A FRAMEWORK FOR KNOWLEDGE MANAGEMENT

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'By 1999, knowledge management will generate as much hype, consulting revenues, misunderstanding and genuine business value as business process re-engineering'

Gartner Group

DISSERTATION SUMMARY

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Transformation from the industrial age to the knowledge age introduces a new environment with new rules governing business. In this knowledge economy, competitive advantage primarily depends on the quality of the organisation's knowledge assets and on the ability to leverage these assets. Currently, the market place attempts to measure these capabilities or intangible assets of the organisation. This is evident in the high discrepancy found between the market value and book value of organisations. A balanced portfolio of intellectual capital can be obtained through the management of the organisation's capacity to identify and solve problems in order to retain the learning and avoid 're-inventing the wheel' in the future.

The changes in the market place mentioned above are imperative to the need to manage the company's knowledge assets and place an emphasis on the importance of knowledge management. Knowledge management implies the ability to manage and utilise the intellectual assets of the company. This is possible by providing an infrastructure to capture and filter useful knowledge and to make it available to enhance the effectiveness of the organisation's decision-making process.

Aside from the explicit or codified knowledge sources of the company, the wealth of the company's knowledge resides within the tacit thoughts and experience of knowledge workers. This creates a challenge, as tacit knowledge assets are difficult to manage. It is influenced by the willingness to share knowledge and the time constrains experienced by knowledge workers, which depends on the organisational culture and on the existence of trust relationships. In

addition, the quality of knowledge transfer is highly dependent on the level of face-to-face contact between different parties.

The framework for a knowledge management initiative involves a holistic integration of the strategic, process, technology and people dimensions of the organisation to enable the intellectual assets of the organisation.

The *strategic* component of a knowledge management initiative, relates to the strategic direction of the business unit, i.e. knowledge creation or –retention focus. This includes determining the business objectives and strategic benefit of a knowledge management initiative. The *people* component refers to the organisation's culture maturity and preparedness for a knowledge management initiative. The management style, reward practices and corporate value system also exert an influence on the organisation-wide willingness to create and share knowledge.

A knowledge management initiative incorporates new *processes* to enable the knowledge creation, preservation and re-use capability of the organisation. This includes new roles and responsibilities for the management and maintenance of knowledge assets. The *technology* considerations of knowledge management address the need for a corporate memory while considering that knowledge workers have a limited capacity to attend to information triggers. This requires innovative system solutions that provide relevant information to users.

The phased implementation approach of a knowledge management initiative includes steps such as establishing a knowledge management strategy, developing a common understanding among staff and assessing the organsation's knowledge needs. In addition, it includes the development of measures to indicate the success of the initiative and the development of the infrastructure required to enable knowledge management.

Finally, the prime directive of knowledge management is to create and maintain superior knowledge by making it available at point-of-need and enabling a learning-organisation culture for the future.

SAMEVATTING VAN VERHANDELING

Titel:	A Framework for Knowledge Management
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Graad:	Magister in Ingenieurswese (Bedryfs)
Sleutelterme:	Eksplisiete kennis, intellektuelekapitaal, implisiete kennis, kennisbestuur, kennisdatabasis, kennisekonomie, kennishulpbronne, leergierige organisasie, nie-tasbare bates

Transformasie vanaf die Inligtings-era na die Kennis-era skep 'n nuwe sake-omgewing met nuwe besigheidsreëls. Die kompeterende voorsprong in die kennisekonomie is geleë in die kwaliteit van die organisasie se kennishulpbronne en die vermoë om hierdie bates suksesvol te benut. Huidiglik plaas die aandelemark 'n premie op die intrinsieke waarde van organisasies wat bekend staan as nie-tasbare bates. Die merkbare verskil in die markwaarde en die boekwaarde van tegnologie-aandele is 'n bewys hiervan. 'n Gebalanseerde portefeule van intellektuelekapitaal kan slegs gehandhaaf word indien die vermoë ontwikkel word om probleme op te los en 'n 'geheue' ontwikkel word rondom leerervarings.

