

CHAPTER 4

KNOWLEDGE MANAGEMENT FRAMEWORK

4. KNOWLEDGE MANAGEMENT FRAMEWORK

A knowledge management initiative requires a balanced integration of strategy, process, technology and people dimensions in order to enable the development of intellectual capital (see *Figure 14: Knowledge Management Framework*).

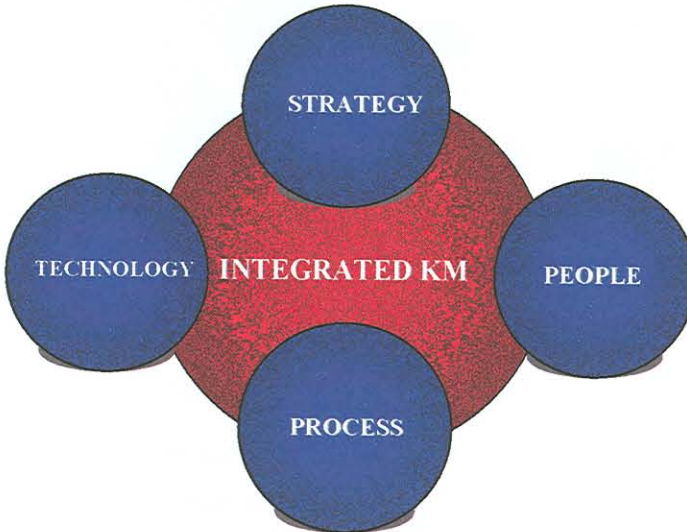


Figure 14: Knowledge Management Framework

A knowledge management project depends on:

- the formulation and communication of a knowledge management strategy;
- the facilitation of a knowledge paradigm amongst employees by using change management techniques;
- the selection of applicable technologies; and
- the development of knowledge related processes.

By placing an equal emphasis on and integrating these critical components the result of a knowledge management project is increased intellectual capital. None of these components operate independently. Each provides a different dimension of the knowledge management challenge.

Figure 15 illustrates the interaction between these components in the organisation, i.e. organisational strategy, process, people enablement and technology enablement. The higher the level of abstraction of the organisational strategy, the higher the level of innovation required and the greater the requirement for people involvement as opposed to technology enablement. On the other hand the more tangible the strategic consideration the higher the ability of technology to enable the execution of the strategy and the lower the level of human intervention required.

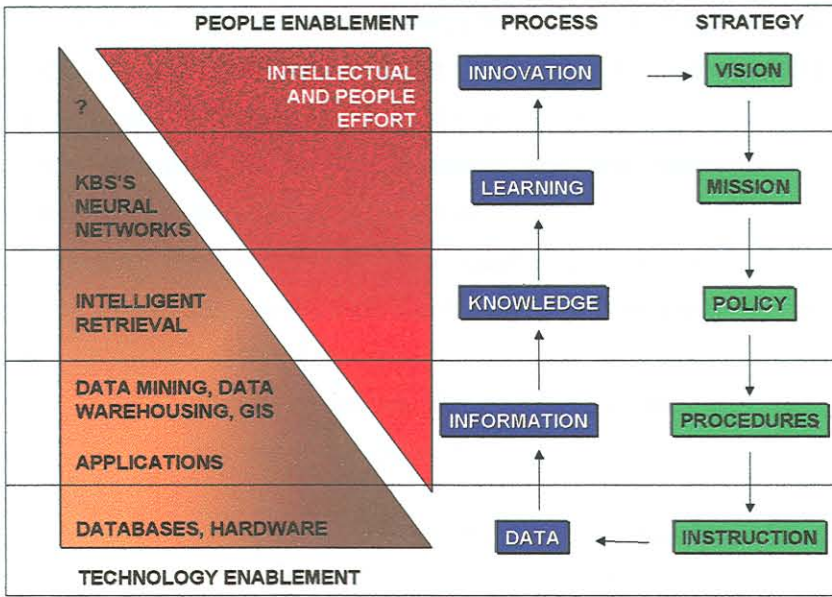


Figure 15: Interaction between Technology, People, Process and Strategy

An example of this is where the organisation’s strategy is translated into low-level business rules (instructions) that are incorporated into the information systems and applications to form part of daily transaction or data processing. These instructions are automated and do not require human inputs to be executed. On the other hand the high-level strategic decision-making that takes place around the organisation’s vision requires the intellectual input of experienced and innovative knowledge workers and cannot be substituted by a system.

This chapter provides a detail description of these four components of the knowledge management framework, i.e. strategy, people, process and technology.

4.1 Strategic Component

A knowledge management strategy is developed through:

- determining the knowledge management *direction*;
- establishing an *approach* to implementing a knowledge management initiative; and
- defining the *objectives* of the organisation’s knowledge management initiatives.

4.1.1 Different Strategies for Managing Knowledge (‘Direction’)

The organisation has to differentiate and choose between two distinct strategies for managing knowledge, focusing on knowledge utilisation versus knowledge creation [16] (see Figure 16: Different Knowledge Management Strategies).

A codification or *knowledge utilisation* strategy refers to an economic model similar to that followed by consulting companies such as Andersen Consulting. This approach involves an extensive investment in establishing the explicit or codified knowledge assets of the organisation, i.e. best practise and methodologies that can be leveraged and reused throughout the company. In turn it results in an increased return on the knowledge investment when reused by employees. The technology considerations involve developing a comprehensive repository where knowledge can be captured and accessed by all the employees in the company. Finally, the people complement of the organisation consists of knowledge workers who prefer utilising established methodologies above the creation of new knowledge.

Strategy	Knowledge Utilisation Strategy	Knowledge Creation Strategy
Examples	Andersen Consulting	McKinsey & Company
Economic Model	Invest in knowledge assets that can be reused	High fees to create customised solutions
Information Technology	Infrastructure to capture knowledge	Infrastructure to connect experts
Human Resources	People who can reuse knowledge	People to create solutions
Knowledge	Explicit knowledge	Tacit knowledge

Figure 16: Different Knowledge Management Strategies

The economic model of the personalisation or *knowledge creation* strategy entails charging higher fees in order to create highly customised solutions for clients as opposed to the reuse of standard best practices. McKinsey and Company is a good example of a company that pursue this strategy. The technology decisions focus on the tacit knowledge of the company. This involves providing high levels of connectivity between expert knowledge workers to facilitate knowledge creation, e.g. through video conferencing technology.

The selection of one of the given strategic directions depends on –

- ❑ the level of standardisation vs. customisation of the organisation’s products;
- ❑ the degree of maturity versus innovation of the organisation’s products; and
- ❑ the employees’ dependence on tacit or explicit knowledge sources to solve their problems.

Furthermore, the adoption of these strategies are complicated by the fact that:

- The existence of different business units in the organisation suggests that the two strategies could coexist within the same organisation. Yet, due to the differences between the two strategies on all the levels of the organisation, i.e. human resource, technology and strategy, it can only exist in different business units if they operate like total separate businesses with different strategies and people.
- The commoditisation of created knowledge over time brings an interesting dimension to the two strategic scenarios. The organisation needs to understand the balance between switching from one strategy to the other. This is emphasised because the continuous creation of knowledge without sufficient reuse can result in the reinventing of the wheel, whereas the continuous knowledge reuse without knowledge creation can lead to redundancy.

4.1.2 Knowledge Management Approach [7]

Successful knowledge management projects follow specific formal approaches. Some of these formal approaches described in literature include the alignment of knowledge management with corporate strategy, the valuation of knowledge and intellectual capital, and the establishment of a culture that enhances knowledge transfer and use.

In their research, authors found that although most knowledge management projects followed a specific approach, some sought to follow a mixed approach by adopting more than one of the following approaches:

- *Creating knowledge repositories* treats knowledge as an entity and attempts to preserve knowledge by storing it. This approach includes the implementation of well tested IT tools and approaches, to support broad knowledge management.
- *Improving knowledge access* focuses on the location of knowledge sources in an organisation and on providing access to these sources. This facilitates knowledge transfer and preservation amongst individuals. In addition, this approach includes the development of comprehensive supporting infrastructures, such as R&D facilities and specialised knowledge management support practices.
- *Enhancing the knowledge environment* focuses on preserving knowledge by establishing an environment conducive to more effective knowledge creation, transfer and use. This includes developing an organisational culture, promoting

and supporting knowledge sharing as well as implementing incentives to influence knowledge retention and -sharing related behaviours of employees.

