The five-tier knowledge management hierarchy

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This paper is based on a paper presented at the Proceedings of the 35th Annual Meeting of the Decision Sciences Institute, Boston, MA, November 2004.

Abstract

Purpose – *Many terms commonly used in the field of knowledge management (KM) have multiple uses and sometimes conflicting definitions because they are adapted from other research streams. Discussions of the various hierarchies of data, information, knowledge, and other related terms, although of value, are limited in providing support for KM. The purpose of this this paper is to define a new set of terminology and develop a five-tier knowledge management hierarchy (5TKMH) that can provide guidance to managers involved in KM efforts.*

Design/methodology/approach – *The 5TKMH is developed by extending the knowledge hierarchy to include an individual and an innovation tier.*

Findings – *The 5TKMH includes all of the types of KM identified in the literature, provides a tool for evaluating the KM effort in a firm, identifies the relationships between knowledge sources, and provides an evolutionary path for KM efforts within the firm.*

Research limitations/implications – *The 5TKMH has not been formally tested.*

Practical implications – *The 5TKMH supports a KM life-cycle that provides guidance to the chief knowledge officer and can be employed to inventory knowledge assets, evaluate KM strategy, and plan and manage the evolution of knowledge assets in the firm.*

Originality/value – *In this paper, a new set of terminology is defined and a 5TKMH is developed that can provide guidance to managers involved in KM efforts and determining the future path of KM in the firm.*

Keywords *Knowledge management, Knowledge process*

Paper type *Research paper*

Introduction

There are many definitions of knowledge management (KM) but the following definition by the Gartner Group is quite succinct and appropriate for the perspective expressed in this paper:

> Knowledge management promotes an integrated approach to identifying, capturing, retrieving, sharing, and evaluating an enterprise's information assets. These information assets may include databases, documents, policies and procedures, as well as the un-captured tacit expertise and experience stored in individual workers' heads (Gartner Group, 1999).

Before proceeding, we should define our terms, as the definition of knowledge has been debated since the Greeks and is still being debated in academic circles. A common theme in the KM literature is that data is combined to create information, and information is combined to create knowledge. There is a consensus that data are discrete facts, but after that, consensus is lacking. The lack of consistent definitions for data, information, and knowledge make rigorous discussions of KM difficult. For example, Alavi and Leidner (2001) states:

> We posit that information is converted into knowledge once it is processed in the minds of individuals and knowledge becomes information once it is articulated and presented in the form of text, graphics, words, or other symbolic forms.

In other words, the same unit of knowledge becomes information when it is stored in a computer, but then becomes knowledge again when it is transferred to another human.

Information has been defined as data with special relevance and purpose (Drucker, 1995). It has also been defined as data that makes a difference (King, 1993), data in context (Galup *et al.*, 2002), and a result of analyzing and interpreting data that carries meaning (Bourdreau and Couillard, 1999).

There is even less consensus about the meaning of knowledge. Knowledge has been defined as:

- the power to act and make decisions (Kantner, 1999);
- information in context coupled with an understanding of how to use it (Davenport and Prusak, 1998);
- professional expertise appropriate for the domain (Bourdreau and Couillard, 1999);
- things that are held to be true and drive people to action (Bourdreau and Couillard, 1999);
- justified personal belief that increases an individual's capacity to take effective action (Alavi and Leidner, 1999);
- information that has been authenticated and thought to be true (Vance, 1997);
- integrated information in context (Galup *et al.*, 2002);
- information made actionable (Maglitta, 1996); and
- information made actionable in a way that adds value to the enterprise (Vail, 1999).

Following the lead of Polanyi (1958), some even contend that knowledge exists only in a human mind (Nonaka, 1994), which is similar to the concept expressed by Churchman (1972) that ''knowledge resides in the user and not in the collection.''

