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**Literature review for C-Sand: Knowledge Management**

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## **Executive Summary**

A profound revolution is occurring within western society; this revolution is based on information and knowledge and led by developments in computing and communications technology. *“We are entering (or have entered) the knowledge society in which the basic economic resource...is knowledge...and where the knowledge worker will play a central role”*(Drucker 1993).

Such changes within the workplace have led to a need to improve the management of knowledge which in turn led to further workplace changes. A number of authors have devised categorisations of knowledge management approaches, of particular relevance to this study is a division between a functionalist perspective, in which knowledge is considered as an “object” existing in a number of forms and locations, and an interpretivist perspective in which knowledge is considered not to exist independent of human experience, social practice, knowledge and knowledge use and where such knowledge is shaped by the social practices of communities of individuals.

### **Examples of functionalist perspectives:**

#### 1) Intellectual capital approaches:

The term “intellectual capital” highlights the value of knowledge as an organisational asset. These approaches are highly scientific, employing accounting methods, codification (the capturing of knowledge into information and documents), and structures to exploit knowledge capital as an asset of the organisation. Such approaches have been criticised for their attempt to objectively measure a subjective “thing”, and for privileging technology and database led activities.

#### 2) Considering knowledge through categories.

Such approaches define knowledge in distinct forms, each of which may be considered separately and potentially dealt with in different ways. For example *Tacit* and *Explicit* knowledge. Tacit knowledge is personal, context-specific and hard to formalise or communicate. Explicit knowledge is transmitted in formal systematic language. Such approaches have been criticised for failing to capture the complexity inherent in knowledge creation.

### **Example of Interpretive perspective:**

#### 1) Considering knowledge as socially constructed

A wide definition of knowledge is employed, linking knowledge with the social and learning processes of the organisation. The focus of knowledge management is on supporting the social structures and processes within which knowledge is shared such as communities of practice. In adopting such an approach our interest shifts from supporting, mapping, storing and disseminating an object called knowledge, to supporting and creating the many possible activities undertaken by individuals taking action by applying their knowledge. This leads us to see the role of technology not

as simply processing knowledge but rather in support of social activity. Such a stance necessarily requires that technology be considered as part of a socially based knowledge management solution, rather than as the solution itself.

In addition to these contrasting approaches to knowledge management it is suggested that literature from other fields contribute to the debate.

Sensemaking emphasises the way individuals make sense of their organisational context. Sensemaking suggests that in order to build a form of understanding (and thus a form of knowledge) retrospectively individuals are affected by their identity, create environments, act socially, and are driven by plausibility rather than accuracy. Such complex action suggests that simplistic “codification” approaches are inappropriate to knowledge management.

Knowledge can be created and applied through rational thought processes. For example problem structuring methods enable the development of knowledge about, and approaches to managing difficult to define problems. These structured approaches allow the exploration of a problem domain, yet they require rational thought outside their usual activity.

Within organisations it is argued that individuals apply and create knowledge through action in addition to rational thought processes. Knowledge is deeply embedded in our way of operating such that one only becomes aware of it, and thus reflect upon its use, when learnt knowledge does not help the task. It is thus necessary to consider action within knowledge management practice, as at the point of action knowledge is being created and used. There is great emphasis on communication within knowledge management, such communication occurs within social structures (such as communities of practice). Stories are used within such communication to create and distribute knowledge from experience.

The social construction approaches outlined above emphasises the messy nature of knowledge, and the challenge in effectively capturing and mapping the processes of knowledge use. It has however been suggested that it is possible to map the environment in which knowledge is created and shared. Such mapping approaches generally rely on categories of knowledge, and highly codified knowledge management activity. However we intend to develop these ideas in an interpretive manner.

Thus we recognise that there is interdependence between knowledge and organisational context. This has increased significance when considering knowledge management between organisations where experience, language and context will be different. However knowledge management between organisations can provide valuable innovation. New organisational forms may be required for such exchanges.

## ***Introduction***

This review begins by describing the situation out of which the field of knowledge management emerged, describing the “knowledge economy” and the “knowledge organisation”. This is followed by a broad discussion of the concepts of knowledge management. A number of models are then presented which allow categorisation of knowledge management approaches.

Within this knowledge management review approaches are broadly categorised as either “functionalist” or “interpretivist”. These terms represent the approaches underlying philosophy, based either on a belief in knowledge as a potentially tangible, understandable asset, or on a belief that knowledge is emergent and linked to human cognition. This distinction allows the inclusion of relevant external literature. The document concludes by considering organisational structure’s affect on knowledge management, leading into the content of volume two which shall discuss the specific implications of knowledge management within the construction industry.

## ***Knowledge and the changing world***

**Outline:** The following section introduces the background and history of knowledge management

### ***The knowledge economy***

In order to understand Knowledge Management, it is necessary to see the subject within the broader context of the enormous changes taking place in the global economic framework itself (Neef 1999).

It has been argued that western society is in the midst of a profound revolution, a second industrial revolution based not on energy, but on information, linked to the development of the computer. Princeton economist Fritz Machlup noticed as early as the 1960s that there was an increasing proportion of knowledge workers making up the workforce (Checkland and Holwell 1998), coining the phrase “knowledge industries” in his discussions.

Alfred Marshall, a forefather of neo-classical economics, was one of the earliest authors to state explicitly the importance of knowledge within economic affairs; *“Capital consists in a great part of knowledge and organisation... knowledge is our most powerful engine of production.”* (Marshall 1965). However, as pointed out by Nonaka and Takeuchi (Nonaka and Takeuchi 1995), neo-classical economists were concerned only with the utilisation of existing knowledge, not with the creation of new knowledge.

In 1993 Peter Drucker, commenting on the manufacturing, service and information sectors said: *“We are entering (or have entered) the knowledge society in which the basic economic resource... is knowledge...and where the knowledge worker will play a central role”* (Drucker 1993). Changes in computer technology during the mid 1980s were key to this shift; as computers grew exponentially in speed, reduction in cost and availability their uses changed. Organisations were, for the first time, able to quickly capture, codify and disseminate huge amounts of information across the globe (Tapscott 1996).

As global telecommunications and networking expanded it became possible to re-engineer organisation's processes changing the way organisations operated. Such business process reengineering can provide valuable return on investment, but gained bad press in Europe and the USA as the changes were often too much for the culture of the organisations to handle (Neef 1999). This led David Snowden of IBM to describe it as the “last breath of Taylorism” (Snowden 2000). The rapid increase in technology within the workplace required new skills and flexibility on the part of the employee. Organisations began to see that they needed to coordinate information and knowledge in a new way. This meant helping employees to respond to change, encourage creativity and innovation and learn and improve productivity (Neef 1999). Organisations needed to become “knowledge organisations”.

### ***The knowledge organisation***

As companies expand there is a limit to the effectiveness of the informal ways

knowledge has always been shared within organisations. Davenport and Prusak suggest that companies above two to three hundred employees are too large for people to have a grasp of collective organisational knowledge (Davenport and Prusak 1998). There is a need for companies to “know-what-they-know”(Sieloff 1999). If knowledge is to become a valuable corporate asset it must be accessible, developed and used (Davenport and Prusak 1998). Knowledge management was born out of this desire to improve the knowledge-organisation, yet this occurred without an accepted definition of knowledge management.

Ikujiro Nonaka and Hirotaka Takeuchi (Nonaka and Takeuchi 1995) define the knowledge-organisation through its ability to adapt to the changing environment by creating new knowledge, disseminating it effectively and embodying this knowledge into practice. According to these authors, the sole business of a “knowledge-creating company” is continuous innovation.” (Nonaka 1991) (Nonaka, Toyama et al. 2000).

### ***What is knowledge management?***

**Outline:** The difficulty of finding a definition of knowledge management is discussed, alongside a critical discussion of the terms status.

The term knowledge management is often problematic as there is little consensus regarding its definition (Neef 1999; Bhatt 2001). A recent study by Raub & Ruling outlined that there is not an accepted single area of discourse within either the academic or popular management literature (Raub and Ruling 2001). Many authors simply avoid the term completely, preferring to focus on specific aspects of the topic such as knowledge, innovation or learning (Costello 1996). Furthermore others argue that knowledge management is closely related to concepts such as organisational learning, organisational memory, information sharing, and collaborative work (Schultze 1998).

Raub and Ruling (Raub and Ruling 2001) analysed 434 articles from ABI/Inform. They identified two distinct speech communities involved in the knowledge management debate – those focusing on IS/IT and those focusing on general management issues. These authors argue that these communities are both engaged in a joint effort to sustain knowledge management as a fashionable field. An emphasis on

IS/IT is discussed by Harry Scarborough who, in a literature review of knowledge management for the institute of personnel and development, says that 70 percent of articles in 1998 appeared in the IS/IT literature (Scarborough, Swan et al. 1999). This emphasis on IS/IT literature in knowledge management led Gold *et al* to suggest that many knowledge management projects are little more than information projects. Such projects often focus on consolidation of data within organisations, without addressing issues of innovation (Gold, Malhotra et al. 2001). Bob Galliers has also argued that knowledge management, as conventionally described, is limited to little more than information management (Galliers and Newell 2001).

There is no consensus on a definition of knowledge. Many authors have avoided epistemological debate on the definition of knowledge by comparing knowledge with information and data (Alavi and Leidner 2001). A commonly held view is that data is raw numbers and facts, information is processed data and knowledge is authenticated information (Dreske 1981, Machlup 1983 and Vance 1997 From (Alavi and Leidner 2001)). Yet, as Alavi and Leidner highlight, the presumption of hierarchy from data to information to knowledge with each varying along some dimension such as context, usefulness or interpretability is inaccurate. Alavi and Leidner argue that the effective distinguishing feature between information and knowledge is not found in the content, structure, usefulness or interpretability, but rather *“knowledge is information possessed in the minds of individuals: it is personalized information (which may or may not be new, unique, useful or accurate) related to facts, procedures, concepts, interpretations, ideas, observations, and judgements”*. Similarly, Dahlbom and Mathiassen (Dahlbom and Mathiassen 1995) argue that data, information, knowledge and competence correspond to different levels or forms of human activity. They argue that data is a formalised representation of information, and that information is essentially a charting of knowledge within a shared practice. It is only possible to do this by relying on shared practices and experiences of situations. *“Think of what a cookbook for a true novice would look like. Every recipe would begin: “Turn on the light in the kitchen”*(Dahlbom and Mathiassen 1995).

A significant implication of this view of knowledge is that for individuals to arrive at the same understanding of data or information, they must share a history or context (Alavi

and Leidner 2001). Thus systems designed to support knowledge in organisations may not appear radically different from other forms of information systems, but will be geared toward enabling users to assign meaning to information and to capture some of their knowledge in information and/or data.

Tuomi (Tuomi 1999) provides an alternative view, arguing that the often assumed hierarchy from data to knowledge is actually inverse; *“knowledge must exist before information can be formulated and data can be measured to form information”* (Alavi and Leidner 2001). “Raw Data” does not exist *a priori*; thought and knowledge processes are always employed in identifying and collecting even the most elementary data. Tuomi argues that knowledge exists which, when articulated, verbalized and structured, becomes data. *“Critical to this argument is the fact that knowledge does not exist outside of an agent (a knower); it is indelibly shaped by one’s needs as well as one’s stock of knowledge”* ((Fahey and Prusak. 1998), (Tuomi 1999) from (Alavi and Leidner 2001)).

Within a literature review of knowledge management, Harry Scarbrough defines knowledge management as *“any process or practice of creating, acquiring, capturing, sharing and using knowledge, wherever it resides, to enhance learning and performance in organisations.”*(Scarbrough, Swan et al. 1999). Hedlund (Hedlund 1994) suggests that knowledge management addresses the generation, representation, storage, transfer, transformation, application, embedding, and protecting of organisational knowledge. Such definitions, while encompassing many aspects of “process” around knowledge management, imply an essentially objectivist view of the subject. Even more emphasis on technology within knowledge management may be found in writings by technology vendors. For example the following definition of knowledge management was quoted on Microsoft’s web site: *“Knowledge management is the use of technology to make information relevant and accessible wherever that information may reside. To do this effectively requires the appropriate application of the appropriate technology for the appropriate situation. Knowledge management incorporates systematic processes of finding, selecting, organising, and presenting information in a way that improves an employee’s comprehension and use*

*of business assets.*” (From (Brown and Duguid 2000))

Others counter such views arguing knowledge is also concerned with the establishment of an environment and culture in which knowledge can evolve (Davenport and Prusak 1998) (Wenger 1998; Wenger and Snyder 2000). For example Davenport criticised technological approaches to knowledge management (KM) as early as 1996:

*“The emphasis on codification in the KM literature probably reflects the dominance of the information systems view: many of the articles have focused on developing and implementing KM databases, tools (e.g. decision support tools) and techniques despite a now fairly wide acknowledgement that “the most dramatic improvements in KM capability in the next ten years will be human and managerial” (Davenport, Jarvenpaa et al. 1996).*

Karl Sveiby, however, highlights that human approaches to knowledge sharing can be slow and are often unconscious. He argues that we must find new innovative ways such as interactive-media rather than rely on “information” to efficiently transfer knowledge. He suggests the open-plan office as one such innovation. (Sveiby 1996).