- *Managing knowledge as an asset* focuses on managing knowledge as an asset, either by implementing means to measure the value of an organisation's knowledge assets, or by "managing specific knowledge intensive assets more effectively to improve their return" [7].

4.1.3 Knowledge Management Objectives

Different short-term objectives for knowledge management initiatives include:

1. Determining the required business value of the new knowledge management-driven paradigm.
2. Measuring the value of the company's knowledge capital.
3. Identifying the knowledge that is needed in the organisation.
4. Identifying available knowledge and its locations.
5. Determining the organisation's core competencies.
6. Assessing the opportunity and impact of transforming the organisation into a knowledge organisation.
7. Leveraging knowledge via technology by creating a knowledge repository.
 - Developing a process to capture knowledge and motivate participation.
 - Storing the internal tangible documentation for easy retrieval.
 - Assessing the potential of new and different information contributed to the knowledge base.
 - Establishing a discussion database, with recorded 'lessons learned' and reactions on it.
8. Improving the access to knowledge and the transfer among individuals ('yellow pages').
 - Research has found that the quality of tacit knowledge exchange is directly related to the level of face-to-face contact between the participants.
9. Enhancing the knowledge environment.
 - Creating the awareness that the knowledge embedded in customer- and other relationships, will, if shared enhance performance.

- Increasing the ease of use and the accessibility of knowledge as well as motivating the use of it.

10. Managing the knowledge asset.

- Assigning ownership to centres of excellence.
- Actively maintaining the knowledge by removing obsolete knowledge.

The knowledge management strategy should address the required knowledge management direction (see paragraph 4.1.1 on page 39), define the project approach and establish clear project objectives.

4.2 People Component

"In general, if the cultural soil isn't fertile for knowledge management, no amount of technology, knowledge content, or good project management practices will make the effort successful". [6]

The aspects to consider in relation to the people view of knowledge management are:

- the human factor in the knowledge management initiative;
- a structured approach to the employees of the organisation during a knowledge management initiative; and
- techniques for managing the soft issues with regards to knowledge management.

4.2.1 Human Factor

Designing the workplace for continuous improvement and learning requires consideration of and provision for the different cognitive learning styles in the organisation. Users with a verbal style will prefer conference calls, those with a visual style electronic mail, while employees with a tactile style face-to-face contact and relationship building [14]. The enablement established by a knowledge management initiative must address the different communication and learning needs that exist in the organisation.

Participation in, and especially contribution to knowledge management systems must become an integral part of the knowledge worker's daily routine. This is in part a technical issue, e.g. the provision of user-friendly systems that enables the capturing of knowledge once at the source as part of the normal work routines, but it is mostly a cultural challenge [18]. People have to understand that it is part of their jobs to add knowledge to the system and to find knowledge with knowledge maps ('yellow pages') within the organisation [22].

Unfortunately, knowledge management is not just about rolling-out a preferred system. It includes bridging the two worlds of human sciences and technology with transitional instruments such as change management and human interventions (see *Figure 17: Soft vs. Hard Factors of Knowledge Management*).

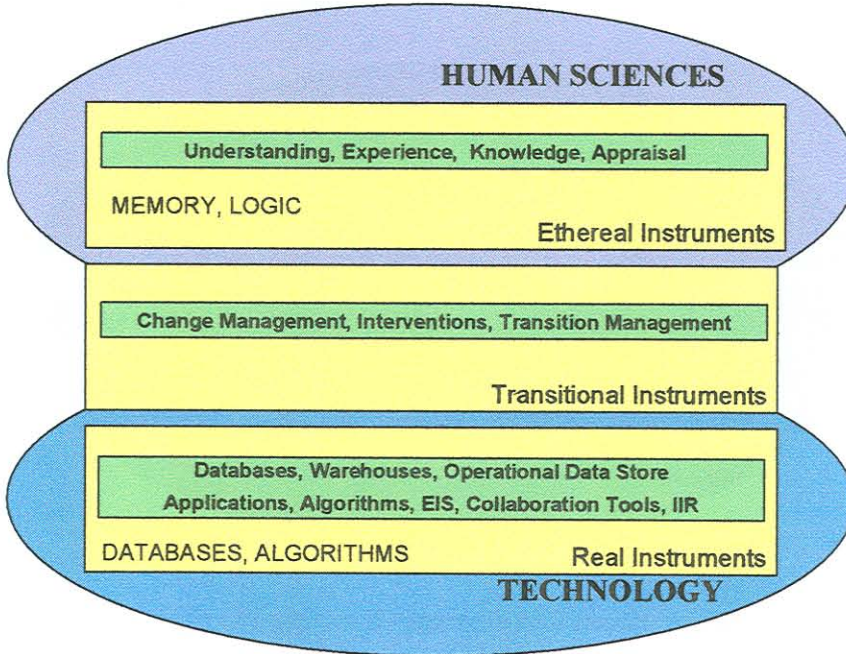


Figure 17: Soft vs. Hard Factors of Knowledge Management

4.2.2 Structured Approach to the People Component

A knowledge management initiative necessitates a structured change management process to create buy-in and to develop a culture that is conducive to the knowledge management mindset (see *Figure 18: Change Management Approach for Knowledge Management*).

A phased approach to managing the change introduced by a knowledge management initiative includes the following steps:

- ❑ *STEP 1:* Assess the mental models of the organisation, i.e. the corporate culture, management style and motivational practises;
- ❑ *STEP 2:* Create an awareness and understanding of the new rules and drivers of business amongst all the employees of the organisation;
- ❑ *STEP 3:* Mobilise a sharing culture by enabling the natural sharing that take place among communities with similar interests;

- **STEP 4:** Enable knowledge sharing across these different communities in the organisation to create a healthy knowledge market in the organisation; and
- **STEP 5:** Track and reward performances that reinforce knowledge sharing related behaviour and consequently enhance awareness, which in turn will repeat the change management cycle.

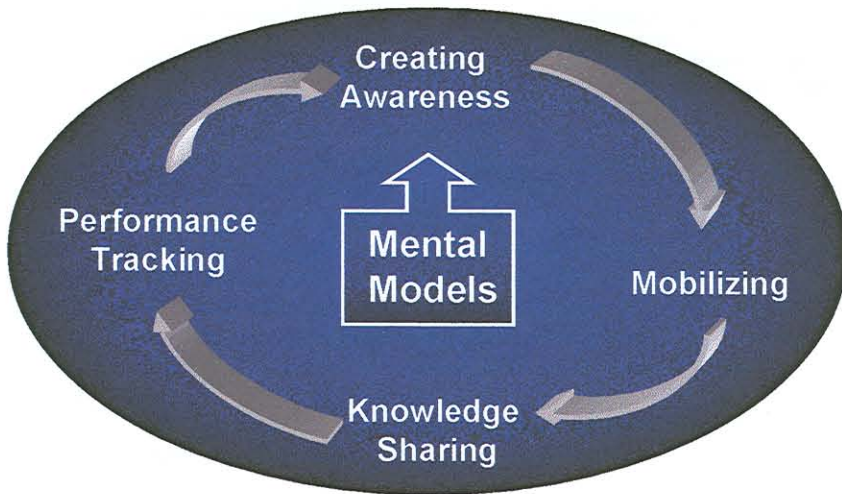


Figure 18: Change Management Approach for Knowledge Management

The following paragraphs discuss each step of the change management process in more detail.

STEP 1: Assess the Mental Models / Culture

Initially, the change management process starts with an assessment of the organisation’s culture, business paradigm, management style and motivational practises.

a) Culture Factors

Firstly, evaluate the organisation in terms of the positive and negative culture factors that can influence the implementation of a knowledge management system, as mentioned in *Table 2: Culture Factors* [34].

