Reviewing the knowledge management literature: towards a taxonomy

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Abstract *Academic and practitioner interpretations of knowledge management are captured through a comprehensive taxonomy of knowledge models. How knowledge is absorbed raises the question as to whether focus should be placed on knowledge transfer or knowledge management. It is concluded that the contextual demands for knowledge application dictate which pathway to pursue.*

Keywords *Information, Learning, Knowledge management*

Introduction

Knowledge management (KM) is currently receiving considerable attention, from both academics and practitioners, and is being addressed by a broad range of academic literature and popular press. In this paper, various literatures are examined through the insights they allow into assumptions about knowledge and consequential KM models and, as such, the paper seeks to contribute to the further understanding of KM goals and orientations. Five dominant models in the KM approach are identified and analyzed. However, while the literature is revealing in particular aspects of KM models, a deeper understanding of KM complexity requires, it seems, a multi-model and multi-disciplinary approach.

The study of human knowledge has been a central subject matter of philosophy and epistemology since the ancient Greeks. An historical perspective of KM reveals that it is an old quest pursued both by Eastern and Western philosophers. Eastern philosophers, Tzu and Confucius in China and their contemporaries in India, have an equally long and well-documented tradition of emphasizing knowledge and understanding for the conduct of spiritual and secular life. Practical knowledge or ''know how'' has always been important although KM was, and often still is, an implicit task. The first attempts at KM, such as capture, storage and retrieval, began with the Cuneiform language in about 3000 BC. Knowledge was inscribed with a stylus in wet clay and then baked. Through centuries, new technologies found their way in influencing KM processes. For example, the craft guild culture of the thirteenth century introduced more explicit and systematic KM practices.

The last century has seen the re-discovery of the knowledge debate, starting with scholars from economics (Hayek, 1945; Arrow, 1962; Marshall, 1965), organizational theory (March and Simon, 1958) and philosophy (Polanyi, 1966). These perspectives concerned with the characteristics of knowledge and its role within the organization has led to invigorating debate among scholars and practitioners from other disciplines in the last decade. Knowledge received

explicit acknowledgement in economic analysis by the neo-classical economist, Alfred Marshall (1965, p. 115), who argued that capital consists, in the greater part, of knowledge and organization and that knowledge is the most powerful engine of production organizations increasingly focused on management. In 1959, Drucker (1993) coined the term ''knowledge worker'' and later argued that, in the ''knowledge society'', the basic economic resource is no longer capital, natural resources or labor but is, and will be, knowledge. The ability to use intellectual capability and create new solutions for human needs now takes central place in the global info-economy. Human knowledge and capabilities have always been at the core of value-creation, but this truism has become more visible in the info-age where the ''intellective'' component of work is increasingly important (Zuboff, 1988). For years, organizations paid lip service to the management of knowledge, being concerned with more tangible and physical assets. The knowledge component of the value-chain had been obscured by the tendency to think of work as fundamentally a physical activity (Zuboff, 1988).

Knowledge is seen at the center of global economic transformation (Bell, 1978), competitive advantage of an organization (Mayo and Lank, 1994) and a shift from ''info-war'' to ''k-warfare'' (knowledge warfare) (Baumard, 1996). Increasingly, knowledge is seen as outstripping traditional resources such as land, labor and financial capital and is considered the key source of comparative or competitive advantage (Grant, 1996; Swan and Newell, 2000). For some, knowledge is ''economic ideas'' (Wiig, 1997) or ''intellectual capital'' (Stewart, 1997; Van Buren, 1999) and is talked about in terms of ''stockpiles'', ''reservoirs'', ''exchange'', ''capture'' and ''utilization'', without questioning whether it can actually be managed or understanding its epistemology – knowing it exists and understanding its context and, hence, its importance (Swan and Newell, 2000). Practitioners see knowledge as having distinctive characteristics of a marketable commodity, as defined by economists. It is non-monopolistic – once produced it can be re-used by others; non-excludable – it is difficult to protect once in the public domain; and indivisible – it can be aggregated to a certain minimum scale to form a coherent picture before it can be applied (Johnstone and Blumentritt, 1998). Knowledge is of limited commercial value unless ''bundled'' in some way. For example, a line of a software code is of little utility until it is combined with other pieces of software to constitute a program (Teece, 2000b, p. 37). For others, knowledge is a commodity that ''shares attributes with money in that it seems of value only when it is moved and used'' (Murray, 2000, p. 186). There are many definitions and models of KM, each adding new insights to a crucial, but nebulously defined, field. This paper examines selected concepts and models of knowledge and provides a taxonomy for understanding different approaches to KM. It first addresses different meanings and definitions of knowledge as well as the components of knowledge upon which KM models are built. KM models are examined with particular attention given to the role that IT plays in KM. It is proposed that technology is crucial to knowledge information whilst intangible assets (corporate brainpower; organizational knowledge; relationships; innovative ability; employee morale; and identity) are necessary for KM. Considering that knowledge meaning is contextually defined, further research is needed in the area of community of practices.

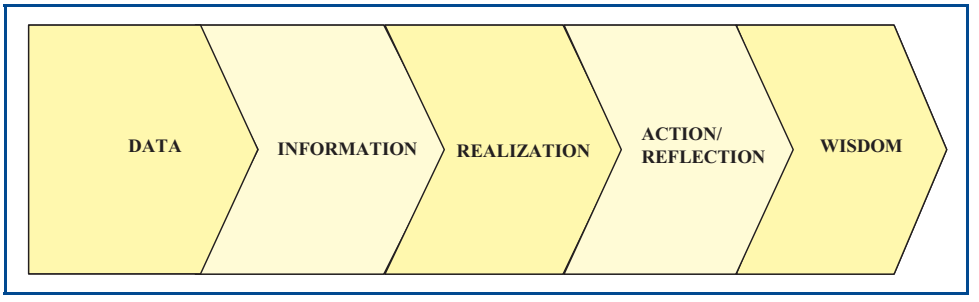
What is knowledge?