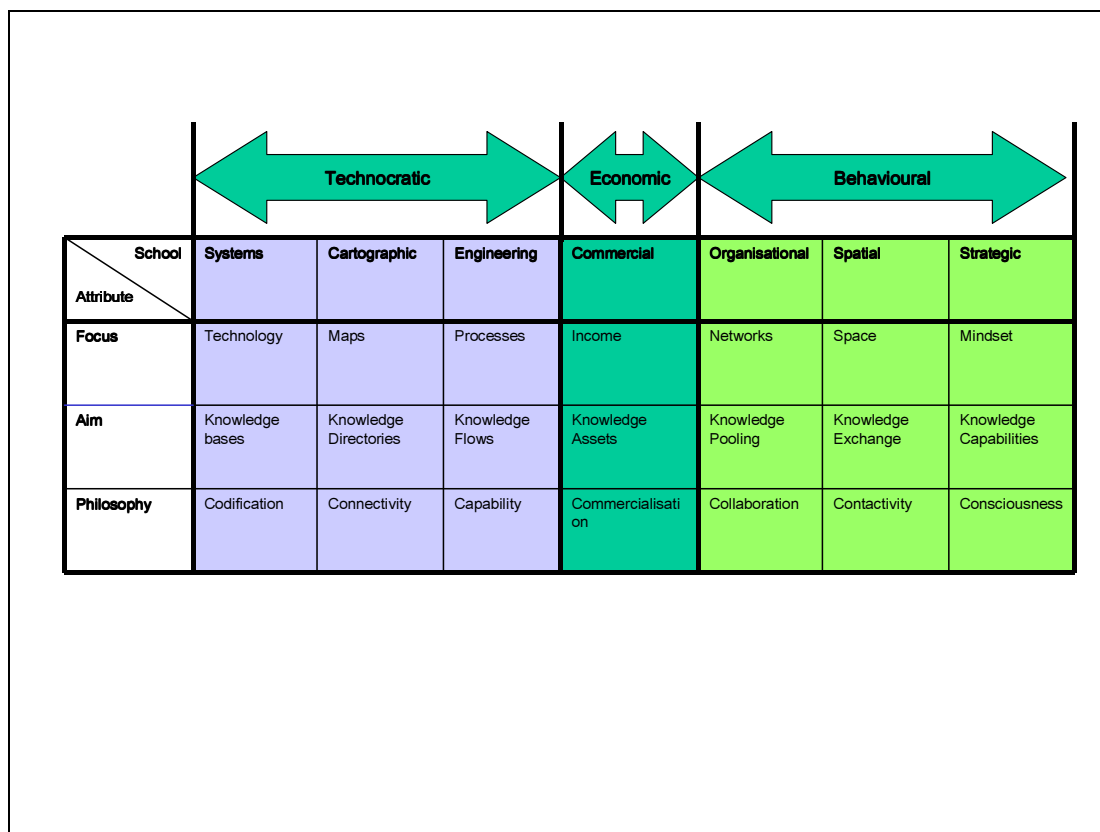
This lack of rigorous definition of the topic, and aggressive promotion from technologists has led many to argue that knowledge management is a fad. While the topic clearly has aspects of “faddishness” (Davenport and Grover 2001) and may even be analysed from a fashion perspective (e.g. (Raub and Ruling 2001)), TFPL consultancy believes it likely that the values and concepts of knowledge management practice will become embedded within organisations’ core business processes (TFPL 1999).

## ***Models for knowledge management***

**Outline:** Various categorisations of knowledge management are introduced. Two are selected for use in the remainder of this study.

Due to the cacophony of view, opinions, and ideas under the broad banner of

knowledge management it is necessary to identify a set of structures with which to make sense of the field. A number of people have proposed or identified such structures. One frequently cited example is provided by Michael Earl (Earl 2001). Earl proposes seven schools of knowledge management strategy: Systems, Cartographic, Engineering, Commercial, Organisational, Spatial and Strategic (see Figure 1) (Earl 2001). These schools identify the types of knowledge management strategy undertaken by organisations. Earl categorises these seven schools into three broad types: Technocratic, Economic and Behavioural. Technocratic schools approach knowledge management through information or management technologies that support and condition employees in their everyday tasks. Economic schools aim to explicitly create revenue through the exploitation of knowledge as an asset. The Behavioural schools approach knowledge management from a behavioural perspective, stimulating and orchestrating managers and managements to proactively create, share and use knowledge resources (Earl 2001). While these schools provide a useful categorisation of specific approaches, particularly in regard to how technology is used within a knowledge management initiative, it is felt that they fail to emphasise the epistemological basis of knowledge management strategies, particularly failing to effectively categorise the social aspects. Within Earl's model social interaction is only fully considered within the spatial school. This school focuses on the use of space within knowledge sharing, such as colleagues chatting around the water-cooler (Brown and Gray 1995) or buildings designed for knowledge sharing (Schultze and Boland 2000; Ward and Holtham 2000). However many authors believe that social interaction for knowledge is more complex than this (McAdam and McCreedy 1999; Nonaka, Toyama et al. 2000; Von-Krogh, Ichijo et al. 2000).



**Figure 1: Schools of knowledge management (from (Earl 2001))**

An alternative structure for understanding knowledge management is provided by McAdam & McCreedy (McAdam and McCreedy 1999) (McAdam and McCreedy 1999). These authors propose three categories of model for knowledge management; intellectual capital models in which knowledge is seen as a tangible asset, knowledge category models in which knowledge is identified through categories, and social constructionist models in which knowledge is intrinsically linked to social and learning processes. This categorisation is simpler than Earl's, yet its focus on the definition of knowledge within approaches makes it more appropriate to this study.

Ulrike Schultze (Schultze 1998) applies a framework developed by Burrell and Morgan (Burrell and Morgan 1979) in order to locate theories of knowledge management. In applying this framework to the theory of knowledge she identifies the following two perspectives which are binary opposites:

- 1) A functionalist perspective: Knowledge exists as an objective representative of the world and is waiting to be discovered by the human

agent. Schultz argues that such approaches may be seen in (Hedlund 1994) and (Nonaka and Takeuchi 1995). This represents an objectivist perspective on knowledge, contending that knowledge exists in a number of forms and locations.

- 2) An interpretive perspective: Knowledge cannot be located in any one place because it has not existence independent of human experience and social practices of knowing. (Schultze 1998) Schultz argues that such approaches may be seen in authors such as (Tenkasi and Boland 1996; Brown and Duguid. 1998). This represents a more subjective or intersubjective perspective, contending that knowledge is continuously shaping and being shaped by the social practices of communities.

In the following sections literatures on knowledge management approaches are categorised using these two perspectives of Schultze. Further categorisation is provided by the previously discussed structure of McAdam and McCreedy. Intellectual Capital and Knowledge Categorisation models broadly fit within the functionalist perspective and Social Construction models broadly fit within the Interpretive perspective.

## ***Functionalist perspectives of Knowledge Management***

### ***Intellectual Capital models***

**Outline:** Intellectual capital models take a highly scientific view of knowledge management. A number of examples of such models are discussed. Knowledge is considered as an asset within the organisation.

Initially conceived by Leif Edvinsson (Edvinsson and Malone 1997), the term “intellectual capital” highlights the value of knowledge as an organisational asset (Roos and Roos 1997). Intellectual capital models take a highly scientificised approach to knowledge and its management. Such approaches view knowledge as a “medium of exchange” which is assumed to have intrinsic (or at least believed) value. These approaches fail to ascertain the richness of human activity in creating and sharing knowledge (McAdam and McCreedy 1999). However they are useful in

identifying the part organisational structures play in knowledge sharing within organisations. An example of such approaches may be found in Davenport & Prusak's book "Working Knowledge" (Davenport and Prusak 1998) in which knowledge is seen as a commodity, marketed and traded by the knowledgeable (Davenport and Prusak 1998).

The works of Thomas Stewart include examples of intellectual capital approaches to knowledge management. Thomas Stewart is well known in business circles as editor and author for *Fortune* magazine. Through this magazine he has written a series of papers on the subject of intellectual capital (Stewart 1996; Stewart 1996; Stewart 1997; Stewart 1997; Stewart 1997). These papers led to him being described by the Planning Forum in the USA as "*The leading proponent of knowledge management in the business press*".

Thomas Stewart views the knowledge of an organisation in terms of assets. His 1996 paper "Coins in the Knowledge Bank" (Stewart 1996) includes the line "*knowledge may be intangible but that doesn't mean it can't be measured*" and includes a formula for assessing the knowledge capital of companies. Knowledge management is thus seen as a method of exploiting the "Knowledge" or "Intellectual Capital" of employees, or of capturing their knowledge in order to safeguard it as an asset for the organisation's use (Stewart 1997) (Miles, Miles et al. 1998).

Thomas Stewart's 1997 book "Intellectual Capital – The new wealth of organisations" (Stewart 1998) expands these earlier concepts, describing "hidden gold" within organisations. Hidden gold is defined as the intangible assets or intellectual capital of the firm – the talents of its people, the efficacy of its management systems, the character of its relationships with its customers. Stewart believes that, in the knowledge economy, investment is often in a company's "hidden gold" rather than in its tangible assets.

*Intelligence becomes an asset when some useful order is created out of free-floating*

*brainpower – that is, when it is given coherent form (a mailing list, a database, an agenda for a meeting, a description of a process); when it is captured in a way that allows it to be described, shared, and exploited; and when it can be deployed to do something that could not be done if it remained scattered around like so many coins in the gutter. Intellectual capital is packaged useful knowledge.”* ((Stewart 1998) Page 67)

In the task of exploiting intellectual capital Stewart sub-divides Intellectual Capital into Human Capital, Structural Capital, and Customer Capital.

Human Capital is defined as the capital value of the innovation of employees (Stewart 1998). Such innovation may be the form of creating new products or improving processes. It should be emphasised that routine, low-skilled work does not generate or employ human capital for the organisation. Stewart asserts that human capital requires exploitation, and organisations need to acquire as much human capital as is profitable. Essentially it is the role of knowledge management to exploit such capital value.

Structural Capital is defined as *“the knowledge that doesn’t go home at night”* (Stewart 1998 page 108). Stewart based this idea on the work of Leif Edvinsson of Skandia AFS. Stewart sees Structural capital as more important than human capital, as far as management is concerned because it is the capital over which management has most options for change (Edvinsson and Malone 1997). Essentially, structural capital is employed in the mechanisms which assemble, package, promote and distribute the fruits of human capital’s thinking. As Peter Drucker says *“Only the organisation can provide the basic continuity that knowledge workers need in order to be effective. Only the organisation can convert the specialised knowledge of the knowledge worker into performance”*(Drucker 1994). Examples of structural capital include legal rights of ownership, patents, technologies, inventions, data, publications, standards, machine settings, strategy, culture, structures and systems, organisational routines and procedures. It should also be noted that Stewart refers to these entities

themselves, not their documented form, e.g. the ownership of a patent rather than its paperwork. Stewart makes the point that it is *“assets [such as these] that are often far more expensive and valuable than the codified ones”* (Stewart 1998 page 109)

Customer Capital is defined as the capital value of an organisation’s customers. Thomas Stewart suggests that increasing the return on this customer capital *“requires more than acknowledging that customer relationships are assets, not just events. It demands understanding the dynamics of managing this asset: what makes it grow or depreciate, what makes it more valuable or less?”* Interest in customer relationship management systems and their consideration as part of knowledge management programmes may be an indication of the value ascribed to such capital.

Intellectual Capital models typically give strong emphasis to measurement associated with decomposed elements of knowledge. There is an implicit assumption that such elements may be clearly identified and tightly controlled, as is the case for tangible assets. However as McAdam and McCreedy highlight, (McAdam and McCreedy 1999) this approach can result in attempts to fit objective measures to subjective elements. In order to develop a knowledge management approach, advocates of intellectual capital approaches tend to apply what Hansen refers to as a “codification” approach (Hansen, Nohria et al. 1999). Such an approach involve the searching, storage and retrieval of information through technologies such as databases, Intranets and search engines. Individual’s knowledge requires cataloguing and “making explicit” such that others may use it. Further examples of such approaches may be found in the works of (Davenport 1996; Davenport and Prusak 1998; Leask, Seaward et al. 1999).

### ***Knowledge Category Models***

**Outline:** Knowledge management approaches which attempt to devise categories for knowledge, applying different methods and tools to the interaction between these categories.

Knowledge category models define knowledge into different distinct forms, each of which may be considered and potentially dealt with in different ways.

For example, Frank Blackler (Blackler 1995) defines five types of knowledge (encoded, embrained, embodied, encultured, and embedded). Through these discrete categories he attempts to reduce the focus on the commodification of knowledge as product, system or service. These categories emphasise the complexity of knowledge within all organisations. Alternatively Max Boisot considers knowledge as either codified or uncoded, and as diffused or undiffused within organisations (Boisot 1998).