Table 2: Culture Factors

	Positive culture factors	Negative culture factors
Corporate values	Employees are our most important asset	Financial goals
Corporate beliefs	The people who do the work are in the best position for decision-making	Perception that organisation possesses knowledge and that people are expendable
Level of	Clear mission statement and company	Lack of general understanding of

	Positive culture factors	Negative culture factors
<i>Understanding</i>	goals are conducive for Knowledge Management	enterprise strategies
<i>Management</i>	Proactive management reacting to a changing environment	People provide their best work when under pressure
<i>Operational</i>	Cross-functional team culture for the exchange of ideas	Innovation is highly valued but using another's knowledge is unoriginal
<i>Culture drivers</i>	Openness, honesty, and a high trust culture for sharing knowledge	Knowledge hoarding for personal and professional gain
<i>Preparedness for Change</i>	Open for new opportunities	Fear of restricting opportunities, job loss and loss of own intellectual property Intolerance of ambiguity
	Trust in management	Political games Complacency and arrogance
	Understands and accepts the need for change	Failure to perceive the need for change

b) Business paradigm

The business paradigm of the organisation has a direct influence on the mental model of management and staff as well as on the adoption of the principles of knowledge management. The acceptance of a knowledge management project depends on the degree to which the knowledge paradigm has been accepted in the organisation. *Table 3: Business Perspective* illustrates the difference between the industrial and knowledge paradigms [34].

Table 3: Business Perspective

	Industrial Paradigm	Knowledge Paradigm
<i>People</i>	Cost generators or resources	Revenue generators
<i>Power Base</i>	Position in the organisation's hierarchy	Level of knowledge
<i>Business Struggle</i>	Physical labourers vs. managers	Professionals vs. managers
<i>Management's Responsibility</i>	Supervising subordinates	Supporting knowledge workers
<i>Information</i>	Means for control	Source for communication
<i>Value Offering</i>	Labourers transforming physical resources into tangible products (e.g. hardware)	Knowledge workers transforming knowledge into knowledge embedded products (e.g. software)
<i>Sources of Revenue</i>	Tangible (money)	Intangible (learning, R&D, new customers)
<i>Business Scarcity</i>	Financial capital	Time and knowledge workers
<i>Organisation Size</i>	Economy of scale	Economy of scope
<i>Stock Market Value</i>	Measure of tangible Assets	Reflection of intangible assets
<i>Economy</i>	Principle of diminishing returns	Possible increasing returns
<i>Customer</i>	Market driven	Personal networks driven

c) Management Style

The management style of the organisation is the most determining factor in assessing the potential of a knowledge sharing culture (see *Figure 19: Management Style* [39]). The success or failure of a knowledge management implementation depends on the organisation's knowledge potential.

Style	Characteristics	Knowledge Potential
Balkanized	Multiple 'Warlords' Mutual Suspicion Information Hoarding	Low
Monarchy	Top Down, Authoritarian Officially (Dis)Approved Subjects Sudden Death of Transgressors	Limited
Federation	Local Autonomy Global Framework Civilized Dispute Resolution Cooperation Based on Enlightened Self-Interest	High

Figure 19: Management Style

d) Motivational Practises

Often, a knowledge worker's level of participation in a sharing culture depends on the organisation's motivational practises. Based on Maslow's hierarchy of motivational needs, the workplace must accommodate employees in all the aspects of their work needs [2]. In terms of their *basic needs*, the work environment must provide a comfortable work area with sufficient light, heat, ventilation and support structure, e.g. phone, technology, storage facilities. By providing sufficient security and privacy for the valuables of the employee, e.g. safe, protective parking and working place, access control, lockable storage, visual privacy and sufficient workspace, the organisation supplies in the *security and safety needs* of the employee.

The *social and belonging needs* of the employee are addressed by creating work teams that have a certain level of interdependence, by providing social areas and by facilitating events that leads to better acquaintance. These are also addressed by the close proximity of those working together, which increase the odds that people will talk and share with each other and develop a sense of belonging.

The motivational *need for an identity* refers to the need for status and recognition. Benefits such as sufficient office space, business cards as well as levels of authority in decision making all contribute to addressing this need of employees. Unfortunately these differentiators can create a distance between the different levels

in the organisation and influence the openness of the organisation's culture and must be applied with caution.

The highest level of the motivational needs of the knowledge worker is the *need for self-fulfilment* or self-actualisation, i.e. the opportunity to achieve, to contribute and to develop one's own potential. This need is met when the employee experience a sufficient level of control, freedom and trust as well as access to different working spaces, e.g. working at home.

All these aspects influence the corporate culture of the organisation and the organisation's level of maturity in accepting the practises of knowledge management. A change management process is required to address the culture problems and wrong management style in order to develop and implement a culture that fosters collaboration.

STEP 2: Create Awareness

Creating awareness follows the assessment of the culture and management style of the company. Different communication channels are required to reach every employee. Communication aims at creating a common language and understanding amongst employees on the reasons and concepts of knowledge management. This phase requires creative media to propagate the purpose of knowledge management and necessitate a high level of energy from change agents to prepare for the mobilising phase. The next phase can only follow once the majority of employees understands and accepts the purpose of knowledge management.

STEP 3: Mobilising

This phase includes identifying and mobilising established communities of interest, i.e. *"a group of professionals, informally bound to one another through exposure to a common class of problems, common pursuit of solutions, and thereby themselves embodying a store of knowledge."* [32]

Communities of practise (groups that learn) emerge through both social and professional forces. Group members use each other as soundboards, collaborate, give advice and explore new subject matters. These informal groups serve as the breeding ground for new ideas, knowledge transfer and innovation, and they are cardinal in the organisation structure. These groups are voluntary, develop over time, are the result of a common interest or problem, and involve learning, customs and culture. Communities also tend to be driven by their own little learning enterprise

rather than the total organisation and cannot function within boundaries, as boundaries hamper the free flow of information.

"Knowledge workers...are likely to split their loyalty between their profession and peers on one hand, and their employing organisation on the other. They stay committed to particular firms as long as those firms provide them with the needed resources for working on interesting projects. If this isn't forthcoming, knowledge workers will swiftly trade up to bigger sandboxes..." [32]

Organisations have to foster intellectual communities in areas that can contribute to their competitive advantage and create a vibrant learning community and socialising human capital. By doing so, the organisation retain knowledge ownership even if parts of the community should leave the company.

Management can foster the growth of such communities by recognising them and their importance, making resources available to them, creating a communication system across the organisation, and by frequently moving employees to enable new work related relationships.

By creating thematic communities, one creates a place where people with similar interests can go to define the best way to sell a product, determine some of the best techniques to research the development of a product, or whatever a knowledge worker needs to do as part of their job.

Constructive dialogue that leads to deeper understanding of team related work areas, are other ways to facilitate the adjustment of new employees' mental models to correlate with the value system of the organisation.

The building of communities of practise and person-to-person exchange, and not just technology, is the best way to mobilise the development of the organisation's knowledge and sharing culture.

STEP 4: Knowledge Sharing

The following phase in the process of changing the culture of the company is to evaluate and develop the knowledge market [8] of the organisation to facilitate knowledge sharing across the organisation.

The organisation's knowledge flows is regulated by the same principles as market forces. Markets for knowledge exist within the organisation, due to the scarcity of the knowledge resource. Knowledge transfer occurs as participants believe they will gain value from the transaction, because knowledge serves as a remedy for uncertainty.

Participants exchange knowledge based on credit and a trust relationship, instead of monetary means.

The roles in a knowledge market centre on buyers, sellers, and brokers. A *buyer* is someone that needs insight, judgement, and understanding in order to solve a difficult problem. A knowledge *seller* has a reputation in the internal market as someone who has knowledge, is willing to share it and believes that he will gain from the transaction in the future. Specific individuals in the organisation who are interested in the company as a whole, perform the role of the knowledge *broker* (gatekeeper) and is responsible for connecting sellers and buyers.

The pricing system operating in the knowledge market involves a few intangible motivation factors:

- The “*reciprocity*” factor is a self-interest motive where sellers share their knowledge because they believe that they would be able to gain from the buyers in the future.
- The “*reputation*” factor motivates the sellers because by selling they are perceived as knowledgeable and willing to share, which will enhance their position in the market for buying in the future.
- The last source of motivation is the “*good will*” factor, where the sellers find personal pleasure in sharing their knowledge.

All these motives depend on the level of trust sustained in the organisation and the amount of recognition the seller receives for sharing knowledge.

The knowledge market has a number of indicators that direct knowledge buyers to sources of knowledge. The formal structures of individuals’ education and position within the organisation, as well as informal networks (word of mouth) point buyers to useful and reliable knowledge sources. The informal structures are more dynamic, though, and rely on gossip for frequent updates.

