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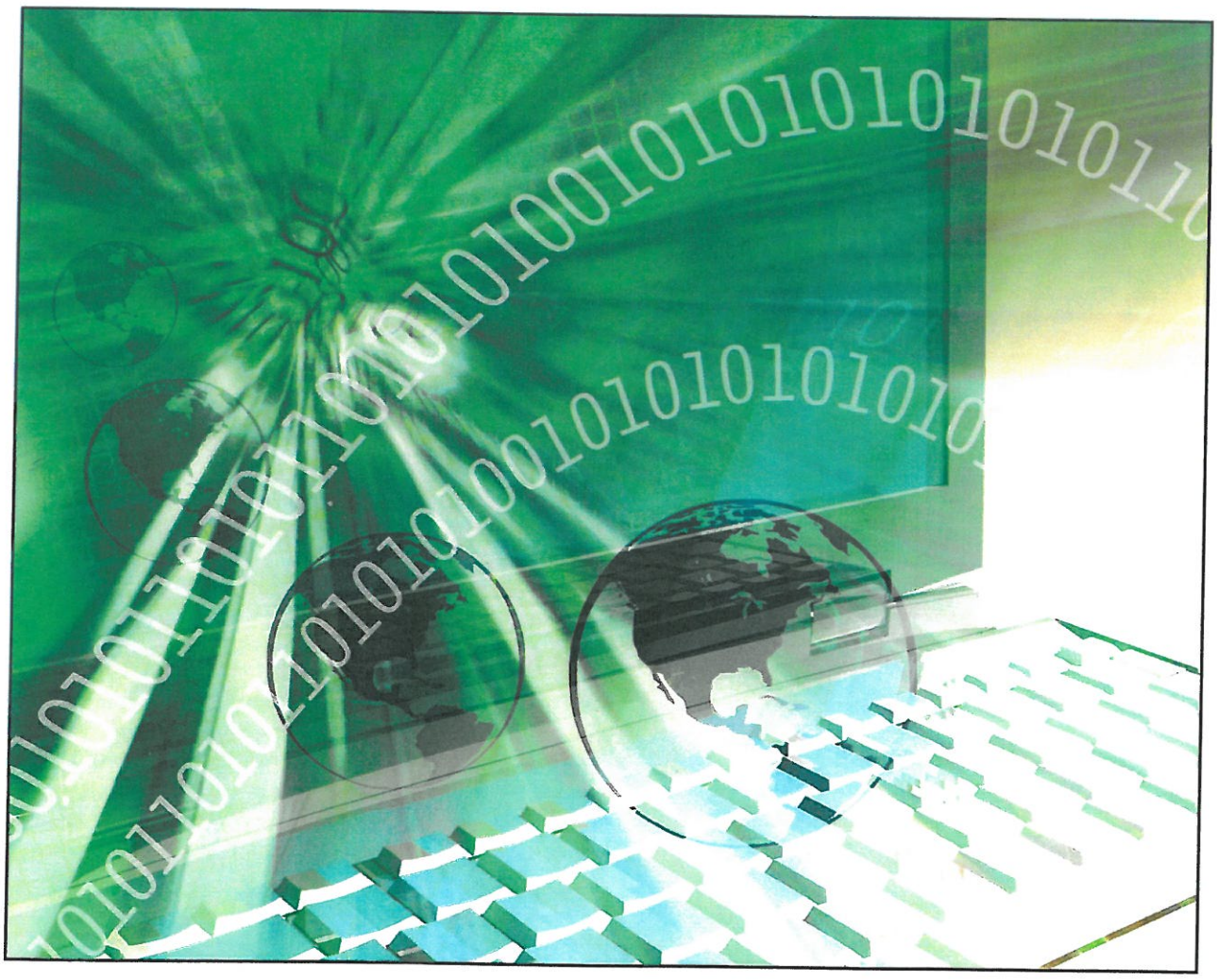
# INNOVATIVE KNOWLEDGE MANAGEMENT

## Concepts for Organizational Creativity and Collaborative Design



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# Foreword

Knowledge Management as a discipline, despite being 20 years old or so, is still in its infancy. And although there have been many pronouncements of its death, I would argue that it is still very much alive and thriving. What you may find surprising though, is that, if you spent some time in the online KM discussion forums, you would discover extensive, heated debate on the nature of KM.

First, people still cannot agree what constitutes knowledge and I don't believe they ever will. For many, knowledge can only exist in the human mind - anything in written form is information but others argue that knowledge can exist in two forms: implicit knowledge, that exists only in the human mind and explicit knowledge that is recorded, such as in a book or a digital format. These two mindsets are the root cause of much confusion and argument. And even when this difference is recognised, there is still great debate as to "What is knowledge?"

In addition, the relationship of data to information and knowledge and even wisdom is hotly argued and the validity of the so called data-information-knowledge-wisdom hierarchical model (D-I-K-W) that is much hallowed in some circles has been called into question. Even the SECI model of Nonaka and Takeuchi—long a staple of KM academics and practitioners—is dismissed by many and has been held responsible by some for the failure of a large number of KM projects.

Yet another hot debate is the role of incentives and rewards in motivating people to share their knowledge. Most people still believe that you need rewards and incentives, whilst the works of Alfie Kohn and Dan Pink show that research demonstrates that tangible rewards in the main do not work and, worse, do great harm.

As for a precise definition of KM itself, there is even less agreement. You can find hundreds of definitions on the web. They have a lot in common but they are also very different. And the definitions you are drawn to vary depending on whether you are an academic, a KM practitioner, an HR manager, a technologist, or a hard nosed business manager. Definitions are also coloured by the industry you are in. Someone in the oil industry may have a very different view of KM than a software developer at Google.

The subject is rich. The subject is broad. The subject is diverse. There is wide disagreement as to the nature of knowledge, what knowledge management is and how you best go about it. But personally, I don't think it matters too much. I am quite capable of working with several definitions of knowledge inside my head, and I would recommend that anyone working in the KM field define what KM means to them in terms of their specific business and business objectives. This lack of a clear definition and at times ambiguity is what I think makes the field an exciting and fulfilling one to work in, though I doubt every one would agree.

What I think is interesting is that KM as a discipline has emerged and is evolving and developing in the age of the World Wide Web. In the past, the ownership, forming, and shaping of a new discipline was

restricted to a relatively small number academics and high profile early practitioners and evangelists. This is not true today. With the web, regardless of knowledge or experience, anyone can contribute to the debate and the evolution of the discipline. The shaping of KM is a more open, democratic process, and there is much to be learnt about the evolution of knowledge and KM itself in observing the conversations, dialogue, and debate that are taking place world wide.

But despite all this argument and debate and a dip in enthusiasm for KM in the mid 90s, I believe that KM today is reviving and thriving. There are many KM societies and networks world-wide. There are a growing number of conferences and an ever increasing number of on-line forums and KM educational courses. And the number of people with "knowledge" in their title and a responsibility for managing knowledge in some way grows daily.

It is still a hard fact however that most KM projects have failed or have not lived up to their expectations. I don't believe that this is inherent in KM tools or methodologies but due more to the fact that KM projects are often poorly conceived and implemented. I think that for KM to be successful, it needs to do three things.