One of the most influential works in the area of knowledge management is the 1995 book “The knowledge creating company” by Ikujiro Nonaka and Hirotaka Takeuchi (Nonaka and Takeuchi 1995). This book followed an article by Ikujiro Nonaka in the Harvard Business Review in 1991 and outlined the role of knowledge in innovation within Japanese manufacturing companies.

The Harvard Business Review article introduced Japanese approaches to knowledge. In particular it criticised the western approaches to dealing with knowledge within organisations. *“Deeply ingrained in the traditions of western management, from Frederick Taylor to Herbert Simon, is a view of the organisation as a machine for “information processing.” According to this view, the only useful knowledge is formal and systematic – hard (read:quantifiable) data, codified procedures, universal principles. And the key metrics for measuring the value of new knowledge are similarly hard and quantifiable – increased efficiency, lower costs, improved return on investment”* (Nonaka 1991).

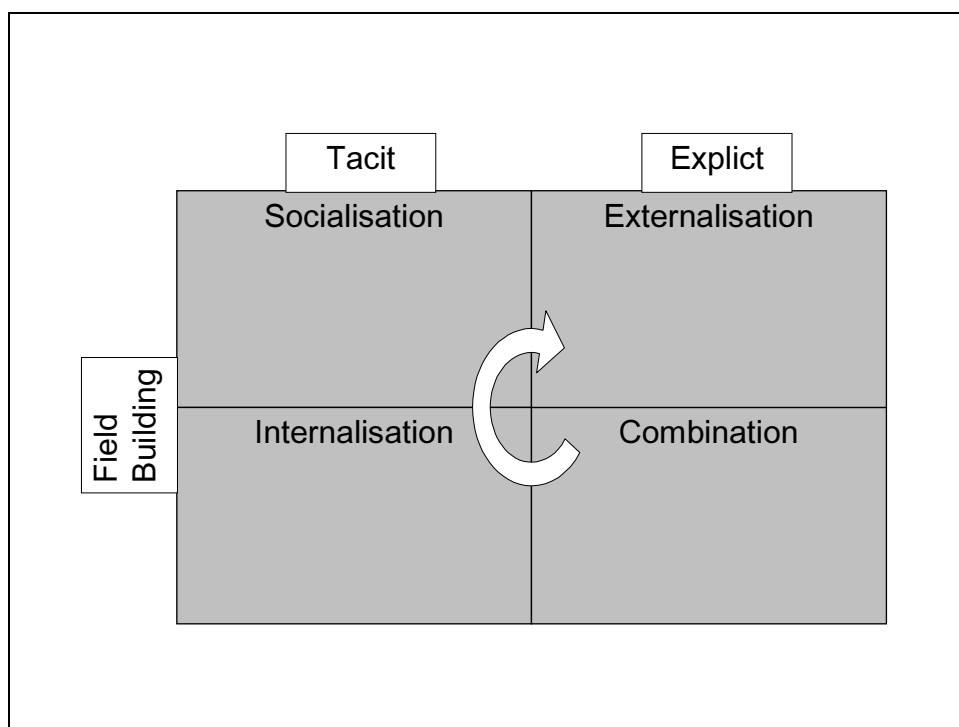
Such approaches are clearly evident in the Intellectual Capital models of knowledge management discussed above. Nonaka, in this early article, called for an approach which recognised that knowledge creation was not simply a matter of “processing” objective information. Instead, the authors argued that it requires the tapping of tacit and often highly subjective insights, intuitions and hunches of individual employees and making such insights available to the organisation as a whole. They argued that making personal knowledge widely available within an organisation was the key to knowledge creation.

In order to achieve this they introduced a model of knowledge creation based on two categories of knowledge which has been previously introduced by Michael Polanyi; *tacit* and *explicit* knowledge (Routledge 2000) . Polanyi believed that the “scientific” account of knowledge as a fully explicit formalisable body of statements did not allow for an adequate account of discovery and growth. In his account of tacit knowledge, knowledge has an ineliminable subjective dimension: we know much more than we can tell. This knowledge is termed “tacit”, while knowledge which we may tell is termed “explicit” knowledge (Routledge 2000). When knowledge is made explicit through language it can be focused for reflection. Polanyi also emphasised the functional aspect of knowledge, i.e. he regards knowledge as a tool by which we either act or gather new knowledge (Sveiby 1996) (Sveiby 1997). Sveiby outlines three main theses in Polanyi’s concept of knowledge: (quoted as in (Sveiby 1997)); *“True discovery, cannot be accounted for by a set of articulated rules or algorithms. Knowledge is public and also to a very great extent personal (i.e. it is constructed by humans and therefore contains emotions, “passion”) The knowledge that underlies the explicit knowledge is more fundamental; all knowledge is either tacit or rooted in tacit knowledge. In Polanyi’s world there is thus no such thing as “objective knowledge”.*

Tacit knowledge is personal, context-specific and therefore hard to formalise and communicate. Explicit or “codified” knowledge, on the other hand, refers to knowledge that is transmittable in formal, systematic language (Nonaka and Takeuchi 1995). Nonaka and Takeuchi extend these epistemological dimensions introducing “knowledge conversion” as the key to knowledge sharing. Tacit and explicit knowledge are not viewed as separate entities, but rather as mutually complementary entities. Knowledge is created through the social interaction between tacit and explicit knowledge, an interaction Nonaka and Takeuchi term “knowledge conversion” (Nonaka and Takeuchi 1995).

Nonaka and Takeuchi outline though a number of case studies how the authors believe knowledge to be rooted in innovation and in the essentially social processes

employees engage in. This notion was highlighted within a theory of knowledge creation, and outlined through a knowledge creation spiral (known as the SECI model and expounded in (Nonaka and Takeuchi 1995)). This model considers knowledge to be created through an interaction of tacit and explicit knowledge. This interaction is shown in Figure 2.



**Figure 2: The SECI process (from (Nonaka and Takeuchi 1995))**

Socialisation is the process by which tacit knowledge is passed onto others; this is achieved through sharing experience, for example during an apprenticeship. During this process more than simple information is shared.

Tacit knowledge, essentially in the minds of the employees is converted into explicit concepts through a process of externalisation. This externalisation is achieved through activities such as creating metaphors, analogies, concepts, hypotheses or models.

Explicit knowledge may then be combined through a process of systemizing concepts into a knowledge system. *“This is achieved by individuals exchanging and combining knowledge through such media as documents, meetings, telephone conversations, or computerised communication networks”*(Nonaka and Takeuchi 1995). Formal

education or training programmes also constitute this form of knowledge conversion.

Such explicit knowledge is then integrated into the tacit knowledge of individuals through a process of internalisation. This is closely related to activities such as “learning by doing”. Documentation is read by individuals and the ideas are combined with the tacit knowledge such an individual possesses.

These four elements form a spiral of knowledge creation, iterations of this spiral create further knowledge, and expands in the ontological dimension at which the knowledge creation is occurring; from individual to group, to organisation etc.

The process was developed from research within a number of Japanese companies to explain the use of metaphor, language, analogy and model-building in allowing individuals to externalise and share their knowledge with other employees. Interestingly, this SECI model was not discussed as a process, but rather a reflection upon the process of knowledge creation. It is also worthy to note that within the SECI process, only the combination aspect specifically refers to computer technologies. The main “tools” discussed in the 1995 book are essentially social acts. However the knowledge creation cycle above was widely (and wrongly) interpreted as a process for the codification of knowledge from the minds of individuals into corporate databases and repositories. The model’s intrinsic social dimension was often ignored and supplanted by a process driven and an objectivised model of knowledge creation, based on the categories of *tacit* and *explicit* knowledge.

McAdam and McCreedy (McAdam and McCreedy 1999) suggest that “*perhaps knowledge transfer in organisations is much more complicated and convoluted than this simple matrix suggests*”. These models often lead to a mechanistic approach to knowledge categorisation. Such knowledge category models of knowledge management involve the transforming processes of socialisation.

In 2000, Ikujiro Nonaka, Ryoko Toyama and Noboru Konno published an article in Long Range Planning (Nonaka, Toyama et al. 2000) which further developed the

SECI model. This new model, termed the “unified model of dynamic knowledge creation”, consists of three elements. Firstly, the SECI process; secondly, *ba*, the shared context for knowledge creation; and thirdly, knowledge assets, the inputs, outputs and moderators of the knowledge creating process. The knowledge creation process is thus defined as a spiral which grows out of these elements, requiring dialectical thinking.

*“Knowledge creation is a continuous, self-transcending process through which one transcends the boundary of the old self into a new self by acquiring a new context, a new view of the world, and new knowledge.”*(Nonaka, Toyama et al. 2000)

In knowledge creation individuals influence, and are influenced by the environment with which they interact. This environment, termed *ba* (which roughly means “place”) offers such a context. Such contexts provide the basis for one to interpret information to create meaning. *“Knowledge is created through the interactions among individuals or between individuals and their environments, rather than by an individual operating alone. Ba is the context shared by those who interact with each other, and through such interactions, those who participate in ba and the context itself evolve through self-transcendence to create knowledge. Participants of ba cannot be mere onlookers. Instead they are committed to ba through action and interaction* (Nonaka, Toyama et al. 2000). This quote emphasises the need for collaboration among individuals in knowledge creation. Note that *ba* is not necessarily bounded by structures such organisations or by physical locale. The key is *interaction*.

The knowledge assets defined in this unified model are defined as *“firm-specific resources that are indispensable to create values for the firm”* (Nonaka, Toyama et al. 2000). Note that Nonaka *et al* explicitly state that *“Although a variety of measures have been proposed”* [with reference to Thomas Stewart’s work on intellectual capital], *“existing accounting systems are inadequate for capturing the value of knowledge assets, due to the tacit nature of knowledge”* (Nonaka, Toyama et al. 2000). Four types of knowledge asset are described: (i) Experiential knowledge

assets, consisting of shared tacit knowledge. (ii) Conceptual knowledge assets, consisting of explicitly knowledge articulated through images, symbols and language. (iii) Systemic knowledge assets, consisting of systematised and packaged explicit knowledge, such as specifications, manuals, documentation, patents, and (iv) Routine knowledge assets consisting of the tacit knowledge that is rooted and embedded in the actions and practices of the organisation.

*“Using its existing knowledge assets, an organisation creates new knowledge through the SECI process that takes place in ba. The knowledge created then becomes part of the knowledge assets of the organisation, which becomes the basis for a new spiral of knowledge creation”* (Nonaka, Toyama et al. 2000).

Nonaka points out that the knowledge creation process can not be managed in a traditional sense, but rather it is the job of management to lead the organisation to actively and dynamically create knowledge.

Knowledge assets can hinder as well as foster knowledge creation. Organisations are subject to inertia and it is difficult for them to diverge from the course set by their previous experiences. Successful experience leads to excessive exploitation of the existing knowledge, and it turn hinders the exploration of new knowledge.

These three articles (Nonaka 1991; Nonaka and Takeuchi 1995; Nonaka, Toyama et al. 2000), written by the same primary author over a period of ten years have been highly influential in leading thinking in Knowledge Management. It is clear that they are all based on categorising knowledge as either “Tacit” or “Explicit” and that, while the authors’ emphasise the social action associated with knowledge creation, the aim has still been to define knowledge in terms of a process of knowledge creation. The inclusion of *ba* and *knowledge assets* in the later work emphasise a need to encompass the structure in which such a knowledge creation process exists.

While this process is valuable in conveying the needs for social interaction in

developing knowledge, it has been criticised for essentially failing to capture the true complexity inherent in knowledge creation. The model that follows, defined as Social Construction, does not have the defined boundaries of the SECI model and as such it is harder to conceptualise in terms of process, and thus is harder to exploit. Its focus is not upon the process of knowledge creation, but rather on the process of human action and interaction, the outcomes of which may be knowledge.

### ***Interpretive perspectives on Knowledge management***

**Outline:** Knowledge management approaches are considered which take an interpretivist social approach.

#### ***Social Construction of Knowledge models***

Social construction of knowledge models assume a wide definition of knowledge, viewing it as intrinsically linked to the social and learning processes of the organisation (McAdam and McCreedy 1999). Essentially, such models emphasise the social nature of knowledge creation, thus leading to approaches to knowledge management that emphasise what Hansen refers to as “personalisation” (Hansen, Nohria et al. 1999). Such models are similar to those models seeking to represent the learning organisation and organisational learning. A typical example of a socially constructed model is given by Marc Demarest (Demarest 1997). Demarest’s model emphasises the construction of knowledge within the organisation. Demarest’s model assumes that it is through a process of social interchange that constructed knowledge is embodied within organisations. Once embodied within the organisation, knowledge is disseminated through social processes (Demarest 1997; McAdam and McCreedy 1999).

Other authors explicitly emphasise the human and social aspects of knowledge management. Chun Wei Choo (Choo 1998) talks about the “knowing organisation” in order to explicitly suggest that knowledge is not an object or thing that has to be acquired.