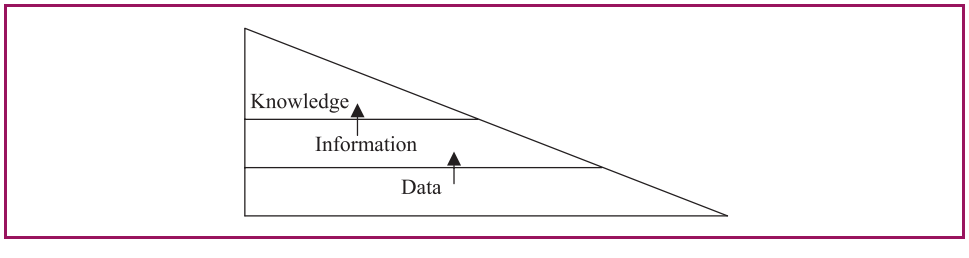
In the next section, a discussion of the various hierarchies of data, information, knowledge, and other related terms are presented. Although of value, these hierarchies are limited in providing support for KM so a new set of terminology is defined and a five-tier knowledge management hierarchy (5TKMH) is developed. Following this will be a section on how to apply 5TKMH to provide guidance to managers involved in KM efforts. The last section contains our conclusions and directions for future research.

The knowledge hierarchy

The most common paradigm in the KM literature is the knowledge hierarchy (Nissen, 2000; Davenport and Prusak, 1998), which is depicted in Figure 1. The knowledge hierarchy depicts the conventional concept of knowledge transformations, where data is transformed into information, and information is transformed into knowledge.

Variations on this central theme include Tuomi (1999), who proposes an inverted hierarchy. His position is that knowledge is required to represent information, which must be done to store data. Nissen (2000) extends this concept with a model containing two hierarchies. One hierarchy models the view of the knowledge seeker, where the second hierarchy is inverted and represents the view of the knowledge creator. From the seeker's perspective, data is

Figure 1 Knowledge hierarchy



> **"The lack of consistent definitions for data, information and knowledge makes rigorous discussions of KM difficult."**

placed in context to create information, and information that becomes actionable is knowledge. From the creator's perspective, knowledge is necessary to create information, which in turn is necessary to create data. These transformations are not mutually exclusive.

An extension to the knowledge hierarchy is expressed by Ackoff (1996), who defines data as symbols, information as data that are processed to be useful, knowledge as application of data and information to answer ''how'' questions, Understanding as the ability to answer ''why'' questions, and wisdom as evaluated understanding. Instead of a hierarchy, Kakabadse *et al.* (2003) views data, information, realization, action/reflection, and wisdom as a ''chain of knowledge flow''. Realization refers to information put to productive use. Action/reflection is reflective and integrative thought and the will to act. Through action/reflection, one may gain wisdom. As understanding and wisdom are unlikely to be possessed by computers (Ackoff, 1996), we consider them to be dimensions of personal knowledge.

The knowledge hierarchy can be used to predict the actionability and volume of each tier in the hierarchy. Knowledge is the most actionable level but the most rare, where data is the least actionable level but has the greatest volume (Nissen, 2000).

Personal knowledge and KM

There is also a lively debate about the definitions of explicit and tacit knowledge.

> Tacit knowledge is an elusive or maybe illusive term that its implication depends on the nature and resources of tacitness expected (Li and Gao, 2003).

A useful perspective is shown by Tsui, who classifies KM initiatives as codified and personal (Tsui, 2003). Codified systems emphasize explicit knowledge and technology. Personal systems, on the other hand, focus on individual knowledge and sharing through common interests. We will use this perspective to define the following classes of knowledge in the context of KM:

- Personal knowledge is defined as ''knowledge contained only in the mind of one person.''
- Codified knowledge is defined as ''knowledge that has been captured and may be shared.''

The knowledge hierarchy was introduced to describe management information systems (Davenport and Prusak, 1998), which by definition are codified systems. The knowledge hierarchy is useful but limited in respect to KM because it excludes personal knowledge. Personal knowledge is half of the foundation of KM and is in some way the source of all codified data, information, and knowledge. Personal knowledge may contain facts, influences, solutions, and innovations. Personal knowledge is stored only in the mind of the expert and, while contact information for the expert can be stored in a knowledge directory or ''Yellow Pages'', the knowledge itself is not available for inspection and has not been captured.

Markus (2001) adds that:

> Only explicit knowledge is the province of information technology, including the communication systems by which people informally share their observations and the more formal repositories in which structured knowledge is stored for later reuse.

This position encourages the storage and algorithmic execution of knowledge. As an example, should knowledge about drug interactions be used only in the mind of a human or

should it also be used in a function of a prescription delivery software system? Codified knowledge is retained by the company, where personal knowledge walks out the door every night (Edvinsson and Malone, 1997). Knowledge embedded in a computer program, as exemplified by expert systems, can be used to automate complex processes with the result of higher effectiveness, higher efficiency, and lowered costs. Codified knowledge also provides a basis for deriving value producing knowledge-based products or services.

