Knowledge management framework for the development of an effective knowledge management strategy

J.C. Mostert
CSIR National Metrology Laboratory
PO Box 395
Pretoria, South Africa
jmostert@csir.co.za

M.M.M. Snyman
Department of Information Science
University of Pretoria
Pretoria, South Africa
rsnyman@lantic.net

To survive and prosper in a highly competitive and rapidly changing environment, organizations need to explicitly manage their knowledge. This article reports on a knowledge management framework that provides a clear and unambiguous knowledge base, which in turn can serve as a platform for the development of an effective knowledge management strategy. An appropriate knowledge framework is selected and combined with an appropriate management framework to create a well defined, theoretically sound knowledge management framework.

Contents

1 Introduction

To survive and prosper in a highly competitive and rapidly changing environment, organizations need to develop sustainable competitive advantages. According to the resource-based view of an organization, sustainable competitive advantages can only be achieved with what is termed 'strategic resources'. Strategic resources are characterized as rare, valuable, imperfectly imitable and non-substitutable (Meso and Smith 2000:224; Wickramasinghe and James 2003:296). Meso and Smith (2000:224) state that organizational knowledge, having all of these characteristics, is gaining increasing recognition as the only true strategic resource while Grant (1997:451) argues that 'knowledge is the overwhelmingly important productive resource in terms of its contribution to value added and its strategic significance'.

However, knowledge in itself will not ensure the success of an organization. To optimize the benefits that knowledge can provide, it is necessary to explicitly manage knowledge. The aim of this article is to report on a knowledge management framework that provides a clear and unambiguous knowledge base, which in turn can serve as a platform for the development of an effective knowledge management strategy. Although various authors such as Snyman and Kruger (2004), Ndlela and Du Toit (2001), Von Krogh, Nonaka and Aben (2001), Bater (1999), Zack (1999), Davenport, De Long and Beers (1997) formulated knowledge management frameworks, the uniqueness of this framework lies in the combination of an appropriate knowledge framework with an appropriate management framework to create a well-defined knowledge management framework. This strategy is supported by McBriar *et al.* (2003:30) when they write: 'There are … concepts within the knowledge management domain that are based around the organization's ability to manage knowledge as opposed to protecting it. Such concepts should correctly be related to the term "manage" and the term "knowledge".'

2 Research methodology

The research methodology followed to address the above-mentioned objective consisted of three main steps. The first step was to collect data on knowledge, management and knowledge management by means of a literature study. The second step was to use the literature study data to derive a knowledge framework and a management framework respectively. The final step was to combine the two separate frameworks into a single knowledge management framework.

3 Knowledge framework

3.1 Characteristics of knowledge

An analysis of the information obtained during the literature study reveals some important characteristics of knowledge. These characteristics are summarized in Table 1.

Table 1 Knowledge characteristics

Knowledge location	Static/Dynamic	Knowledge type	Expressibility	Relevant terms and descriptions
In the mind of an individual	Static knowledge	Implicit knowledge Focal knowledge *Information*	Expressible	'Objects which can be articulated or codified through formal systematic language' 'Knowledge being acted upon by knowledge.' *'Structure and patterns'*
		Tacit knowledge Focal knowledge	Inexpressible	'Knowledge acting on knowledge' 'Fluid mix of framed experience, values, contextual information' 'Ingrained schema, beliefs and mental models which are taken for granted' 'Skills or concrete know-how'
	Dynamic knowledge (knowledge as a processes)	Tacit knowledge *Knowledge*	Inexpressible	Dynamic 'knowing' 'Knowing or learning' 'Tacit coefficients' 'Expert insight that provides a framework' *'Exploitation of information'*
In the external environment outside the 'knower'	Static knowledge	Explicit knowledge Data	N/A	'Articulated' 'Codified through formal systematic language'

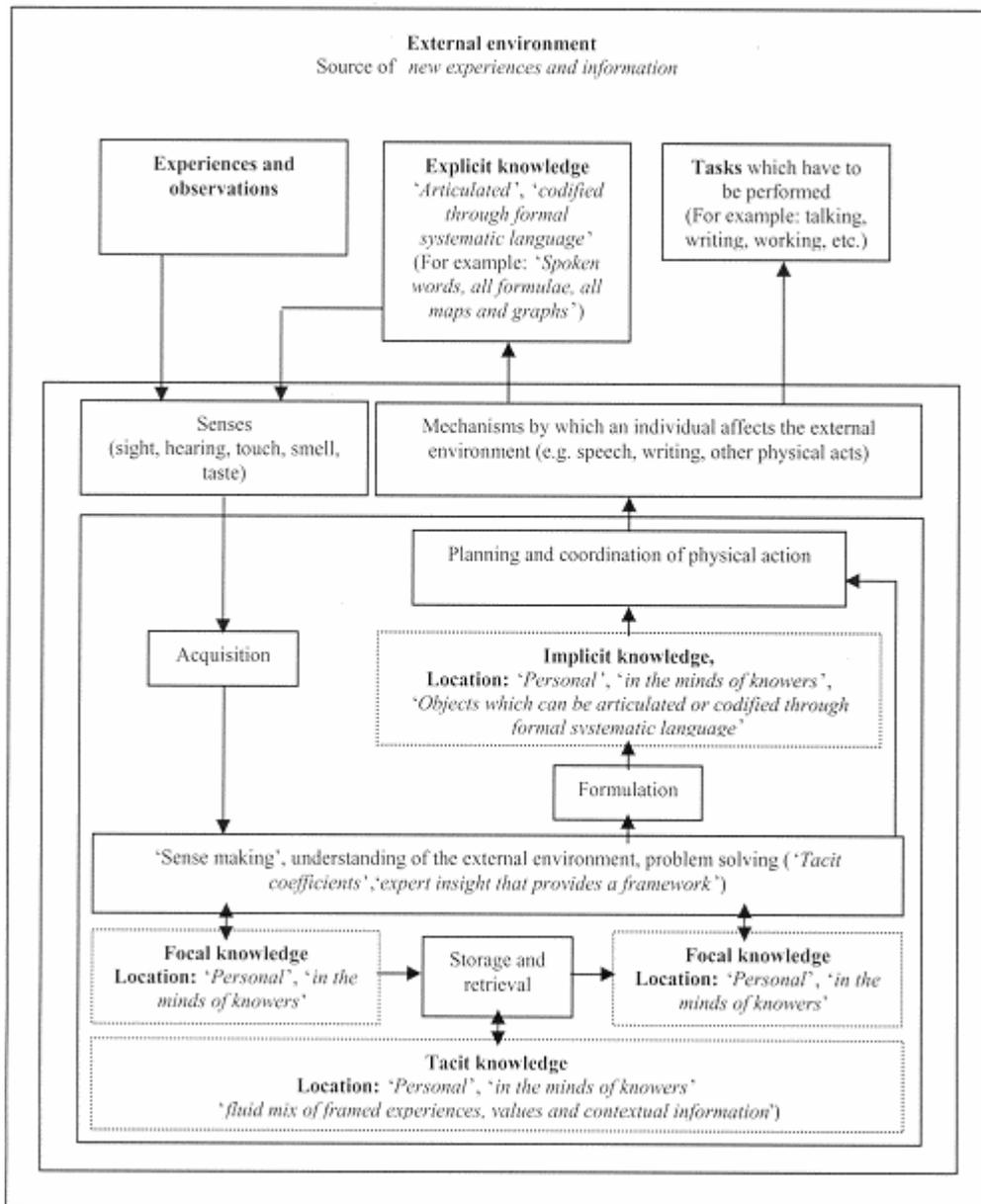|				'Spoken words, all formulae, all maps and graphs' '*Facts and observations which are essentially meaningless unless it is placed within a particular context*'