1. It needs to focus intensely on the critical business issues that need to be addressed within an organisation and not on visionary concepts such as creating a knowledge sharing culture or a knowledge driven organization. Such concepts deflect us from the real issue of solving business problems, mitigating business risks and identifying and exploiting new business opportunities and are too often a one way street to frustration and ultimate failure.
2. It should place more emphasis on working with and obtaining buy-in from senior managers in the organization, not only by developing a business case but recognizing that managers are human and can be swayed by other motivations other than a traditional ROI analysis.
3. It needs to obtain the buy-in from people in the organization by working with them, engaging and involving them much earlier in the project life cycle then most traditionally managed projects. Unlike other systems, people cannot be coerced into using a "KM system" —they need to have ownership.

I am often asked "How do you do KM?" My response is that "You don't do KM! We should respond to business problems and develop business opportunities using KM tools."

I also don't believe there should such things as KM initiatives. Again, we should not "do KM". There is no such thing as a KM strategy. There are only business problems, business challenges and opportunities, business strategies, and business projects.

To my mind, the problem with KM initiatives and strategies is that they conceptualize problems and make it far too easy for us to take our eye off the business, and this is one of the key reasons why so many KM projects fail.

It is also rare that a business issue is purely a KM one. We usually need more than just KM tools and techniques to fully address a business problem or opportunity. We should use KM tools and methodologies to help respond to business problems and opportunities.

If we must have a KM strategy it should be in response to clear business goals and tie in to the top level business objectives of the organization or our organizational unit. The business purpose and outcomes should come first!

I also believe that there are no benefits to KM as such. As KM is about improved communication, learning and knowledge sharing it can be applied to any human endeavor. So asking what are the benefits

of KM is a meaningless question as the answer is "what ever we want them to be!" We need to start by asking "What do we want to achieve in terms of business outcomes and how can KM thinking, KM tools and KM techniques help?"

Not everyone will agree with my views. And that's fine. That's the nature of KM.

What I like about this book is that it includes contributions from academics, researchers, managers and practitioners in a wide variety of areas relating to KM and innovation. Much of what they have to say is in disagreement with each other or represents alternative view points.

This is good. This is how we take the discipline forward. So let me finish by saying something I say again and again about KM. There are no recipes for KM. There are no prescriptions for KM. There is no substitute for thinking for yourself about KM.

Read the book, reflect, think hard and join the conversation—both the dialogue and the debate! Help shape KM for the 21st century.

*David Gurteen*
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**David Gurteen** *has over 30 years' experience working in high technology industries. He was a professional software development manager and in the late 80s worked for Lotus Development, ensuring that Lotus products were designed for the global marketplace. Today he works as an independent knowledge management advisor, facilitator and speaker, helping people to innovate and to work together more effectively. He is the founder of the Gurteen Knowledge Community—a global learning network of over 17,000 people in 160 countries. He publishes a monthly Knowledge Letter, now in its 11th year, and the Gurteen Knowledge Website—a resource website that contains book reviews, articles, people profiles, event calendars, inspirational quotations, an integral weblog and more on subjects that include knowledge management, learning, creativity and innovation. He is known for his Gurteen Knowledge Cafés and the Knowledge Café Masterclasses that he runs regularly in London and in other cities around the world. In June 2010, He won the Ark Group's lifetime achievement award for services to KM.*

# Chapter 2
# Key Characteristics Relevant for Selecting Knowledge Management Software Tools

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## ABSTRACT

*The shift to innovation and knowledge as the primary source of value results in the new economy being led by those who manage knowledge effectively. Today's organizations are creating and leveraging knowledge, data, and information at an unprecedented pace—a phenomenon that makes the use of technology not an option, but a necessity. Software tools in knowledge management (KM) are a collection of technologies and are not necessarily acquired as a single software solution. Furthermore, these KM software tools have the advantage of using the organization's existing information technology infrastructure. Organizations and business decision makers spend a great deal of resources and make significant investments in the latest technology, systems, and infrastructure to support KM. It is imperative that these investments are validated properly, made wisely, and that the most appropriate technologies and software tools are selected or combined to facilitate KM, knowledge creation, and continuous innovation. In this chapter, a set of characteristics are proposed that should support decision makers in the selection of software tools for knowledge creation. These characteristics were derived from both in-depth interviews and existing theory in publications.*

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## INTRODUCTION

Imagine that, in the same way that a disc failure on your personal computer or laptop erases all information in the file folders, all intellectual capital within your organization is erased from the employees' minds and the organization's storage media. There is no doubt that the market value of such an organization will be affected severely as decisions in an organization are made based on sufficient, relevant and accurate knowledge. Stewart (1997) supports this notion that the management of knowledge turned out to be the most important economic responsibility of individuals, businesses and nations, as it forms a key component of what is acquired, produced and sold.

Knowledge assets are of much greater value than any tangible asset, which includes natural resources, large factories, equipment and land – all of which provided organizations with a competitive edge in the past (Alavi & Leidner, 2001; Davenport & Prusak, 1998). This knowledge asset provides the basis for creating sustainable competitive advantage in the knowledge age (Nonaka, Toyama, & Byosiere, 2001; Vandaie, 2007). Furthermore, as new technologies, innovation, organizational flexibility and new and better forms of leadership propel the growth and earnings of knowledge-intensive companies, so the need to extract wealth from brainpower and knowledge (individual and organizational) becomes increasingly pressing. This importance of knowledge is confirmed by Becker et al (2001) who conclude that machinery and equipment are not the distinguishing aspects any more, but rather the capability to use it resourcefully. An organization that kept its workforce skills and expertise could operate quickly even though it lost all of its equipment. An organization that lost its workforce, while keeping its equipment, would never recover.

This shift to knowledge as the primary source of value results in the new economy being led by those who manage knowledge effectively - organizations that create, find and combine knowledge into new products and services faster than their competitors (Moss-Kanter, 1997). Drucker (Hibbard, 1997, p. 46) states that "*We now know that the source of wealth is something specifically human: knowledge. If we apply knowledge to tasks we already know how to do, we call it productivity. If we apply knowledge to tasks that are new and different, we call it innovation. Only knowledge allows us to achieve those two goals.*"

Today's organizations are creating and leveraging knowledge, data and information at an unprecedented pace and the extraordinary growth in on-line information makes the use of technology not an option, but a necessity (Folkens & Spiliopoulou, 2004; Lindvall, Rus, Jammalamadaka, & Thakker, 2001). This influence of technology on the maintenance of KM actions is widely accepted, as technology adds value by reducing time, effort and cost in enabling people to share knowledge and information (Chua, 2004). It is especially relevant when it is closely aligned with organizational requirements - the way people work and are supported by and integrated with relevant processes (Hoffmann, Loser, Walter, & Herrman, 1999; Wind & Main, 1998).

In addition to the growth in information technology (IT), organizations embark on employee information access projects, like the creation of knowledge bases, intranets, chat rooms, full-text indexing tools and document management tools as necessitated by KM (Lindvall, Rus, Jammalamadaka, & Thakker, 2001). KM agility and optimal support of technology motivate the need for research in which the focus is on an understanding of the key characteristics of a KM solution by exploring and describing the nature of knowledge. Therefore, this chapter focuses on providing guidelines in the selection of a KM system solution and provides an example where the selection criteria have been applied as a cost saving solution.

## BACKGROUND

While some epistemologists spent their lives trying to understand what it means to know something (Clarke & Rollo, 2001; Davenport & Prusak, 1998). Plato first introduced the concept of knowledge as justified, true belief in 400 B.C. (Meno, Phaedo and Theaetus as quoted by Nonaka & Takeuchi, 1995). Advances in knowledge described the achievements of the ancient Greek, Roman, Egyptian and Chinese civilisations and the transforming impact of the industrial revolution was characterised by the application of new knowledge in technology (Clarke & Rollo, 2001; Moteleb & Woodman, 2007).