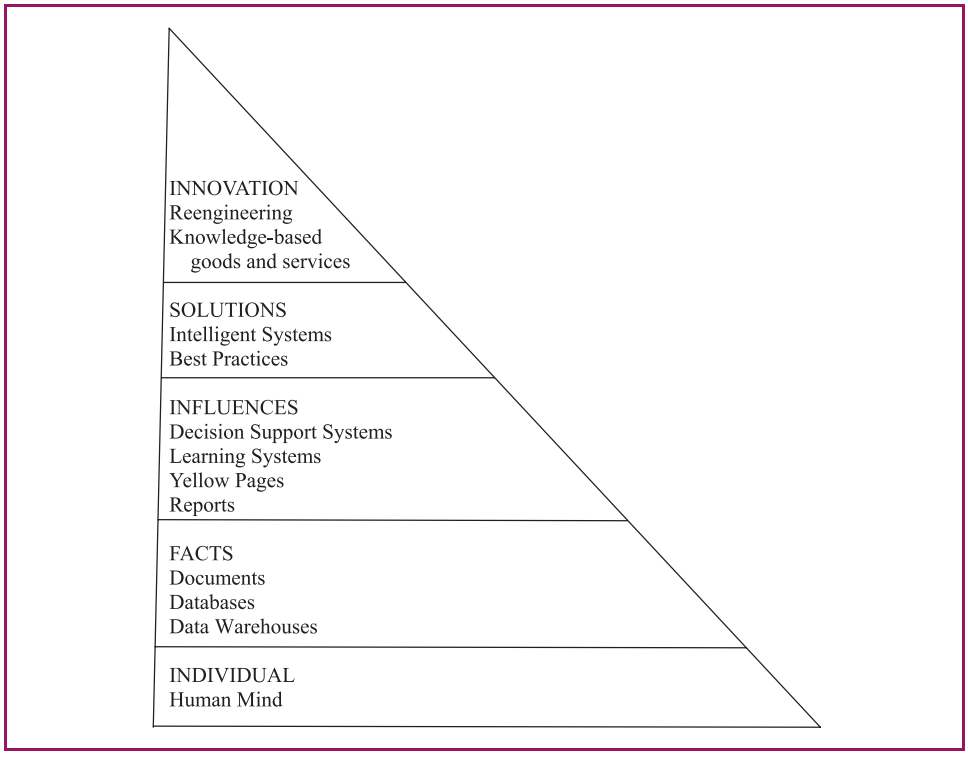
The five tiers of knowledge management

To derive a hierarchy suitable for KM research, we extend the knowledge hierarchy by adding a new personal knowledge class consisting of two tiers – the individual tier and the innovation tier (see Figure 2). As individuals create, use, and maintain all of the tiers of the codified knowledge class, we will position the individual tier as the foundation of our hierarchy. We add innovation as the highest level because it integrates all of the other tiers, using strategy to exploit both personal and codified knowledge assets.

Since there is considerable debate over the definitions of the terms data, information, and knowledge, we will use instead the classifications facts, influences, and solutions, respectively. We do this in order to reach a consensus between the various viewpoints and still arrive at a clearly distinguishable set of definitions for the 5TKMH. The definitions for all five tiers are:

1. Individual knowledge is defined as ''knowledge contained only in the mind of a person.''
2. Facts are defined as ''atomic attribute values about the domain.''
3. Influences are defined as ''data in context that has been processed and/or prepared for presentation.''
4. Solutions are defined as ''clear instructions and authority to perform a task.''
5. Innovation is defined as ''the exploitation of knowledge-based resources.''

Figure 2 Five tier knowledge management hierarchy



Individual tier

The role of the individual tier is to create, use, and maintain all tiers of knowledge. The individual tier contains or may use the facts, influences, and solutions that are stored only in the mind of each individual, and not in any book, computer, or other shared media. It can be located computationally with a ''Yellow Pages'' system but cannot be stored, integrated, or retained.

Some researchers may contend that the individual tier represents the peak, not the foundation, of the hierarchy because one of the goals of KM is to transfer knowledge between individuals. We have positioned the individual tier as the foundation of the hierarchy because it is a necessary pre-condition for the other tiers (Figure 3).