An ineffective knowledge market may exist in an organisation due to numerous factors:

- A lack of complete indicators (yellow pages) on where knowledge resides in the organisation.
- A lack in the diffusion of knowledge through the organisation due to differences in purchase power or the lack of an effective distribution system.
- The price of getting the most effective knowledge is too expensive due to the size of the organisation. The size of the organisation influences the distance between

- seller and buyer and subsequently the transaction cost involved in getting the knowledge.
- A monopoly exists where there is only one expensive resource, thus leading to a scarcity due to knowledge hoarding or downsizing.
- The company culture that values the principle of 'not invented here' and thus discouraging employees to buy knowledge.
- No effective knowledge transfer infrastructure exists.
- Buyers with limited time to investigate the knowledge market.

The development of yellow pages, i.e. information on which knowledge resides, as well as the infrastructure for virtual sharing, facilitate effective knowledge markets. The knowledge market will operate successfully if a space exists for knowledge exchange and discussion as well as a forum where sellers can introduce knowledge for sale and buyers have time to shop. Finally, when a substantial reward for using the knowledge market exists, it will flourish and the individual participation as well as the company's morale and knowledge stock will increase.

STEP 5: Performance Tracking

Finally, an important way to reinforce the knowledge-sharing culture in the company is by measuring and incentivising such behaviour. Examples of these incentives are summarised in *Table 4: Knowledge Management Incentives*. By openly rewarding knowledge-related behaviour, one creates more awareness among employees and confirms management's commitment to the knowledge management paradigm.

Table 4: Knowledge Management Incentives

Type of Incentive	Description of Behaviour
Awards and Recognition	Knowledge-related activities
Bonuses on Rewards	Publishing papers and developing patents
Evaluation & Promotion	Criteria that emphasise personal learning, collaboration, knowledge creation
Opportunity to Present at Enterprise-wide Conferences	Recognise expertise and performance
Communication Infrastructure and social events	Incentive for informal networks with knowledge-sharing culture
Group recognition	Team performance and sharing
Funding	Provide funds as incentives for education, training, and conferences

4.2.3 Techniques to Manage the Soft Issues of Knowledge Management

Numerous techniques exist to motivate employees as part of a knowledge management project:

□ *Incentive/motivation scheme*

Implement an incentive scheme to establish the knowledge market in the organisation by rewarding the sharing and utilisation of knowledge.

□ *Provide an open learning environment*

Empower employees by giving them access to the corporate knowledge, accompanied with a code of ethics. Train employees to use the technology and corporate knowledge to learn by themselves.

□ *Subject matter experts (COE)*

Define roles and responsibilities for individuals to create, capture, maintain, and leverage the organisation's knowledge, in order to invite employee participation in the project.

□ *New staffing models / profiles*

Touting a philosophy that skills and knowledge is the ultimate company advantage should lead to a paradigm shift in managers' views of individuals. Individuals must be valued and new employees appointed according to their competence and alignment with the organisational culture.

□ *Communication strategy*

A systematic communicative approach to all the employees in the organisation, throughout the knowledge management project will exponentially increase the level of acceptance and buy-in among personnel.

□ *Trust-based relationships*

It is essential for management to maintain the trust and relationship of employees throughout the project, through change agents.

□ *Awareness programs*

Conduct workshops to create buy-in, common understanding and language and to extract valuable ideas from employees with regards to the knowledge management program.

As stated before, the people component of knowledge management will ultimately determine the outcome of any initiative and requires a strong emphasis.

4.3 Process Component

The process component of the knowledge management framework involves the establishment of an effective knowledge creation and retention process in the organisation.

4.3.1 Knowledge Management Process

Newly created knowledge and best practices initiates the knowledge management process. These new ideas are then captured and shared, after which other employees access and apply it. Once the application of these ideas leads to more learning, new ideas are created to close the knowledge management process cycle.

The support structures that facilitate the knowledge management process like management, culture, measures, and infrastructure are addressed in other components of the knowledge management framework.

The core knowledge management activities are (see *Figure 20: Knowledge Management Process Diagram*):

- *Creating new knowledge* – triggers the knowledge management process and subsequent activities;
- *Capturing knowledge* – converting personal knowledge into corporate, shared knowledge;
- *Organising knowledge* – contributions are organised to ensure the ease of future retrieval;
- *Accessing knowledge* – employees use captured knowledge to establish an understanding and to learn from it;
- *Distributing knowledge* – knowledge is published or transferred to the relevant party in the right format;
- *Using knowledge* – applying knowledge in practical situations (performance) lead to learning and increased value;
- Finally, by *adding value* to the current knowledge, the user creates additional knowledge that closes the knowledge creation and retention loop.

For this process to be effective, a continuous feedback from the application of knowledge to the other activities must exist to ensure that the knowledge is maintained and renewed.

The activities that support the core knowledge management process (*Figure 20: Knowledge Management Process Diagram*) include:

- *Identifying* sources of knowledge and knowledge needs;
- *Evaluating* the integrity and usefulness of knowledge that is contributed to the system;
- *Maintaining* the content of the knowledge repository to reflect the learning that takes place in the organisation;
- Continuous *collaboration* between knowledge workers throughout the knowledge management process to test and develop knowledge and to enhance users' awareness of the availability of knowledge sources;
- Measuring the *value addition* during the application of knowledge.

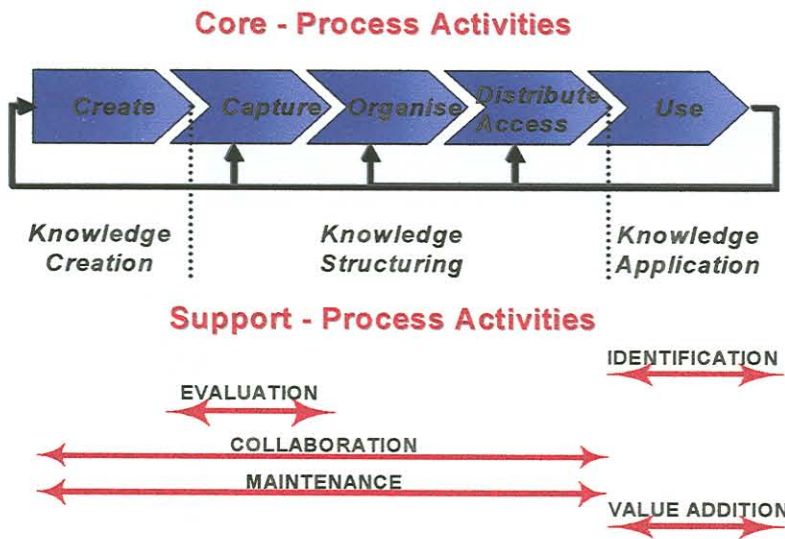


Figure 20: Knowledge Management Process Diagram

The knowledge creation, -structuring and -application processes are discussed in the following paragraphs.

4.3.1.1 Knowledge Creation

The knowledge creation process triggers all the knowledge management processes. Subsequently the organisation's infrastructure must accommodate the different ways in which knowledge is created in the organisation. According to Nonaka knowledge creation occurs in four different ways (see *Figure 21: Knowledge Creation*) [20]. Knowledge emerges when interaction takes place between tacit or uncodified knowledge embedded in the knowledge workers thoughts and explicit knowledge or codified sources of information.

- The first dimension is the formation of knowledge from *Socialisation*. This occurs when tacit knowledge is transformed into more tacit knowledge to create more understanding, e.g. when people are in conversation or someone gives a presentation. This is called sympathized knowledge and resides within the tacit thoughts of those who participate in the process.
- The *Externalisation* dimension refers to the transformation of tacit knowledge into an explicit form to create conceptual knowledge, e.g. when knowledge workers codify their thoughts into documents.
- The *Internalisation* process is the transformation of knowledge from an explicit to a tacit form, e.g. when a knowledge worker reads and translates a book into his own thoughts and understanding to generate operational knowledge.
- The last dimension is the *Combination* of different explicit sources to form system knowledge, e.g. the combining of different documents to develop a new document.

	Into Tacit Knowledge	Into Explicit Knowledge
From Tacit Knowledge	1 SOCIALISE Sympathized Knowledge	2 EXTERNALISE Conceptual Knowledge
From Explicit Knowledge	4 INTERNALISE Operational Knowledge	3 COMBINE System Knowledge

Figure 21: Knowledge Creation

Another view of transforming information into knowledge refers to the three different ways in which value can be added to information. These are as follows -

- *semantics* - adds value to information by adding language meaning and by describing it with words;
- *visualisation* - adds spatial meaning to information by visual representation or schematic illustration of information; and
- *collaborative* - adds meaning to information through sharing and discussing a topic.