Plato (1953) first defined the concept of knowledge as ''justified true belief'' in his *Meno, Phaedo and Theaetetus*. Plato's (1953) concept was debated from Aristotle (1928), a student of Plato, throughout continental rationalism (Descartes, 1911); British empiricism (Locke, 1987); German philosophy (Kant, 1965; Marx, 1976; Hegel, 1977) to twentieth-century philosophers (Dewey, 1929; Husserl, 1931; Sartre, 1956; Wittgenstein, 1958; Polanyi, 1958; Heidegger, 1962; Merlau-Ponty, 1962; James, 1966; Habermas, 1972; Popper, 1972; Tsoukas, 1996). Although imperfect in terms of logic, this definition has been predominant in Western philosophy (Nonaka and Takeuchi, 1995).

The terms ''knowledge'' and ''information'' are often used inter-changeably in the literature and praxis but a distinction is helpful. The chain of knowledge flow is data-information-realization-action/reflection-wisdom (see Figure 1).

Data represents observations or facts out of context that are, therefore, not directly meaningful (Zack, 1999). Information results from placing data within some meaningful content, often in the

Figure 1 Chain of knowledge flow



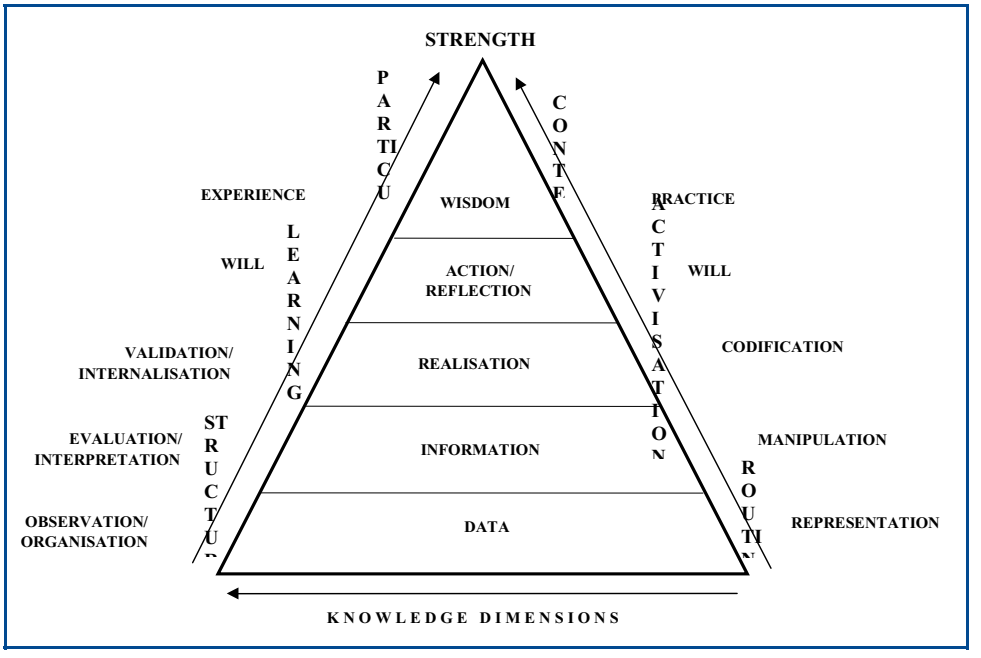
form of a message (Zack, 1999). Knowledge, as a ''justified true belief'', is that which people believe and value on the basis of the meaningful and organized accumulation of information (messages) through experience, communication or inference (Dretske, 1981; Lave, 1988; Blacker, 1995). To obtain information that one needs and to assess the value of information, one has, or needs, to acquire both theoretical and practical knowledge – it implies operation of discipline or action (Kakabadse *et al.*, 2001). Thus realization/(''knowledge'') can be conceived of as information put to productive use. There is a body of literature on KM dealing with important issues such as the distinction between explicit and tacit knowledge (Polyani, 1966; Nonaka and Takeuchi, 1995), the composition and organization of knowledge (Tsoukas, 1996; Spender, 1996a; Boisot, 1998) and the systems and structures for optimum efficacy (Davenport and Prusak, 1998; Brown and Duguid, 1991). It delineates an analytical space and, in consisting of an area of knowledge, provides the basis for action and intervention (Townley, 1993). Through action and reflection one may also gain wisdom. Knowing how to use information in any given context requires wisdom. Wisdom is a mode of symbolic processing by a highly developed will. It is a dialectical integration of all aspects of the personality: including affect, will, cognition and life experience (Pascual-Leone, 1983). Table I provides a summary of knowledge flow and its links. However, there is a range of theoretical positions dealing with the ''movement'' of knowledge. For example there is the ''stickiness'' of knowledge and the factors inhibiting the flow of knowledge from one location to another (Szulanski, 1996; Orliowski, 2002; Von Hippel, 1994), the characteristics of that knowledge (Hlupic *et al.*, 2002), speed of transfer (Zander and Kogut, 1995) and the contrast between knowledge and knowing (Cook and Brown, 1999).