For the purpose of this chapter, a more pragmatic approach has been followed and the following working description of knowledge has been explored (Davenport & Prusak, 1998, p. 5): "*Knowledge is a fluid mix of framed experiences, values, contextual information and expert insight that provides a framework for evaluating and incorporating new experiences and information. It originates and is applied in the minds of knowers. In organizations, it often becomes embedded not only in documents or repositories but also in organizational routines, processes, practices and norms.*"

Knowledge can either be categorized as being explicit or implicit. *Explicit knowledge* can be defined as knowledge that has been articulated in the form of text, diagrams, product specifications and so on (Clarke & Rollo, 2001). Nonaka (1995) refers to explicit knowledge as formal and systematic, like a computer program. In organizations today, explicit knowledge resides in best practices documents, formalised standards by which goods and services are procured and even within performance agreements that have been documented in line with company and divisional goals and objectives.

*Implicit knowledge* is far less tangible than explicit knowledge and refers to knowledge deeply embedded into an organization's operating practices (Kothuri, 2002). *Tacit knowledge*, as a dimension of implicit knowledge, includes relationships, norms and values. It is knowledge that cannot be articulated and it is much harder to detail, copy or distribute, to the contrary, the knowing is in the doing in this instance (Clarke & Rollo, 2001). Tacit knowledge can provide competitive advantage to organizations as it is protected from competitors (Hahn & Subramani, 2000; Wessels, Grobbelaar, & McGee, 2003) unless key individuals are lured away, of course (Lindvall, Rus, Jammalamadaka, & Thakker, 2001). The management of explicit and implicit knowledge is a multifaceted subject based on the dimensions of knowledge and therefore there are various and varied definitions for it (Newman & Conrad, 1999). McCullough (2005) concludes that, based on the vast majority of academic research into KM, there is a general difficulty for organizations to explain what they mean when they use the term KM.

Sveiby (1997, p. 37) defines the management of knowledge as "*the art of creating value by leveraging intangible assets*". Meyer and Botha (2000, p. 278) define it as "*the management of corporate processes designed to create, disseminate and protect knowledge in support of sound decisions leading to profit*". Godbout (1999) defines KM by suggesting that it is not knowledge that gives the competitive edge, but the capacity to transform knowledge into competencies and replicate know-how. According to Drucker (Edersheim, 2007), the most direct use of knowledge within an organization is to build its own capabilities, and that the application of knowledge to knowledge is the critical factor in productivity moving forward. Lindvall, Rus et al (2001, p. 3) define KM as "*the practice of transforming the intellectual assets of an organization into business value*".

For the purpose of this chapter the following definition of KM as suggested by Choo (2000) will be used: "*a framework for designing an organization's goals, structures and processes so that the*

*organization can use what it knows to learn and to create value for its customers and community*".

Technology is a key enabler of KM and KM processes as it extends the reach and enhances the speed of knowledge transfer (Chua, 2004; Wilson & Snyder, 1999; Yu, Kim, & Kim, 2004). Technology permits the knowledge of an individual or group to be structured and codified and allows distribution of knowledge across the world (Davenport & Prusak, 1998; Wessels, Grobbelaar, & McGee, 2003). KM technology is a broad concept and organizations apply a wide variety of technologies to the objectives of KM (Davenport & Prusak, 1998; Lindvall, Rus, Jammalamadaka, & Thakker, 2001).

Explicit knowledge is found in reports, documents and manuals and can easily be gathered and stored as a knowledge base (Dix, Wilkinson, & Ramduny, 1998; O'Leary, 1998). Organizations use groupware applications to collect, store and share their explicit knowledge, and once this has reached a sufficient level of efficiency, collaborative technologies such as intranet, the internet, extranet, e-mail, video-conferencing and tele-conferencing are used to assist in the growth of tacit knowledge transfer. In order to enable organizations to retrieve captured knowledge, knowledge route maps and directories are developed to create an understanding of the location of knowledge (Alavi & Leidner, 2001; Clarke & Rollo, 2001). Knowledge networks are created using virtual business environments such as chat rooms, team web sites and learning communities with the development of specific applications of technology such as databases, workflow systems, personal productivity applications and enterprise information portals (O'Leary, 1998; Wilson & Snyder, 1999). According to Tsai and Chen (2007, p.258) are "*knowledge management systems more than just information systems or IT-enabled tools in support of knowledge management activities. Instead, a knowledge management system must be a socio-technical system as a whole which comprises the knowledge itself (the intellectual capital of the organization), organizational attributes (intangibles such as trusting culture), policies and procedures, as well as some form of electronic storage and retrieval systems.*"

Different ways of classifying KM technologies are utilised in the literature and Antonova, et al (2006) categorised technological solutions according to the following KM processes: (1) generation of knowledge, (2) storing, codification and representation of knowledge, (3) knowledge transformation and knowledge use and (4) transfer, sharing, retrieval, access and searching of knowledge. These specific implications of knowledge and KM on KM solutions are important as these different views lead to different perceptions and definitions of KM systems (Asgarkhani, 2004). As such a KM solution enables knowledge creation, it provides the basis for continuous innovation as one innovation leads to another (Nonaka & Takeuchi, 1995).

## KEY CONSIDERATIONS IMPACTING KNOWLEDGE MANAGEMENT

Organizations today face the challenge of creating an infrastructure that facilitates knowledge transfer – both explicit and implicit. Explicit knowledge is easy to identify based on the definitions above, but implicit – and specifically tacit – knowledge transfer, remains an area of focus. Organizations have to manage this process and key issues in order to enable the organization to transform tacit knowledge into explicit knowledge and make it available and accessible company-wide (Clarke & Rollo, 2001; Gordon, 1999).

### Information Technology

Nonaka, Reinmoller and Toyama (2001, p. 829) identify several problems with the current use of software tools as the challenge for IT is to aid a dynamic process of knowledge creation, not a stagnant process of information management

and often emphasises the efficiency of processing existing information rather than creating new knowledge. Furthermore, current IT-based KM mainly focuses on knowledge that has been articulated in some tangible form and fails to deal with implied knowledge such as hunches and gut feelings. Less or no emphasis is placed on new visions and innovation as these KM software tools extract profits through knowledge economies of scale by re-using existing knowledge only (Marwick, 2001). KM that relies only on such packaged tools, cannot gain sustainable competitive advantage due to the rapid dissemination of best practice in IT (Davenport & Prusak, 1998).

A long-term view of fostering the knowledge-base competence of an organization is required when selecting KM software tools and IT is needed that aids an effective and efficient knowledge-conversion process while increasing the swiftness and ease of switching from one such process to another (Yu, Kim, & Kim, 2004).

## Knowledge Work

KM is defined in this chapter as a framework for designing an organization's goals, structures and processes so that the organization can use what it knows to learn and to create value for its customers and community (Choo, February 2000). In addition to this framework, organizations must take key strategic steps to define and quantify the source and nature of the bodies of knowledge that need to be included in the KM framework (Wilson & Frappaolo, 1999). The organization must protect itself from knowledge leaving the organization in order to optimally use what it knows across all perspectives – vision and strategy, roles and skills, policies and procedures and tools and platforms (Holloway, 2000; Lindvall, Rus, Jammalamadaka, & Thakker, 2001). An understanding of knowledge in organizations, the modes and context of conversion of knowledge and the technologies used in this conversion are tactical approaches to knowledge creation. A strategic knowledge creation solution encompasses all of these steps in one seamless and complete procedure for knowledge work (Hoffmann, Loser, Walter, & Herrman, 1999; Kothuri, May 2002; Marwick, 2001; Vequist & Teachout, 2006).