Bogenoemde faktore skep die behoefte om die organisasie se kennis te bestuur en plaas die klem op die nuwe dissipline van kennisbestuur. Kennisbestuur behels die vermoë om die intellektuelebates van die organisasie te bestuur deur waardevolle kennis te filtreer, te stoor en instand te hou. Sodoende kan kennis in die organisasie beskikbaar gestel word waar dit benodig word en uiteindelik die effektiwiteit van besluitneming in die organisasie verbeter.

Behalwe vir eksplisiete kennisbronne is die grootste waarde van die organisasie se kennis in die implisiete gedagtes en ervarings van kenniswerkers gesetel. Die uitdaging verbonde aan kennisbestuur is in die feit dat implisiete kennisbronne moeilik is om te bestuur. Die grootste rede hiervoor is dat die kultuur van die organisasie bepaal tot watter mate vertrouensverhoudings bestaan in die organisasie en hoe gewillig kenniswerkers is om hul kennis te deel. Nog 'n faktor is die feit dat die kwaliteit van kennisoordrag afhanklik is van aangesig-tot-aangesig kontak.

Die raamwerk vir kennisbestuur behels 'n gebalanseerde integrasie van die strategiese-, proses-, tegnologie- en personeeldimensies van die organisasie ten einde die ontwikkeling van intellektuelekapitaal in staat te stel.

Die *strategiesekomponent* van kennisbestuur hou verband met die strategiese rigting van die besigheid, met ander woorde 'n kennisskepping- of kenniskodifiseeringsfokus. Dit sluit die bepaling van die besigheidsdoelwitte en die identifisering van die strategiese voordele van so 'n kennisbestuurinisiatief in. Die *menskomponent* hou verband met die volwassenheid van die organsasie se kultuur en sy gereedheid vir 'n kennisbestuurinisiatief. Die bestuurstyl, beloningspraktyke en waardestelsel van die organisasie het ook 'n direkte impak op die gewilligheid van werknemers om kennis te ontwikkel en te deel.

'n Kennisbestuurinisiatief inkorporeer nuwe *besigheidsprosesse* ten einde die organisasie se kennisontwikkeling-, beskerming- en hergebruikvermoëns daar te stel. Dit behels nuwe rolle en verantwoordelikhede rondom kennisbatebestuur en instandhouding. Die *tegnologiese-oorwegings* van kennisbestuur adresseer die behoefte vir 'n organisasie-wye geheue en neem in ag dat kenniswerkers 'n beperkte kapasiteit het om aandag te skenk aan inligtingprikkels. Dit vereis innoverende stelsel-oplossings wat alleenlik relevante inligting aan gebruikers beskikbaar stel.

Die benadering tot kennisbestuurinisiatiewe behels fases soos onder andere die ontwikkeling van 'n gemeenskaplike begrip rondom kennisbestuur en die versameling van inligtingbehoeftes in die organisasie ten einde 'n kennisbestuurstrategie te ontwikkel en te implimenteer. Verder behels dit die ontwikkeling van metingskriteria wat kan dien as 'n indikasie van die sukses van so 'n inisiatief en die ontwikkeling van tegnologie om die kennisbestuurvermoë van die organsasie te ondersteun.

Die primêre oogmerk van kennisbestuur is om hoë kwaliteit kennis te ontwikkel en instand te hou, dit beskikbaar te stel by die punt-van-behoefte en om 'n leergierige-organsasie-kultuur te vestig vir die toekoms.

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ABBREVIATIONS

Abbreviation	Description
BPR	Business Process Reengineering
CKO	Chief Knowledge Officer
COE	Centre of Excellence
DMA	Document Management API
DMS	Document Management System
EDM	Enterprise Document Management Software
EAI	Enterprise Application Integration
GIS	Geographical Information System
HTML	Hypertext Markup Language
IDOM	Integrated Document and Output Management
IR	Information retrieval
KB	Knowledge Base
KM	Knowledge Management
OCR	Optical Character Recognition
ODMA	Open Document Management API
PDF	Portable Document Format
TQM	Total Quality Management
WAN	Wide Area Network