From the quotes in Table 1, it is clear that knowledge is mostly considered in the context of the individual. The reason is probably that discussions on the definitions and origins of knowledge usually associate knowledge with intellect, a unique human characteristic. Since organizations consist of groups of individuals, a link between organizational and individual knowledge is likely. Grant (1997) acknowledges this when he states that individuals are the primary agents of knowledge creation in organizations. In the case of tacit knowledge, individuals are also the principal repositories of knowledge.

To relate organizational knowledge to individual knowledge, fundamental similarities and differences between organizations and individuals have to be explored. These similarities and differences can be used to build a model for organizational knowledge that is based on the principles that have already been uncovered for individual knowledge.

3.2 Model of individual knowledge

The development of a model for organizational knowledge that is based on the similarities and differences between organizations and individuals, presupposes the existence of a model for individual knowledge. Such a model was constructed using the knowledge characteristics presented in Table 1 together with an adaptation of the OODA (observation, orientation, decision, action) loop concept presented by Boyd (1996) and adapted by Hall (2005). The OODA loop summarizes the processes through which an entity responds to its dynamic environment (Hall 2005:178, 182). The model is illustrated in Figure 1.

Figure 1 Model of individual knowledge

External environment
Source of *new experiences and information*

Experiences and observations

Explicit knowledge
'Articulated', *'codified through formal systematic language'*
(For example: *'Spoken words, all formulae, all maps and graphs'*)

Tasks which have to be performed
(For example: talking, writing, working, etc.)

Senses
(sight, hearing, touch, smell, taste)

Mechanisms by which an individual affects the external environment (e.g. speech, writing, other physical acts)

Planning and coordination of physical action

Acquisition

Implicit knowledge,
Location: *'Personal'*, *'in the minds of knowers'*, *'Objects which can be articulated or codified through formal systematic language'*

Formulation

'Sense making', understanding of the external environment, problem solving (*'Tacit coefficients'*, *'expert insight that provides a framework'*)

Focal knowledge
Location: *'Personal'*, *'in the minds of knowers'*

Storage and retrieval

Focal knowledge
Location: *'Personal'*, *'in the minds of knowers'*

Tacit knowledge
Location: *'Personal'*, *'in the minds of knowers'*
'fluid mix of framed experiences, values and contextual information')

The model portrays an individual's personal knowledge as consisting of a knowledge base of static knowledge and dynamic knowledge processes. The knowledge base is shown as tacit, implicit and focal knowledge. Bennet (1998:590) describes tacit knowledge as 'an idiosyncratic, subjective, highly individualized store of knowledge and practical know-how gathered through years of experience and direct interaction within a domain', while Tranfield *et al* (2004:375) state that tacit knowledge 'is gained from experience, rather than instilled by formal education and training'. Thus, tacit knowledge consists of an individual's memories of his or her experiences of the external environment. These memories may be conscious or unconscious and may be expressible or inexpressible. Implicit knowledge is essentially the component of tacit knowledge that can be expressed through formal systematic language to create explicit knowledge in the external environment (Chang, Byouggo and Heeseok 2004:207; Kim, Yu and Lee 2003:296). Focal knowledge is described by Sveiby (1997:on-line) as 'knowledge about the object or phenomenon that is in focus'. It can be seen as knowledge that has been brought to the foreground for the purpose of being operated on by one or more knowledge processes. In this sense, focal knowledge is the knowledge that has been selected from the individual's knowledge base to be applied to the situation at hand.

The dynamic knowledge processes presented in the model follow from an analysis of the

flow of information and knowledge in an individual. These processes are the following:

- Knowledge acquisition
- Knowledge storage and retrieval
- 'Sense making', understanding and problem solving
- Explicit knowledge creation
- Expression of knowledge through physical skills
- Knowledge process coordination.

Based on the model for individual knowledge, knowledge acquisition refers to the processes of information flow from the external environment to the individual and includes processes of evaluation and judgement based on previous experience and values. Knowledge storage and retrieval refer to the processes by which acquired knowledge is stored as well as the processes through which knowledge is retrieved when it is needed. The knowledge retrieval processes include mechanisms for determining which knowledge is most appropriate for the situation at hand.

'Sense making', understanding and problem solving occur in both the incoming (acquisition and storage) and the outgoing (application) directions of the knowledge flow loop. During knowledge acquisition, the model suggests that this process is responsible for enabling the individual to understand the situation at hand and to evaluate the newly acquired information against his or her existing knowledge base. During knowledge application, the model suggests that this process is responsible for utilizing the individual's personal knowledge base to create effective strategies for achieving the objectives related to the task at hand.

Explicit knowledge creation refers to the processes in which implicit knowledge is codified through the use of formal systematic language and expressed as explicit knowledge in the external environment. The expression of knowledge through physical skills refers to the processes through which physical skills are applied in a reasoned manner to achieve an individual's objectives in the external environment. Finally, knowledge process coordination refers to the processes that are responsible for the overall coordination of an individual's knowledge processes.