A codified KM system is only as effective as the knowledge that it obtains from the knowledge holder and that can be delivered to the knowledge seeker. The three codified tiers of facts, influences, and solutions are by definition implemented as a set of software solutions that must be able to acquire the necessary knowledge and distribute it to all knowledge seekers. This implies that the knowledge holder and knowledge seeker must have access to and training in the selected software such as groupware, databases, and expert systems.

Facts tier

The role of the facts tier in KM is to provide raw data for higher-level KM tiers. Much of the Codified data about the company is contained in documents, which are discussed in the influences tier, and stored in databases at the facts tier. Data warehouses and data marts are constructed with the purpose of creating influences for decision-making, while transaction databases contain most of the accessible facts about the company and its business. Many software programs exist that focus on the analysis of data housed in databases.

Influences tier

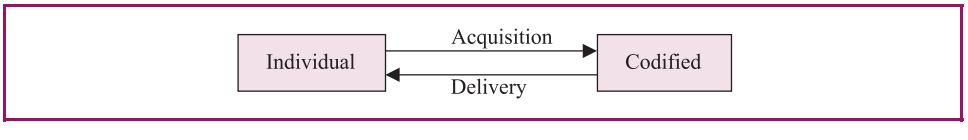
The role of the influence tier is to assist people in making decisions. Influence is defined as integrated data put in context, often through presentation or processing. In this tier, data is processed by learning systems, decision support systems (DSS), reports, knowledge pooling, and knowledge directory systems to influence decisions. The influence tier consists of three subclasses: computer-assisted decision making, cooperative influence creation, and computer assisted influence dissemination.

There are three main types of computer-assisted decision making systems: learning systems, DSS, and reports. Learning systems are composed of computer software applications that may be used create solutions or influences through analysis of data without human intervention. DSS use a static set of models that analyze local data. As their name implies, these systems provide assistance for decisions, but do not make decisions. Reports represent data that has been processed and presented in context.

The differences between learning systems and DSS systems are:

- that the context is predefined in the DSS systems and must be defined for learning systems;
- the DSS uses generic models with data, where the learning school does not necessarily use models; and
- no human intervention is needed with learning systems.

Figure 3 Acquisition and delivery systems



"To derive a hierarchy suitable for KM research, we extend the knowledge hierarchy by adding a new personal knowledge class consisting of two tiers – the individual tier and the innovation tier."

Learning systems themselves are classified as influences because they are a tool used by the knowledge seeker, not the desired knowledge itself. The output of learning systems may become influences or solutions, depending on the completeness and actionability of the output. Examples of learning systems applications are (on a continuum from creating solutions to creating influences): induction, case-based reasoning, neural networks, genetic algorithms, intelligent agents, data mining, executive information systems, and geographic information systems. As an example, Visa uses neural networks to locate fraud in credit card use. In 1995, Visa lost $655 million to fraud. In less than one year of neural network use, fraud losses were reduced by over sixteen percent. Nike uses intelligent agents to support employee cafeteria-style benefit programs (Turban *et al.*, 2001).

The second subclass of the influence tier is cooperative influence creation. Knowledge pooling and groupware are integrated in context, facilitating the creation of solutions and influences.

The third subclass of the influence tier, computer-assisted dissemination of influence, contains three subclasses. They are ''Yellow Pages'' that locate humans containing individual influence or solutions, document management systems that locate and display documents by context, and systems that catalog and locate intellectual property. Individual documents are classified by their content as facts, influences, or solutions.

Solution tier

The role of the solution tier is to make decisions and execute them. As defined in this paper, the solution tier is defined as a shareable source that contains a complete solution for a specific task and the authority to act. This implies a complete, verified solution for the decision-making context combined with local data. Expert systems are an example of a solution tier system, as these systems contain all of the knowledge necessary to solve a problem, access to local data, and the ability to make and execute a decision.

Another subclass of the solution tier is best practices. These represent the company's ''school solution'' to a decision-making context. We classify these systems as solutions instead of influences because they define the complete solution desired by the company, implying that the solution is complete and verified. It should be noted that deviation from the best practices might be difficult to justify, where deviation from a solution reached by influences is defensible.