GLOSSARY

Term	Description
Community of Interest	"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]
Customer Capital (External Structure)	Relationships with customers and suppliers, brand names, trademarks and reputation, or 'image' in the market.
Human Capital (Personnel Competence)	The people assets of an organisation. It includes owners, employees, contractors, suppliers, and all other people who collectively bring to the firm their skills, know-how, and individual abilities. Human Capital is one of the three major elements comprising Intellectual Capital.
Intellectual Property	The codified, tangible or physical described knowledge assets over which the organisation may assert ownership rights and which can be legally protected by law, e.g. patents, trade marks, trade secrets, copyrights, and products or services.
Intellectual Capital	The intellectual material that can be used to create value such as the internal and external structure as well as personnel competence of the organisation. It is also referred to as the intangible assets which is reflected in the difference between the organisation's market value and book value.
Knowledge	The understanding, know-how and expertise produced by combining experience with data and information in a tacit and explicit form.
Knowledge Management	The systematic management of vital knowledge and its associated processes of creating, gathering, organising, distribution, and using. It requires turning personal knowledge into corporate knowledge that can be widely shared throughout and appropriately applied an organisation.
Knowledge Worker	Employees who are actively involved in the process of using technology for collecting data, analysing information, communicating knowledge and acting on it.
Organisational Capital (Internal Structure)	The physical and technical infrastructure, concepts, models and patents that are owned by the organisation and used to support the human resources, the corporate culture as well as the internal networks of the organisation.

CHAPTER 1

INTRODUCTION TO THE RESEARCH SUBJECT

1. INTRODUCTION TO THE RESEARCH SUBJECT

1.1 Introduction

"Knowledge Management is broad, multidimensional and covers most aspects of an enterprise's activities." [41]

Transformation from the industrial to the knowledge age implies a change in the rules of business. Products have become primarily knowledge embedded, introducing the principle of increasing returns, whereas industrial age products generally offer diminishing returns. In addition, organisations face an information overload and the challenge of conducting business where the traditional geographical, time, and information barriers no longer exist.

Natural resources, once the most valuable asset of the organisation has been replaced by the knowledge created by and imbedded in the knowledge worker. Unlike industrial age assets that were managed on the principle of scarcity the knowledge asset, if managed and exploited appropriately, increases through sharing. The knowledge asset is unfortunately much less tangible, is extremely difficult to control and cannot be owned by the company, because it is the property of the mobile knowledge worker. Subsequently the knowledge asset cannot be retained in a static repository because the true value of knowledge is in the knowledge worker's capability to apply knowledge.

The challenge to manage the knowledge assets of the organisation introduces a new business philosophy, Knowledge Management (KM), which aims at leveraging the knowledge worker's true knowledge creating potential. Much has been said about this new philosophy but little success stories exist on how this should be done. Thus, like many other researchers, the author attempts to define the new rules of managing the knowledge organisation's most valuable resource, its knowledge worker.

1.2 The Knowledge Management Scenario

Currently business perceives knowledge management as:

- a business *philosophy*;
- the most important *organisational competence* in the knowledge age;
- critical in the *knowledge creation and retention* process of companies;
- the key differentiator between *knowledge organisations*;
- the primary enabler of the *intellectual capital* of the company; and
- the way forward...*but...*

The Gartner Group illustrates the adoption and success rate of knowledge management during its life-cycle in terms of different phases (see *Figure 1:*):

1. Knowledge management will grow in adoption during an *initiation phase*, due to numerous technology triggers, e.g. the Internet. This phase will be characterised by various different views on the definition of knowledge management.
2. Subsequently, the acceptance of the knowledge management concept will then accelerate along a hype curve, known as the *contagion phase*. The adoption rate will be faster than normal due to the bandwagon-effect. This will occur as consultants and software vendors create an inflated level of expectation through the promotion of their products as knowledge management solutions.
3. The *implementation phase* is likely to result in a trough of disillusionment, due to immature technology, cultural barriers and a lack of sufficient understanding of all the aspects of knowledge management.
4. Finally, this will lead to a *maintenance phase*, where an increase in business productivity will occur and the adoption rate will stabilize.