The concept of knowledge implies development and growth as, at each stage of knowledge dimensions, there are activities that one must perform in order to release the knowledge dimension (see Figure 2). From observing and organizing data, one starts a learning process from structured to particular knowledge. Through evaluation and interpretation of information, one moves to a realization of knowledge that requires validation and internalization and then a

Table I Knowledge links

	Data	*Information*	*Realization*	*Action and reflection*	*Wisdom*
Content	Events	Trends	Expertise	Commitment to course of action	Life experience
Knowledge component	Observation – explicit	Evaluation - explicit	Learning – explicit and tacit	Reflective and integrative approach to thinking	Understanding pre-suppositions and meanings as well as limitations within context and time
Context component	Context free	Context insensitive	Context sensitive	Appreciation in environment of depth of understanding	Life-span contextualizm
Value test	Building block	Uncertainty reduction	New understanding	Will to act	Value guiding (What one ought to do?)

Figure 2 Knowledge triangle



will to act and reflect in order to gain wisdom which grows, with experience, towards strength. At the same time, starting from routine data representation, manipulation of information, codification of realizations and the will to act and reflect on one's practice, wisdom is achieved within particular contexts that require a strength to sustain.

There are numerous definitions and taxonomies of knowledge that contribute to theory and praxis from a variety of perspectives. Greek philosophers held knowledge as ''justified true belief'' and Plato theorized that knowledge needed to be concerned only with universal objects (Plato, 1953). Socrates started the tradition of dialogue (Plato, 1953), whilst Aristotle (1984) encouraged story telling as a way of defining justified true belief. For Francis Bacon (1605), knowledge was the fruit of experience. In the tradition of Bacon (1605), who held that ''knowledge itself is power'', some scholars from critical and post-modernist perspectives argue that procedures for inquiry, such as the use of statistical correlation, classificatory tables and their ilk, although operating as a procedure of knowledge, can, as well, operate as a technique for power. These scholars have undertaken a critique of positivist knowledge, favoring post-structuralism and post modernist theories of science by exposing the connection between knowledge creation and politics/values/ideology and control (Kouzmin, 1980; Alvesson, 1991; Alvesson and Wilmott, 1991).

For example, Foucault (1980, p. 52) asserts that ''the exercise of power perpetually creates knowledge and, conversely, knowledge constantly induces effect of power . . .. It is not possible for knowledge not to engender power''. Knowledge defines an analytical space and, as such, provides the basis of action and intervention or the operating domain of power (Townley, 1993). Habermas (1972) argues that knowledge does not exist as some abstract entity, but is the product of intentional and, sometimes, unconscious human activity. It points to the necessity of engaging in self-reflection in order to be free from the restrictions and repression from established order and its ideology. Building on the work of Habermas's (1972; 1984) critical theory, some scholars have undertaken a critique of positivist knowledge, favoring post-structuralist and post-modernist theories of science by exposing the connection between knowledge creation and politics/control (Kouzmin, 1980; Alvesson and Wilmott, 1991; Alvesson, 1991).

Scholars from the post-modern perspective draw on Kuhn's (1970) analysis of the history of science, Habermas's (1972) critical theory, Foucauldian (1980) power/knowledge discourse,

> **“ The concept of knowledge implies development and growth. ”**

Derridian (1976; 1978) de-construction and Loytard's (1984) essay on post-modern conditions and view scientific truth/knowledge as merely a construction/reconstruction of language in localized context. In the post-modernist movement, there is an appreciation of plasticity and the continual change in ''reality'' and ''knowledge''; a conviction that no single *a priori* thought system should govern belief or investigation. For example, Heron (1996) asserts that practical knowledge is the highest form of knowledge, as it remains open to the lenses offered by new experience.

Post-modernists take critical departure from scientific knowledge and the search for universal truth and argue that ''there is no universal foundation of knowledge, only the agreement and consensus of the community'' (Barabas, 1990, p. 61). When one classifies objects one operates within a system of possibilities which, in turn, both enables one to do creative things and limits use to the system (Foucault, 1970). Each definition and philosophical perspective requires reflection over the ideological nature of knowledge, as they are a critical part of well-informed and consensus scholarship. ''All knowledge is contextualized by its historical and cultural nature'' (Agger, 1991, p. 121). Human knowledge is subjectively determined by a multitude of factors, exemplified by pedagogical, socio-economic, cultural and psychological issues as well as language and context – most of these operating unconsciously (Kuhn, 1970). Consequently, there is a variety of knowledge definitions and taxonomies. A brief overview of knowledge taxonomies are presented in Table II.

Knowledge management

There are a variety of disciplines that have influenced and informed the field of KM thinking and praxis – prominent being philosophy, in defining knowledge; cognitive science (in understanding knowledge workers); social science (understanding motivation, people, interactions, culture, environment); management science (optimizing operations and integrating them within the enterprise); information science (building knowledge-related capabilities); knowledge engineering (eliciting and codifying knowledge); artificial intelligence (automating routine and knowledge-intensive work) and economics (determining priorities). As a result, there are a host of working definitions of KM and embryonic philosophies circulating in the literature and around corporations of the world.

For some, KM is a ''conscious strategy of getting the right knowledge to the right people at the right time and helping people share and put information into action in ways that strive to improve organizational performance'' (O'Dell and Jackson, 1998, p. 4). For others, it is ''formalization of, and access to, experience, knowledge and expertise that create new capabilities, enable superior performance, encourage innovation and enhance customer value'' (Beckman, 1997, pp. 1-6). A total of 73 percent of 260 UK and European corporations voted for the business definition of KM as the ''collection of processes that govern the creation, dissemination and utilization of knowledge to fulfill organizational objectives'' (Murray and Myers, 1997, p. 29). However, most working definitions in the literature point to fundamentally the common idea that KM can incorporate any or all of the following four components: business processes, information technologies, knowledge repositories and individual behaviors (Eschenfelder *et al.*, 1998). With the aim of improving organizational productivity and competitiveness, these four permit the organization to methodically acquire, store, access, maintain and re-use knowledge from different sources (Eschenfelder *et al.*, 1998). A consistent theme in all espoused definitions of KM is that it provides a framework that builds on past experiences and creates new mechanisms for exchanging and creating knowledge.