Innovation tier

As defined by Edvinsson *et al.* (2004), innovation = (reuse + invention) × exploitation. Innovation occurs when knowledge from any tier is combined with strategy, facilitating a process reengineering, increasing corporate efficiency, increasing corporate effectiveness, or creating knowledge based goods or services. The NIMCube thinking process defined the following dimensions of innovation: stakeholder contribution, knowledge reuse, mutation of existing knowledge, exploitation, outcome measures, and operating context (Edvinsson *et al.*, 2004). Innovation may result from the integration of sources from many tiers with corporate strategy. For example, Frito-Lay's hand-held computer system, which used data from the facts tier combined with a corporate strategy that integrated and analyzed data from all of the computers to reengineer the job of the salesman and the processes that the salesman performed (Applegate, 1991). Another example, Visa, uses neural networks from the influences tier for fraud detection (Turban *et al.*, 2001). Another example, the XCON

computer configuration expert systems used by Digital, enabled the company's strategy (Bachant and Solloway, 1989). Examples of the marketing of knowledge-based goods and services include consultants, magazines, and computer software. In each of these cases, a strong corporate strategy facilitates innovation.

The innovation tier and individual tier are very closely related to the intellectual agility and competence sub-divisions, respectively, of human capital by Roos *et al.* (1997). Examples of intellectual agility include innovation, imitation, adaptation, and packaging. Often, successful diversification can be traced to intellectual agility. Roos *et al.* (1997) use The Virgin Group and Philip Morris as examples. Competence is composed of knowledge and skills.

> If competence is the content, intellectual agility is the ability to use the knowledge and skills, building on it, applying it in practical contexts and increasing it through learning (Roos *et al.*, 1997).

Transformations

The traditional knowledge hierarchy supports the transformation of data to information and the transformation of information into knowledge. Extensions to these transformations are supported in the double hierarchy and the reverse hierarchy as previously noted. In addition to the previously identified transformations, the 5TKMH supports transformations directly between any of the tiers. For example, data from the facts tier can be transformed into a solution by neural networks without creating influences, and the database used in an innovation may be transposed into facts when used in another context by another KM asset.

The 5TKMH and KM

We hold that the 5TKMH is more suitable for KM research than the knowledge hierarchy because it encompasses personal knowledge. As an example of the breadth of KM, Earl's (2001) taxonomy derives the three major branches of KM: the technocratic school, which consists of codified systems; the commercial school, which uses codified systems to manage intellectual assets; and the behavioral school, which is concerned with personal knowledge. The knowledge hierarchy includes Earl's technocratic and commercial schools, but does not include the behavioral school.

The 5TKMH includes all of the KM systems classified by Earl. The individual tier includes the social culture component of the organizational school. The facts tier contains databases and data warehouses from Earl's engineering school. The influences tier of the 5TKMH contains the KM components contained in Earl's cartographic school, commercial school, and groupware contained in Earl's organizational school. The solutions tier contains the systems school and the best practices component of the organizational school in Earl's taxonomy, and the innovation tier contains Earl's strategic school and spatial school. In summary, the 5TKMH encompasses all of the schools of KM identified by Earl (2001).

Using the five tier knowledge management hierarchy

The 5TKMH can be used to evaluate KM efforts, inventory knowledge assets, alleviate possible confusion, support a KM life-cycle that provides guidance to the chief knowledge officer, and plan and manage the evolution of knowledge assets in the firm. Some managers may prefer to view the 5TKMH in a table format, as shown in Table I.

"A codified KM system is only as effective as the knowledge that it obtains from the knowledge holder and than can be delivered to the knowledge seeker."

Table I Knowledge management tiers and examples

Knowledge tier	*KM application*	*Example*
Individual (PK Class)	Stored in human mind, accessed by ''yellow pages''	Bain and Company (Hansen *et al.*, 1999), Shell (Earl, 2001)
Facts (CK Class)	Databases, data warehouses	Frito-Lay (Applegate, 1991), CIGNA (Turban *et al.*, 2001)
Influences (CK Class)	Learning systems, DSS, reports, yellow pages, knowledge pooling	Visa (Turban *et al.*, 2001), Skandia (Earl, 2001), IBM (Willigan and Mullen, 2000), Bain and Company (Hansen *et al.*, 1999), Shell (Earl, 2001)
Solutions (CK Class)	Best practices, expert systems	Shell (Earl, 2001)
Innovation (PK Class)	Integrates various KM systems with corporate strategy	Frito-Lay (Applegate, 1991), Scandia (Earl, 2001)

The 5TKMH can be used to evaluate the current state of the KM effort in a company from both depth and breadth perspectives. A knowledge inventory is developed, classifying KM systems by tier and obtaining metrics. The depth of the KM effort of the company can be determined by evaluating the knowledge inventory and metrics. The breadth of KM in the company can be determined by determining the highest tier identified in the inventory, or by a weighted calculation based on the performance of the KM assets in different tiers.