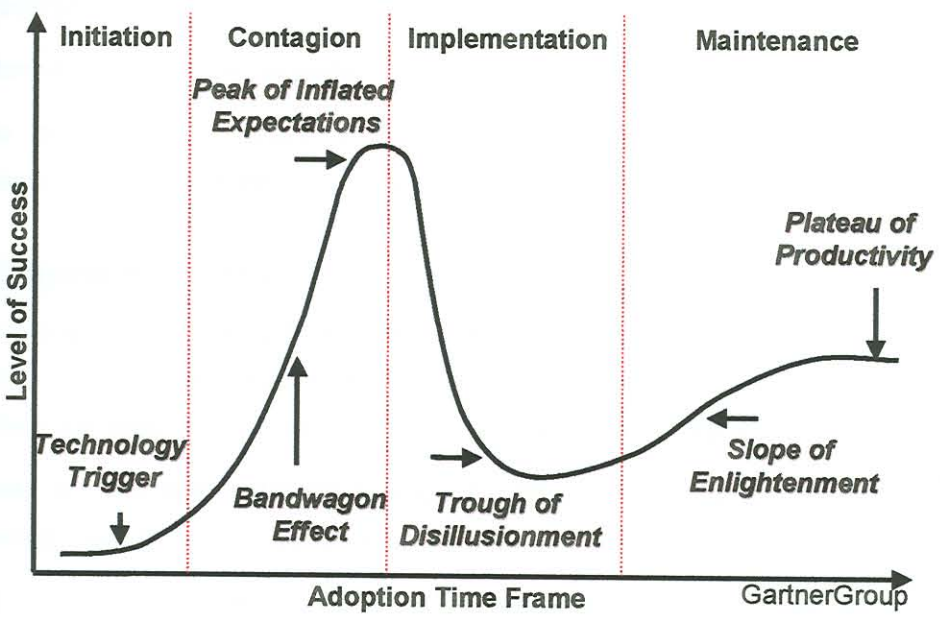

Figure 1: Projected Knowledge Management Life Cycle

Currently, the industry appears to be in the Contagion phase of this life cycle. This is evident in the different opinions that exist on the topic, the number of vendors that promotes it and the growing level of interest with regards to knowledge management.

When considering the proposed projection of the success and adoption rate of knowledge management as illustrated by the Gartner Group, it is not surprising that organisations hesitate when considering such an initiative. This research project attempts to address issues that impact on the success and adoption rate of knowledge management initiatives. It addition the author will endeavour to establish a better understanding of the philosophy behind knowledge management. Thereby potentially avoiding unrealistic expectations and disillusionment during implementation as well as increasing the final impact of such an initiative on the productivity levels of the company.

1.3 Research Approach

Currently, there are a limited number of mature knowledge management initiatives in the world and even fewer initiatives launched in South Africa. Due to the contemporary nature of the field under discussion the author followed a theoretical approach in conducting the research and used the following techniques during the project:

- research;
- interviews with subject experts; and
- the investigation of case studies from a selected number of knowledge management implementation initiatives.

1.4 Purpose of Research

The *purpose* of this dissertation is to define the discipline of knowledge management, establish the principles to consider in managing the knowledge organisation and to propose a framework for implementing a knowledge management initiative.

Whereas the *goal* is to establish a working methodology on the implementation of knowledge management, supported by the following *objectives*:

- To identify the *drivers* that initiated the business concept of knowledge management.
- To understand the changes in business requirements of the *knowledge company* in the knowledge era.

- To develop a comprehensive insight into the *theory and concepts* related to knowledge management.
- To define a methodology for launching a knowledge management initiative in a service industry type organisation.

1.5 Document Layout

This document consists of the findings related to the objectives of the project and is structured as follows (*Figure 2*):

- Drives which led to the development of the knowledge management business philosophy (Chapter 2).
- Literature study on the underlining theory of the knowledge asset and the management thereof (Chapter 3).
- A knowledge management framework for a knowledge organisation (Chapter 4).
- A methodology for the implementation of a knowledge management initiative (Chapter 5).
- A conclusion on the critical success factors and risks of implementing a knowledge management initiative as well as recommendations on how to improve the success thereof (Chapter 6).