Literature and praxis reveal that there are as many KM models as there are practitioners and theorists alike – from specialized functional or packaged KM models of business functions to diffused KM, such as in terms of different groupings. However, a cognitive model of KM is receiving considerable attention in the literature and praxis (Swan and Newell, 2000). Other

Table II Taxonomies of knowledge

Authors	*Types, forms of knowledge and level of embodiments*
Socrates (Plato, 1953)	■ Mythos refers to that part of "knowledge" that is arguable and can be demonstrated and identified with precision and agreement – it is extremely personal ■ Logos derives from gathering, reading and coming to connote counting, reckoning, explanation, rules or principles and, finally, reasons. Although mythos and logos represent two realms that constitute knowledge, they are also complementary and interactive poles of knowledge
Bacon (1605)	■ "Pure knowledge of nature and universality, a knowledge by the light where of man did give names unto other creatures in paradise . . ." ■ "Proud knowledge of good and evil, which give intent in man to give law unto himself . . ."
Boswell, (1979)	■ "We know a subject ourselves" or ■ "We know where we can find information about it"
Polanyi (1958, 1996)	■ Tacit (awareness of things that we may not be able to tell; all knowledge is either tacit or rooted in tacit knowledge) ■ Explicit (capable of being clearly stated)
Schank and Abelson (1977)	■ General knowledge – information about, and interpretation of, human intention, disposition and relationships (satisfaction, enjoyment, achievement, preservation, crisis, instrumental) and "themes" (role themes, interpersonal themes and life themes) ■ Specific knowledge – a "script", a representation of the expected sequential flow of events in a particular situation (cooking, applying for a job) ■ Expert knowledge – "factual knowledge" (extensive data base about life matters) and "procedural knowledge" (mental procedures, heuristics)
Frantzich (1983)	■ Resident knowledge – insider knowledge residing within networks and gate-keepers ■ Access knowledge – readily transferable information
Anderson (1985)	■ Declarative knowledge or describing something ■ Procedural or how something occurs or is performed ■ Causal or why something occurs
Holliday and Chandler (1986)	■ Knowledge as a general competence (a dimension that overlaps with local intelligence or technical ability) ■ Pragmatic knowledge – experience based ■ Knowledge as a reflective or evaluative meta-analytical skills and abilities
Blacker *et al.* (1993)	■ Embrained (conceptual skills and abilities) ■ Embodied (acquired by doing) ■ Encultured (acquired though socialization) ■ Embedded (organizational routines) ■ Encoded (sings and symbols)
Nonaka and Takeuchi (1995)	■ Technical ("know-how") ■ Cognitive ("mental models")
Heron (1996)	■ Propositional – theoretical ideas about things ■ Practical – action related know how ■ Experiential – things as actually experienced ■ Presentational – a feedback loop from experiential to propositional knowing in a form of a creative output
Tsoukas (1996)	■ "Taxonomic" knowledge – knowledge that makes distinction between explicit and tacit knowledge
Edvinsson and Malone (1997)	■ Product knowledge ■ Routine knowledge ■ Process knowledge

models, such as network, community (Swan and Newell, 2000), and philosophical are also receiving attention. With advances in quantum physics, the quantum perspective is also emerging. Each model treats knowledge in its own particular way; thus, has different KM approaches (Swan and Newell, 2000). Table III provides a summary of each perspective.

Philosophy-based model of KM

The philosophical model is concerned with the epistemology of knowledge or what constitutes knowledge. Its main concern is how one gathers information about social and organizational reality and is focused on objectives (values, abstractions, minds), type (concepts, objects,

Table III Knowledge management perspectives

	Philosophy-based model	*Cognitive model*	*Network model*	*Community model*	*Quantum model*
Treatment of knowledge	Knowledge is ''justified true belief''	Knowledge is objectively defined and codified as concepts and facts	Knowledge is external to the adopter in explicit and implicit forms	Knowledge is constructed socially and based on experience	System of possibilities
Dominant metaphor	Epistemology	Memory	Network	Community	Paradox
Focus	Ways of knowing	Knowledge capture and storage	Knowledge acquisition	Knowledge creation and application	Solving paradox and complex issues
Primary aim	Emancipation	To codify and capture explicit knowledge and information – knowledge exploitation	Competitive advantage	Promote knowledge sharing	Learning systems
Critical lever	Questioning, reflecting and debating	Technology	Boundary spanning	Commitment and trust	Technology
Primary outcomes	New knowledge	Standardization, routinization and recycling of knowledge	Awareness of external development	Application of new knowledge	Creation of multi-reality
Role of IT based tools	Almost irrelevant	Critical integrative mechanism	Complimentary interactive mechanism	Supporting integrative mechanism	Critical-Knowledge centric

Source: Compiled from Swan and Newell (2000), Murray (2000), and Tissen *et al.* (2000)

prepositional) and the source of knowledge (perception, memory, reason). It is also concerned with the relationship of knowledge to other notions such as certainty, belief justification, causation, doubt and revocability.