3.3 From individual knowledge to organizational knowledge

Similar to individuals, all organizations exist within larger external environments. Organizations exist because of the needs of their stakeholders. Only if they fulfil these needs, can organizations survive and prosper. Organizations do what they have to do to fulfil the needs of their stakeholders by responding to and interacting with the external environments in which they exist. Therefore, just as individuals, organizations need to have knowledge of the needs of their stakeholders, knowledge of their environments and the ability to apply this knowledge effectively in order to survive and prosper.

There are also important differences between individuals and organizations as far as knowledge is concerned. Most notable of these is the fact that individuals are single sentient entities, while organizations are non-sentient group entities consisting of distributed sentient components (individuals) connected through relatively limited communication channels. In addition, while explicit knowledge is considered to be separate from an individual 'knower', an organization's knowledge base can include this type of knowledge as well. Furthermore, in an individual, the coordination of knowledge processes is largely an implicit cognitive process with some conscious decision. In an organization, the implicit component of knowledge process coordination is confined to individuals. It is therefore necessary to explicitly implement organizational knowledge management processes to coordinate and integrate the organization's individual and explicit knowledge stores and to ensure that the

organizational knowledge processes are executed effectively.

3.4 Model for organizational knowledge

The idea that organizational knowledge can be related to individual knowledge on the basis that the behaviour of organizations, as far as knowledge is concerned, relies fundamentally on human cognitive processes served as the starting point for the development of a model of organizational knowledge. Continuing with the principle that knowledge has both a static and dynamic character, taking into consideration the differences between individual and organizational knowledge and taking note of Hall's adaptation of Boyd's OODA loop for organizations (Hall 2005:182), a model for organizational knowledge was developed. This model is shown in Figure 2.

Figure 2 Model of organizational knowledge
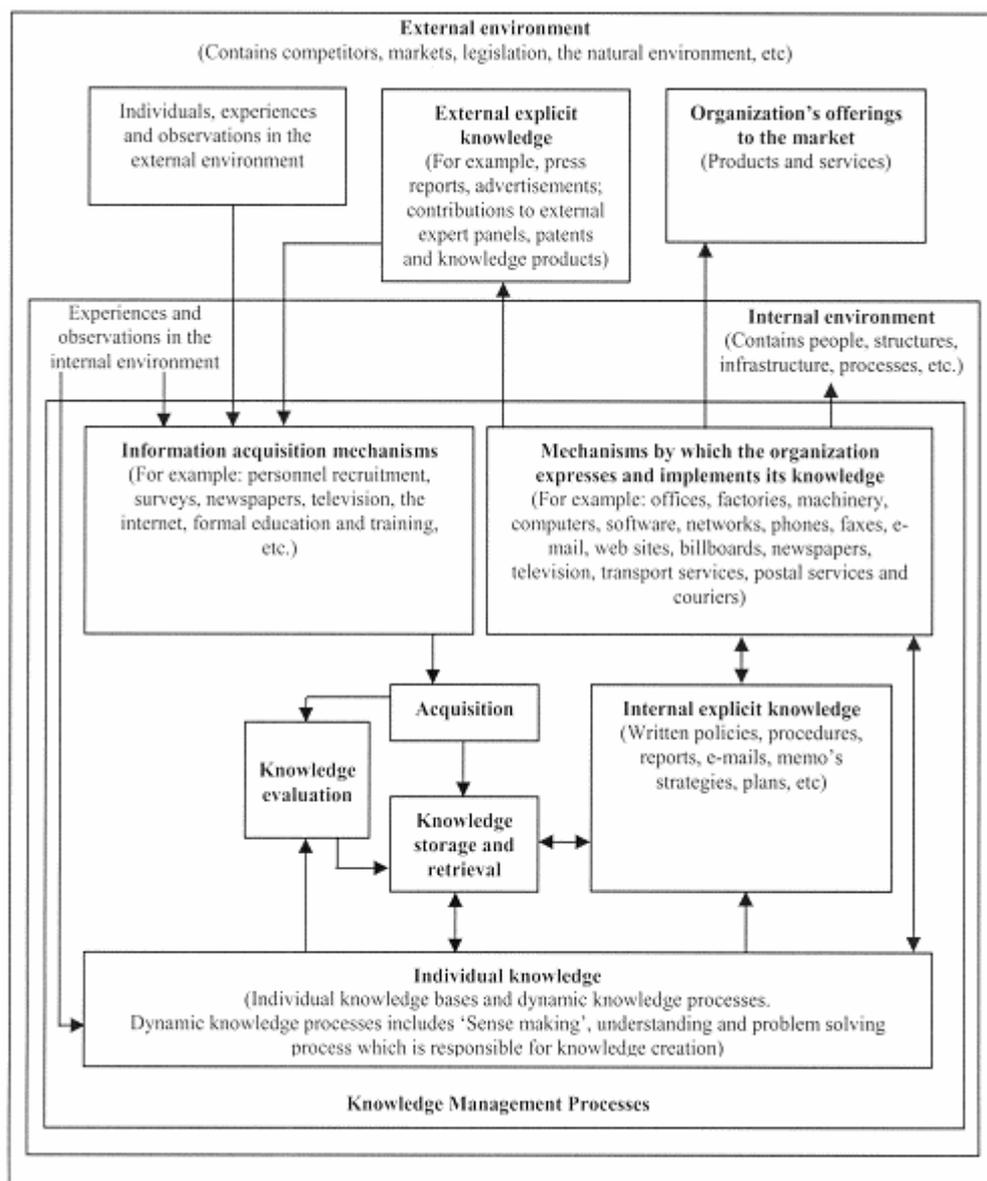
The model depicts organization's knowledge as consisting of a knowledge base of tacit and explicit knowledge as well as dynamic knowledge processes. The knowledge base consists of the tacit knowledge of individuals and collections of explicit knowledge such as written policies, procedures, reports, e-mails, memorandums, strategies, plans, etc. The

organization's dynamic knowledge processes consist of individual knowledge processes as well as explicitly implemented organizational knowledge processes.