Social constructionist approaches often focus on the support for the social structures and processes within which knowledge is shared and created. For example, the works of Etienne Wenger and John Seely Brown identify a community of practice as such a structure (Brown and Gray 1995; Brown and Duguid. 1998; Wenger 1998; Brown and Duguid 2000; Wenger and Snyder 2000). A community of practice is a group of individuals that collectively create, and share, knowledge through shared practice. The term practice emphasises the relationship between action and knowledge creation within such groups.

Communities of practice have many of the inherent properties of *Ba*, however they should not be considered identical. A community of practice is a living place in which members can innovate. Such innovation then becomes available for others in the community to learn from. The boundary of a community of practice is set by its tasks, culture and history and requires an identity. In contrast *ba* is a more fluid concept, changing quickly. Rather than being constrained by history, *ba* has a “here and now” quality to it (Nonaka, Toyama et al. 2000). Both community of practice and *ba* form the social capital of an organisation. Social capital is defined as the “*relationships that make the organisation work*” (Prusak and Cohen 2001).

It should be further noted that unplanned and unbounded social interaction may lead to innovation and knowledge. Serendipitous meetings should be fostered and structures put in place to “increase the probability of serendipity” (examples of fostering serendipity may be found in Nonaka (Nonaka 1991) and Ward and Holtham (Ward and Holtham 2000)).

A social constructionist approach to knowledge sharing emphasises the relationship between action, understanding and communication as key to the creation and dissemination of knowledge. Such models often reference the work on learning and reflection of authors such as Chris Argyris and Donald Schön (Schön 1982; Argyris 1991; Argyris 1995; Argyris and Schön 1996). By considering the works of these authors, usually regarded as being on the periphery of knowledge management, it is possible to understand knowledge management issues further. Such works are

grounded in a coherent theory and are related to the management practice of knowledge management. The following bodies of knowledge have been reviewed in order to build this understanding:

- Sensemaking: Work outlining the way individuals make sense of their organisational context, particularly focusing on the work of Karl Weick.
- Requisite Variety: In order to act within an organisation, individuals need a requisite level of variety. Works in this area are discussed, with particular emphasis on Raul Espijo's writings.
- Reflection-in-action: Reflection upon action is key to developing knowledge, so works on learning and reflection-in action are reviewed.

The selection of these works is roughly based on Choo's model for using information and knowledge within a "knowing organisation" (Choo 1998; Choo 2000). Choo's models view sense-making, knowledge creating and decision making as representing three concentric layers of organisational informational behaviour (Choo 1998).

These works are discussed in relation to group, or organisational wide knowledge practices. In particular the support of the organisational conversation as a means by which knowledge is created and shared within an organisation is discussed.

## **Sensemaking**

**Outline:** Sensemaking is the method by which individuals construct "meaning". It's relevance to knowledge management is discussed and contrasted with other approaches.

Sensemaking is essentially the structuring of the unknown, it is the questioning of how individuals construct what they construct, why, and with what affect (Weick 1995) (Weick 1996). In contrast to Herbert Simon's (Simon 1945) model of organisations as "information-processing machines", proponents of sensemaking emphasise the a rational and ambiguous nature of human problem solving and decision-making. The organisation is framed as a system of perception, making retrospective sense of what has happened. *"The basic idea of sensemaking is that*

*reality is an ongoing accomplishment that emerges from efforts to create order and make retrospective sense of what occurs... Sensemaking emphasises that people try to make things rationally accountable to themselves and others”*(Weick 1993).

In his 1995 book (Weick 1995), Weick outlines sensemaking as a process that is:

- Grounded in identity construction: The establishment and construction of identity on the part of the sensemaker as key to the sensemaking process. In making sense of a situation the sensemaker’s notion of self is constructed. Their identity is not fixed.
- Retrospective: By definition we can only make sense of that which has already occurred; our view of reality is interpreted and historic.
- Enactive of sensible environments: Within organisations individuals often produce part of the environment they face, once created these environments constrain the actions of these individuals. The environment is not a separate external body but something the individual is part of.
- Social: *“Conduct is contingent upon the conduct of others, whether those others are imagined or physically present”* (Weick 1995). Decisions are made in the knowledge that others will see the outcome and be involved in its execution.
- Ongoing: Sensemaking neither starts nor ends. People are always in the middle of things. People may retrospectively chop this flow into actions, yet they seldom face a situation where observations are made, hypothesis formed and finally a rational course of action is consciously chosen (Winograd and Flores 1986).
- Focused on and by extracted cues: In order to make sense of a situation, individuals search for a cue onto which they may build sense. Such a cue is not necessarily a complete or correct piece of information, but the cue may be used to search for further cues to update the “sense” made.
- Driven by plausibility rather than accuracy: In order to make sense of a situation an individual needs plausible information in a sufficient quantity to undertake their work.

These seven qualities of sensemaking provide important lessons for knowledge

management. They highlight the construction of the environment for knowledge creation and exchange, the knowledgeable will create their identity, express their knowledge based on the expressions they have previously made, and alter the environment they are part of by any decision to share their knowledge. Such knowledge sharing is part of a social process, in particular the people involved will make sense of how the audience of the knowledge reacts. Many knowledge management approaches fail to appreciate such complexity. For example, codification strategies (Hansen, Nohria et al. 1999) emphasise the storage of accurate complete information, while sense-making points to sufficiency and plausibility. Codification approaches do not emphasise that small quantities of information within the repository may be grasped to create the cues to a decision based on prior unarticulated appreciation of a complex situation, rather than an explicit formulated analysis and decision-making process using most or all available information. Further to this, codification strategies require structure, often imposed around the structures existent within the organisation; codified documents are often clustered around structures such as projects, initiatives or hierarchies with little questioning whether these artificial structures are an efficient way to catalogue such information.

While sense-making emphasises the process by which individuals arrive at an understanding of an unfamiliar situation, it is also necessary to understand how such individuals may reflect upon this understanding and apply knowledge in order to make a decision and to act.

### **Requisite Variety**

**Outline:** Requisite Variety is discussed in terms of individuals. Its relevance to knowledge management is discussed in terms of individual's information and action.

For an effective knowledge management programme it is necessary to put in place structures to allow individuals within organisations to create possibilities and responses to external disturbance (Nonaka and Takeuchi 1995). According to Ross Ashby an organisation's internal diversity should match the variety and complexity of the external environment in which it is placed in order to deal with changes in this

environment (Ashby 1956) (Nonaka and Takeuchi 1995). The law of requisite variety states that only variety can destroy variety (Ashby 1956). Within his paper on requisite variety, Raul Espejo argues that in order to achieve a task, individuals must effectively manage the complexity they face. The ability of an individual to implement improvement is dependent upon a balance between attenuators of environmental complexity and the amplifiers of managerial complexity (so called task-closure). Espejo argues that in modern organisations too much amplification occurs, and too little attenuation. Espejo argues that in the design of information systems too much attention is given to the informational requirements of individuals, while too little attention is given to the structures to which such information is provided. The effectiveness of an information system, and arguably of a knowledge management system, is in the flow of information it enables, not the information itself. The aim of such systems is to create some form of organisational change, which is itself the outcome of a closed network of multiple adjustments taking place among employees. Raul Espejo points out that *“Change is thus determined by the internal coherence of the system and not by information about external events. Change may be triggered by information, but is not determined by it”* (Espejo 1993). To a large degree it is not the content of the information that determines the individual’s response, but rather the structure into which the information is absorbed. *“Information should be combined differently, flexibly and quickly with equal access to all relevant parties”* (Nonaka and Takeuchi 1995).

In developing knowledge management initiatives there should be a balance between observations of the external environment (i.e. information), the structure into which such observations are attenuated and the amplification of individuals’ action in order to initiate change. Knowledge management solutions should thus be focused upon human action as well as the provision of information. A codification of individuals’ knowledge is thus insufficient. Furthermore, within a complex changing environment information and individuals’ knowledge may become out of date quickly, it is thus necessary to foster the challenging of assumptions, and support individuals in reflecting upon their knowledge and its appropriateness to new situations.

### **Reflection in action**

**Outline:** Reflection-in-action is discussed as the way individuals create knowledge about their ongoing practice. This analysis includes discussion of improvisation and knowledge creation and use during activity.

Donald Schön (Schön 1982) studied professional practice and the application of reflection in action to professions. In his study he asserts that professional practice is dominated by an epistemology of technical rationality; a view that knowledge exists objectively and that the role of the professional is to solve problems by the rigorous applications of scientific techniques. Such rationalistic approach leads to a split between research (the creation of knowledge) and practice (the application of knowledge).

Schön believes that such positivistic approaches are valuable once a “problem” is defined. In practice, well-formed problems are seldom given but must be constructed from messy problematic situations (Schön 1982). Organisations are not faced with problems such as “poorly managed knowledge” to which no obvious solution exists; rather they are faced with a variety of complex situations, what Russell Ackoff defines as “a system of external conditions that produce dissatisfaction”, which he neatly terms a “mess” (Ackoff 1974). The problems associated with such messes have been called “wicked problem” (Rittel 1971) in that no complete solution may ever exist; only improvement may be sought.

Challenging a purely technical rationale in which knowledge is said to exist and is simply applied to a situation; Schön proposes a notion of *knowledge-in-action* by which the process of acting reveals a “*kind of knowing which does not stem from a prior intellectual operation*” (Schön 1982) (notice the parallels with the work on tacit knowledge of Polanyi discussed previously). Schön suggests that “knowing” has the following properties (taken from page 54 of (Schön 1982))

- *There are actions, recognitions, and judgements which we know how to carry out spontaneously; we do not have to think about them prior to or during their performance.*
- *We are often unaware of having learned to do these things, we simply find ourselves doing them.*

- *In some cases we are once aware of the understandings which were subsequently internalised in our feelings for the stuff of action. In other cases, we may never have been aware of them. In both cases, however, we are usually unable to describe the knowing which our action reveals.*

Such knowledge-in-action is applied when the situation faced is familiar, however upon a new situation, a “breakdown” (Winograd and Flores 1986) occurs; individuals are forced to think about what they are doing. They must consider the new situation and the appropriateness of their knowing to it, they make sense of the situation and how they may act upon it. This is reflection-on-action, the consideration of what people do. Furthermore, in performing an action people may reflect upon it. Such reflection-in-action is the process a jazz musician may undertake during improvisation – *“thinking about what they are doing and in the process evolving the way of doing it”*. Through reflection the individual is able to *“surface and criticise the tacit understandings that have grown up around the repetitive experiences of a specialised practice, and can make new sense of the situations of uncertainty or uniqueness which he may allow himself to experience”*(Schön 1982). In facing a changing situation employees may feel uneasy because they cannot say what they know how to do, and cannot justify the quality or rigour of their actions (Schön 1982). Such a response will require the individual to appreciate the situation and consider different ways to frame the problem.

The previous discussion of the knowledge economy outlined the rapid nature of change within knowledge organisations. Schön’s work points to a need to engender reflection-on-action and reflection-in-action by employees, in addition to “educating” them of knowledge-in-practice as part of knowledge management initiatives. Mitroff and Linstone (Mitroff and Linstone 1993) also argue for a similarly reflective approach to thinking in their book “The Unbounded Mind”. This text suggests that systems thinking, along with appreciation of conflict and multiple realities, can provide a better picture for decision making. A similar argument is provided by Peter Senge who suggests that in addition to team-learning and communication, systems

thinking has a key role in organisational learning (Senge 1990).

## ***Problem Structuring Methods***

**Outline:** Problem structuring methods are formal approaches which enable the creation of knowledge about problems. In contrast to the actions discussed above these methods are applied consciously.

Problem Structuring Methods, or Soft OR Methods, are a set of approaches based on the model building approaches enable problem owners to develop knowledge about, and manage, their wicked problems (Rosenhead and Mingers 2001). These approaches are based upon a variety of theoretical frameworks: Soft Systems Methodology (SSM) (Checkland 1981; Checkland and Scholes 1990) is based on systems theory; Strategic Options Development and Analysis (SODA)(Eden and Ackermann 1998) is based upon the theory of personal constructs from social psychology (Kelly 1955); Drama Theory (Howard, Bennett et al. 1993) is a radical extension of traditional game theory; while Strategic Choice (Friend and Hickling 1997) and Robustness Analysis (Rosenhead 2001) have much less clear foundations, the former being a codification of facilitative practice and the latter the application of mathematical modelling approaches to non-numeric data.

What each of these methods has in common is the centrality of problem descriptions based on the problem owners' perceptions and interactive processes to enhance their knowledge of the problem as a basis for commitment to future action. We will briefly describe three of these approaches

- SODA is concerned with developing knowledge about perceived chains of causality and in the development of understanding and knowledge through dialogue about different perceived chains of cause and effect. A key notion drawn from Kelly is that concepts are defined in terms of their polar opposites and therefore a significant location of knowledge is in these polarities.
- SSM attempts to describe holons mental models of systems of systems not systems in the real world. Knowledge is created through the discussion of these holons and through modelling the consequences of adopting particular interpretations.