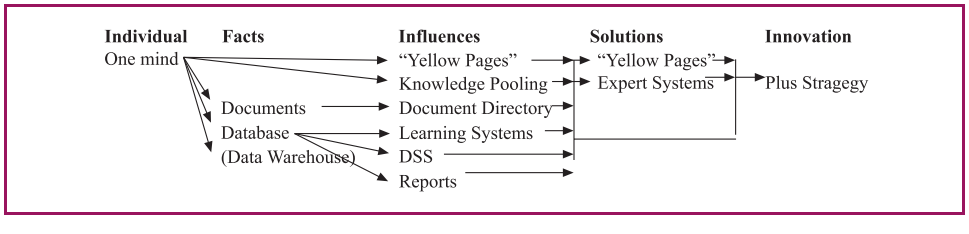
A company with transaction processing systems that were not utilized for decision support would be said to be at the facts tier. To move to the influences tier, the company may leverage this data by using it in decision support systems, learning systems, or reports. It may also move to the influences tier by adopting unrelated KM technologies such as ''Yellow Pages'' or knowledge dictionaries.

The second use for this hierarchy is to identify opportunities for the evolution of the KM effort within a company. Evolution of KM within a company can be guided by the availability of sources and software, as knowledge at one tier of the hierarchy can be used as sources for knowledge at a higher tier, as shown in the KM path of least resistance shown in Figure 4. Firms with databases or data warehouses, for example, can use them as input to learning systems, DSS, and reports to create Influence. Firms with groupware for Influence dissemination can also use them for influence creation through knowledge pooling. Firms with a ''Yellow Pages'' effort have identified many of the personnel necessary to create a best practices component or an expert system.

Let us now consider the use of the 5TKMH in business. Most importantly, can it be used to answer the eternal chief knowledge officer (CKO) question – ''What do I do next?'' The following life cycle uses the 5TKMH as a tool in the management of the KM assets in a firm:

1. *Step 1: develop a knowledge inventory.* Identify each KM asset, context, 5TKMH tier, knowledge holders and/or data source, knowledge seekers supported, potential knowledge seekers, software availability, acquisition system, and delivery system. As this inventory is being developed, evaluate the usage, reliability and accuracy of the existing knowledge assets. Perform any necessary maintenance.

Figure 4 Knowledge path of least resistance



Each knowledge inventory provides a checkpoint describing the state of the KM effort in the firm. Use the 5TKMH to determine the highest tier of KM available in the firm, and the knowledge inventory to determine the breadth of KM assets. When complete, this inventory can be used to implement a delivery system such as the enterprise knowledge dictionary (Galup *et al.*, 2002), which allows knowledge seekers throughout the organization to see what types of KM assets are available and access the asset and the necessary software from a common interface.