Organizational knowledge processes can be either tacit or explicit or may have both tacit and explicit components. A knowledge process is tacit when it is mostly an individual knowledge process. It is explicit if the process is mostly an explicitly implemented organizational process. The knowledge processes presented in the model follow from an analysis of the information and knowledge flows in the organization. These processes are knowledge acquisition, evaluation of knowledge. knowledge storage and retrieval, knowledge utilization and creation, knowledge application and, knowledge management.

3.4.1 Knowledge acquisition
The main objective of the knowledge acquisition process is to obtain knowledge from the internal and external environments that can be used to develop and sustain competitive advantages. Since knowledge can also be acquired by explicitly creating it in the organization, the knowledge acquisition process is differentiated from knowledge creation by defining it more specifically as the processes through which:

- Existing tacit or explicit knowledge is obtained from the external environment; and
- information is obtained by observing the internal and external environments and analysing the results.

In view of the more detailed definition of the knowledge acquisition process stated above, the objectives of the process can be described as follows:

- *Acquisition of knowledge from the external environment.* An organization can acquire both tacit and explicit knowledge from the external environment. Since tacit knowledge is situated in individuals, the acquisition of tacit knowledge from the external environment refers to the recruitment of individuals for appointment in the organization. The acquisition of explicit knowledge from the external environment refers to obtaining explicit knowledge from the external environment and making it part of the organizational knowledge base. An example is the adoption of an international standard such as ISO17025.
- *Acquisition of knowledge from observations of the external and internal environments.* The organization can acquire knowledge from observations of the external and internal environments. From the perspective of the data-information-knowledge view, this type of knowledge is data and information. A market survey is an example of acquiring data and information from the external environment. An employee satisfaction survey is an example of acquiring data and information from the internal environment. The responses to the survey questions are data, while the underlying structure and patterns revealed through analysis of the data constitute information.

3.4.2 Evaluation of knowledge
Some knowledge that flows from the external and internal environments may be invalid or may not be applicable in the contexts that the organization operates. Incorporating such knowledge into the organization's knowledge base could jeopardize the organization's endeavour towards developing sustainable competitive advantages. To prevent or minimize occurrences of undesired knowledge being incorporated into the organization's knowledge base, new knowledge must be subjected to appropriate evaluation. Since the organization only has a need of knowledge that will enable it to develop and sustain competitive advantages, the acceptance of new knowledge will be based on criteria related to its usefulness in this regard.

The objectives of the knowledge evaluation process can be described as follows:

- *Evaluation of knowledge acquired from the external environment.* Both tacit and explicit knowledge from the external environment has to be evaluated. Psychometric testing and interviews with applicants for a vacant position in the organization are examples of the evaluation of tacit knowledge from the external environment. The evaluation and selection of technical articles from a journal for inclusion in a corporate database of useful technical information is an example of the evaluation of explicit knowledge from the external environment.
- *Evaluation of knowledge acquired through observations of the internal and external environments.* The knowledge evaluation process includes the evaluation of information obtained from the analyses of observational data from the external and internal environments. In terms of the data-information-knowledge view, only information obtained in this manner will have to be evaluated as the data will have been evaluated during the analysis processes that revealed the underlying information.
- *Evaluation of knowledge created in the organization.* Knowledge created in the organization has also to be evaluated. An example of newly created tacit knowledge is that of a junior individual who has just completed a period of apprenticeship under a knowledgeable senior individual. The junior individual's tacit knowledge may be evaluated through a practical test. If the junior individual completes the test satisfactorily, his or her knowledge will be considered suitable for use in the organization. An example of newly created explicit knowledge is a set of different possible designs for a new product. The designs may be evaluated by presenting them to a panel of possible users of the product.

3.4.3 Knowledge storage and retrieval

As an entity that acquires and applies knowledge to survive and prosper, an organization must have knowledge storage and retrieval processes to ensure that knowledge that has been gained previously is available for current and future use.

The purpose of the knowledge storage and retrieval process is to store knowledge and to enable the retrieval of relevant knowledge when it is needed. In addition, the process must ensure that the stored knowledge does not get lost or become corrupted and that no unauthorized access is gained to the organization's knowledge base.

Knowledge storage

Although the organizational knowledge base consists of both tacit and explicit knowledge, the knowledge storage processes are only responsible for the storage of explicit knowledge. Tacit knowledge cannot be separated from the individuals of whom it is part and can therefore not be stored by the organization.

Explicit knowledge can be stored in a large number of ways. It should however be taken into consideration that the mechanisms that an organization adopts for the storage of its explicit knowledge, will have an important effect on the other objectives of the knowledge storage and retrieval process.

Knowledge retention

Knowledge retention refers to the processes through which the tacit and explicit knowledge in the organization's knowledge base is prevented from being lost.

The retention of tacit knowledge refers to the prevention of the loss of individual knowledge. Tacit knowledge is lost when an individual resigns, retires or leaves the organization for another reason. Examples of strategies to prevent this type of loss are incentive schemes aimed at retaining knowledgeable individuals, and mentoring schemes aimed at transferring

the knowledge of senior individuals to junior individuals.

An organization may also lose tacit knowledge when individuals forget. An example is when an individual works with a very large knowledge domain where he or she uses some knowledge very infrequently. Infrequent use may erode his or her knowledge base in a specific area with the consequence that he or she may have to relearn some knowledge when it is required. This constitutes a potentially costly inefficiency. An example of a strategy to prevent this type of knowledge loss is to cross-train different individuals in a large knowledge domain, thereby minimizing the risk of losing important tacit knowledge.

Ways in which an organization could lose explicit knowledge are through decay or damage to the media on which the knowledge is stored, through damage, decay or loss of equipment that reads the storage media or through the loss of the knowledge of how to decode or interpret the knowledge. It can be lost inadvertently in an accident or a disaster or through ignorance or negligence. It can also be lost through malicious action such as theft, vandalism or sabotage. General strategies for the prevention of the loss of explicit knowledge are to use high quality storage media and to keep storage media in an environment, which will prevent or delay any decay processes. If explicit knowledge is stored on media that requires special equipment to read it (e.g. CDs or DVDs*)*, provision should be made for the possibility that the equipment or the storage formats or both may become obsolete and that, after some time, the stored information may not be retrievable any more. Sensitive or valuable explicit knowledge can be safeguarded against malicious action such as theft, vandalism or sabotage by physical access control or electronic protection measures such as firewalls, anti-virus systems, encryption and password protection.