The effectiveness of the knowledge management process depends on its ability to accommodate all the different forms and processes involved with the knowledge creation process.

4.3.1.2 Knowledge Structuring [25]

Knowledge must be structured to allow for easy storage and future access. Knowledge representation deals with the encoding of knowledge and influences the effectiveness of knowledge capturing, organising, accessing, and distribution. In this section the author proposes a knowledge structure for the organisation's business objects.

Initially, the sources of information available for the organisation's knowledge base as well as the information that is important and required by the organisation are identified. Once this has been established, the development of the knowledge structure of the business objects follows.

Business objects are categorised into three different types of objects. Each of these objects is managed according to the dynamics of the object.

- **Core static objects** have a characteristic of permanence and include the following objects: Location (site), Supplier, Sub Contractor, Client, Plant & Equipment, Material and Labour.
- **Primary dynamic objects** have the characteristic of relating to the core objects through inheritance and include the following: Bill of Materials, Work Programme, Tenders, Proposals and Contracts.
- **Secondary dynamic objects** are volatile and will live in the system for a short period of time and include Requisitions, Purchase Orders, Progress Certificates, Invoices and Statements.

Each core business object of the organisation requires a knowledge structure that includes different dimensions as presented in *Figure 22: Business Object Knowledge Cube*. The dimensions of each business object's knowledge structure are:

- different *knowledge types*, i.e. know what, know how, and know why knowledge;
- *intangible knowledge* related to each business object, divided into four categories, namely functional, regulatory, cultural and positional types of assets;
- *specialised knowledge* or environmental related knowledge such as industrial, technology, functional, and client knowledge related to the business object.

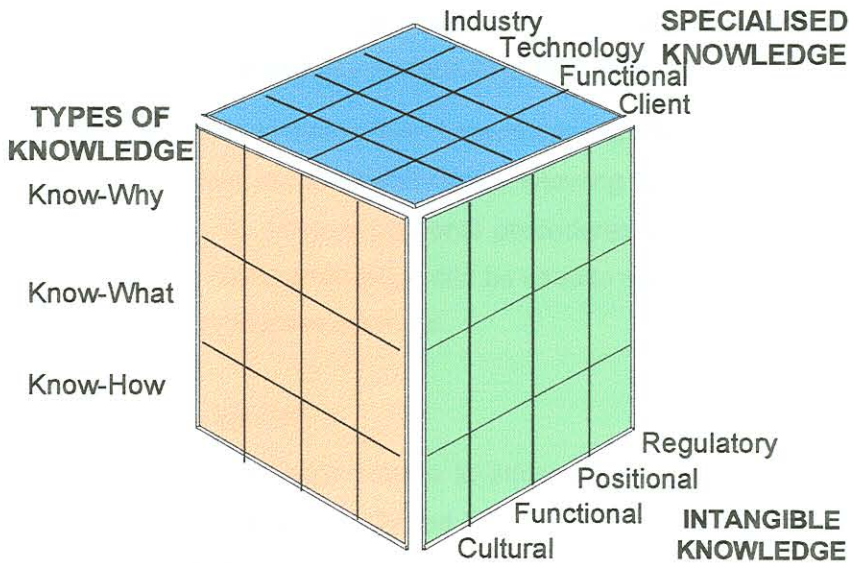


Figure 22: Business Object Knowledge Cube

These business objects form the primary contents of the organisation’s knowledge base. The remainder of this section focuses on each dimension related to these objects.

a) Knowledge Types

There are three dimensions of knowledge: knowledge of facts, knowledge of associations and knowledge on how to do something [23]. Knowledge of facts can easily be codified and stored in a database, but knowledge acquired through experience and knowledge on how to do things, is not necessarily factual and structured. The solution is to categorise unformatted knowledge in open fields in the knowledge structure.

In the proposed knowledge structure, the first classification is to differentiate between three categories of knowledge [29]: purpose, process, and state knowledge. These categories represent different levels of causality.

- **Purpose knowledge** defines *know-why* knowledge, which is acquired either by ‘bottom-up’ learning through application or through ‘top-down’ learning by emulation, metaphor or imagination. Purpose knowledge is used to develop new procedures, products and services.
- **Process knowledge** defines *know-what* knowledge, which is acquired through theoretically directed learning and can be used to adapt existing procedures and processes, or to develop new approaches. Process knowledge describes how the

organisation functions as a whole and can be divided into three categories: best practise, practise to avoid and key performance indicators.

- **State knowledge** defines *know-how* knowledge, which is acquired through learning-by-doing. State knowledge includes knowing which procedures apply during which conditions, when exceptional procedures should be followed, the contingency plan, etc. State knowledge can be used to maintain control of current product designs and production systems.

b) Intangible Knowledge [15]

Another classification of knowledge relates to information regarding the intangible assets of the company. This can be divided into four categories: regulatory assets, functional assets, positional assets and cultural assets. Intangible assets are categorised by following a very simple routine of classification (see *Figure 23: Knowledge Categories on Intangible Assets*).

Once intangible knowledge has been identified, knowledge must be gained in terms of the following aspects:

- **Protection** – Does the organisation recognise the value of the asset and can the law protect it?
- **Sustainability** - Is the asset durable, will it decline over time, and how easily can the asset be imitated?
- **Enhancement** - Is the 'stock' of the asset increasing and how can the organisation ensure an increase?

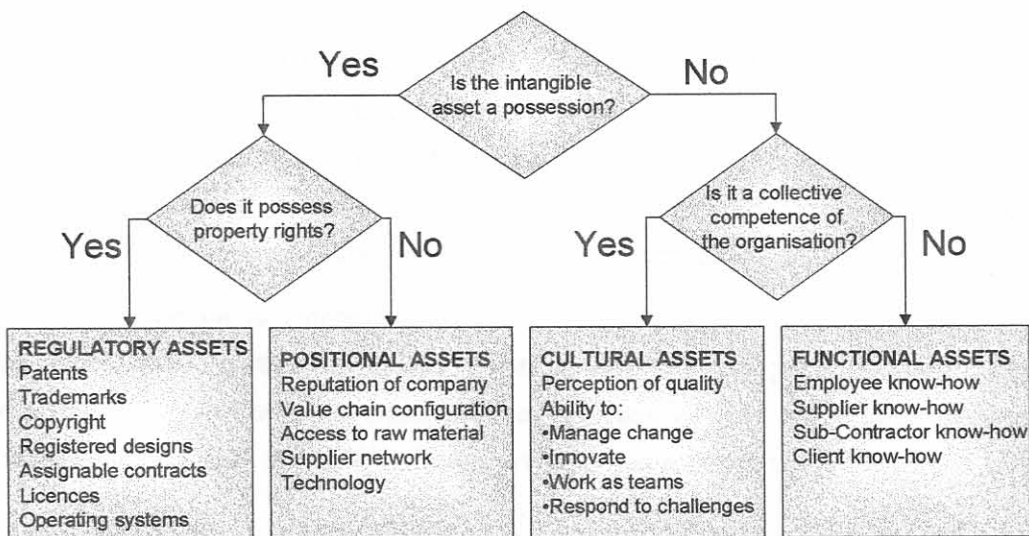


Figure 23: Knowledge Categories on Intangible Assets

c) Specialised knowledge

The next classification of knowledge is the scope of knowledge in relation to its network-relatedness. Network knowledge [30] may be industry-specific, technology-specific, functional-specific or client-specific.

- **Industry-specific knowledge** is knowledge on developments within a specific industry, e.g. industrial trends.
- **Technology-specific knowledge** is knowledge on technologies that is relevant to the company.
- **Functional-specific knowledge** is knowledge of the organisations' business areas.
- **Client-specific knowledge** refers to knowledge that relates to client requirements.

4.3.1.3 Knowledge Application [25]

The last phase of the knowledge management process, is knowledge application. *Figure 24* illustrates that the knowledge resources of the organisation include the sum of the employees' knowledge (theory), which gives rise to skills (application of knowledge) that result in behaviour (attitudes). This also equates to the different roles that the individual or team plays that contribute to the collective competency profile of the organisation. The individual requires a certain competency profile to perform a role within a team, and the competencies of the individuals collectively manifest itself according to the value drivers of the company.