- Strategic Choice is a facilitated workshop methodology which develops concepts (categorised as decision, uncertainty and comparison areas) through discussion and attempts to ascribe consensual meanings to these concepts through the agreements of labels for concepts that stand as tokens of the knowledge embedded in the concepts. Uncertainties, particularly those recognised as uncertainties about values, as described in the approach, in part represent ambiguities of meaning and the approach is designed to provoke participants into investigations to reduce these uncertainties/ambiguities.

## Organisational Conversation

**Outline: Knowledge management requires communication. Organisaional conversations are discussed in terms of how knowledge is created and shared through communication.**

Both the functionalist and interpretivist perspectives outlined above emphasise communication in its various forms as key to knowledge creation and sharing. Particular emphasis to communication as a social process is given within the social constructionist approach. In particular within organisations, language and conversation (both in voice and through documents or e-mail) are the main method of such exchanging meaning. *“Conversations are the way that knowledge workers discover what they know, share it with their colleagues, and in the process create new knowledge”* (Webber 1984).

Conversation has been defined as *“a calibration of our own mental models against those of others around us”* (Goleman 1985). It is possible that through organisational conversations knowledge emerges, and thus the task of “knowledge management” is to make possible and enrich such conversations. *“Knowledge is not communicated. Knowledge is a critical social product accomplished in communication”* (Deetz 1992). It is perhaps surprising to find, therefore, that very little currently exists within the literature linking knowledge management with communication (More 1998).

Communication occurs within social structures, these are either imposed by the organisation (e.g. project teams, hierarchy or offices) or emergent, such as

communities of practice (Wenger 1998). These structures may greatly influence the sharing and creation of knowledge within knowledge management.

One form of organisational conversation is the telling of stories. *“Stories infuse events with meaning ... through the magic of plot”* (Gabriel 2000). Stories are seen as a method by which individuals present events and experience as the storyteller wishes to believe they happened rather than as they actually happened. Their narrative and plot allow them to be remembered by others, altered and shared to allow meaning to defuse (Gabriel 2000). Such stories can be used as knowledge sharing devices, to be created and shared to pass on experience and knowledge (Snowden 2000). It should however be noted that once an individual has told their story they lose control of the story and its meaning. Its message may be altered and even reversed through subsequent telling (Gabriel 2000).

### ***Knowledge mapping***

**Outline:** Knowledge mapping is a method of understanding the “knowledge environment” and context within which knowledge is used.

In order to introduce effective knowledge management programmes there is a need to build understanding of the “knowledge environment” and context within which the knowledge is used. The political nature of knowledge and its link to human activity requires a method which can address such flexibility, as suggested by Frank Blackler:

*“Knowledge is analysed as an active process that is mediated, situated, provisional, pragmatic and contested. The approach suggests that attention should be focused on the systems through which people achieve their knowledge and on the processes through which new knowledge may be generated.”*(Blackler 1995)

John Van der Pijl and Walter Van Bovel outline a principle for creating inventory of the “stock of knowledge” within an organisation (a knowledge mapping) (Van-der-Pijl and Van-Boven 1999). The authors outline four forms of knowledge (human, documented, automated and mechanised) within three areas (company knowledge, support knowledge and operational knowledge). These dimensions are then used to

construct a “knowledge housekeeping” model, with similar characteristics to the n-form knowledge organisation of Hedlund (Hedlund 1994). This model expands upon elements of Nonaka’s knowledge spiral and provides a basis for understanding knowledge.

Knowledge mapping methodologies have been developed within the field of knowledge engineering. Knowledge engineering is a branch of artificial intelligence research concerned with methods to effectively transport knowledge from experts into computer systems. Shadbolt Milton (Shadbolt and Milton 1999) suggests that the methods and tools used in the development of intelligent systems may be more useful to knowledge management than intelligent systems themselves. These authors suggest the following principles from knowledge engineering may be of use in knowledge management:

- 1) Recognise that there are different types of knowledge.
- 2) Recognise that there are different types of expert –and expertise.
- 3) Recognise that there are different ways of representing knowledge.
- 4) Recognise that there are different ways of using knowledge.
- 5) Use structured methods.

These principles are clearly derived through the functionalist view of knowledge management – considering knowledge within organisations as a resource to be catalogued and stored.

### ***Knowledge Management and Innovation.***

**Outline:** A discussion is introduced of the relationship between KM and innovation.

Sustainability within the construction industry is a new and emerging issue. As such innovation and the creation of knowledge will be key. There is a need to develop structures by which innovation can occur. Literature from industries of rapid innovation may provide support to this thinking (e.g. (Corso and Pavesi 2000)) .

Furthermore, Corso and Pavesi argue that competitive advantage may be gained by

extending innovation to later phases in the product-life-cycle (e.g. manufacturing, maintenance and service) through viewing new-product-development projects as part of a corporate wide knowledge creation process rather than distinct (Corso and Pavesi 2000). These lessons from product manufacturing may resonate within this project as PFI (public finance initiatives) and PPP (public private partnerships) lead the construction industry to consider these later-phases in greater detail.

One roadmap to the development of innovation is provided by Dorothy Leonard in her book “Wellsprings of knowledge” (Leonard 1995). The book argues that core capabilities, in many forms, are also rigidities when taken to extreme or when the competitive environment changes. The book suggests that such capabilities are interlocking systems of knowledge bases and flows. Leonard advocates activities such as integrated problem solving across different cognitive and functional boundaries, implementation of new methodologies and process tools, experimentation and importing know-how (Leonard 1995).

### ***Knowledge Management and the structure of “Organisation”.***

**Outline:** The relationship between organisational structure and KM is discussed. Particular interest is taken to KM and inter-organisational relationships.

In their recent paper “Sharing knowledge across boundaries” (Ciborra and Andreu 2001), Claudio Ciborra and Rafael Andreu discuss the specific interdependence between knowledge and organisational context. In particular, these authors suggest that while knowledge management systems may be implemented within organisations, these systems may prove too ridged, closed and incompatible to cross an inter-organisational boundary. Their paper discusses the differences between three main contexts: the single firm, alliances between relevant firms and web arrangements of multiple businesses where knowledge does not belong fully to a single stakeholder. In considering the notion of inter-organisational learning the authors highlight that a source of competitive advantage may stem from the establishment of inter-firm linkages which create new distinctive knowledge routines and competencies (Ciborra and Andreu 2001). Importantly for the construction industry, the paper suggests that *“it is not only a matter of compatibility or transferability, but how compatible and*

*transferable practices, routines and capabilities coming from different firms and contexts can be newly combined and coordinated.*”(Ciborra and Andreu 2001).

“Boundary objects” (Star & Ruhleder 1996 from (Ciborra and Andreu 2001)) within webs of organisations, such as standards, shared systems and applications that may be exchanged easily by members of the community constitute an important knowledge infrastructure (Steinmueller 1996 from (Ciborra and Andreu 2001)) facilitating the efficient exchange and recombination of knowledge from multiple sources(Ciborra and Andreu 2001). Usefully, the “Learning Ladder” model provided in this paper may provide a model for assessing the knowledge processes with the construction industry.

A further analysis of inter-organisational knowledge management, is provided by Levy *et al's* paper on knowledge sharing between SMEs (Levy, Loebbecke et al. 2001). This short paper highlights the notion of “co-opetition”, simultaneous co-operation and competition. Of particular interest is the concept of using game-theory as a framework for analysing inter-organisational knowledge sharing where knowledge gained by co-operation may be exploited for competition (Levy, Loebbecke et al. 2001).

In order to innovate effectively there is a need for created inter-firm collaboration (Ding and Peters 2000). Ding argues that in order to achieve such innovation, and when faced with differing knowledge management practices of various organisations (a disparity identified in the literature), there is a need to establish inter-form collaborative networks which enable discontinuous innovation (Ding and Peters 2000).

A number of authors have argued a need to introduce forms of knowledge management practice within the construction industry in order improve the partnering process (Bresnen and Marshall 2000) (Cushman 2001; Egbu and Botterill 2001).

Hedlund argues that the structure of the organisation has a large impact on knowledge management success (Hedlund 1994). He argues that early models of knowledge

management (in particular Nonaka's knowledge spiral) build on the interplay between explicit and tacit knowledge at four levels: individual, small group, the organisation and the inter-organisational domain. Hedlund suggests that a departure from this model is required, proposing the n-form organisation focused on the combination of knowledge rather than the division seen in hierarchy. Such an organisation is characterised by temporary constellations of people, the importance of personnel at local levels, lateral communication, a catalytic and architectural role for top management, strategies aimed as focusing on economies of depth and hierarchical structures (Hedlund 1994).

### **Conclusions:**

**Outline:** The literature review is considered holistically to suggest a stance on knowledge management for use in the C-Saand project.

The purpose of this document is to introduce and place the myriad of knowledge management concepts such that a consistent view may be discussed.

In reviewing this literature it becomes clear that the selection of an overt management approach depends upon whether one sees knowledge as true facts about the world or as socially constructed. Such a commitment defines the *flavour* of approach taken; whether codification methods or personalisation methods are given greater emphasis (Hansen, Nohria et al. 1999). While, the identified perspectives may be mutually exclusive epistemologically, as is implied by Schultz's use of Burrell and Morgan, in practice elements of methods of each are employed within each approach. It is the way these methods are introduced and employed which is of significance.

What does this mean in practice? Firstly, through appreciating the "environment"

within which a knowledge management initiative is planned, a perspective and approach can be adopted; however building of such understanding is non-trivial. Secondly, a set of social, technical and managerial methods must be selected to implement any such approach. This requires a mapping between environment, approach and method. Thirdly, such methods must be implemented.

The interpretive perspective appears to be more complex to implement and model through ICT. However, in adopting such a stance our interest shifts from supporting, mapping, storing and disseminating an object called knowledge, to supporting and creating the many possible activities undertaken by individuals taking action by applying their knowledge. Our technological action is thus shifted from a belief that technology can aid in “managing knowledge” to a belief that knowledge management technologies and approaches may improve the various complex purposeful activity individuals are engaged in– the management of knowledge is left to the individual, the owner-creator of the knowledge. These philosophies may not necessarily employ different technologies or approaches; it is the way such technologies are conceived of and deployed which is different.

Interestingly, and as an aside to this literature review, such an interpretive epistemic commitment would suggest that any technology developed should be extensible and adaptable to the action undertaken. For this purpose the development of an API that can be employed in the creation of everyday tools that are more knowledge rich, rather than the development of a singular “knowledge management solution” would appear appropriate.

As final caveat to this document, the topic of knowledge management generates a huge volume of material, however simply reviewing such materials often only provides a picture of the topic from “within”. To understand knowledge management further it is suggested that literature from closely related topics be reviewed. While some of these topics have been touched upon within this review, further reading is suggested. Topics such as individual and organisational learning, communication, computer support for cooperative work, organisational change and information systems are suggested.

## Bibliography

Ackoff, R. (1974). Redesigning the Future. New York, John Wiley & Sons.

Alavi, M. and D. Leidner (2001). "Review: Knowledge Management and Knowledge Management Systems: Conceptual Foundations and Research Issues." MIS Quarterly 25(1): 107-136.

Knowledge is a broad and abstract notion that has defined epistemological debate in western philosophy since the classical Greek era. In the past few years however, there has been a growing interest in treating knowledge as a significant organisational resource. Consistent with the interest in organisational knowledge and knowledge management (KM), IS research have begun promoting a class of information systems referred to as knowledge management systems (KMS). The objective of KMS is to support creation, transfer and application of knowledge in organisations. Knowledge and knowledge management are complex and multi-faceted concepts. Thus effective development and implementation of KMS requires a foundation in several rich literatures.

To be credible KMS research and development should preserve and build upon the significant literature that exists in different but related fields. This paper provides a review and interpretation of knowledge management literatures in different fields with an eye towards identifying the important areas for research. We present a detailed process view of organisations knowledge management with a focus on the potential role of information technology in

this process. Drawing upon the literature review and analysis of knowledge management processes we discuss several important research issues surrounding the knowledge management processes and the role of IT in support of these processes.

Argyris, C. (1991). "Teaching Smart People How to Learn." Harvard Business Review **69**(3): 99-109.

Any firm that aspires to succeed in the more competitive business environment of the 1990s must first resolve a basic dilemma: success in the marketplace increasingly depends on learning, yet most people do not know how to learn. In particular, the well-educated, high-powered, high-commitment professionals who occupy key leadership positions in the modern corporation are not very good at learning. Most firms are not even aware that the dilemma exists because they misunderstand what learning is and how to bring it about. If learning is to persist, managers and employees must look not only at the external environment but also inward. They need to reflect critically on their own behaviour, identify the ways they often inadvertently contribute to an organization's problems, and change how they act. Companies can learn how to resolve the learning dilemma. What it takes is to make the ways managers and employees reason about their behavior a focus of organizational learning and continuous improvement programs.

Argyris, C. (1995). "Action Science and Organizational Learning." Journal of Managerial Psychology **10**(6): 20-26.

Describes how individuals hold theories which govern their actions and how these theories unintentionally create organizational defensive routines and inhibit learning. Presents an action science approach whereby consultant researchers can help individuals see their taken-for-granted theories, test them and then redesign their action in the light of their learning.

Argyris, C. and D. Schön (1996). Organisational Learning 2 :Theory, Method and Practice, Addison-Wesley.