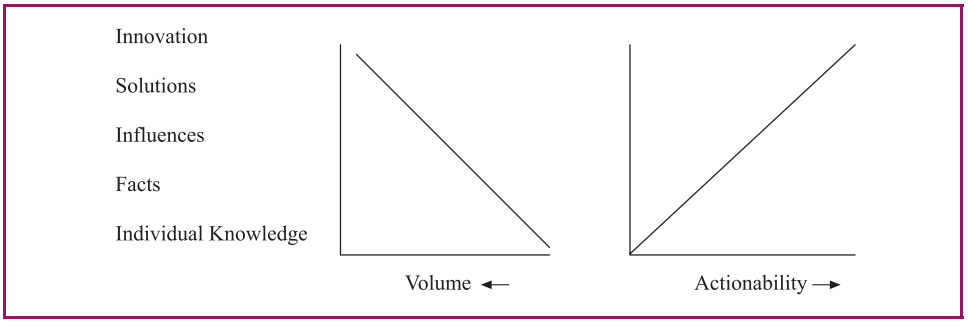
2. *Step 2: determine the knowledge needs of the firm.* Some knowledge cannot be captured, some knowledge is not worth capturing, and some problems cannot be solved with KM. Starting with the firm's core competency, determine the tasks that are most expensive or most difficult to perform. Evaluate potential KM and IT solutions to these tasks. Use the KM path of least resistance to identify opportunities for leveraging existing KM assets.
3. *Step 3: develop an integrated KM strategy which maximizes the impact of KM assets on the firm's strategy within political, budget, and manpower constraints.* In addition to developing an appropriate portfolio of KM projects and maintenance for internal use, the strategy may include marketing knowledge-based goods and services for external use. The KM strategy must then be accepted and funded by the stakeholders.
4. *Step 4: implement the KM strategy.* Each new KM asset may involve application development, hardware acquisitions, software acquisitions, training, knowledge acquisition, metrics development, data costs, maintenance, and distribution issues.
5. *Step 5: evaluate the performance of KM assets toward achieving the firm's strategy.* Compare the metrics of the new solution to those at the last knowledge inventory. For new systems, reevaluate costs and benefits using actual performance instead of estimates.

After evaluation is complete, return to step one. Update the knowledge inventory by adding the new KM assets, and evaluate the firm's operations for the next sequence of KM opportunities.

Finally, let us consider the predictive characteristics of the 5TKMH. The knowledge hierarchy, which corresponds to the facts, influences, and solutions tiers, is predictive in volume and actionability (Nissen, 2000). To facilitate this discussion, we have created the following graphs that extend the knowledge hierarchy to indicate the potential volume and actionability of KM assets (Figure 5).

Empirical evidence does not exist, but we argue that the 5TKMH is an accurate predictor of volume and actionability. We would expect the largest volume of knowledge to be in the individual tier, as it contains all of the knowledge in all of the worker's minds. The knowledge hierarchy has established (Nissen, 2000) that there is a greater volume of facts than influences, and more influences than solutions. Finally, we contend that there are fewer innovations than solutions, indicating that the 5TKMH is accurate in predicting the volume of KM assets.

Figure 5 Volume and actionability of the knowledge tiers



Ranking of actionability is slightly more problematic. We contend that when comparing the actionability of the individual tier is comparable to a codified source, the actionability of the individual tier is lower than that of facts because the persistent, retrievable nature of codified sources and their high accuracy. If, for example, a worker stated that he had mined 16 tons of coal, and the computer weighing station had only recorded 15 tons, the facts would usually be judged as more actionable. Additionally, it could be argued that one individual can transform the company, to which we respond that the transformation would be classified as innovation. The actionability of facts, influences, and solutions becomes higher with each tier, as in the knowledge hierarchy (Nissen, 2000). Innovation, as a component of corporate policy, would seem to be the most actionable, indicating that the 5TKMH is an accurate predictor of the actionability of KM assets.

The 5TKMH will provide a CKO with a tool that is useful in inventorying knowledge assets, planning KM projects, leveraging existing knowledge sources, and evaluating the performance of KM assets. The tiers indicate the amount of corporate effort that has been made toward the goal of being a knowledge driven company. A company with only individual and facts tiers is not as advanced in their KM as a company that utilizes DSS, ''Yellow Pages'', and reports with information needed for business decisions from the influences tier.

The challenge of sharing knowledge

There is considerable discussion about the best ways to codify knowledge, so let us consider the implementation needs of the two personal knowledge tiers.

The innovation tier exploits all classes of knowledge, and includes the strategic and spatial schools in Earl's (2001) taxonomy. The spatial school is implemented by placing knowledge workers in an environment that promotes personal interaction and sharing. The strategic school focuses on the use of KM to reengineer processes or create knowledge-based goods and services. Sharing of the strategy may be done through a variety of computerized and non-computerized means, but creation of the strategy is still a task that requires the human mind.

The individual tier represents the knowledge that is stored in the mind of an individual. It may be located through ''yellow pages'' or similar lists. The sharing of knowledge is predominantly performed on a person-to-person basis.

Locating any type of knowledge can be difficult. An enterprise knowledge dictionary (Galup *et al.*, 2003) acts as a knowledge portal. The user selects a topic and the relevant knowledge is presented in list boxes for each tier of knowledge or type of implementation. Selecting a knowledge source executes the appropriate application and data.