According to the organisation's value drivers, individuals and teams contribute in terms of their competencies to the codified knowledge base of the organisation. This takes place within a specific environment, which influence the availability and development of the individual and the organisational knowledge. The internal environment (culture) of the organisation determines the extent to which information is shared and a learning environment exists within the organisation.

Codified knowledge is extracted and utilised by the employees and impacts the activities of the organisation, which results in learning during the *learning cycle*. Consequently, the knowledge base changes constantly where some information is updated and renewed, and other information becomes redundant.

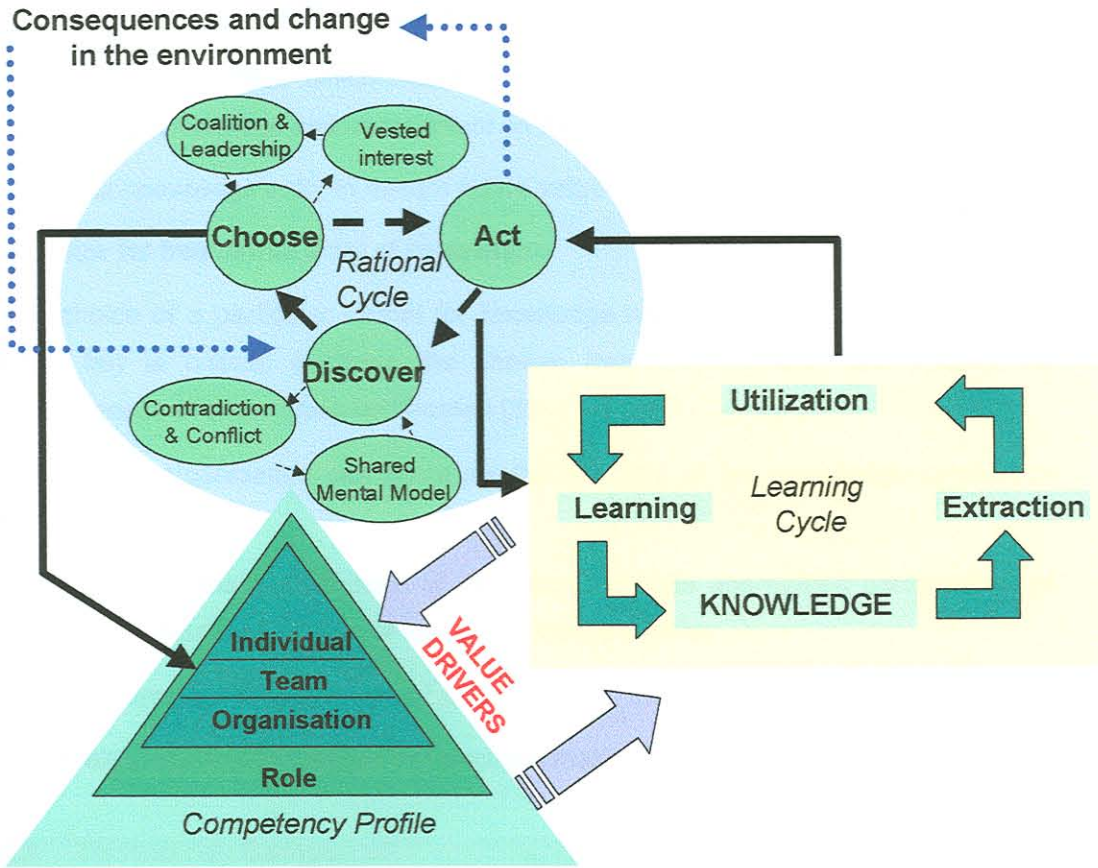


Figure 24: Application of Knowledge

Learning also takes place as knowledge guides activities during the *rational cycle*. Activities result in new discoveries, influenced by external variable and changing forces in the environment that require the individuals to make choices. The discovery process yields contradictory opinions until a shared mental framework emerges. Finally, the choices increase the competencies of individuals as they experience successes and failures and the experience results in knowledge of best and poor practise.

To ensure that the knowledge management process cycle is complete this learning must again be codified into the available knowledge structure. But the knowledge network within which knowledge workers must store and access knowledge, will only be used if employees find it logically structured, easy to use and its contents accurate and up-to-date.

The structure of the knowledge presentation in the knowledge base must:

- ensure timeliness and integrity of the knowledge;
- organise knowledge to simplify search and maintenance procedures;

- reflect a language and semantics that is familiar to employees;
- create an interface which makes it easy to enter new knowledge, to change existing knowledge and to comment on existing knowledge;
- guide knowledge entry to ensure future value from it; and
- allow for free format entry of knowledge.

The choice of a particular format for knowledge representation (refer to 4.3.1.2 on page 56) is critical, because the chosen format will control and restrict the effectiveness of information codification [38].

Finally, the organisation can measure the success of the knowledge application process by:

- monitoring the performance of individuals and the aggregated performance of the organisation in terms of their competency profiles;
- measuring the effective use of and addition to the knowledge base; and
- evaluating the effectiveness of decision making in the organisation.

4.4 Technology Component

The technology considerations of a knowledge management initiative include:

- assessing the need for effective knowledge management technology;
- understanding the knowledge management technology architecture;
- differentiating key characteristics of a knowledge management technology architecture; and
- considering current and future maturing technology.

4.4.1 Need for Knowledge Management Technology

The volume of available data sources has increased exponentially over time (see *Figure 25: Information Overflow*), whilst knowledge workers' capacity to internalise information stayed the same. This brings with it yet another business concept namely attention management, i.e. managing the relevance of information that a knowledge worker encounter. This information overflow emphasises the need for technology to enable the user to interact with and quickly access only that information which is relevant to his specific requirements.

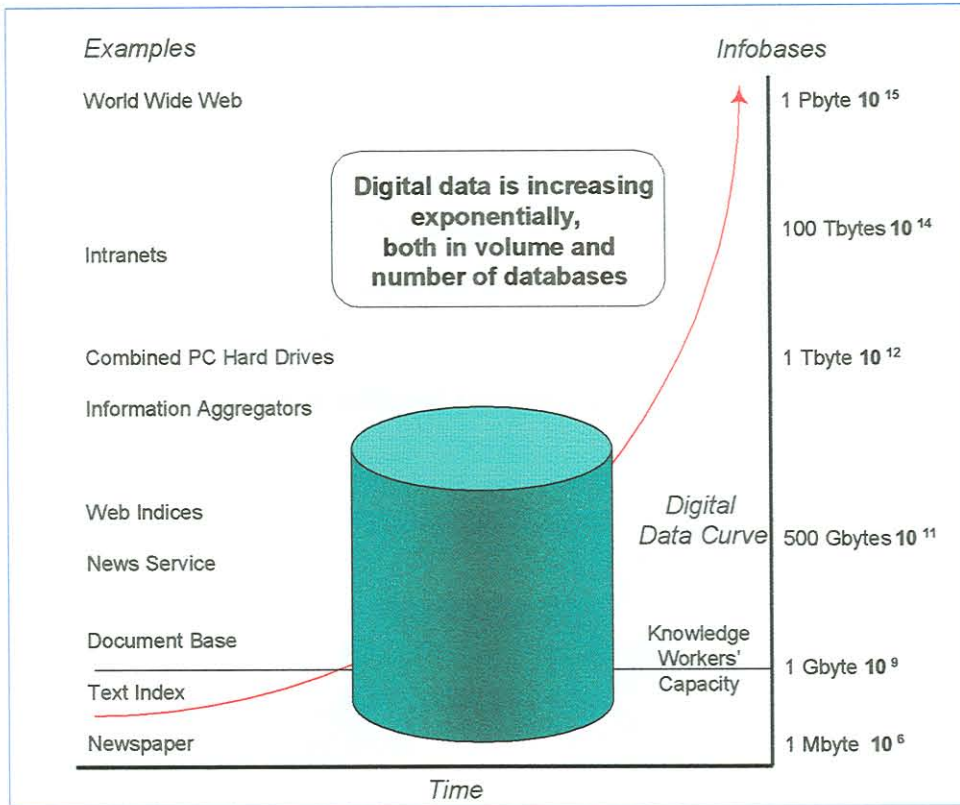


Figure 25: Information Overflow

4.4.2 Knowledge Management Technology Architecture

The following section discusses a proposed knowledge management technology solution in terms of the conceptual architecture, the functionality requirements and the physical technology architecture.