Ashby, W. R. (1956). An introduction to cybernetics. London, Methuen & Co Ltd.

Bhatt, C. (2001). "Knowledge management in organisations: examining the interaction between technologies, techniques, and people." Journal of Knowledge Management **5**(1): 68-75.

Argues that the knowledge management process can be categorized into knowledge creation, knowledge validation, knowledge presentation, knowledge distribution, and knowledge application activities. In general, such a balancing act requires changes in organisational culture, technologies, and techniques. A number of organisations believe that by focusing exclusively on people, technologies, or techniques, they can manage knowledge. However, that exclusive focus on people, technologies or techniques does not enable a firm to sustain its competitive advantages. It is, rather, the interaction between technology, techniques, and people that allow an organisation to manage its knowledge effectively. By creating a nurturing and "learning-by-doing" kind of environment, an organisation can sustain its competitive advantages.

Blackler, F. (1995). "Knowledge, Knowledge Work and Organizations: An Overview and Interpretation." Organization Studies **16**(6): 1021-1046.

There is current interest in the competitive advantage that knowledge may provide for organizations and in the significance of knowledge workers, organizational competencies and knowledge-intensive firms. Yet the concept of knowledge is complex and its relevance to organization theory has been insufficiently developed. Common images of knowledge in the organizational literature are identified, and a typology of organizations and knowledge types is constructed. Knowledge is analyzed as an active process that is mediated, situated, provisional, pragmatic and contested. The approach suggests that attention should be focused on the systems through which people achieve their knowledge and on the processes through which new knowledge may be generated.

Boisot, M. (1998). Knowledge Assets : Securing Competitive Advantage in the Information Economy. Oxford, Oxford University Press.

Bresnen, M. and N. Marshall (2000). "Building partnerships: case studies of client-contractor collaboration in the UK construction industry." Construction Management and Economics **18**: 819-832.

Despite the enormous groundswell of interest in partnering and alliancing in recent years, there has been comparatively little research that has set out to investigate systematically the nature, feasibility, benefits and limitations of forms of client-contractor collaboration. This is despite the growing recognition that conditions conducive to partnering may well vary considerably and that partnering may not be the solution for problems within the industry that many commentators have taken it to be. This paper sets out to add to the growing literature and empirical database on partnering by reporting the findings of a research project designed to explore the economic, organisational and technological factors that encourage or inhibit collaboration in practice. The paper follows on from an earlier review and critique of the literature on partnering (Bresnen, M and Marshall, N 2000, *Construction Management and Economics* **18** (2) 229-37) It includes as its database nine case-studies of medium-to-large-scale projects, selected from across the industry, on which processes of collaboration are examined from the viewpoints of clients, contractors, designers and subcontractors. In contrast to much of the prescriptive work in this area, the analysis of the data and the paper's conclusions stress some of the practical problems, limitations and paradoxes of partnering and alliancing when the effects of important economic, organisational and psychological factors are taken into account.

Brown, J. and P. Duguid. (1998). "Organizing knowledge." California Management Review **40**(3): 90-112.

Countering claims that cyberspace will bring the end of organizations in general and of the firm in particular, this article points to the role organizations play in fostering the production and synergistic development of knowledge. Formal organizations help turn the partial, situated insights of individuals and communities into robust, organizational knowledge. To organize knowledge in

this way requires acknowledging the boundaries inevitably erected within organizations through the division of labor and the division of knowledge. Infrastructure for organizing knowledge must overcome these boundaries. Assuming that knowledge is a frictionless commodity possessed by individuals makes communications technologies and social organization curious antagonists. This article argues instead for compatible organizational and technological architectures that respond to and enhance the social production of knowledge. (Reprinted by permission of the publisher.)

Brown, J. and E. Gray (1995). *The People are the Company*. Fast Company: 78. Xerox and National Semiconductors learn to take advantage of their employees' most productive time - informal knowledge exchange around the coffee pot or water cooler.

Brown, J. S. and P. Duguid (2000). The Social Life of Information. Boston, Massachusetts, Harvard Business School Press.

Burrell, G. and G. Morgan (1979). Sociological Paradigms and Organisational Analysis. London, Heineman.

Checkland, P. (1981). Systems Thinking, Systems Practice. Chichester, Wiley.

Checkland, P. and S. Holwell (1998). Information, Systems and Information Systems. Chichester, John Wiley & Sons.

Checkland, P. and J. Scholes (1990). Soft systems methodology in action. Chichester, Wiley.

Choo, C. W. (1998). The Knowing Organisation: How organisations use information to construct meaning, create knowledge, and make decisions. New York, Oxford University Press.

Choo, C. W. (2000). "Working with knowledge: how information professionals help organisations manage what they know." Library Management 21(8): 395-403.

In order to manage knowledge, we need to understand the nature of knowledge in organisations. It is helpful to distinguish between three categories of organisational knowledge: tacit knowledge, explicit knowledge, and cultural knowledge. Tacit knowledge is personal knowledge, explicit knowledge is codified knowledge, and cultural knowledge is based on shared beliefs. We use this framework to discuss the role of the information professional with respect to each category of knowledge. Knowledge management initiatives led by information professionals in three organisations are then examined. An analysis of these experiences suggests many opportunities for information professionals to make important contributions in managing an organisation's knowledge for growth and innovation.

Ciborra, C. and R. Andreu (2001). "Sharing knowledge across boundaries." Journal of Information Technology 16: 73-81.

Practical solutions concerning the strategic use of knowledge and its

management depend upon the relevant organizational context. By applying the 'learning ladder' model (i.e. a compact way of describing the unfolding of multiple organizational knowledge creation, transformation and transfer processes), three different contexts are explored. First, the single firm is considered and the governance of its internal knowledge processes performed according to the tenets of the resource-based view of strategy. Second, the boundaries of the single firm are crossed and the characteristics of the processes of knowledge transfer and production between allied firms are considered. Finally, emerging features of how knowledge is managed among a large number of interdependent organizations and individuals are explored with reference to the case of open source soft-ware. The latter context highlights behaviours that seem, in a sense, at odds with the traditional principles of knowledge management. This is puzzling: conventional strategic and knowledge management frameworks break down precisely when dealing with the case of highly distributed, knowledge intensive businesses.

Corso, M. and S. Pavesi (2000). "How management can foster continuous product innovation." Integrated Manufacturing Systems **11**(3): 199.

## **introduction**

Starting from the early 1980s, a growing emphasis has been placed on the role of product innovation management as a potential source of competitive advantage. For more than one decade, however, innovation management literature remained almost totally focused on how new product development (NPD) projects, seen as isolated efforts, are managed and organised. In the 1990s, starting from the example of successful practices, new approaches to product innovation emerged calling for an enlargement of the traditional boundaries of product innovation. Attention progressively shifted from the single product to families of related products over time, driven by the consideration that planning innovation at product family level is essential to cope with the competitive pressure to renew and enlarge the product range. Evidence from excellent companies also showed that relevant competitive advantages can be gained by extending innovation to later phases in the product life-cycle. Manufacturing, maintenance and service, for instance, though not part of the development process itself, can provide valuable feedback and additional opportunities to innovate products. Both these approaches can be explained by looking at NPD projects as steps within a corporate-wide process of knowledge creation, embodiment and transfer to which Bartezzaghi et al. (1998) refer as continuous product innovation (CPI). In this perspective, innovation is a continuous and cross-functional process of learning and improvement involving and integrating a growing number of competencies inside and outside the organisational boundaries. Stimulating knowledge creation, embodiment and transfer to foster innovation become one of the primary managerial tasks. Hence the need for new and more adequate management models and tools. Based on evidence from ten explorative studies, this paper explains how companies can facilitate CPI by stimulating

adequate behaviours at organisational level.

The paper represents a preliminary contribution to a support methodology that is being developed in the context of the research project CIMA by a consortium of five European and three Australian research centres and will be tested on a sample of 150 companies in Europe and Australia.

The next section will define the research setting and background, explaining where knowledge can be generated and used in the process of CPI. The third section will introduce a behavioural model, explaining how management can foster learning and improvement in CPI. In the final section, the application of the model to two cases is presented to show its managerial implications.

Costello, G. (1996). *Knowledge Management in Strategic alliances: The Role of Information Technology*. Templeton College. Oxford, University of Oxford. Strategic alliances have been advocated as an efficient means to synergistically combine the core competencies of organisations to achieve competitive advantage. Central to this strategy is the contribution of proprietary strands of knowledge by alliance partners. Management of this process is termed alliance knowledge management. Knowledge management is defined as the process of managing the cycle of capturing knowledge from organisational activities and learning from that knowledge about scope for improved organisational effectiveness through changes to behaviours and organisational activity. paradoxically , knowledge management within alliances is notoriously difficult and achievement of potential synergies requires extensive management support. Information technology is acknowledged as playing a significant role in supporting knowledge management within organisations , however its interorganisational potential remains largely unexploited....

Cushman, M. (2001). Action research in the UK construction industry - the B-Hive Project. IFIP 8.2, Boisit USA.

Dahlbom, B. and L. Mathiassen (1995). Computers in Context: The Philosophy and Practice of Systems Design. Oxford, Blackwell Publishers Ltd.

Davenport, T. (1996). *Knowledge Management at Ernst & Young*, Center for Business Innovation: Ernst & Young. **1999**.

Ernst & Young's Management Consulting practice underwent a strategic shift when it included knowledge as a key component of the firm's strategic plan. The outline of this plan included three areas of emphasis in knowledge management: capturing and leveraging knowledge, contribution by all to a firm-wide stock of knowledge, and recognition by clients as a valuable source of knowledge and thought leadership. In implementing this plan, the group created knowledge development centers and organized the client services into knowledge networks. The Center for Business Knowledge maintained a library, a call center, and databases of knowledge available throughout the firm. The CBK created a taxonomy and architecture for the knowledgebases and worked directly with subject matter experts from the knowledge networks

to address issues of contribution, filtering, acquisition, and updating.

This case was also explored and described in relation to the research on Leveraging Knowledge for Business Value: Creating Living Knowledge Representations through the Power of Communities. E&Y clients interested in knowledge management may be invited to visit the Center for Business Knowledge.

Davenport, T. and V. Grover (2001). "Special Issue: Knowledge Management (editorial)." Journal of Management Information Systems **18**(1): 3-4.

Davenport, T., S. Jarvenpaa, et al. (1996). "Improving knowledge work processes." Sloan Management Review(Summer): 53-65.

Davenport, T. and L. Prusak (1998). Working Knowledge: how organisations manage what they know. Boston, Harvard Business School Press.

What is knowledge

What does it look and sound like

who has it...

Deetz, S. (1992). Democracy in an Age of Corporate Colonization: Developments in Communication and the Politics of Everyday Life. Albany, NY, State University of New York Press.

Demarest, M. (1997). "Understanding Knowledge Management." Long Range Planning **30**(3): 374-384.

It has become commonplace to assert that the post-industrial global economy is information-intensive. What is perhaps more remarkable is that the call to knowledge is being sounded at all levels of economic analysis: at the macro level of global markets and economic trends, at the meso level of the inter-firm networks and value chains that construct and deliver value to customers, and at the micro level of the firm: the basic unit of analysis. The notion that more and more of what is delivered by value chains to end-consumers is based on information, either as the raw material from which value is produced, as the means of production, or as components of the actual end-product. In some senses, knowledge - the actionable information embodied in the set of work practices, theories-in-action, skills, equipment, processes and heuristics of the firm's employees - is now the core intangible asset of firms competing in global information-intensive economies. This article discusses the rise of knowledge management as a discipline, defines the relationship between knowledge management, and tradition measures of firm performance like marketplace innovation, internal efficiency and profitability, describes some basic models for understanding how knowledge is created, embodied and distributed within organisations, and traces the connection between knowledge management and the infrastructure that supports it: particularly, new information technologies.

Ding, H. B. and L. S. Peters (2000). "Inter-firm knowledge management practices for technology and new product development in discontinuous innovation." International Journal of Technology Management **20**(5-8): 588-600.

Discontinuous, or radical, innovation has been regarded as a critical factor in

renewing firms' competitive position. The results of the Rensselaer Radical Innovation Project (RRIP) show that the development of new businesses and product lines based on discontinuous innovations requires distinct inter-firm knowledge management practices. Knowledge management studies suggest that inter-firm collaborative networks, such as strategic alliances, enhance corporate innovative capability by facilitating flow of knowledge across companies. Due to the increasing significance of inter-firm collaborative networks, there is a need for further understanding of knowledge management at the inter-firm level. By reviewing the literature on knowledge management practices, this article suggests that knowledge management practices vary from one organization to another. The variety of corporate knowledge management practices attribute to distinct organizational settings, and technology domains in the context of technology and new product development. The authors propose that the different types of inter-firm collaborative networks are established to fulfil specific knowledge management requirements for divergent technology and new product development in discontinuous innovation.

Drucker, P. (1993). Post-Capitalist Society. Oxford, Butterworth Heinemann.

Drucker, P. (1994). "The Age of Social Transformation." The Atlantic Monthly(November 1994): 68.