Protection of knowledge integrity

The protection of knowledge integrity refers to the processes through which tacit and explicit knowledge in the *organization*'s knowledge base are prevented from becoming corrupted. Knowledge corruption refers to degradation or unwanted changes to the knowledge in the organizational knowledge base.

The protection of the integrity of tacit knowledge refers to the prevention of the corruption of individual knowledge. If tacit knowledge is defined broadly enough to include emotions and attitudes, actions or practices that lead to negative emotions and attitudes among individuals in an organization can affect the organization's ability to develop and sustain competitive advantages and can thus be seen as the corruption of tacit knowledge.

Explicit knowledge can be corrupted by many of the processes through which it can be lost. Therefore many of the general strategies for the prevention of the loss of explicit knowledge will also be effective in the prevention of the corruption of explicit knowledge in an organizational knowledge base.

Retrieval of relevant knowledge when required

The retrieval of relevant knowledge when required refers to the processes through which relevant tacit and explicit knowledge is located and made available for use whenever and wherever it is required.

To successfully locate specific knowledge in an organization's knowledge base, mechanisms for searching, organizing and indexing the knowledge base must be available. Explicit knowledge is generally well suited for searching, organizing and indexing. Tacit knowledge does not however lend itself readily to organizing, indexing and searching. Consequently, to successfully locate specific tacit knowledge in an organization, alternative strategies are

required. An example of a mechanism for the location of tacit knowledge is a meta-knowledge database. An example of such a database is an expert register that contains references to individuals and the type of knowledge that they possess.

Prevention of unauthorized access to knowledge

Prevention of unauthorized access to knowledge refers to processes through which access to knowledge by individuals, systems or processes that are not entitled to the particular knowledge are prevented. There are many reasons for implementing access restrictions on certain organizational knowledge. The most obvious reason is to prevent competitors from copying products, services or processes, that is, destroying the organization's competitive advantages. There are, however, also many other reasons for restricting access to organizational knowledge. The protection of privacy is a good example. Personnel records are usually protected from unauthorized access to protect the privacy of the individuals employed by an organization.

Both tacit and explicit knowledge may need to be protected from unauthorized access, depending on the risks that such access holds. This means that the risks associated with various types of unauthorized access to the knowledge in the organization's knowledge base have to be evaluated and access control measures have to be devised and implemented.

Access to explicit knowledge can be controlled by various measures. These may include physical access control measures such as safes, access cards or even security guards. Electronic access control measures such as passwords and firewalls are common examples of methods, which may be employed to prevent access to explicit knowledge that is stored electronically.

The prevention of access to tacit knowledge is more difficult as this knowledge is situated in individuals. To prevent unauthorized access to individual knowledge, individuals have to be convinced not to share sensitive tacit knowledge that they possess with any person or system unless authorized to do so.

3.4.4 Knowledge utilization and creation

The processes of knowledge utilization and knowledge creation enable the organization to apply the knowledge in its knowledge bases to make sense of problems, threats, opportunities and all other situations it is presented with all the time. It also enables the organization to come up with strategies and plans to solve problems, overcome threats and exploit opportunities in an effective manner.

The knowledge utilization part of the process enables the organization to interpret a situation or information presented by either its internal or external environments. A convenient way in which to illustrate this interpretation is to describe it as a process through which the situation or information is made part of the organization's model of reality, which in turn is based on the knowledge in its knowledge stores. If the situation or information causes the organization's model of reality to be expanded, learning takes place. This is also an example of knowledge creation. Hall (2005:183) writes of this process when he states: 'Through iteration, observation and orientational comparison of results of observed actions with memories of earlier iterations, the modelling and understanding of external reality approaches the "truth"' of that external reality. From an organisational point of view, this may be said to be "conscious" organisational learning to improve organisational adaptation.'

The knowledge creation part of the process can be described as the process through which strategies and plans are developed to achieve the aims of the organization. In terms of the modelling illustration that was used with the knowledge utilization process, the knowledge

creation process can be described as the process through which the organization's model of reality is used to project which strategies and plans will be most effective in achieving its objectives. It can be said that this process's effectiveness will be determined by the accuracy of the organization's model of reality (knowledge base and knowledge utilization or understanding) and the accuracy with which this model can reproduce the dynamics of the external reality.

3.4.5 Knowledge application

The knowledge application process is defined as the physical enactment or performance of the organization's processes. It is important to understand that here the process itself represents knowledge while the act of performing the process is the knowledge application process. Consider, for example, an organization's process for hiring new employees. In this example, the knowledge lies in the documented procedures and policies as well as in the individuals who do the interviewing and perform the administrative tasks. The application of this knowledge is the actual performance of the tasks that the procedures dictate.

The organizational processes, in which knowledge is imbedded, include all activities throughout the organization and range from formal well defined organizational procedures, representing explicit knowledge to informal habits and rituals, representing tacit knowledge. Knowledge application refers to the enactment or performance of both types of processes. The tacitness of knowledge that is embedded in any organizational process will depend on how explicitly the steps of the process are defined. Some process may not be completely explicitly definable and is therefore at least partly tacit. An example of such a process is the work of a skilled craftsman such as a welder. Although the welding process can be described explicitly in work procedures or instructions, it can only be done in general terms. The skill required for welding cannot be captured in this manner. Some processes are so perfectly definable that they can be performed by computers. Such processes are usually exactly defined and documented and are therefore completely explicit. Data storage and data processing are good examples of such processes.

The performance of a particular process (knowledge application) may also be either tacit or explicit. Even if a process itself is explicit it may be applied in a tacit manner. An example of such a process is the visual inspection of a product for defects after manufacture. The procedure for performing the check can be exactly defined, but it may be performed by a human inspector, which means that the evaluation of the manufactured product takes place in a tacit manner.

The previous example illustrates a process, in which explicit knowledge is embedded, being applied in a tacit manner. Similarly, a process in which explicit knowledge is embedded can be applied in an explicit manner. An example of this would be if the inspection were done with a robotic camera and the necessary software. In this case the application of the knowledge embedded in the inspection procedure would be completely defined (in the software documentation, for example) and would therefore be explicit.

A similar type of argument can be used to show that a process that embeds tacit knowledge can be performed in a tacit manner. However, it seems inconceivable that a process that embeds tacit knowledge can be performed in an explicit manner.