According to Naisbitt (1982, as quoted by Nickols, 2000), white-collar workers first outnumbered blue-collar workers in the USA in 1956 where the ratio of manual workers to knowledge workers was 2: 1 in 1920 and 1: 2 by 1980. The number of knowledge workers in the computer industry in the USA was estimated at 72% based on a testimony before a senate sub-committee (Nickols, 2000). This new type of worker requires a different type of management (Edersheim, 2007; Frappaolo, 2006; Garvin, 1998; Westhuizen, 2002) and although knowledge is not new, the recognition of knowledge as a corporate asset, is new (Davenport & Prusak, 1998; Hoffmann, Loser, Walter, & Herrman, 1999; Stewart, 1997). Davenport (1998) concludes that there is currently a greater need than in the past to optimize organizational knowledge and to obtain as much value as possible from it. Table 1 summarises the definition of manual work and knowledge work (Nickols, 2000).

A major difference between knowledge work and manual work is that knowledge work is information-based and manual work is materials-based. A manual work process, regardless of how much skill and knowledge is required of the worker, consists of converting materials from one form to another with tangible results. Knowledge work, on the other hand, consists of converting information from one form to another with frequently intangible results (Nickols, 2000; Stewart, 1997). This difference in work output informs how these workers will be performance managed and how they will be measured (Edersheim, 2007; Krogh, Ichijo, & Nonaka, 2000).

## The Learning Organization

Senge (1990) presented tools and ideas for the learning organization during the early 1990s. He claimed that learning organizations can be built "where people continually expand their capacity to create results they truly desire, where new and expansive patterns of thinking are nurtured, where collective aspiration is set free and where people are continually learning how to learn together" (Senge, 1990, p. 3). He identified five key dimensions for building organizations that can truly *learn* namely systems thinking, personal mastery, mental models, building shared vision and team learning.

The learning organization creates an environment where the behaviours and practices involved in continuous learning, are actively encouraged and facilitated. This process of continuous learning includes the exchange of both explicit and implicit knowledge (Asgarkhani, 2004; Garvin, 1998; Kotelnikov, 2001; Marwick, 2001; Salisbury, 2003; Senge, 1990; Vequist & Teachout, 2006). Compared to a learning organization, a coaching organization goes beyond this exchange and also focuses on how to unlock the inner power of people in the organization in order to make them innovators and self-leaders (Hoffmann, Loser, Walter, & Herrman, 1999; Kotelnikov, 2001). The next stage entails moving from a teaching organization where both learning and teaching take place to a coaching organization where coaching is added to the learning and teaching dimensions.

Kotelnikov (2001) defines unique advantages of such a coaching organization. The first advantage entails ensuring enhanced development of individuals and collective tacit knowledge through cross-coaching conversations. The second advantage is creating enhanced teamwork through facilitating a better understanding among team members and fostering a deeper integration of their activities (Agostini, Albolino, Boselli, Michelis, Paoli, & Dondi, 2003). The third advantage is ensuring improved development of people and the utilisation of their talents by building their personal capabilities (Yu, Kim, & Kim, 2004) and the last advantage is creating better employee empowerment by developing them as self-leaders (Edersheim, 2007).

*Table 1. Manual work vs. knowledge work (Nickols, 2000)*

| Manual work | Knowledge work |
|---|---|
| Materials-based | Information-based |
| Manual work process consists of converting materials from one form to another | Knowledge work process consists of converting information from one form to another |
| Tangible results | Often intangible |
| Works *with* knowledge, information | Works *with* and *on* knowledge, information |
| Working behaviours are public | Working behaviours are private |
| Visibility of working is high | Visibility of working is low |
| Results almost always immediate | Results are not so apparent and rarely immediate |
| Relatively simple matter to observe linkage between manual worker, tools or equipment being used and materials being processed | Linkage between behaviour and results not apparent |
| Locus of control over work with manager | Locus of control over work shifted to worker |
| Political and positional balance of power | Political and professional balance of power |
| Worker is focus of control | Work is focus of control |
| Compliance is measure of performance | Contribution is measure of performance |
| Efficiency, the ability to get things done is key measure | Effectiveness, the ability to get the right thing done is key measure |

## Knowledge Management Barriers

Organizations in the new economy deal with two major management tasks given the dynamics of hyper-competition and globalization: the resulting re-invention of businesses and pressure for innovation, as well as the related re-alignment of corporate activity (Barclay & Murray, 1997; Kothuri, 2002). Further changes in this landscape that organizations need to deal with include global integration (Kotelnikov, 2001; Kothuri, 2002) and geographic distribution associated with the globalisation of markets and growth in organizational scope – organizations have to do more with less and at an accelerating pace of change (Barclay & Murray, 1997; Gordon, 1999).

Obstacles for KM reveals three main groups of factors when staff attrition due to downsizing and reengineering, growing knowledge-intensity of products and services and the revolution in IT are considered (Barclay & Murray, 1997; McCullough, 2005).

The first factor refers to flaws in the organizational KM process (Murray, 2004), the second factor points to misconceptions of the role of technology in the process (Moteleb & Woodman, 2007) and the third factor is a disregard of the importance of the human factor in realising a successful knowledge managing and knowledge-sharing culture (McCullough, 2005).

Van der Westhuizen (2002) describes some of the opponents of successful KM as follows:

- *The empowered middle manager*. A middle manager that forms part of a cross-functional value chain running an autonomous operation as if his/her small section is the whole business, creates internal competition rather than focusing on the external competitors;
- *The knowledge management software vendor*. The software vendor becomes an enemy of knowledge management if software products are sold as if it is a solution.

In addition to obstacles of knowledge management that organizations deal with, there are also barriers to sharing knowledge as summarised in Table 2. These barriers are organization specific and include organizational hierarchy, geographical barriers, human nature and personality.

Motivating users of a KM system to contribute their knowledge to the system is critical for the success of the overall KM initiative (Muller,

*Table 2. Summary of knowledge management barriers*

| | **Knowledge management barriers** |
|---|---|
| Hierarchy (Andrew & Westhuizen, 1999; Kotelnikov, 2001) | • Implicit assumption that wisdom accrues to those with the most impressive organizational titles<br>• Inequality in status among the participants in a knowledge sharing session is a strong inhibitor for tacit knowledge sharing, especially when aggravated by different frameworks of reference |
| People and Human Nature (Frappaolo, 2006; Godbout, 1999; Krogh, Ichijo, & Nonaka, 2000) | • Knowledge transfer is often a case of *who* you know versus *what* you know<br>• Sharing one's best thinking, data, understanding and opinion with others diminishes one's personal competitive advantage<br>• Improving by generating new ideas continuously while getting rid of old conventional ideas is difficult due to resistance to change<br>• Use of other people's knowledge often presents a problem as the notion of "it-was-not-invented-here" is difficult to break down |
| Geographical barriers (Kotelnikov, 2001; Marwick, 2001) | • Distance – both physical and time – is a strong inhibitor for tacit knowledge sharing. |
| Personality (Marwick, 2001; McCullough, 2005; Muller, Spiliopoulou, & Lenz, 2005) | • Strong preference for analysis over intuition discourages employees to offer ideas without hard facts to back it up<br>• Penalties for failure discourage experimentation |

Spiliopoulou, & Lenz, 2005). In view of the barriers to sharing knowledge, the motivation of people to share their knowledge remains a challenge (Frappaolo, 2006; Muller, Spiliopoulou, & Lenz, 2005). Any KM initiative in an organization must address and alleviate these barriers to optimize knowledge sharing as it forms the basis of value creation and leveraging of the intangible assets of the organization.