The philosophical model of KM is an attempt to think deeper on how one thinks and acts by posing deep-knowledge questions about knowledge within organizations (Murray, 2000). The model provides a high-level strategic overview and creates a valuable framework of understanding, which informs later knowledge initiatives. It requires questioning and reflection in one's practice. For example, one may pose questions such as, ''What do we know that we don't know about our competitors?''. in order to bring to the surface one's ignorance about competitor's R&D efforts or strengths in the particular market segment (Murray, 2000, p. 179). Hence, a questioning along the lines, ''What do we not know that we know?'', ''Why do we not know?'' and ''How can we know what we know?''. This model is built along the lines of Polanyi's (1966, p. 16) argument that ''We can know more than we can tell and we can tell nothing without relying upon our awareness of things we may not be able to tell'' and that a sharp division between tacit and explicit knowledge does not exist.

Polanyi (1966) sees tacitness and explicitness as two different dimensions of knowledge. Hence, ''all knowledge is either tacit or rooted in tacit knowledge'' (Polanyi, 1966, p. 7) and, as such, is human activity. The philosophy-based KM model is based on interactive dialogues within a strategic context. Numbers of international research studies conducted by the Cranfield School of Management (Murray and Myers, 1997; Kakabadse and Kakabadse, 1999) show that the philosophy-based model of KM is practised by top teams in learning organizations; where the environment is conducive to an open, quality dialogue. Due to its higher level of operationally – strategic organizational capacity and its focus on dialogue, top teams have a very low dependency on technology. The philosophy-based model of KM has its roots in Socratic dialogue and has been unchanged through the centuries; preserving its importance to date, especially in strategic decision making and visioning processes that have vital implications for

organizational longevity. The model holds that KM need not be technology intensive and should not be technology driven – rather, it is actor intensive and actor centered. It is based on the Socratic definition of knowledge and a search for the highest knowledge – wisdom (Plato, 1953).

Cognitive model of KM

Leading management and organizational theorists have popularized the concept of knowledge as a valuable strategic asset by suggesting that for an organization to remain competitive it must effectively and efficiently create, locate, capture and share knowledge and expertise in order to apply that knowledge to solve problems and exploit opportunities (Winter, 1987; Drucker, 1991; Kougot and Zander, 1992). The recognition of the economic value of knowledge by business and economic disciplines, continuous efforts to derive benefits from information via information management and the proliferation of information technology (IT) all contribute to the proliferation of the cognitive model of KM (Swan and Newell, 2000). The model is deeply embedded in positivistic science as the tool for understanding a mechanical universe driven by single cause-effect relationships; a most poplar view for modern civilization (Skolimowski, 1994). For knowledge-based industries, knowledge itself is the commodity traded (Gibbons *et al.*, 2000). In the increasing knowledge economy, knowledge industries add value by the reiterated use of knowledge and the re-configuration of knowledge with other forms of knowledge to solve a problem or to meet a need (Gibbons *et al.*, 2000). For the cognitive model of KM, knowledge is an asset; it is something that needs to be accounted for and a number of efforts are being made to develop procedures for measuring it (Sveiby, 1997; Swan and Newell, 2000). Knowledge is seen as something that needs to be managed (Dodgson, 2000, p. 37). This model builds particularly on definition of knowledge by Schank and Abelson (1977), Holliday and Chandler (1986), and Edvinsson and Malone (1997).

Variations of the cognitive model of KM are practiced by most organizations with formal KM processes in place. Some prominent cognitive models of KM are the SECI model (socialization, externalization, combination, internalization) (Nonaka and Takeuchi, 1995; Nonaka and Konno, 1998); state of knowledge (Earl, 1998), organization knowledge networks model, based on organizational knowledge and meta-knowledge models (Carayannis, 1999), pillars and functions of knowledge management model of intellectual capital (Wiig, 1993; Edvinsson and Malone, 1997); intellectual capital management model consisting of intellectual capital stock that includes human capital, innovation capital, process capital and customer capital, as well as financial performance and business effectiveness (Van Buren, 1999); and the knowledge management model based on cognitive science, semiotics and epistemological pragmatism (Snowden, 1998). Johnson and Blumentritt (1998) derive a typology of KM that consists of eight processes that need to be managed. These are: knowledge identification; knowledge acquisition; knowledge generation; knowledge validation; knowledge capture; knowledge diffusion; knowledge embodiment; knowledge realization; and knowledge utilization/application. Knowledge refinery models (Meyer and Zack, 1996; Zack, 1999) have similar knowledge processes – named acquisition; refinement; storage/retrieval; distribution; and presentation.

Some scholars argue that the cognitive model of KM may be most applicable to the re-utilization of knowledge; exemplified by instances when a new technology has been effectively adopted by an organization and becomes embedded within organizational practices and routines so that it is an accepted part of the organizational culture (Clark and Staunton, 1989; Swan and Newell, 2000). The organizational focus is to ensure the efficient exploitation of the technology, which is achieved by making explicit the rules, procedures and processes surrounding its use. At this

> **“KM can incorporate any or all of the following four components: business processes, information technologies, knowledge repositories and individual behaviors.”**

stage, IT tools can be particularly useful for codification, storage, retrieval and transfer of codified knowledge (Clark and Staunton, 1989; Swan and Newell, 2000: Hayes, 2001). It makes extensive use of, and is dependent on, databases, group ware, and enterprise and Web-based systems (McKinlay, 2000). Cognitive models of KM are integrative or controlling in approach, operating predominately at the operational level (McKinlay, 2000). Many organizations focus on utilization of knowledge through IT, whilst few focus on the creation of new knowledge. The focus of many cognitive models is on repetitive action, replication and standardization or routinization of knowledge and its replication (Swan and Newell, 2000). At the same time, this model can become an obstacle for change and new knowledge as changing static routines is difficult. In today's environment of putative rapid change and technological discontinuity, even knowledge and expertise that can be shared often and quickly becomes obsolete (Zack, 1999). Establishing a dynamic balance is the fine line between exploration and exploitation proposed by the SECI model (Nonaka and Konno, 1998) and has been achieved only by a few organizations.