3.4.6 Knowledge management

The knowledge management process ensures that the organization's knowledge processes are performed as effectively and efficiently as possible. It is therefore responsible for identifying knowledge processes and implementing measures that will facilitate their effective and efficient execution.

Knowledge processes associated with both tacit and explicit knowledge have to be managed. This means that knowledge management in the organization must not only address well-defined processes such as those supported by information technology, but it must also address the knowledge processes taking place in and between individuals such as knowledge sharing and knowledge creation.

Knowledge management processes themselves may be both explicit and tacit. Explicit knowledge management processes are well defined and explicitly documented. An example is a documented procedure describing the process that the organization will follow in rewarding employees for contributing to an organizational knowledge system. Tacit knowledge management processes are not explicitly defined and are performed by individuals in the organization. An example of a knowledge management process that is at least partially tacit is the process through which a knowledge manager arrives at an appropriate strategy for the management of the knowledge processes in his or her department.

4 Management framework

The widest accepted views on fundamental strategies for the achievement of competitive advantage are those of Michael Porter. Porter (1980) describes three generic strategies through which firms can achieve competitive advantage. These generic strategies are cost leadership, differentiation and market segmentation (or focus).

Michael Treacy and Fred Wiersema generalized Porter's three strategies and introduced three basic 'value disciplines' through which the firm can create value and gain competitive advantage. These value disciplines are operational excellence, product leadership and customer intimacy (Wigg 1997:9).
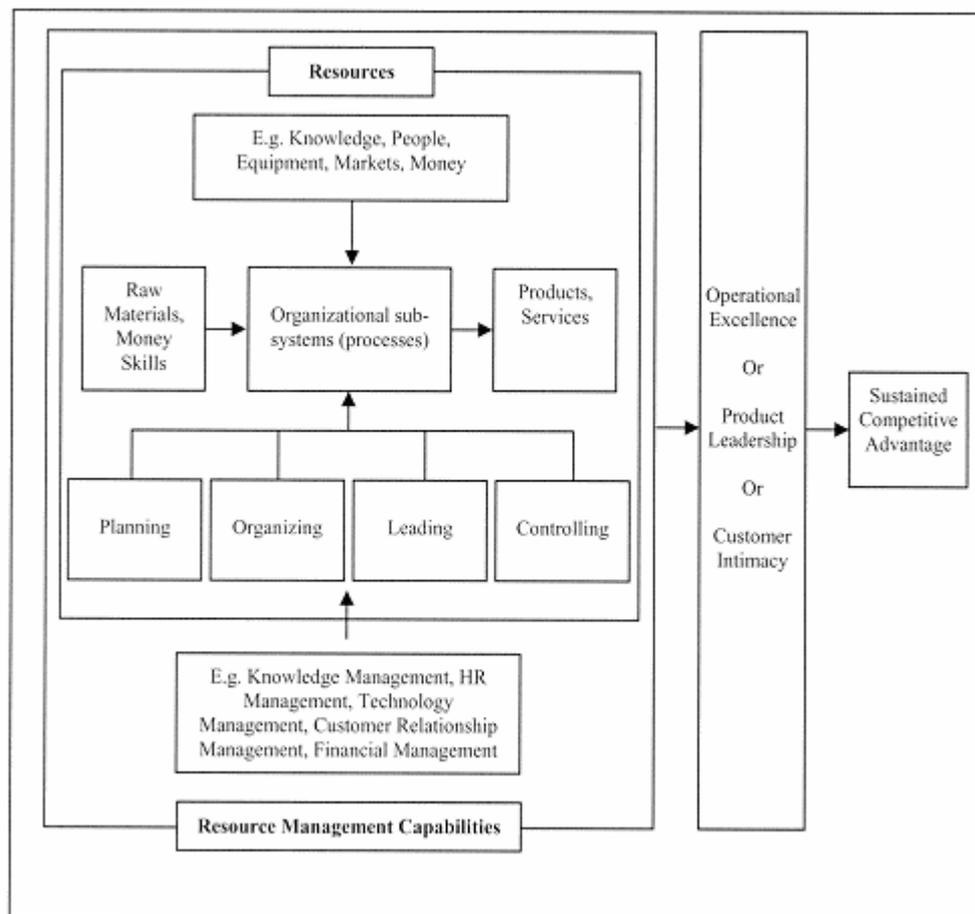
Operational excellence, product leadership or customer intimacy should be the outcomes or end results of the implementation of the firm's fundamental competencies. Chief among these fundamental competencies are the management capability of strategic resources such as knowledge. Therefore, the firm's strategic management capabilities must be implemented so as to have as their objectives operational excellence, product leadership or customer intimacy, which in turn leads to the achievement of sustainable competitive advantages (Thompson and Richardson 1996).

Porter's and Treacy and Wiersema's fundamental strategies for obtaining competitive advantage only describe the fundamental strategic objectives that the firm should strive to achieve. They do not describe actual strategies of how to achieve those objectives. One way to move towards a solution to this problem is by applying the concepts of system theory to the functioning of the organization. According to Smit and Cronjé (2002:61) this approach provides an effective means of explaining the interrelationships between the organization and its environment as well as the interrelationships between the various components of the organization itself. Wessels, Grobbelaar and McGee (2003:5) write that a system is a combination of interrelated sub-systems, organized in such a way as to ensure the efficient operation of the system as a whole. An important attribute of a system is that there must be a high degree of coordination between the various sub-systems to ensure that the desired outputs of the greater system are achieved. Smit and Cronjé (2002:61) observe that 'a business organisation is a system that operates in a specific environment' and continue to explain that a business organization uses resources such as people, physical resources, capital and information, which it then transforms into products or services for the marketplace.

Management itself is a sub-system of the large overall organizational system (Smit and Cronje 2002:8). Management comprises a number of interrelated functions that enable the organization to achieve its goals. These functions are planning, leading, organizing and controlling. The management functions are not simply a sequential set of operations that are performed one after the other. Although planning always precedes all the other functions, its relationship with the controlling function, for example, has an iterative or cyclical nature rather than a sequential one. The same is true of the relationship between planning and organizing, and planning and leading. Another reason for the complexity of the interrelatedness of these functions is the fact that the management functions are always applied to the processes in the organization. Since each of the four functions are themselves organizational processes, they must in effect be applied to themselves as well.