Earl, M. (2001). "Knowledge management strategies: Toward a taxonomy." Journal of Management Information Systems **18**(1): 215-233.

**ABSTRACT:** This paper draws on primary and secondary data to propose a taxonomy of strategies, or "schools," for knowledge management. The primary purpose of this framework is to guide executives on choices to initiate knowledge management projects according to goals, organizational character, and technological, behavioural, or economic biases. It may also be useful to teachers in demonstrating the scope of knowledge management and to researchers in generating propositions for further study.

Eden, C. and F. Ackermann (1998). Making Strategy: the Journey of Strategic Management. London, Sage.

Edvinsson, L. and M. Malone (1997). Intellectual Capital. London, Judy Piatkus Limited.

Egbu, C. and K. Botterill (2001). Knowledge Management and Intellectual Capital: Benefits for project based industries. CoBRA.

National and international governments, practitioners and academics have identified the area of knowledge management (KM) as critical for organisational and national competitiveness. Similarly, intellectual capital (IC) in the form of human capital is also seen as vital for project and organisational effectiveness. Managing knowledge and human capital is particularly relevant to the construction industry which is characterised by projects that are prototypical in nature, has temporary multi-disciplinary teams and structures

and relies heavily on experiences as a basis for planning, decision making and the forming of project and organisational networks. This paper is based on an on-going postgraduate research study, which is aimed at investigating the role of knowledge management and intellectual capital assets on organisational innovations in project based industries. The study employs a combination of research approaches, including ethnographic interviews, postal questionnaires, and the analysis of archive documentation. Through a thorough review of the relevant literature and interviews with personnel from different organisations and project environments, the paper explores the challenges associated with understanding and applying KM and IC, together with the practical benefits that could ensure from their effective management. Lessons for the construction industry and for surveying practices in particular are also highlighted. The paper concludes that the effective management of KM and IC has the potential to contribute to time saving, cost reduction, improved supply chain management, respect for people, trust building and improves process and product innovations. It is suggested that there is ample scope for empirical investigations in the areas of KM and IC, especially from a human resources management perspective. There is also a need for improved awareness of these important areas in construction and the quantitative and qualitative measurements of the contribution of KM and IC to projects and to organisational strategy.

Espejo, R. (1993). Giving Requisite variety to strategy and Information systems. Systems Science, Plenum Press.

Fahey, L. and L. Prusak. (1998). "The eleven deadliest sins of knowledge management." California Management Review 40(3): 265-277.

This article draws attention to a number of errors that could potentially cripple the efforts of any organization attempting to generate and leverage knowledge. Many of these errors are associated with the concept of knowledge itself - how knowledge is understood in organizational settings. The article notes the sources of each error as well as some key implications for managing knowledge. It concludes with some brief suggestions on how to avoid, or at least ameliorate these errors. (Reprinted by permission of the publisher.)

Friend, J. and A. Hickling (1997). Planning Under Pressure: the Strategic Choice Approach. Oxford, Butterworth-Heinemann.

Gabriel, Y. (2000). Storytelling in Organisations. Oxford, Oxford University Press.

This reference is made from an Imperial Collage Alumni presentation - Details found in early part of notebook 8.

Galliers, B. and S. Newell (2001). Back to the future: From knowledge management to data management. The 9th European Conference on Information Systems, Bled, Slovenia, Moderna Obganizacija,.

This paper argues for a return to fundamentals as we enter the new millennium. It argues that the field of Information Systems should no longer be distracted from its natural locus of concern and competence, or claim more than it can actually achieve. More specifically, and as a case in point, we

eschew IT-enabled Knowledge Management, both in theory and in practice. We view Knowledge Management as the most recent in a long line of fads and fashions embraced by the Information Systems community that have little to offer. Rather we argue for a refocusing of attention back on the management of data, since IT processes data - not information and certainly not knowledge. In so doing, we develop a model that provides a tentative means of distinguishing between these terms. This model also forms the basis for on-going empirical research designed to test the efficacy of our argument in a number of case companies currently implementing ERP and Knowledge Management Systems

Gold, A. H., A. Malhotra, et al. (2001). "Knowledge management: An organizational capabilities perspective." Journal of Management Information Systems **18**(1): 185-214.

A hallmark of the new economy is the ability of organizations to realize economic value from their collection of knowledge assets as well as their assets of information, production distribution, and affiliation. Despite the competitive necessity of becoming a knowledge-based organization, senior managers have found it difficult to transform their firms through programs of knowledge management. This is particularly true if their organizations have long histories of process and a tradition of business success. This research examines the issue of effective knowledge management from the perspective of organizational capabilities. This perspective suggests that a knowledge infrastructure consisting of technology, structure, and culture along with a knowledge process architecture of acquisition, conversion, application, and protection are essential organizational capabilities or "preconditions" for effective knowledge management. Through analysis of surveys collected from over 300 senior executives, this research empirically models and uncovers key aspects of these dimensions. The results provide a basis for understanding the competitive predisposition of a firm as it enters a program of knowledge management.

Goleman, D. (1985). Vital Lies, Simple Truths :The Psychology of Self-Deception. London, Bloomsbury.

Hansen, M. T., N. Nohria, et al. (1999). "What's your strategy for managing knowledge?" Harvard Business Review: 106-116.

Some companies automate knowledge management; others rely on their people to share knowledge through more traditional means. Emphasizing the wrong approach - or trying to pursue both at the same time - can quickly undermine your business.

Hedlund, G. (1994). "A Model of Knowledge Management and the N-form Corporation." Strategic Management Journal **15**: 73-90.

A model of knowledge management is developed. It builds on the interplay between articulated and tacit knowledge at 4 different levels: the individual, the small group, the organization, and the interorganizational domain. The model is applied on differences between Western and Japanese patterns of knowledge management. These are related to organizational characteristics,

such as employment systems, career patterns, and organization structure. Effective knowledge management is argued to require departures from the logic of hierarchical organization and the M-form structure. The alternative N-form is characterized and suggested as more appropriate. It entails combination of knowledge rather than its division, which is the basic principle of the M-form. Other attributes of the N-form are temporary constellations of people, the importance of personnel at lower levels, lateral communication, a catalytic and architectural role for top management, strategies aimed at focusing and economies of depth, and hierarchical structures.

Howard, N., P. Bennett, et al. (1993). "Manifesto for a Theory of Drama and Irrational Choice." Journal of the Operational Research Society 44(1): 99-103.

Kelly, G. A. (1955). The psychology of personal constructs. New York, W.W. Norton.

Leask, C., R. Seaward, et al. (1999). "Combining Methodologies: Issues arising, and lessons learned, from developing a knowledge management system."

This paper examines how more than one methodology can be used in an industrial setting to achieve a desirable outcome, and critically evaluates the degree to which the methodologies and methodology users can be effectively combined. It is written in the context of projects that analyse and design a system to facilitate effective knowledge sharing.

Leonard, D. (1995). Wellsprings of Knowledge. Boston, Massachusetts, Harvard Business School Press.

Levy, M., C. Loebbecke, et al. (2001). SMEs, Co-opitition and knowledge sharing: The IS role. Global Co-Operation in the New Millennium  
The 9th European Conference on Information Systems, Bled, Slovenia.

Co-opetition, simultaneous co-operation and competition, is a recent phenomenon. Co-opetition entails sharing knowledge that may be a key source of competitive advantage. Yet, the knowledge gained by co-operation may also be used for competition. There is little investigation of how this problem may be modelled and, hence, managed. A game-theoretic framework for analysing inter-organisational knowledge sharing under co-opetition and guidelines for the management of explicit knowledge, predicated on co-ordination and control theory has been proposed, but remains untested. This research empirically investigates these issues in the context of small and medium-sized enterprises (SMEs). SMEs provide an interesting setting as they are knowledge generators, but are poor at knowledge exploitation. The paper uses data from UK SMEs to investigate co-opetition, management of knowledge sharing and the role of IS.

Marshall, A. (1965). Principles of Economics. London, Macmillan.

McAdam, R. and S. McCreedy (1999). "A critical review of knowledge management models." The Learning Organisation 6(3): 91-100.

There is an increasing interest in the area of knowledge management (KM)

within organisations and academia. Because of the emergent nature of the field there is a lack of classification of suitable knowledge management models to use in conducting further research, literature evaluation and organisational applications. This paper discusses the definitions and classifications of knowledge management, representing a wide spectrum of views from mechanistic to more socially orientated. An evaluative framework is established from which three knowledge management models can be critically discussed. Three KM model classifications are critiqued, namely knowledge category models, intellectual capital models and socially constructed models. Finally a modified KM model is tentatively suggested to act as a useful guide for further research and organisational application. This model takes a holistic approach to scientific and socially constructed knowledge, assuming the need for both emancipatory and business benefits for KM. The model represents KM as a highly recursive process, rather than sequential.

McAdam, R. and S. McCreedy (1999). "The process of Knowledge Management within Organisations: a Critical Assessment of both Theory and Practice." Knowledge and Process Management 6(2): 101-112.

This article critically assesses the current understanding of the theory and practice of the emergent field of Knowledge Management (KM), so that it can be more beneficially applied to organisations and those who work in them. More specifically the article discusses the emergent nature of KM, presents a short critical assessment of the literature on KM models, gives the results of primary research to assess the current state of KM theory and practice in organisations, and develops a model based on the research to illustrate the knowledge management process within organisations.

Miles, G., R. E. Miles, et al. (1998). "Some conceptual and research barriers to the utilization of knowledge." California Management Review (Special Issue on Knowledge and the Firm) 40(3): 281-289.

Whether in high-tech, service, or traditional industries, the role of knowledge as a primary driver of development is being increasingly recognized. It is not clear, however, whether managerial approaches based on mindsets rooted in past practice are appropriate for, or capable of, fully realizing the potential value of knowledge within the firm and/or industry. At least three related issues stand in the way of full knowledge utilization: conceptualization and measurement of knowledge capital as a primary organizational asset, the integration of knowledge capital into the strategic management process, and the development of knowledge. While leading-edge firms are already wrestling with these issues, advances in theory and research are needed to help develop appropriate responses and provide frameworks that will help spread these new approaches. In doing so, advances may also be made that allow for the recognition of the central role of collaboration in the knowledge process. (Reprinted by permission of the publisher.)

Mitroff, I. and H. Linstone (1993). The Unbounded Mind. Oxford, Oxford University Press.

More, E. (1998). "The role of communication in current debates on knowledge

management." Journal of Communication Management **3**(4): 353-361.

The management of knowledge goes far beyond the storage and manipulation of data, or even of information. It is the attempt to recognize what is essentially a human asset buried in the minds of individuals, and leverage it into an organisational asset that can be accessed and used by a broader set of individuals on whose decisions the firm depends.

The ability to manage human intellect and its conversion into useful "product" is, perhaps, the most critical management skill in our age, providing the ultimate in competitive edge. Unfortunately, in most organisations managing intellectual capital remains largely unexplored territory, especially understanding the human side of knowledge management.

Moreover, given the centrality of communication to organising, it is surprising how little recent work in the field of knowledge management or intellectual capital focuses on, never mind even mentions, the concept of communication per se. Perhaps it is time that organisation communication scholars tackled this void.

This paper then takes up such a challenge reflecting on the role organisation communication might play in dealing with knowledge management in contemporary and future organisational practice.

Neef, D. (1999). "Making the case for knowledge management: the bigger picture." Management Decision **37**(1): 72-78.

Despite several years of hearty media and academic interest, for most people "knowledge management" still remains an ill-defined and woolly concept. The problem may be that knowledge management proponents have usually focused on either the minutiae of implementation - intranets and data mining techniques - or worse, on abstract theories such as the value of trust in a knowledge sharing culture. This article contends that it is only really possible to appreciate the contrite importance of knowledge management in the workplace if the subject is seen in a much broader context - as causally related to the enormous changes taking place in the global economic framework its left. These more fundamental changes to the economic environment are what are driving organisations toward adopting the sophisticated new set of policies and practices known as "knowledge management". In short, there is a broad "knowledge-based revolution" taking place, and it comes in a matching set: the knowledge based economy for nations, and knowledge management for the organisations themselves

Nonaka, I. (1991). "The Knowledge Creating Company." Harvard Business Review(November-December): 2-9.

Nonaka, I. and H. Takeuchi (1995). The knowledge-creating company: how Japanese companies create the dynamics of innovation. New York, Oxford University Press.

Nonaka, I., R. Toyama, et al. (2000). "SECI, Ba and Leadership: a Unified Model of Dynamic Knowledge Creation." Long Range Planning **33**: 5-34.