Network model of KM

The networking perspectives of KM emerge parallel with the theories of the network organization and focus on acquisition, sharing and knowledge transfers. Network organizations are considered to be characterized by horizontal patterns of exchange, interdependent flow of resources and reciprocal lines of communication (Powell, 1990). From the network perspective, the idea of knowledge acquisition and sharing is seen as a primary lever for organizational learning in order for an organization to choose and adopt new practices where relevant (Everett, 1995). The network perspective acknowledges that individuals have social as well as economic motives and that their actions are influenced by networks of relationships in which they are embedded; hence the socialization of knowledge (Swan and Newell, 2000). This model builds on conception of knowledge as defined by Samuel Johnson (quoted in Boswell, 1979), and Frantzich (1983) where the important knowledge concerned resides within networks of actors. The perspective also highlights individual contributions of ''boundary spanners''; those who are able to tap into external networks and acquire new ideas which they can then share within their own organization (Tushman and Scanlan, 1981; Swan and Newell, 2000). The focus is on how patterns of links between individuals and interest groups structure cliques, coalitions and cleavages and facilitate knowledge sharing and transfer. Thus, networking, or actively building new and maintaining old social relations, with a view to creating a vantage position (Useem, 1987) in the flow of knowledge exchange and transfer, is regarded as being an important activity in its own right. The perspective focuses on awareness of ideas that exist outside focal organizations that can be adopted for a vantage position.

Daily sharing of knowledge goes on in and amongst most organizations, of course, and in geographically-dispersed companies some of this has been a practice for many years (Hayes, 2001). With procreation of Web-based technology, IT-based tools gained increased importance in the network perspective of KM as a facilitating tool for maintaining and building networks with a common function or interest and knowledge sharing and transfer it (Hayes, 2001; Swan and Newell, 2000). Knowledge managing is perceived as collaboration that requires special collaborative and networking skills, with less emphasis on individual achievement and more on teamwork. IT-tools are seen as complementary facilities providing access to other knowledge and/or other databases. In praxis, this model aligns with strategic alliances and IT-networks perspectives (Swan and Newell, 2000). Network models of KM are integrative in approach as they try to develop networks structures and a way to control flow of information. It has the strategic intention of tapping across levels within organization and industry (Swan and Newell, 2000).

Community of practice model of KM

Perhaps one of the oldest models of KM, community of practice (CP), is receiving revival and recognition within contemporary organizations. The CP model of KM builds on the sociological and historical perspective. Kuhn (1970, p. 201) argued that scientific knowledge is ''intrinsically the common property of a group or else nothing at all''. Others expanded this assertion and argued that all knowledge, not just scientific knowledge, is founded in the thinking that

circulates in a community (Rorty, 1979; Barabas, 1990). Barabas (1990, p. 61) argues that ''there is no universal foundation for knowledge, only the agreement and consensus of the community''. In addition, as children, we first learn from stories. Knowledge has been traditionally passed from generation to generation in this way. Storytelling is a well-known technique for conveying complicated meaning in a simplified format to handle complex situations. However, it is a highly detailed technique that must be learned and practiced to be successful.

The term ''community of practice'' was coined in the context of studies of traditional apprenticeship (Lave and Wenger, 1991). A CP model is widely distributed and can be found at work, at home or amongst recreational activities. The model assumes the sense of joint enterprise that brings members together, relationships of mutual engagement that bind members together into a social entity and the shared repertoire of communal resources that members have developed over time through mutual engagement (Wagner, 2000). Members of a community of practice are informally bound by the values they find in learning together and from engaging in informal discussion to help each other solve difficult problems. In organizations, community of practice arises as people address recurring sets of problems together. By participating in a communal manner, they can do the job without having to remember everything themselves (Wagner, 2000). Because membership is based on participation rather than on official status, community of practice is not bound by organizational affiliation. Models of community of practice have a variety of relations to the organization in which they exist, ranging from completely unrecognized to largely institutionalized (Wagner, 2000). The CP model builds on the concept of knowledge defined by Heron (1996) and Nonaka and Takeuchi (1995) which holds that one cannot separate knowledge from practice. CP models can retain knowledge in ''living'' ways rather than in the form of a database or manual. Even when formalized through processes and documented, some practices are contextually sensitive to formal practices so that they preserve the identity of the group. Community of practice is self-sufficient but needs resources; for example, in organizations they require time and environments conducive to learning. In a way, communities of practice are self-managed groups that exist within and across organizations (Swan and Newell, 2000).

Some contend that the CP model is also particularly important for selection and implementation activity which require that explicit knowledge be re-interpreted, re-created and appropriated alongside locally-situated, contextually-specific, often tacit, knowledge about organizational practices and processes (Wilson *et al.*, 1994; Swan and Newell, 2000). These episodes require actors with relevant tacit knowledge and expertise to work together, re-creating and applying transferred information in new and appropriate ways at the local level (Swan and Newell, 2000). However, the engagement of actors with relevant tacit knowledge (Wilson *et al.*, 1994), the development of social cultures and communities of practice, the social construction of new meanings and understandings (Weick, 1995) and the politics of decision making and change (Scarbrough and Corbett, 1992) need to be conducive to the CP approach (Swan and Newell, 2000). Selection and implementation occurs, through combining explicit with tacit knowledge, where IT based tools may play a limited, even possibly disabling, role (Swan and Newell, 2000). Hence, KM is based on interpersonal relationships, respect and trust which are critical and become magnified in the CP model (Swan and Newell, 2000). It is an interactive-based model that is often found at various operational levels of organizations. However, Orlikowski (2002) identifies seven ''boundaries'' to knowledge movement in organization: temporal, technical, social, political, geographic, cultural and historic.