An overall management framework was created by combining the notions of Treacy and Wiersema's value principles, Thomson and Richardson's idea that these value principles are outcomes based on the firm's fundamental competencies, a systems theory according to Wessels, Grobbelaar and McGee, and Smit and Cronjé's definition of management. This framework is illustrated in Figure 3.

Figure 3 Management framework

The figure shows the firm's strategic management capabilities being applied to its full spectrum of resources in order to achieve the objectives of operational excellence, product leadership or customer intimacy, which in turn leads to sustainable competitive advantage for the firm. The framework depicts the firm's resources as being moderated by its management capabilities. The firm's management capabilities are depicted in terms of the fundamental management functions of planning, organizing, leading and controlling. The four management functions are also shown as part of the resources of the organization since they

are themselves sub-systems (or processes) of the larger organizational system.

In accordance with Smit and Cronjé's description of the management functions, the framework suggests that the four functions are applied throughout the firm to all the organizational processes. It is therefore found that the management function of the organization manifests itself in a variety of different management disciplines such as human resource management, financial management, customer relationship management, technology management and knowledge management. An important realization that flows from this illustration, which is based on the resource-based view of the firm, is that management always refers to the management of resources and in particular the management of the processes that are associated with resources. To illustrate this notion, consider the case of human resource management as an example. The management of human resources refers to the management of processes associated with human resources, such as recruitment and appointment, remuneration, training, etc. In any other context, the 'management' of human resources (people) does not make any sense at all. In the context of knowledge management, this point of view answers the objections of some authors (Wilson and Borås Borås 2002) who consider the notion that knowledge can be 'managed' as nonsense.
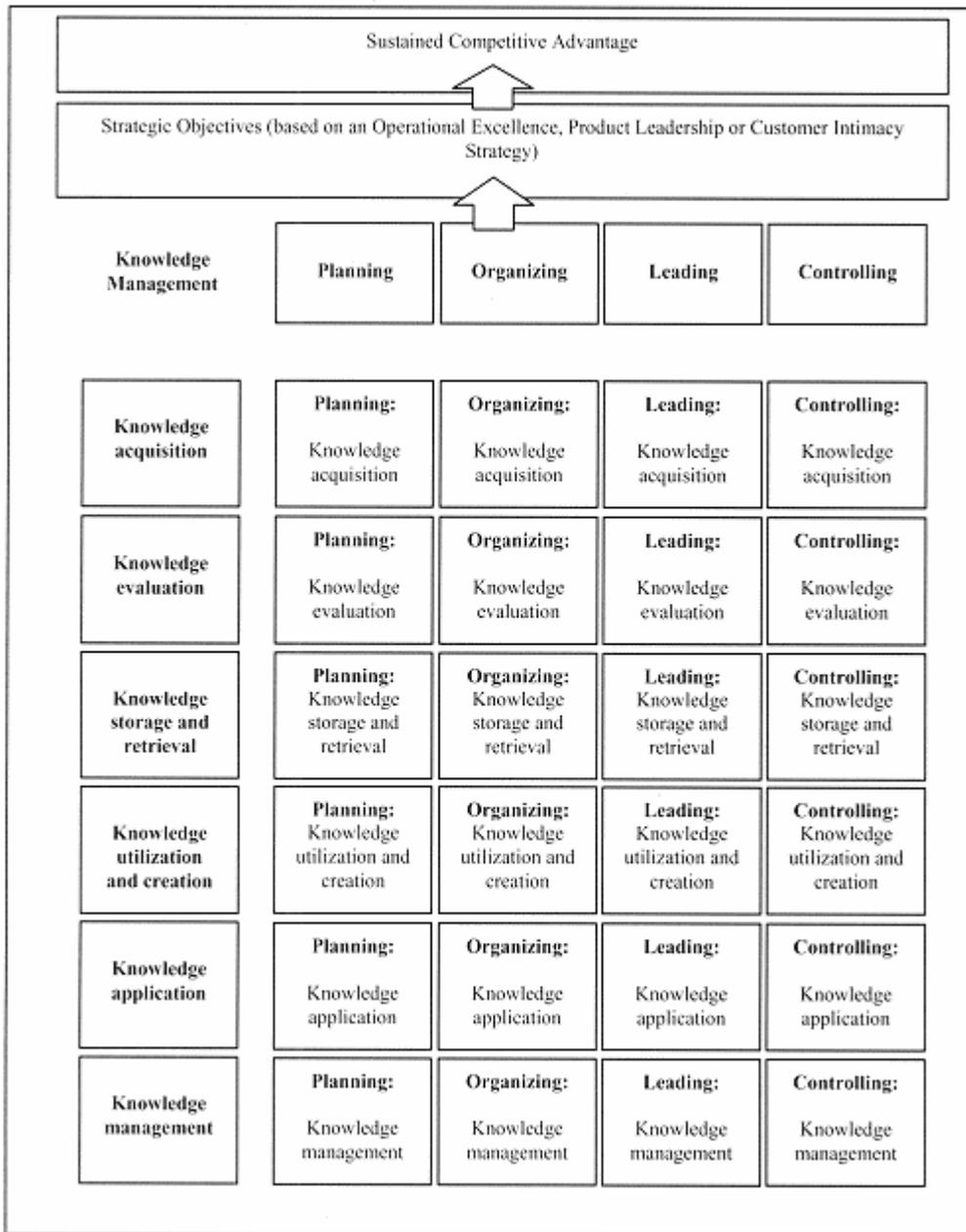
5 Knowledge management framework

The contention of this article is essentially that knowledge management can be described as the application of management functions to the processes associated with an organization's knowledge resources. In terms of the management framework described in the previous section, this means that knowledge management is the application of the planning, organizing, leading and control functions to the organization's knowledge processes with the aim of producing outcomes through which the organization can achieve and maintain competitive advantages. This notion is supported by various authors in their definitions of knowledge management. Dimitriades (2005:319) writes that 'knowledge management (KM) is defined ... as the *management discipline* concerned with the systematic *acquisition, creation, sharing and use of knowledge* in organizations, *aiming to improve a firm's competitiveness*.' Du Plessis and Boon (2004:75) explain that 'knowledge management [is] a planned, structured approach to *manage the creation, sharing, harvesting and leveraging of knowledge* as an organisational asset, to enhance a company's ability, speed and effectiveness in delivering products or services for the benefit of clients, *in line with its business strategy*' (emphasis added).