4.4.2.1 Conceptual Technology Architecture

The conceptual architecture of a knowledge management system includes the following layers (see Figure 26: Conceptual Knowledge Management Technology Architecture):

- The underlying layer of the knowledge management system includes a *knowledge repository* (see paragraph 4.4.2.2 on page 63) as well as unstructured and structured data sources;
- The *knowledge retrieval* layer entails a search engine that categorise and index all the available sources of information;
- The *collaboration layer* enables sharing and communication between employees in connection with the retrieved information;

- ❑ The following layer includes *intelligent agents* that distributes relevant sources to knowledge workers, according to their personal interest, in the right format;
- ❑ The *administration layer* provides the functionality to organise and maintain the content of the knowledge sources with management information about the usefulness or redundancy of the content of the repository;
- ❑ The *user interface* level provides universal access to any authorised user through his required interface (portal); and
- ❑ Finally, one must ensure sufficient scalability of the different technologies across the infrastructure.

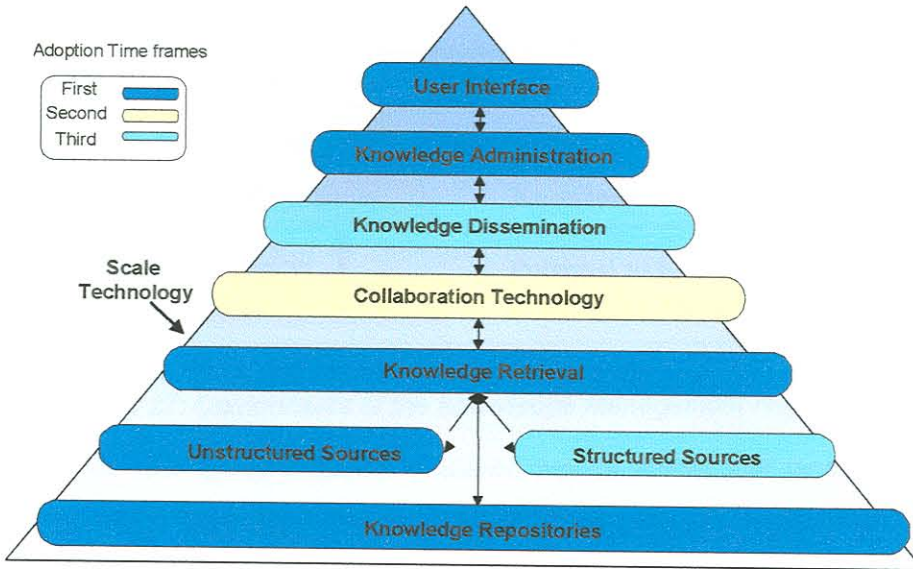


Figure 26: Conceptual Knowledge Management Technology Architecture

4.4.2.2 Required Functionality of the Knowledge Management Repository

There are five different types of knowledge that needs to be accommodated in the proposed knowledge repository (see *Figure 27: Components of the Knowledge Management Repository*) [25], which include:

- ❑ a general knowledge repository with the organisation's knowledge structure;
- ❑ a directory where domain experts can enter domain specific knowledge;
- ❑ a directory of the specific knowledge, skills, and experience held by individual employees or groups within the company as well as their contact information;
- ❑ a directory of learning resources specifically aimed at addressing the knowledge needs of the company; and

- the capability that enables unstructured collaboration, captures the sharing of knowledge and enables learning among employees.

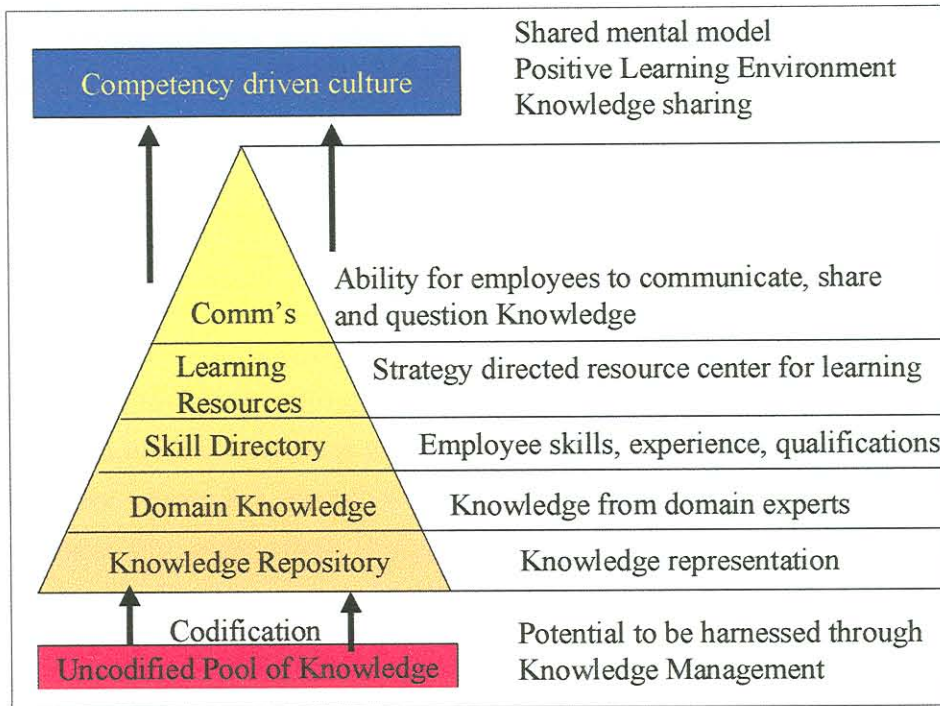


Figure 27: Components of the Knowledge Management Repository

The result of such a repository is a shared mental model and language among employees, which facilitates the learning and sharing culture of the organisation.

It is essential that this knowledge base be protected and stored in a secure environment. In addition, the knowledge base must allow for the organisation of the information that resides in the database. The functionality should include easy access to specific information, appropriate and user-friendly means of extracting the necessary information, and the means for updating and maintaining information contained in the knowledge base.

The knowledge base must allow for comments by means of electronic and manual additions. These may include concrete information to be shared with others in the organisation, as well as opinions and comments on best practice and aspects to be avoided. This will ensure that all the individuals and specialists within the organisation are able to continually update the knowledge base, and that real-time information is available to all the individuals in the organisation.

The utility value or redundancy cycle of when what information is redundant, may be controlled and checked by:

- *User defined checks* – here the organisation is able to set parameters within which the information is searched and redundant information automatically eliminated or made available for update.
- *Change overwrites* – this allows for updating of information either by manual or electronic means.
- *Date dimensions* – allows for the software to be programmed in such a way that information that has been entered without any changes for a specific period (e.g. 3 months) is automatically brought to the knowledge manager or the author's attention as a reminder, which allows for an update.

For information to be of value to the organisation it must be readily available and easily accessible to all appropriate individuals. This allows for quick retrieval of relevant information, increasing the speed of decision-making and speed to market. This kind of information utilisation allows for a continual learning process to take place within the organisation, thereby enhancing the knowledge and skills of all employees and increasing the competitive edge of the organisation as a whole.

4.4.2.3 Physical Technology Architecture

The physical architecture of knowledge management technologies consists of four different levels, which are separated into the operating systems layer and the integrated information store. The integrated information store includes the application and the retrieval layer as well as the user interface (see *Figure 28: Physical Knowledge Management Technology Architecture*) [3].

- The *operating systems layer* includes the network, platform and physical data stores on which the rest of the infrastructure operates. This includes Intranet and Extranet technology and the ability to synchronise replicated data.
- The *application layer* consists of:
 - departmental workgroup applications (e.g. e-mail) for unstructured sources with intelligent agents and collaboration technology; and
 - database management applications for structured sources with data mining and business intelligence functionalities.
- The *retrieval ware layer* includes search engines that match the users' inquiries with the content of documents via its index.
- The *user interface layer* includes a uniform interface for user access, including remote access through a web interface.