Despite the widely recognised importance of knowledge as a vital source of competitive advantage, there is little understanding of how organisations actually create and manage knowledge dynamically. Nonaka, Toyama and

Konno start from the view of an organisation as an entity that creates knowledge continuously, and their goal in this article is to understand the dynamic process in which an organisation creates, maintains and exploits knowledge. They propose a model of knowledge creation consisting of three elements: (1) the SECI process, knowledge creation through the conversion of tacit and explicit knowledge; (2) "Ba", the shared context for knowledge creation; and (3) knowledge assets, the input, outputs and moderators of the knowledge-creating process. The knowledge creation process is a spiral that grows out of these three elements ; the key to leading it is dialectical thinking. The role of top management in articulating the organisation's knowledge vision is emphasised, as is the important role of middle management ("knowledge producers") in energising ba. In summary, using existing knowledge assets and organisations creates new knowledge through the SECI process that takes place in ba, where new knowledge, once created becomes in turn the basis for a new spiral of knowledge creation.

Prusak, L. and D. Cohen (2001). "How to invest in Social Capital." Harvard Business Review(June): 86-93.

Businesses thrive when people trust one another - but such "social capital" is under assault at many companies today. What can executives do to fight back?

Raub, S. and C. C. Ruling (2001). "The knowledge management tussle - speech communities and rhetorical strategies in the development of knowledge management." Journal of Information Technology **16**(2): 113-130.

Knowledge management has become a major trend since the mid- 1990s. Different professional communities, among them information systems/information technology (IS/IT) and more business management-oriented actors, have created strong conceptual ties with the idea of managing knowledge. This paper studies the structure and development of the knowledge management discourse over an 18-year period with an emphasis on the role of the IS/IT community in shaping this discourse. In order to do so, a content analysis of 434 article abstracts from the ABI/Inform database referring to 'knowledge management' was performed. The argument here is based on a theoretical framework derived from recent theorizing about popular management knowledge as fashion and it is assumed that different professional or 'speech communities' gathering around a concept such as knowledge management enter into competition for limited organizational resources. The paper's findings show the co-existence of two distinct speech communities involved in the knowledge management debate, focusing on either IS/IT or general management issues and they support the idea that both communities engage in a joint effort at sustaining knowledge management as a fashion field.

Rittel, H. (1971). "Some principles for the design of an educational system for design." Journal of Architectural Education **26**: 16-27.

Roos, G. and J. Roos (1997). "Measuring your Company's Intellectual Performance." Long range planning **30**(3): 413-427.

Rosenhead, J. (2001). Robustness Analysis: Keeping Your Options Open. Rational Analysis for a Problematic World Revisited: Problem Structuring Methods for Complexity, Uncertainty and Conflict. J. Mingers. Chichester, Wiley: 181-207.

Rosenhead, J. and J. Mingers, Eds. (2001). Rational Analysis for a Problematic World Revisited: Problem Structuring Methods for Complexity, Uncertainty and Conflict. Chichester, Wiley.

Routledge (2000). Concise Routledge Encyclopedia of Philosophy. New York, Routledge.

Scarborough, H., J. Swan, et al. (1999). Knowledge Management: A literature review. London, Institute of Personnel and Development.

Schön, D. (1982). The Reflective Practitioner: How Professionals Think in Action, Basic Books.

Schultze, U. (1998). Investigating the Contradictions in Knowledge Management. IFIP WG8.2 & WG8.6 Joint Working Conference on Information Systems: Current Issues and Future Changes, Helsinki, Finland, Omnipress, Wisconsin, USA.

Schultze, U. and R. Boland (2000). "Place, Space and knowledge work: a study of outsourced computer systems administrators." Accounting Management and Information Technology 10: 187-219.

Information technology has the capacity to change time-space configurations making new organisational forms possible. Two principle time-space configurations known as *space* and *place* are used to characterize some of the broad transformations occurring in social and organisational structures associated with the intensified use of information technology. the time-space configuration of place with its sense of boundedness, localness and particularity, is contrasted with that of space and its sense of the universal . the generalizable and the abstract. Today's evolving organisational forms reflect an increased reliance on space as a guiding image for organisation design and technology deployment. Space as a guiding image brings the hope of making an organisation more flexible by freeing it from the constraints of place. This is reflected in the emergence of market-based forms of organizing with their emphasis on outsourcing and inter-organisational alliances.

We present an ethnographic account of outsourced computer system administrators in a company that is seeking to be a lean, knowledge-intensive, learning organisation. Drawing on Bourdieu's theory of practice we explore the tensions between place and space in the firm as well as in the system administrators' work lives. We argue that place and space are always operating simultaneously in an organisation, and that they provide an ongoing source of dialectic tension for the individual worker. In keeping with Bourdieu's generative structuralism, we further argue that the computer contractors' work practices, especially their practice of writing serve to reproduce the conditions under which those tensions emerge.

Senge, P. M. (1990). The Fifth Discipline: The Art and Practice of The Learning Organization. New York, NY, Doubleday.

Shadbolt, N. and N. Milton (1999). "From Knowledge Engineering to Knowledge Management." British Journal of Management **10**: 309-322.

Knowledge management is seen by many to be a prerequisite for the successful organization, and one that relies heavily, though not exclusively, on a sound technological infrastructure. A major drawback, though, with current technology (e.g. Lotus Notes and www) is its focus on information management and communication rather than on knowledge itself. What knowledge management needs is tools and techniques that are more oriented towards knowledge – its creation, mapping, transfer and use. We show how many of the methods and tools used in the branch of artificial intelligence known as knowledge engineering can be adapted to provide such a knowledge-oriented technology, and lead to significant benefits for organizations. A number of case studies are presented which illustrate our points, including decision-making at Andersen Consulting and best practice at Rolls-Royce. A more elaborated use is shown in the context of business process re-engineering, where a new software tool kit called SPEDE is being applied and validated within the aerospace and automotive industries.

Sieloff, C. G. (1999). "'If only HP knew what HP knows": the roots of knowledge management at Hewlett-Packard." Journal of Knowledge Management **3**(1): 47-53.

While the term "knowledge management" is relatively new, many of the concepts have deep historical roots. Hewlett-Packard's strong culture and traditional business practices established an environment that encouraged innovation and the sharing of knowledge throughout the company. However, the reliance on local and informal approaches eventually became a weakness when the company had to deal with rapid growth and increased competitive pressures. The growing gap between the potential and actual value of HP's collective intellectual assets was reflected in a widely quoted management complaint from the 1980s, "If only HP knew what HP knows." However, the need for more explicit and deliberate strategies for managing knowledge has only recently become clear, as the disruptive technology of the Internet and the World Wide Web triggered an explosion in the availability of information and knowledge, but did nothing to expand our limited attention capacity.

Simon, H. (1945). Administrative Behaviour. New York, Macmillan.

Snowden, D. (2000). Private Presentation (Senior Consultant on Knowledge Management at IBM).

Stewart, T. (1996). The Coins in the Knowledge Bank. Fortune.

Here's a nifty way to measure the value of your most important asset -- and thought about those boring tangible assets too.

Stewart, T. (1996). The invisible key to success. Fortune (online).

Shadowy groups called communities of practice are where learning and

growth happen. You can't control them - but they are easy to kill.

Stewart, T. (1997). Getting real about brainpower. Fortune.  
US West, Monsanto, Hewlett-Packard and others have proved that mapping corporate knowledge adds lots of value -- to the bottom line.

Stewart, T. (1997). Mapping Corporate Brainpower. Fortune.  
Who knows what knowledge lurks in the minds of your colleagues ?  
Companies are learning to bring their know-how out of the shadows.

Stewart, T. (1997). Why Dumb Things Happen to Smart Companies. Fortune.  
You've hired the smartest people and you're spending tons on R&D and customer service, yet you keep blowing it. Time to look at how you manage brainpower

Stewart, T. (1998). Intellectual Capital - The New Wealth of Organisations. London, Nicholas Brealey Publishing.

Sveiby, K. E. (1997). Tacit Knowledge, [www.sveiby.com.au](http://www.sveiby.com.au). 1999.  
Human knowledge articulated through language is essentially metaphoric in character. "Knowledge about knowledge" is therefore a question of which metaphors one chooses to express one's knowledge in.

Michael Polanyi (1891-1976) was a Hungarian medical scientist whose research was mainly done in physical chemistry before he turned into philosophy at the age of 55. He accepted a personal chair in social studies at the university of Manchester in 1948. His lectures were collected in his opus magnum Personal Knowledge, Towards a Post Critical Epistemology in 1958. Although very influential in the background he was never recognised as a "true" philosopher by his contemporaries.

Tacit Knowledge is of particular interest for those who are interested in how to manage Knowledge Organizations or those involved in Intellectual Capital.

The concept also explains some of the paradoxes on the Information Markets.  
Michael Polanyi called his book Personal Knowledge because he wanted to underline that the intellect also in science is connected with a "passionate" contribution of the person knowing. Emotions are a vital component of the person's knowledge. But this does not make our understanding subjective.

Knowing is objective in the sense of establishing contact with a hidden reality.

Sveiby, K.-E. (1996). "Transfer of Knowledge and the Information Processing Professions." European Management Journal 14(4): 379-388.  
How is Knowledge best transferred? Via Information or via Tradition (face-to-face socialization)? This article draws upon Micheal Polanyi's concepts of "Tacit knowing" and "Tradition", contrasting it with Information Theory to explore the two methods. The present growth in information seems to be supply push, not a customer demand, which is potentially dangerous.

ON today's information markets the suppliers pay - not the consumers, suggesting that the value of information in transferring knowledge is very small. The value can even be negative, because the reader does not know until after reading, whether the information was worth spending time on or not. The money makers have the information suppliers as customers or have created standards that force the readers to use their tools.

It seems false - and possibly unprofitable - to base transfer of human knowledge on information. I suggest that those carrying a "radical " definition of information as being *equal and meaningless* are less likely to be disappointed and less likely to lose money on information markets.

Human knowledge is action oriented and is best transferred via tradition, in social interaction with people, because humans have a huge capacity to absorb signals unconsciously in face-to-face communication. However, tradition is slow and unconscious. We must find new ways and other interactive media other than information, for efficient knowledge transfer. On such "medium" is the open plan office.

Tapscott, D. (1996). Digital Economy, McGraw-Hill.

Tenkasi, R. and R. Boland (1996). "Exploring Knowledge diversity in knowledge intensive firms :a new role for information systems." Journal of Organizational Change Management 9(1): 79-91.

TFPL (1999). Skills for knowledge management: building a knowledge economy. London, TFPL Ltd, 17-18 Britton Street London EC1M 5TL.

Tuomi, I. (1999). "Data is more than knowledge: Implications of the reversed knowledge hierarchy for knowledge management and organizational memory." Journal of Management Information Systems 16(3): 103-117.

The knowledge management literature often points out the importance of distinguishing among data, information, and knowledge. The generally accepted view sees data as simple facts that become information as data are combined into meaningful structures, which subsequently become knowledge as meaningful information is put into a context and when it can be used to make predictions. According to this view, data are a prerequisite for information, and information is a prerequisite for knowledge. This paper explores the conceptual hierarchy of data, information, and knowledge, showing that data emerge only after we have information, and that information emerges only after we already have knowledge. The reversed hierarchy of knowledge is shown to lead to a different approach in developing information systems that support knowledge management and organizational memory. It is also argued that this difference may have major implications for organizational flexibility and renewal.

Van-der-Pijl, G. J. and W. Van-Boven (1999). Getting knowledge organised: The knowledge management framework. Information Systems at the Core. Finnegan and

Murphy, Blackhall Publishing.

Von-Krogh, G., K. Ichijo, et al. (2000). Enabling Knowledge Creation: How to Unlock the Mystery of Tacit Knowledge and Release the Power of Innovation. Oxford, Oxford University Press.

Ward, V. and C. Holtham (2000). The role of private and public space in knowledge management. Knowledge Management: Concepts and Controversies, University Of Warwick.

Webber, A. (1984). "What's so new about the new economy?" Harvard Business Review(Jan-Feb).

Weick, K. (1993). "The Collapse of Sensemaking in Organisations: The Mann Gulch Disaster." Administrative Science Quarterly(38): 628-652.

The death of 13 men in the Mann Culch fire disaster, made famous in Norman Maclean's *Young Men and Fire*, is analysed as the interactive disintegration of role structure and sensemaking in a minimal organisation. Four potential sources of resilience that make groups less vulnerable to disruptions of sensemaking are proposed to forestall disintegration, including improvisation, virtual role systems, the attitude of wisdom, and norms of respectful interaction. The analysis is then embedded in the organisational literature to show that we need to re-examine our thinking about temporary systems, structuration, nondisclosive intimacy, intergroup dynamics and team building.

Weick, K. (1995). Sensemaking in Organisations. London, Sage Publications.

Weick, K. (1996). "Prepare Your Organisation to Fight Fires." Harvard Business Review(May-June): 143-148.

IN 1949, a forest fire claimed the lives of 13 young men. Their tragedy holds lessons for today's organisation.

Wenger, E. (1998). Communities of practice : Learning, meaning and identity. Cambridge, Cambridge University Press.

Wenger, E. and W. Snyder (2000). "Communities of Practice: The Organisational Frontier." Harvard Business Review(January - February): 139-145.

Not so long ago, companies were reinvented by teams. Communities of practice may reinvent them yet again - if managers learn to cultivate these fertile organisational forms without destroying them

Winograd, T. and F. Flores (1986). Understanding computers and cognition. Norwood,NJ, Ablex.