Building on the foundation of the definition of knowledge management as the application of management functions to organizational knowledge processes, a knowledge management framework was created. This was done by combining the organizational knowledge framework presented in a previous section with the management framework illustrated in Figure 3. The knowledge management framework, which is illustrated in Figure 4, is essentially a matrix that depicts knowledge management as a set of processes, which are defined through the application of the four management functions to each of the organizational knowledge processes.

Figure 4 Knowledge management framework

Knowledge Management	Planning	Organizing	Leading	Controlling
Knowledge acquisition	**Planning:** Knowledge acquisition	**Organizing:** Knowledge acquisition	**Leading:** Knowledge acquisition	**Controlling:** Knowledge acquisition
Knowledge evaluation	**Planning:** Knowledge evaluation	**Organizing:** Knowledge evaluation	**Leading:** Knowledge evaluation	**Controlling:** Knowledge evaluation
Knowledge storage and retrieval	**Planning:** Knowledge storage and retrieval	**Organizing:** Knowledge storage and retrieval	**Leading:** Knowledge storage and retrieval	**Controlling:** Knowledge storage and retrieval
Knowledge utilization and creation	**Planning:** Knowledge utilization and creation	**Organizing:** Knowledge utilization and creation	**Leading:** Knowledge utilization and creation	**Controlling:** Knowledge utilization and creation
Knowledge application	**Planning:** Knowledge application	**Organizing:** Knowledge application	**Leading:** Knowledge application	**Controlling:** Knowledge application
Knowledge management	**Planning:** Knowledge management	**Organizing:** Knowledge management	**Leading:** Knowledge management	**Controlling:** Knowledge management

(Above the matrix: Sustained Competitive Advantage ← Strategic Objectives (based on an Operational Excellence, Product Leadership or Customer Intimacy Strategy))

In addition to defining a complete set of knowledge management processes, the framework also addresses the link between knowledge management practice and business strategy. Nomura (2002:266) writes in this regard that the 'objective of KM is to directly enhance corporate value according to business strategy', while Clark (2001:189) concludes that 'knowledge management initiatives are unlikely to be successful unless they are integrated with business strategy'. Drawing on the management framework presented earlier, the knowledge management framework suggests explicitly that the purpose of knowledge management is to enable the organization to achieve its strategic objectives and develop sustainable competitive advantages.

The core of the knowledge management framework is the matrix of processes that combine the four management functions with the organizational knowledge processes. Analysing the knowledge framework processes down the columns of the matrix yields knowledge management processes that can be categorized according to the management functions as planning, organizing, leading and control processes. Analysing the matrix along its rows would yield exactly the same knowledge management processes, although they would be categorized in terms of the organizational knowledge processes.

For the purpose of the article, the matrix will be analysed along its rows with the bottom row of the matrix being analysed first. The reason for analysing the bottom row first, is that the bottom row of the matrix represents the application of the four management functions to the organizational knowledge process of 'knowledge management'. The bottom row therefore represents the processes that describe the management of 'knowledge management' in the organization. In the opinion of the authors, the clarification of the management of 'knowledge management' is the best place to start the practice of knowledge management in an organization.

The bottom row of the knowledge management framework matrix represents the application of the four management functions to the organizational knowledge process of 'knowledge management'. With the insight that has been gained from the analysis of management in general, the organizational knowledge process of 'knowledge management' can now be more specifically defined as the planning, organizing and controlling of, and the application of leadership in the organizational knowledge processes.

The first process in the bottom row of the knowledge management framework matrix (Planning: knowledge management) implies that goals and objectives with their associated strategies and plans have to be drawn up for the planning, organizing and controlling of, and the application of leadership in the organizational knowledge processes. This simply means that there must be goals and objectives for knowledge management with associated knowledge management strategies and detailed plans.

The second process (Organizing: knowledge management) implies that an organizational structure has to be created that will be responsible for ensuring that the planning, organizing and controlling of, and the application of leadership in the organizational knowledge processes, effectively enables the organization to achieve its knowledge management goals and objectives. The creation of the structure must include the outlining of tasks and activities, the design of jobs (or functions) and the assignment of these jobs to employees, the definition of worker relationships and the grouping of related activities and tasks where required. There must also be a control mechanism that monitors the performance of this process, so that any deviations from planned activities and performance levels can be detected and corrected.

The third process (Leading: knowledge management) implies the application of leadership in the planning, organizing and controlling of, and the application of leadership in the organizational knowledge processes. The application of leadership in the planning, organizing and controlling of organizational knowledge processes is simple enough to understand, but the application of leadership in 'the application of leadership' may sound strange. It simply means that knowledge managers must motivate employees, some of whom may be managers as well, to apply their own leadership power to motivate employees in their spheres of influence to work towards accomplishing the goals and objective of the organization's knowledge management initiatives.

The final process (Controlling: knowledge management), in the bottom row of the knowledge management framework matrix, implies the monitoring of performance and the detection and correction of deviations from planned activities and performance levels in the planning, organizing and controlling of, and the application of leadership in the organizational knowledge processes. This means that there has to be processes that monitor whether, for example, knowledge management planning has been done according to the appropriate standards. These processes must include the evaluation of possible deviations and the implementation of corrective actions. The results of these evaluations and any associated corrective actions must then be fed back into the first process (planning) of the bottom row of the matrix.

The analyses of the framework processes are completed by following the same processes as described for the bottom row for each of the other rows of the matrix. The analyses will yield a set of processes that represents a complete set of knowledge management processes.

6 Conclusion

Although it lays down principles and guidelines for knowledge management, the knowledge management framework presented here cannot be considered a knowledge management strategy in its own right. For a strategy to be complete, it has to relate to a particular organization and, most importantly, to the organization's business strategy. Therefore the principles presented in the framework have to be applied to a specific organization in order to develop a complete knowledge management strategy. The effectiveness of the strategy will be directly related to the quality of the framework. This means however that, only after a strategy has been developed in accordance with the principles and guidelines of the framework, can the effectiveness of the framework be evaluated. Both the attributes as well as the lessons learnt from applying the principles of the framework within a specific organization in order to develop a knowledge management strategy will be discussed in a subsequent article.

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