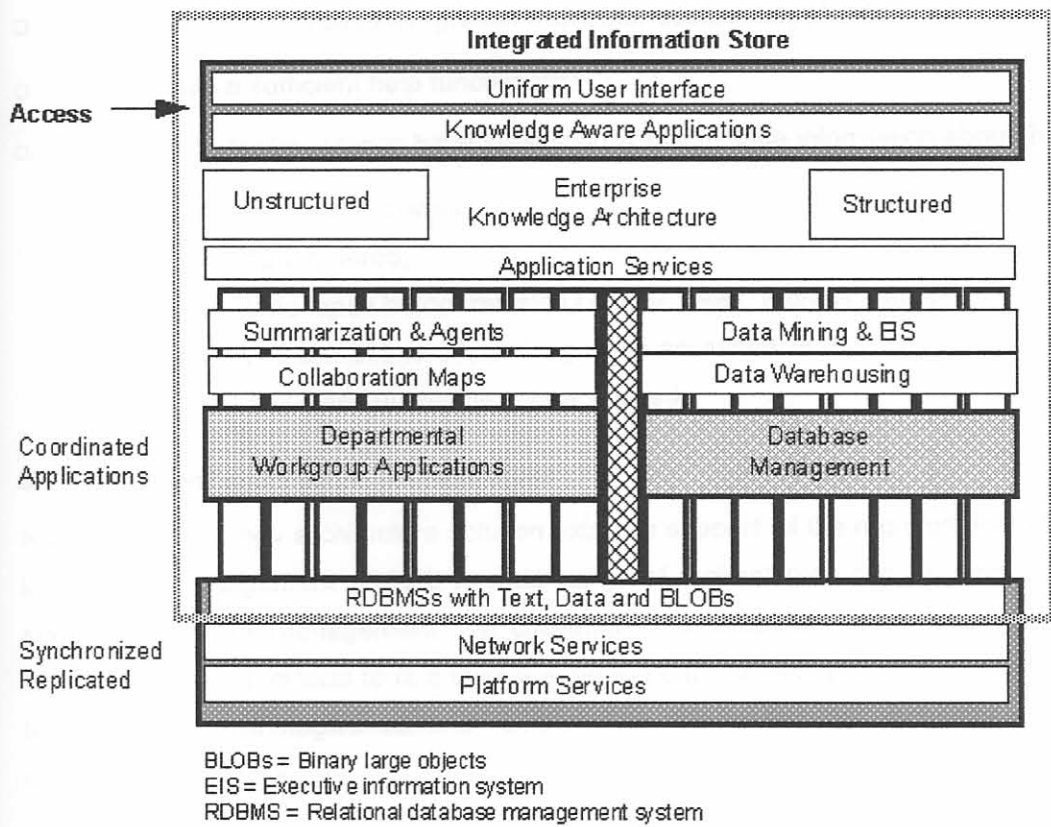


Figure 28: Physical Knowledge Management Technology Architecture

4.4.3 Characteristics of Knowledge Management Technology Architecture

The key characteristics of the knowledge management technology in the organisation include that the system:

- ❑ must provide complete access for all users, including remote users;
- ❑ must provide for effective navigation and high-speed retrieval;
- ❑ must utilise the appropriate mainstream knowledge management technology;
- ❑ must be standardised across the organisation;
- ❑ must provide an open, flexible, easy-to-use, transparent environment with optimal connectivity between users;
- ❑ must be effectively supported and its effective working must be a high priority in the organisation;
- ❑ database must be organised and its information accurate and secure;
- ❑ must be scalable to incorporate a wide range of data types in different physical locations;

- ❑ must provide for sufficient integration with other business applications;
- ❑ must contain a sufficient help functionality;
- ❑ must provide for knowledge base submissions that include information about the
 - ❑ knowledge owner,
 - ❑ date entered,
 - ❑ time lapse before revision i.e. day, week, months, years,
 - ❑ number of times knowledge was accessed, and
 - ❑ last date knowledge was accessed.

4.4.4 *Current and Future Technologies*

No single technology architecture solution exists to support all the requirements of a knowledge management project. A wide range of technologies can be utilised to support knowledge management. The challenge is to combine a variety of available technologies and products to fit a unique environment. Following is a list of enabling technologies, technologies currently available in the market and technologies to consider in the future.

4.4.4.1 *Enabling Technologies*

Technology decisions must be based on the organisation's long term knowledge management strategy and must enable the knowledge creation process (see paragraph 4.3.1.1 on page 54) with, for example, the following types of technologies:

- ❑ **Socialising Process** – Discussion Databases, Groupware, Interactive Intranet/WebPages, Collaboration software, Video Conferencing.
- ❑ **Externalisation Process** – Knowledge repository, Workflow, E-mail, Artificial Intelligence.
- ❑ **Internalisation Process** – Help line, Centres of Excellence, RetrievalWare, DistributionWare such as Intelligent agents (push technology).
- ❑ **Combination Process** – Component Document Management Systems, Imaging.

4.4.4.2 *Current technologies*

The mature technology alternatives that are currently available in the market place include:

- ❑ **E-mail** to facilitate a-synchronised, different-time, different-place communications between employees, which is an important factor for knowledge exchange.

4. Knowledge Management Framework

- ❑ **GroupWare** to support different forms of collaboration between several individuals on the development of new ideas.
- ❑ **Intranet and Internet** to provide a powerful information exchange platform and a repository in support of knowledge management practices.
- ❑ **Video conferencing** to allow individuals, although geographically separated to interact through synchronised, verbal communication.
- ❑ **Global knowledge sharing system** provide a structured environment to capture, reconstruct and archive knowledge as well as make relevant knowledge available ranging from lessons learned and recommended practices to emerging ideas.
- ❑ **"Yellow pages"** to allow individuals (and groups) to advertise their expertise in support of the development of networks of expertise.
- ❑ **Corporate knowledge map and knowledge inventory system** to facilitate navigation when searching for special expertise by providing an easy-to-grasp overviews or more detailed information of "who knows what" and where it can be found.
- ❑ **Corporate memory database** to provide a structured repository and retrieval environment for important enterprise knowledge and information.
- ❑ **Distance learning systems** provide opportunities for employees no matter where they are located, to develop their own understanding and knowledge.
- ❑ **Knowledge-Based Systems / Artificial Intelligence / Expert systems** to automate and deploy structured and less complex knowledge so that it is available to practitioners "at their finger tips".
- ❑ **Knowledge mining** to identify complex or non-obvious patterns, valuable information and important trends hidden in databases.
- ❑ **Intelligent agents** to access multiple, large databases automatically to search for, acquire, organise, and summarise information on specified topics.
- ❑ **Search and Retrieve** - natural language, semantic search, pattern recognition.

4.4.4.3 *Future maturing technologies*

Other technology functionalities that are becoming available in the market place but that have not reached full maturity yet, include:

- ❑ **Collaborative filtering** - the ability of people to hear personal recommendations from parties with the same interest.

- **Semantic Models** - maps the relationship between concepts and phrases to present users with clusters of related documents for a specific topic.
- **Passive group memory** - automatic capturing and indexing of information in meetings and discussions.
- **Content abstraction** - the ability to extract and summarises the core meaning of the content of text to generate answers to questions.
- **Structure and Navigate** - ability to structure and index knowledge sources and enable effective search of the sources.
- **Profile and Personalise** - customise search and dissemination of information to the personal needs of the employee.

4.5 Conclusion

Any knowledge management initiative requires an equal amount of attention to the different components of knowledge management, i.e. strategy, people, process and technology.

The *strategic* component of a knowledge management initiative relates to the strategic direction of the business unit, i.e. knowledge creation or -retention strategy. Subsequently, this decision has an influence on the people and technology considerations of the unit.

The *people* component refers to the organisation's culture maturity and the organisation's preparedness for a knowledge management initiative. The management style, reward practices and corporate mental models exert an influence on the organisation wide willingness to create and share knowledge.

A knowledge management initiative also incorporates new *processes* to enable the knowledge creation, preservation and reuse capability of the organisation. This includes new roles and responsibilities to manage and maintain the knowledge asset.

The *technology* considerations of knowledge management support the corporate memory and address the problems of information overflow. Due to information overload knowledge workers have a limited capacity to give attention to all the information triggers they are confronted with. This requires innovative system solutions to only provide relevant information to users.

The result of integrating all the component of the knowledge management framework becomes visible through the development of the organisation's intangible assets.