## KNOWLEDGE MANAGEMENT AND INNOVATION

Organizations today realize that leveraging the already-accumulated corporate intellectual property is by far the lowest-cost way available to increase their competitive standing (Frappaolo, 2006; Koenig, 1998; Stewart, 1997; Tsai & Chen, 2007; Wind & Main, 1998) and to harness innovation (Krogh, Ichijo, & Nonaka, 2000; Leonard & Straus, 1997; Nonaka & Takeuchi, 1995). KM practices make bottom line differences to all types of organizations (Frappaolo, 2006) and promote the methods and technologies that facilitate the efficient creation and exchange of knowledge at an organization wide level (Krogh, Ichijo, & Nonaka, 2000; Lee, Kim, & Yu, 2001; Tsai & Chen, 2007).

In such a knowledge-based economy with knowledge creation and innovation as the outcome, the infrastructure supporting KM must not be forgotten, as the components of intellectual capital, namely know-how and experience, must be channeled and made available (Frappaolo, 2006). Knowledge that is accumulated externally is shared widely internally, stored as part of the organization's knowledge base and utilised again to develop new technologies, products and services stimulating continuous innovation that in turn leads to competitive advantage (Nonaka & Takeuchi, 1995).

## KNOWLEDGE MANAGEMENT SOLUTION SELECTION

An interpretive case study was concluded at a large telecommunication corporate within the South African context and the issues described in the previous sections of this chapter were considered. Emphasis was placed on an understanding of the key characteristics of a KM solution by exploring and describing the nature of KM. Potential research participants were selected based on their area of expertise and the knowledge work that they perform, by utilising both theoretical and convenient sampling (Whitman & Woszcynski, 2004).

These criteria were then applied across different management (job grade) levels and leadership styles in the organization to obtain different perspectives from a global, as well as local context. By applying the criteria as defined in Table 3, research participants (referred to as RP) with different profiles were selected, as depicted in Table 4. In order to ensure that all research participant profile criteria were addressed, as well as different combinations of criteria, eight participants were identified. This selection ensured that different perspectives on the research questions were obtained in order to contribute to the richness of interview data. Based on the findings of this study, a list of key characteristics that a KM solution must comply with was collated.

The criteria and rationale used to identify the research participants are summarized in Table 3 and both these components informed the typical profile of the research participants. The main criteria that informed the participant profile were environments where knowledge and knowledge sharing are key priorities, behaviors regarding knowledge sharing and some knowledge on human resource aspects in order to obtain input on the human-computer interface and related issues. Furthermore, research participants with a technical background, who understand systems with broad business process knowledge, as well as a

*Table 3. Identification of research participants*

| | Criteria | Rationale | Typical participant profile |
|---|---|---|---|
| 1 | Technical / technology / systems background | Utilise their understanding of systems and systems architecture | Information Systems and Network Group (engineering) participants |
| 2 | Human resources / behavioural background | Obtain input in the human computer interface and any issues regarding this interface; capturing of implicit knowledge | Organizational Development (Human Resources) participants |
| 3 | Environments where knowledge and knowledge sharing are key for success; environments where these key assets leave the organization's premises every day | Determine issues regarding knowledge sharing within the whole company and regarding key specialist skills and knowledge | System specialists, business architecture and system architecture specialists |
| 4 | Job grade | Obtain input from different levels of work and different operational levels; obtain input from different management and leadership styles | Different levels of participants with regards to job grades e.g. executives, general managers, senior managers, etc. |
| 5 | Broad business, people, process and system knowledge | Obtain input on "big picture" issues / requirements regarding business, people and knowledge management | Generalists, participants required to integrate all management aspects in order to deal with their respective departments |

systems and business architecture background, informed the profile.

## Knowledge Management Solution Classification

In a previous section of this chapter, a classification method for KM technologies was referenced consisting of generation of knowledge, storing, codification and representation of knowledge, knowledge transformation and knowledge use and lastly, transfer, sharing, retrieval, access and searching of knowledge (Antonova, Gourova, & Nikolov, 2006). This classification was utilised to group characteristics identified from the literature and to collate it with the characteristics obtained from the research participant interviews.

Some characteristics are relevant to more than one classification dimension and in such instances a primary grouping (■) and a secondary allocation (□) have been defined.

### Classification 1: Generation of Knowledge

The first classification dimension is generation of knowledge which comprises of activities for

*Table 4. Research participant profile*

| | Criteria (referTable 5-1(a)) | RP1 | RP2 | RP3 | RP4 | RP5 | RP6 | RP7 | RP8 |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Technical / technology / systems background | √ | √ | | √ | √ | √ | √ | |
| 2 | Human resources / behavioural background | | | √ | | | √ | | |
| 3 | Environments where knowledge and knowledge sharing are key for success | √ | √ | √ | √ | √ | √ | √ | √ |
| 4 | Job grade (5 = executive; 4 = general manager; 3 = senior manager, 2 = team leader) in global group (G) and in local operation (O) | G5 | O3 | G4 | O3 | O4 | O2 | O4 | O5 |
| 5 | Broad business, people, process and system knowledge | √ | | √ | | √ | | √ | √ |

knowledge creation, acquisition and capturing as shown in Table 5.

With regard to *knowledge content generation*, authoring, knowledge creation, knowledge objects and content validation are important. Authoring encompasses sources of explicit knowledge line documents, manuals, proposals, e-mail messages, etc., as well as implicit knowledge. Knowledge creation refers to the generation of new knowledge through thinking or reasoning and knowledge objects encompass an object of structured information, un-structured information, insight, facts, practical and theoretical experience, as well as best practice to be stored and manipulated. Content validation points to the validation and auditing of knowledge objects when they are captured and resolves data and information conflicts.

*Knowledge discovery* allows the generation of knowledge through knowledge harvesting, content evolution and ensuring that this is made easily accessible and available via various distribution bearers. Knowledge harvesting is the process of pro-actively facilitating the harvesting and capturing of ideas. Knowledge, expertise and content evolution refer to the creation of knowledge by combining new sources of knowledge, optimising feedback loops and by re-applying and re-creating knowledge.

*Data capturing tools* enable the capture of knowledge and consists of characteristics such as externalization, maintenance and update, storing and content capture. This toolset ensures that knowledge in the repository is maintained by providing mechanisms to refresh data and information. *Externalization* refers to the connection of information source to information source and to creating interrelationships while *maintenance and update* ensure that knowledge objects in the KM system stays valid and recent.

It includes a formal change process for captured knowledge and also provides versioning of content. *Storing* supports knowledge creation through exploitation, exploration and codification and *content capture* facilitates the capture of knowledge through mechanisms such as a keyboard, optical character recognition, bar code identification and real-time location sensors.

*Table 5. Characteristics for the generation of knowledge*

| Generation of knowledge | | Source | |
|---|---|---|---|
| **Dimension** | **Characteristic** | **Literature** | **Research participant interview** |
| Knowledge content generation | Authoring | ■ | ■ |
| | Knowledge creation | ■ | |
| | Knowledge objects | ■ | |
| | Content validation | | □ |
| Knowledge discovery | Knowledge harvesting | ■ | ■ |
| | Content evolution | ■ | ■ |
| | Various distribution bearers | | □ |
| Data capturing tools | Externalisation | ■ | ■ |
| | Maintenance and update | | ■ |
| | Storing | □ | □ |
| | Content capture | | ■ |
| | Refresh data and information | | ■ |

■ primary grouping □ secondary grouping

## Classification 2: Storing, Codification and Representation of Knowledge

The second classification dimension is storing, codification and representation of knowledge, which comprises of activities contributing to effective storage, human-readable knowledge and the organization of knowledge, as depicted in Table 6.