Quantum model of KM

The quantum perspective builds on the work of quantum physics, emergent quantum technology and consequential economy. It assumes that current information and communication technology will fundamentally change when built using quantum principles. Quantum computing will be able to make rational assessment of an almost infinite complexity and will provide knowledge that will largely make sense to people (Tissen *et al.*, 2000). In order to cope with new levels of complexity and decision-making, actors will not just need knowledge but meaningful knowledge or, in Aristotilian terms, wisdom. It is knowledge that is not fact driven, but scenario driven (Tissen *et al.*, 2000), hence, one that is not achieved as a result of deep

rational analysis but, also, through intuition, emotions and empathy. Meaningful knowledge is needed that makes it possible to decide, effectively, to make a successful whole from complex, inter-related, dynamically-changing and sometimes even conflicting parts. It allows multiple-reality decision making in business situations where paradoxes prevail and human-level decision making falls short (Tissen *et al.*, 2000). Quantum computing will provide knowledge and social actors with wisdom. Quantum models of KM are highly dependent on quantum computing and assume that most intellectual work will be performed by IT-based tools which will provide simultaneous and virtual scenarios of decision outcomes, whilst actors will prioritize value systems and select desired futures (Tissen *et al.*, 2000). The quantum model of KM is simultaneously integrative and interactive of operations at all levels of organization – hence, solving complex, conflicting and paradoxical problems in a way that is beneficial to shareholders, stakeholders and society.

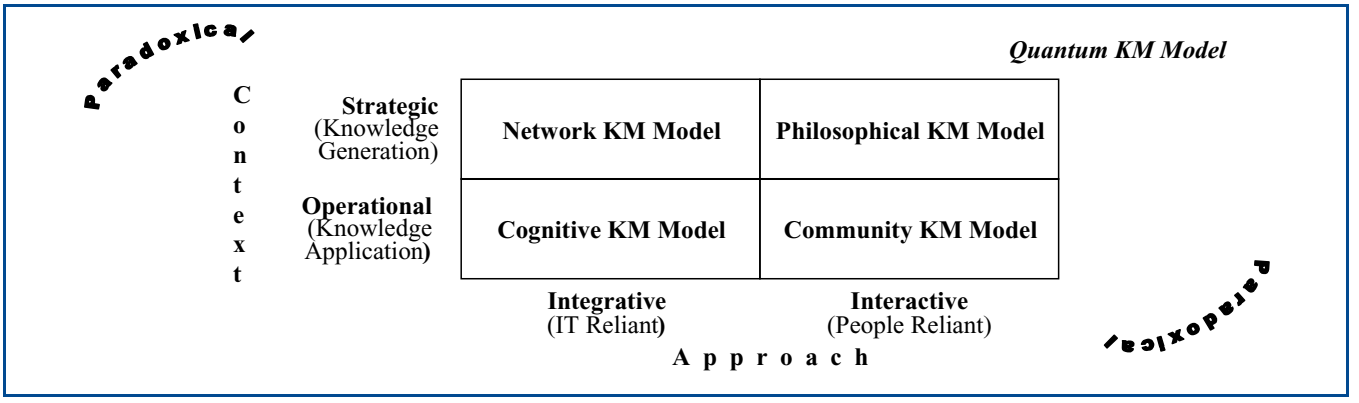
Can knowledge be managed?

Inter-relationships exist between what people do with knowledge (they share it). Why KM is needed (to reduce time spent looking for experts) and how technology can expedite knowledge flow (through an on-line database or on-line community), the meaning of knowledge and KM practice can be only appreciated within a given context, social space and time (Despres and Chauvel, 2000). For some, the knowledge context is planet Earth whilst, for others, it is the individual, group or the organization. For example, Teilhard de Chardin (1947) proposed that the web of the evolving layer of intelligence, or determinate human knowledge or ''noosphere'' (from Greek, ''nous'' or ''noos'' meaning mind), envelops the Earth. The knowledge web gives substance to physical and social phenomena and that without it people would be senseless as to the phenomena of gravity, rainfall or displacement of matter constituting architecture (Teilhard de Chardin, 1947).

For some, it is enterprise (Edvinsson and Malone, 1997), whilst for others KM is anchored in the business context, varying it from business strategy, to human interactions, group dynamics and technological infrastructure. Yet others position KM within values, culture, systems and structures (Despres and Chauvel, 2000). Most organizational studies and management literature, along with practitioners, position knowledge with individuals, group, teams, enterprise and stakeholders (Despres and Chauvel, 2000). Thus, KM is located within enterprise and group levels. The time factor is explicitly addressed by some (Nonaka and Takeuchi, 1995; Van Buren, 1999; Despres and Chauvel, 2000) and implicitly by others (Snowden, 1998). It points to the importance of the knowledge process within a KM realm. The position and the approach of the five models of KM are presented in Figure 3 below.

Although basic KM requirements have not changed, with the proliferation of IT and consequent transformation of the workplace, there has been an explosion of the volume of data and information, as well as an increased speed and ease of changing content and context. In rapidly changing and increasingly complex working arrangements, new knowledge is continuously

Figure 3 KM models



being created, re-defined as well as being distorted. In the increasingly complex and contradictory environment, where knowledge currency changes rapidly, it may be questionable as to what is being managed or contentious to even raise the issue as to whether knowledge can be managed. It can be argued that KM is not about managing knowledge but about changing entire business cultures and strategies of organizations to ones that value learning and sharing. Although some aspects of knowledge, such as culture, organizational structure, communication processes and information can be managed, knowledge itself, arguably, cannot.

