex pluralist case, like a cross-functional project team for a new product development venture, a refined knowledge base and interacting process are necessary for bringing forth creativity and learning among team members. The nature of differentiating approaches is a trade-off of input of efforts and output in terms of performance. The balancing criteria should be the efficiency, effectiveness and efficacy of applying methodologies in real-world contexts (Jackson, 2000).

According to the values of the different participants (unitary, pluralist, or coercive), differentiated approaches can be more effective pertinent to simple or complex systems. Accordingly, managers can select those methods to address the issues within a certain context. They can escape from the intricacies of perspectives, methods and tools and make more efforts to discover the nature of phenomena and nurture a suitable environment.

Other approaches like Herzberg's motivating employee, Argyris's double-loop learning, and Argyris, Schon and Senge's learning organisation, are existing approaches for managing knowledge workers. All of the approaches can be matched into the system of systematic methodologies in Figure 2.

"Tacit knowledge and implicit knowledge are not mutually exclusive; efforts to bring them out in an organization will require the allocation of organizational resources and can produce unexpected outcomes."

Conclusion

In the paper, we have summarized the fundamental development of the concepts of knowledge, management, and knowledge management in a manner of classification. Based on the discussion we conclude that knowledge management in a business organisation means managing the activities of knowledge workers, which is achieved through facilitating, motivating, leading, and supporting knowledge workers and providing or nurturing a suitable working environment. Critical systems thinking and critical systems practice, as powerful thinking tools, not only help us to understand the current situation in the development of knowledge management but also provide potential systems approaches for dealing with the soft, emancipation, and postmodern problem contexts. Exploring how to use those systems approaches as individuals or in combination to support creativity, and reflecting on assumptions and perspectives in knowledge management and on how to develop a model of ''attractive space (i.e. Ba, KM club or community of practice)'' in which people are willing to exchange or share personal, public, or organisational knowledge will be some of our further research. In the domain of knowledge management, we generally agree on a call for improvements in: tacit knowledge exchange, flow of knowledge, making knowledge assets visible (Hotshouse, 1998), or trying to measure information and knowledge quantitatively (Wang, 2006); however, for business organisations, the most important task is to build up unique organisational capabilities, producing competitive knowledge and transferring it into products or services as shown in Figure 2. This is the essence of knowledge management.

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