The *storing, codification and representation of knowledge* classification dimension focuses on KM processes and the quantity, quality, accessibility and representation of the acquired knowledge. Several *technologies for storage* consisting of several relevant characteristics have been identified in the literature and obtained from the research participant interviews. Archiving refers to archiving ability based on certain criteria and business rules specified by knowledge base administrators, while capability is the characteristics indicating the potential to influence action, pro-

*Table 6. Characteristics for storing, codification and representation of knowledge*

| **Storing, codification and representation of knowledge** | | **Source** | |
|---|---|---|---|
| **Dimension** | **Characteristic** | **Literature** | **Research participant interview** |
| Technologies for storage | Archiving | ■ | ■ |
| | Capability | ■ | |
| | Customization | | □ |
| | Flexibility | □ | □ |
| | Distributed architecture | | ■ |
| | Security | ■ | ■ |
| | Hardware platform independent | | ■ |
| | Storing | ■ | ■ |
| | Application scalability | | □ |
| | Back-up and housekeeping | | ■ |
| Human-readable knowledge | Heuristic | ■ | ■ |
| | Content capture | | □ |
| | Content upload | | □ |
| | Content validation | | ■ |
| Knowledge organization | Classification | ■ | ■ |
| | Customization | | ■ |
| | Date and time stamp | | ■ |
| | Externalization | □ | □ |
| | Flexibility | ■ | ■ |
| | Indexing | ■ | ■ |
| | Internalization | □ | □ |
| | Application scalability | | ■ |
| | Knowledge gap identification | | ■ |
| | Appropriateness | | □ |
| | Content upload | | ■ |
| | Taxonomy | | ■ |

■ primary grouping □ secondary grouping

cessing, decision-making and application. Customization points to the configuration and set up of the system reflecting the specific organization or user context ('personalization'). Flexibility refers to the characteristic regarding the handling of various media.

Security is an important characteristic that addresses physical and logical security, since knowledge is such a valuable asset, while storing in this context refers to the commitment of knowledge to the data warehouse, knowledge warehouse, lessons learnt knowledge base or the data mart. Some characteristics like application scalability, back-up and housekeeping, hardware platform independence and distributed architecture ensure that the KM application can be adapted to the size, application and hardware configuration of an organization while ensuring accessibility and proper housekeeping of the physical infrastructure.

*Human-readable knowledge* consists of the characteristic set including heuristic and content capture, upload and validation. Heuristic means that the solution should constantly learn about its users and the knowledge it possesses as it is used. Its ability to provide a knowledge seeker with relevant knowledge should therefore improve over time. Content capture, upload and validation refer to the characteristics that ensure that knowledge is committed to the knowledge repository based on certain rules.

Knowledge organization includes classification, customization, externalization, flexibility, indexing, internalization, appropriateness, taxonomy and content upload. *Classification* handles content management according to the context of the organization, while *customization* refers to the configuration and set-up of the system reflecting the specific organization or user context. *Externalization* refers to the connection of information source to information source and creating interrelationships, as well as the integration of organizational interdependencies. *Flexibility* ensures that knowledge objects of any form as well as different subjects, structures, taxonomies and media can be included, while indexing means content management according to the context of organization. Corporate *taxonomy* refers to the definition of how the knowledge is stored, where *internalization* involves the extraction of knowledge from the external repository and subsequent filtering ensuring greater relevance and *appropriateness* to the knowledge seeker.

Knowledge gap identification is a feature that allows a knowledge user to identify areas of the knowledge repository that is utilized significantly vs. underutilization, as well as to identify areas where more *content can be uploaded* and populated in the knowledge repository. Two features, namely date and time stamp and application scalability, refer to the tagging of knowledge to track 'recency' and the mechanism to add more knowledge areas respectively.

## Classification 3: Knowledge Transformation and Knowledge Use

Classification dimension three is depicted in Table 7, being knowledge transformation and knowledge use. This refers to the fact that once knowledge has been acquired it cannot be used in its raw form and must be transformed in order to become a valuable knowledge asset. *Knowledge transformation* ensures that the knowledge conforms to the format of the target repository and consists of two secondary allocated characteristics namely search and retrieval and access to information, encompassing the transformation of end-user collected data and information before it is committed to the knowledge repository.

*Knowledge reconstruction* ensures that knowledge is presented in the particular reasoning method that is used by the KM system, e.g. editing into case formats to support case-based reasoning or a business intelligence dashboard.

*Knowledge use and retrieval* encompasses expert systems, decision support systems, visualisation tools and knowledge simulation. This classification dimension consists of processes of

applying expertise to knowledge, the ease of learning and teaching how to utilize the KM system through a user-friendly user interface, which is a secondary characteristic allocation in this dimension. Application includes the timely availability of organizational and individual memory and just in time learning, as well as inter-group knowledge access. Cognition refers to the connection of knowledge to process and suggestive, another secondary allocation in this dimension, proposes knowledge associations that the user is not able to make through the user interface.

## Classification 4: Transfer, Sharing, Retrieval, Access & Searching of Knowledge

The fourth classification dimension is transfer, sharing, retrieval, access and searching of knowledge, which comprises of knowledge access, searching, collaboration and sharing characteristics, as shown in Table 8. With regard to *knowledge access and transfer*, only primary allocation of characteristics and features consisting of content delivery, access to information, multi-language support, user-friendly user interface and various distribution bearers, were concluded. Access to information is facilitated via a user-friendly user interface and the delivery of content consisting of the gathering of user-information and delivering appropriate content to meet specific user needs.

*Collaboration* includes person to person as well as team collaboration features encompassing the support of the knowledge sharing process through a social network analysis and collaborative tools, as well as collective insights across operations and different geographical locations. Workflow enablement connects people in different ways supporting increased work performance and productivity.

*Knowledge sharing* includes intermediation - the connection of people to people, i.e. bring together those who are looking for a certain piece of knowledge and those who are able to provide this piece of knowledge – and internalization, the connection of explicit knowledge to people or knowledge seekers.

For the *search and find* dimension accessibility, appropriateness, context-sensitivity, heuristic, suggestive, relevance, search and retrieval, timeliness and responsiveness are important. A multi-language user interface feature supports search and find. Accessibility provides an effective search and retrieval mechanism for locating relevant information, while appropriateness indicates the

*Table 7. Characteristics for knowledge transformation and knowledge use*

| **Knowledge transformation and knowledge use** | | **Source** | |
|---|---|---|---|
| **Dimension** | **Characteristic** | **Literature** | **Research participant interview** |
| Knowledge transformation | Search and retrieval | □ | □ |
| | Access to information | | □ |
| Knowledge reconstruction | User sensitive | ■ | ■ |
| Knowledge use and retrieval | Application | ■ | |
| | Cognition | ■ | ■ |
| | Suggestive | □ | □ |
| | Expertise applying process | ■ | ■ |
| | System learning agility | | ■ |
| | User-friendly user interface | | □ |

■ primary grouping □ secondary grouping

appropriateness level based on the filtering of multiple inputs for the same knowledge object.