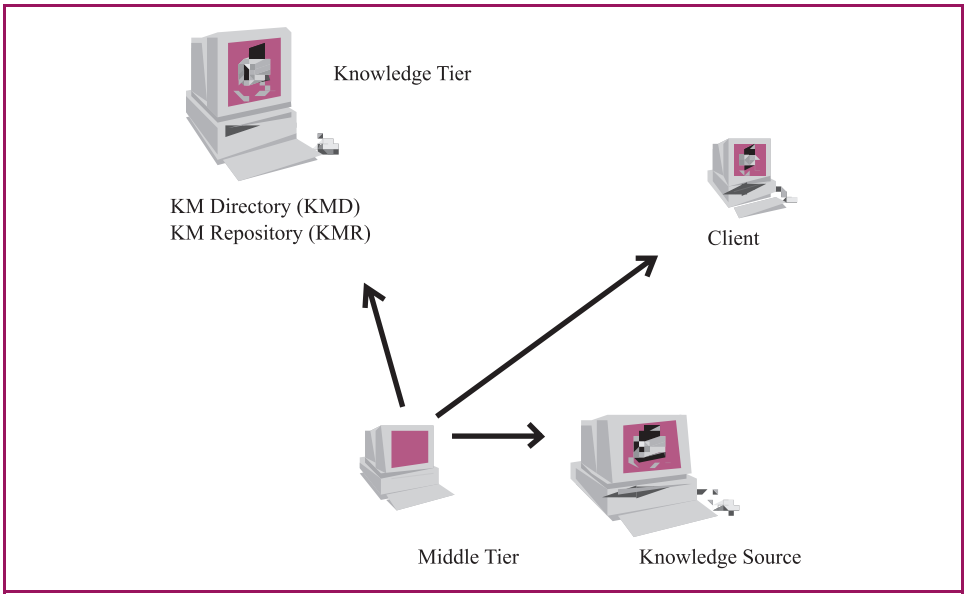
A n-tier architecture suitable for active and passive knowledge is described in (Galup *et al.*, 2002). It uses a knowledge management dictionary, much like the enterprise knowledge dictionary described above, to present the user with the available knowledge and connect the user to the source (Figure 6).

Conclusions and future research

This paper classified knowledge into the following tiers: individual, facts, influences solutions, and innovation. The 5TKMH includes all of the types of KM identified in the literature, provides a tool for evaluating the KM effort in a firm, identifies the relationships between knowledge sources, and provides a path of least resistance for KM efforts within the firm.

Even with the new perspective of this expanded hierarchy, a KM system is still only as good as the quality of the knowledge and the effectiveness of the knowledge integration in the organization. The quality of the knowledge is based on the overall quality of the knowledge residing in the five tiers. The personal knowledge class consisting of the two tiers, the individual tier and the innovation tier, creates new knowledge. Knowledge integration entails broadcasting, searching, teaching, and sharing (McElroy, 2000). The codified tiers of facts, influences, and solutions are the set of software solutions responsible for codified knowledge storage and knowledge integration.

Figure 6 Knowledge management system architecture



Having identified tiers of knowledge, sources of knowledge, and a progression of sources from individual to innovation, the question becomes ''what tier of knowledge management is appropriate for this company?'' Testing of several hypotheses seems in order, such as:

- Is the tier of KM dictated by the processes in the industry?
- Is the tier of KM dictated by the tier of competition in the industry?
- Is the tier of KM dictated by management style?

Another research item suggested by this research is determining if the 5TKMH has predictive characteristics. A starting set of hypothesis might include the following: KM assets at the lower end of the 5TKMH have larger volume, lower specialty, lower actionability, lower risk, lower cost, lower potential payback, and wider dissemination than those at the higher end of the 5TKMH.

McElroy (2000) differentiates first-generation KM systems as focusing on knowledge integration or supply-side KM while second-generation KM systems focus on knowledge production or demand-side KM. Since the 5TKMH considers both knowledge integration and knowledge production or innovation, the 5TKMH can also aid in the study of both first-generation and second-generation KM systems.

It is hoped that this paper will assist researchers and practitioners in the study of KM through our new set of terminology and the 5TKMH.

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