Polanyi (1966, p. 7) argues that the sharp distinction between tacit and explicit knowledge does not exist and that ''all knowledge is either tacit or rooted in tacit knowledge!''. Even if knowledge has been articulated into words or mathematical formulae, this explicit knowledge must rely on being tacitly understood and applied (Polanyi, 1966). Polanyi (1966) also argues that every aspect of knowledge, including explicit dimensions, is accrued over time. In a strict sense, tacit knowledge is inherently non-transferable but it becomes explicit once it is transformed. The transfer of tacit knowledge depends on the credibility of the transferer because tacit knowledge rests in the transferer's deeper awareness of the meaning of communicable details. ''The transferer's teaching about which papers might be meaningless has, in fact, a meaning which can be discovered only by hitting on the same kind of indwelling as the teacher (transferer) is practicing'' (Polanyi, 1966, p. 61). Until this ''same kind of indwelling'' can be achieved, the transferee must accept the transferer's meaning because the transferer can communicate only the knowledge which the transferee recognizes – that is, the concept of skill described by details – without the corresponding tacit knowledge which gives meaning to these details (Tsoukas, 1996).

Hence, one can manage or support processes of learning rather than managing knowledge. Winter (1987) argues that skills may be taught through imitative learning, through trial and error and performance critique by the experienced mentor, rather than through knowledge fully conveyed by communication alone. The imitative learning model needed to achieve a common understanding of tacit elements of knowledge is most effectively achieved through multi-dimensional, robust relationships of face-to-face interaction which capture the ''entire bandwidth of human interaction'' (Nohria and Eccles, 1992, pp. 290-3).

More importantly, the culture in which learning and knowledge transfer takes place must encourage interaction between those who need new knowledge with those who can provide it (Swan and Newell, 2000). Swan and Newell (2000) further argue that culture needs to encourage the organization to change the way it acts as a result of the learning. Hence, the contemporary management techniques, based on the cognitive model of KM, often lose sight of the value of basic human relationships and interactions that lead to trust and knowledge socialization (Swan and Newell, 2000). Computerized databases provide means of storing and retrieving knowledge whilst networks and software packages, such as Lotus Notes and Web based technology, provide means of sharing information (Swan and Newell, 2000). However, creating and applying knowledge need social processes emphasized by philosophy-based, community of practice and network models of KM. Hence, group ware, that supports networking within and across temporal and spatial boundaries, creates opportunities but also limitations (Hayes, 2001).

Conclusion

Organizations need to resolve conflict between the drive for knowledge management or co-modification of knowledge and learning and generation of knowledge. This conflict also propagates itself into a conflict between ''innovation'' and ''productivity'', ''change'' and ''experience'' – the ''productivity dilemma'' (Clark *et al.*, 1987) and acknowledged by economists as a tension between ''dynamic'' and ''allocative'' efficiencies and by organizational theorists as a tension between ''exploration'' and ''exploitation'' (Dodgson, 1993). Knowledge management is about exploitation whilst ''knowledge'' is all about exploration. Existing knowledge and cognitive structures it engenders are continually

challenged by new knowledge that does not fit in old structures but is, eventually, integrated – creating new cognitive structures and having new impacts.

The knowledge debate is emerging from an individual-knowledge focus in the 1970s and 1980s to a group-knowledge focus in the 1990s and 2000s. Similarly, the debate is moving from the focus about the generation, as opposed to the transfer, of explicit knowledge which appears to have been overwhelmed by the emphasis on tacit knowledge implied in what has become known as ''the action turn'' (Reason, 1998). However, this shift of emphasis from explicit knowledge to tacit knowledge overlooks the issue of how tacit and explicit knowledge interact – ''the generative dance'' (Cook and Brown, 1999).

A purposeful action inquiry into knowledge praxis may draw upon the tools of extant group or individual, tacit or explicit knowledge generated (Cook and Brown, 1999). Hence, the clear constructs of knowledge and knowing action have the potential for wider application and further research. In particular, the need for a enhanced understanding and models of how essential non-transferable knowledge and knowing can be generated within organizations, and how education programs can be re-designed to facilitate subsequent knowledge generation as part of professional practice.

There is a need for ''alignment'' between technological requirements and organizational capabilities; the former can only be fully realized through the latter (McKersie and Walton, 1991, pp. 248-9). Individuals are the primary learning entity in an organization (Dodgson, 1993) and organizations ''know how to learn because their people know how to learn'' (Kanter, 1990, p. 320). Concepts of skills and routines are organizational underpinnings to the dynamics of Schumpeterian competition (Nelson and Winter, 1982). Organizations attempt to manage knowledge in order to create and maintain superior organizational routines that reproduce competitive advantage.

In the struggle to improve and innovate, organizations fumble towards better methods with only partial understanding of their own human capabilities and of technological opportunities. Technology, exemplified by databases, can capture information and ''knowledge bytes'', they cannot appropriate the ephemeral social processes that constitute actual practice (McKinlay, 2000). Managing knowledge is not the same as managing human resources – it is more multi-faceted than simply managing people; it also involves managing intellectual property rights and the development and transfer of individual and organizational know-how (Teece, 2000a). In addition, issues such as learning capacity, rooted in education, experiences, social, professional, structural and cultural contexts, equally need to be addressed (Teece, 2000a). Notwsthanding that some aspects of knowledge require management attention in order to avoid duplication of effort and resources, one should not overplay the importance of knowledge management, as the diagnosis and solution of business problems is usually highly situational.

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