Context-sensitivity refers to the feature that the solution should be able to understand the context of the knowledge requirement and tailor responses accordingly. Heuristic indicates that as the solution responds to many requests on a particular subject, it should learn how to assist multiple users in more depth on that subject, while suggestive deduces what the knowledge seeker's knowledge needs are.

Relevance indicates the significance of knowledge objects retrieved, and search and retrieval are primarily concerned with enhancing the interface between the user and information, knowledge sources, user-friendliness and learning agility. Timeliness and responsiveness refer to the feature that knowledge must be available whenever it is needed with almost immediate retrieval and presentation cycles.

## Knowledge Management System Characteristics Application

A list of KM system characteristics were extracted from the literature, obtained from research participant interviews and collated and discussed in the previous sections. The characteristics were

*Table 8. Characteristics for transfer, sharing, retrieval, access and searching of knowledge*

| Transfer, sharing, retrieval, access and searching of knowledge | | Source | |
|---|---|---|---|
| **Dimension** | **Characteristic** | **Literature** | **Research participant interview** |
| Knowledge access and transfer | Content delivery | ■ | ■ |
| | Access to information | | ■ |
| | Multi-language support | | ■ |
| | User-friendly user interface | | ■ |
| | Various distribution bearers | | ■ |
| Person to person and team collaboration | Collaboration | ■ | ■ |
| | User sensitive | □ | □ |
| | Expertise applying process | □ | □ |
| | Refresh data and information | | □ |
| | Workflow enabled | | ■ |
| Knowledge sharing | Intermediation | ■ | ■ |
| | Internalisation | ■ | ■ |
| Search and find | Accessibility | ■ | |
| | Appropriateness | | ■ |
| | Context sensitivity | ■ | ■ |
| | Heuristic | □ | □ |
| | Multi-language support | | □ |
| | Suggestive | ■ | ■ |
| | Relevance | | ■ |
| | Search and retrieval | ■ | ■ |
| | Timeliness | ■ | ■ |
| | Responsiveness | | ■ |

■ primary grouping □ secondary grouping

grouped using a classification mechanism for technological solutions (Antonova, Gourova, & Nikolov, 2006) according to the KM processes, and primary and secondary groupings were identified.

This list of grouped and defined characteristics can be applied in two ways. The first is as a specification of the requirement of a KM system before technology is acquired. The second way is to evaluate existing technologies for compliance to KM solutions, to identify gaps in existing technologies and to assess suitability before purchasing new technology.

The set of characteristics compiled based on the nature of knowledge and KM, can be used to evaluate technologies in order to establish whether it will be suitable as KM applications. Such a typical checklist is depicted in Table 9, where one dimension, namely *person to person and team collaboration,* with the characteristics collaboration, user-sensitivity, expertise applying process, refreshing of data and information and workflow enablement, was used as a requirement of a KM solution. Three technology solutions, namely eGain Knowledge, SharePoint and video-conferencing, were evaluated against these characteristics to establish whether it complies with requirements for a KM solution. From the result of the evaluation reflected in Table 9, a combination of eGain Knowledge and video-conferencing will comply with all the requirements listed for person to person and team collaboration, and a combination of these two technologies can then facilitate KM according to this example.

Merriam-Webster's on-line dictionary (2007) defines a *characteristic* as "*a distinguishing trait, quality or property*" and this broad definition guided the collation of the set of characteristics shown in Table 10 as defined in previous sections of this chapter. Each characteristic is listed showing the distinguishing feature of a KM system, a description of the distinguishing characteristic and an example clarifying the characteristic where appropriate. According to Offsey (1997), KM systems share many basic features although a specific KM system would be informed by the specific organization. The list of characteristics depicted in Table 10 is such a list of common, basic features that knowledge management solutions share.

These characteristics may inform the description of a typical knowledge management system architecture from a knowledge management point of view. This architecture description uses multiple, concurrent views as the initial description of a KM architecture, and such an initial architectural prototype can be evolved to become a real system through several iterations.

## FUTURE RESEARCH POSSIBILITIES

An issue accentuated by this research is the evaluation of technologies suitable for knowledge man-

*Table 9. Knowledge management system characteristics checklist (illustration only)*

| KMS characteristic checklist | | Technology | | |
|---|---|---|---|---|
| **Dimension** | **Characteristic** | **eGain Knowledge** | **Share-point** | **Video-conferencing** |
| Person to person and team collaboration | Collaboration | √ | √ | √ |
| | User sensitive | √ | | |
| | Expertise applying process | | | √ |
| | Refresh data and information | √ | √ | |
| | Workflow enabled | √ | √ | |

*Table 10. Knowledge management system characteristics*

| KM Solution Characteristics | | |
|---|---|---|
| **Characteristi** | **Description** | **Example** |
| Accessibility | Knowledge is a condition of access to information via different mechanisms (e.g. web based) and locations. | Role of IT is to provide effective search and retrieval mechanisms for locating relevant information. |
| Application | Timeous availability of organizational and individual memory, just in time learning. Inter-group knowledge access | Expert systems, rapid application of new knowledge through workflow systems |
| Appropriateness | Indicates the appropriateness level based on the filtering of multiple inputs for the same knowledge object | Prioritised search results |
| Archiving | Refers to archiving ability based on certain criteria specified by knowledge base administrators | Archiving of project specific information |
| Authoring | Encompasses knowledge objects i.e. sources of explicit (e.g. documents, manuals, proposals, email messages) or implicit knowledge (e.g. people) | Supported by standard authoring tools like word processors and database management systems (DBMS) |
| Capability | Knowledge is the potential to influence action, processing, decision-making, application. | Role of IT is to enhance intellectual capital by supporting development of individual and organizational competencies. |
| Classification | Handles content management according to context of organization | Corporate taxonomy as knowledge map supported by classifying and indexing tools |
| Cognition | Refers to connection of knowledge to process | Functions of systems to make decisions based on available knowledge |
| Collaboration | Support the knowledge sharing process through a social network analysis and collaborative tools; collective insights across operations and different geographical locations; multi-dimensional collaboration | Facilitate communication between users, collaboration among users and workflow management |
| Content capture | Enable direct capture of information via front-end or user interface | Bar-code scanning |
| Content delivery | Personalisation involves gathering of user-information and delivering appropriate content to meet specific user needs aligned to user profile | Electronic bulletin boards, through portals is knowledge distributed as needed by different applications |
| Content evolution | Knowledge creation, combining new sources of knowledge, optimize feedback loops and re-apply, re-create | Data mining and learning tools |
| Content upload | Upload documents in various formats into the knowledge repository | Operations manual in.pdf format |
| Content validation | Validation and approval of content prior to making it available generally | Site administrator or editor |
| Context sensitivity | Solution should be able to understand the context of the knowledge requirement and tailor response accordingly | Should be able to understand and respond differently between *animal reproduction* and *document reproduction* |
| Creation | Refers to generation of new knowledge through thinking or reasoning | Brainstorming |
| Customisation | Configuration and set-up of solution aligned to organizational processes, requirements and architecture | Branding |
| Date and time stamp | Refers to date and time knowledge was committed to knowledge base | - |
| Distributed architecture | Ensures that the knowledge management application can be adapted to the size, application and architecture configuration of an organization | - |

*continued on following page*

*Table 10. Continued*

| | | |
|---|---|---|
| Externalization | Refers to the connection of information source to information source and creating interrelationships; integration of organizational interdependencies | Focuses on explicit knowledge and provides a means to capture and organise this knowledge into a knowledge repository |
| Flexibility | Solution should be able to handle knowledge of any form as well as different subjects, structures, taxonomies and media | If knowledge seeker wants to learn about gramophone records, it should supply knowledge on the technology as well as purchasing trends and examples of famous recordings |
| Hardware platform independent | Application should be scalable and applicable to oganisational specific hardware configuration | - |
| Heuristic | Solution should constantly learn about its users and the knowledge it possesses as it is used i.e. continually refine itself as a user's pattern of research is tracked by the system. Its ability to provide a knowledge seeker with relevant knowledge should therefore improve over time | If the solution responds to many requests on a particular subject, it should learn how to assist multiple users in more depth on that subject |
| Indexing | Handles content management according to context of organization, corporate taxonomy | Corporate taxonomy as knowledge map supported by classifying and indexing tools |
| Intermediation | Refers to the connection of people to people i.e. bring together those who are looking for a certain piece of knowledge and those who are able to provide this piece of knowledge | Primarily positioned in the area of tacit knowledge based on its interpersonal focus |
| Internalisation | Refers to the connection of explicit knowledge to people or knowledge seekers | Involves extraction of knowledge from the external repository and subsequent filtering ensuring greater relevance to knowledge seeker |
| Knowledge gap identification | Allows knowledge user to identify areas of the knowledge repository that is utilised significantly vs. underutilisation, as well as to identify areas where more content can be uploaded and populated in the knowledge repository | - |
| Knowledge harvesting | Pro-active facilitation of harvesting and capturing of ideas, knowledge, expertise | Knowledge harvesting workshops and focus groups, defining tangible knowledge and capturing it |
| Knowledge objects | Data is facts, raw numbers. Information is processed / interpreted data. Knowledge is personalised information. Knowledge is an object of structured information, un-structured information, insight, facts, practical and theoretical experience, as well as best practice to be stored and manipulated. | KMS will not appear radically different from existing IS, but will be extended toward helping in user assimilation of information. Role of IT involves gathering, storing and transferring knowledge. |
| Multi-language support | Refers to user specification of preferred language for user interface | - |
| Process | Knowledge is a process of applying expertise. | Role of IT is to provide link among sources of knowledge to create wider breadth and depth of knowledge flows. |
| Refresh data and information | Update of knowledge repository as new data and information becomes available | Mobile handset manual |
| Responsiveness | Knowledge must be available whenever it is needed with almost immediate retrieval and presentation cycles | Different time zone applicable in global companies |
| Scalability | Refers to independence of solution to size of organization | Major corporate vs. small and medium enterprise (SME) |
| Search and Retrieval | Primarily concerned with enhancing the interface between the user and information / knowledge sources, user-friendliness and learning agility | Help users better understand the information and knowledge available by providing subject-based browsing and easy navigation |
| Security | Have to address physical and logical security since knowledge is such a valuable asset | Implemented using inherent mechanisms in each tool or by using specific tools in addition to the existing system |

*continued on following page*

*Table 10. Continued*

| | | |
|---|---|---|
| Storing | Support knowledge creation through exploitation, exploration and codification | Technology enabled store or knowledge repository that can support less structured information |
| Suggestive | Solution should be able to deduce what the knowledge seeker's knowledge needs are | Suggest knowledge associations the user is not able to do |
| System learning agility | Refers to how easy it is to transfer the skill of using the system to the users | - |
| Taxonomy | Organise knowledge repository in a defined way in order to retrieve | Medical term taxonomy |
| Timeliness | Knowledge is available whenever it is needed. | Eliminates time-wasting distribution of information just in case it might be required |
| User-friendly user interface | Refers to ease with which user interface may be applied and whether interface usage is intuitive | - |
| User-sensitive | Solution should be able to organise the knowledge in the way most useful to the specific knowledge seeker | Should give knowledge relevant to knowledge seeker's current knowledge level, facilitating easier understanding |
| Various distribution bearers | Refers to utilization of different mechanisms for distributing knowledge or handling knowledge requests | Mobile phone Short Message Service (SMS) notification |
| Workflow enabled | Connects people in different ways supporting increased work performance and productivity | Notify users when any changes were made to the knowledge repository component that they are interested in |

agement or the optimization of an organization's existing technologies in achieving knowledge management objectives. These ideas could be explored further and a comprehensive checklist and process can be designed to facilitate this in organizations today.

Holm, Olla *et al.* (2006) suggest that a process must be followed in order to create a knowledge management system architecture. The objectives and overall strategy of the knowledge management system must be compiled first after which requirements for individual groups in the organization must be established (Holm, Olla, Moura, & Warhout, 2006; Marwick, 2001). Individual knowledge management tasks can be derived from the requirements that need to be structured in such a way that it provides a successful course of action for the organization (Holm, Olla, *et al.*, 2006; McManus, Wilson, & Snyder, 2004). The next step is to define the services, e.g. capturing tacit expertise and expert directories required as services to integrate processes, people and systems. The final step after the services architecture has been defined is to delineate the system architecture according to a layered approach building on to already existing infrastructure and services (Holm & Olla, *et al.*, 2006).

## CONCLUSION

Various dimensions of knowledge, namely explicit knowledge as well as implicit and tacit knowledge exist. Information becomes knowledge when it is retained as suitable representations of the relevant knowledge and when the value can be increased through analytical thought processes and by transforming knowledge into competencies, replicating know-how in the process. In order to optimally use its know-how, organizations must gain an understanding of the source and nature of knowledge in the organization to create a strategic knowledge solution for knowledge work and to foster continuous innovation. Such a strategic solution is as much about innovation, the know- edge management process, people and

an organization as it is about the technology that optimally supports it.

An understanding of explicit, implicit and tacit knowledge in organizations, the modes and context of conversion of knowledge and the technologies used in this conversion are tactical approaches to knowledge creation. A strategic knowledge-creation solution encompasses all of these steps in one seamless and complete procedure for knowledge work, and these requirements must be considered in the design of a KM system architecture.

KM tools are enhancements of existing technologies although true KM technologies differ in several aspects from traditional technologies based on the nature of knowledge and KM as discussed in the previous section. Some of these aspects include an understanding of the context of knowledge, organization of knowledge in the way most useful to the knowledge seeker, capability of the solution to constantly learn about its users and the ability to deduce what the knowledge seeker's knowledge needs are. Other aspects include access to sources of knowledge rather than the knowledge itself, support in user assimilation of information and providing effective search and retrieval mechanisms in locating relevant information. A variety of software tools are available providing support to KM systems through four main functions, namely the association of people to people, the association of information source to information source, the association of explicit knowledge to knowledge seekers and the association of knowledge to process.

KM systems share many basic features although a specific KM system would be informed by the specific organization. The set of characteristics obtained from the literature and from the research participant interviews are such a list of common, basic features that KM solutions share. This characteristic set can be utilised in two ways: the first is as a specification of the requirement of a KM system before technology is acquired, and the second way is to evaluate existing technologies for compliance to KM specific applications or to assess suitability before purchasing new technology.

The character of KM is about people, systems and processes in building core competencies through managing knowledge reserves. It supports enhanced learning and understanding through provision of explicit and implicit knowledge and aids the assimilation of information. KM is concerned with knowledge flows and the process of creation, sharing and distributing knowledge through organised access to content. It is inherently linked to the sharing of knowledge between individuals, who are not necessarily collocated, by means of collaborative processes creating new knowledge and aiding innovation. Technology is a key enabler of KM and enhances intellectual capital by supporting the development of individual and organizational competencies. It aids the gathering, storing and transferring of knowledge by providing access to sources of knowledge and knowledge itself through user-friendly capture and effective search and retrieval mechanisms enabling continuous innovation.

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