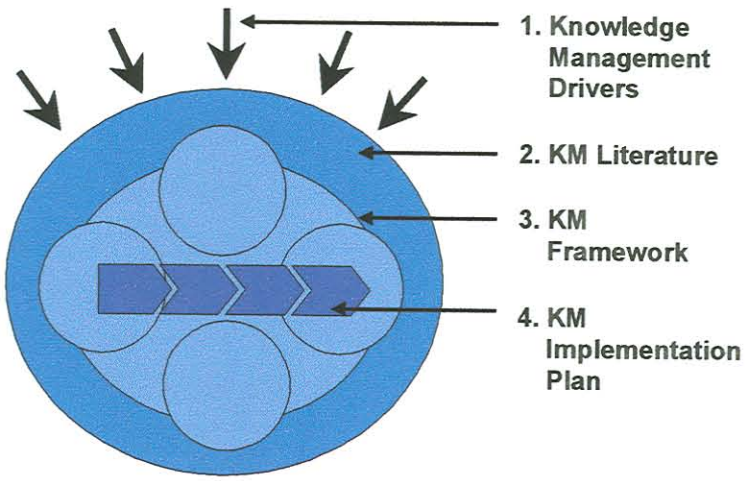

Figure 2: Document Layout

CHAPTER 2

KNOWLEDGE MANAGEMENT IN CONTEXT

2. KNOWLEDGE MANAGEMENT IN CONTEXT

'The emergence of intellect as a highly leverageable asset is shaping both service and product industries and forcing totally new concepts of strategy on companies.' [27]

The long-held belief, as proposed by Porter, that sustainable competitive advantage depends primarily on five forces *(customers, suppliers, product substitutes, barriers to entry* and *competitors)* [26], is now being influenced by three new factors - *digitisation, deregulation,* and *globalisation*. These new factors change the leveragability of the five forces and enabling market penetration in a new way by countering geographic distribution, information accessibility and time barriers. Traditional barriers to entry such as infrastructure and fixed assets do not hold anymore and often become a liability to conducting business.

The change factors that necessitate the management of an organisation's knowledge assets are known as the drivers for knowledge management. In addition, a number of factors, unique to the South African context exert an influence on local companies.

2.1 Drivers for Knowledge Management

Change drivers include inter alia: the emergence of the knowledge era, economics of cyberspace, globalisation, digitisation, customer intimacy, availability of information, role of information technology as well as the costs of reinvention knowledge.

2.1.1 Emergence of the Knowledge Era

"In this society, knowledge is *the* primary resource for individuals and the economy overall" [11]

In the Agriculture Age, mankind used home-based businesses and natural resources to trade and create wealth (see *Figure 3: Emergence of the Skill-Based Economy*) [43]. This continued until the Industrial Age brought with it a change in organisations' competitive advantage. It moved the emphasis of the core organizational asset from natural resources to the utilisation of production assets. This environment favored big factories, which optimised the scarce production resources and focused on creating products for the mass market.

Shortly thereafter, the transformation to the Information Age occurred with yet another emphasis change of the organisation's critical assets towards technology. This business model introduced service organisations that operate independent from production assets and make use of technology to deliver services.

The key differentiator in the Knowledge Age focuses on the organisation's intellectual assets. The knowledge organisation utilises the organisation's intellectual assets to provide a value-added service to customers in the form of business solutions.

Age	**Agriculture**	**Industrial**	**Information**	**Knowledge**
Time	**(Before 1880)**	**(1880-1985)**	**(1955-2000)**	**(1995+)**
Assets	**Natural Resources**	**Production**	**Technology**	**Intellectual Capital**
Value Offering	**Trade**	**Products**	**Services**	**Value Addition**
Business Model	**Home-Based Business**	**Factories**	**Service Organizations**	**Knowledge Organization**
Principle		**TQM**	**BPR**	**KM**

Figure 3: Emergence of the Skill-Based Economy

It is evident that since the Knowledge age has been introduced in a similar way than with the transition from the Agricultural to the Industrial age, a strong financial distinction emerges between those that adhere to the new business principles and those organisations that continue to operate on the principles of a previous economic era.

As organisations move into the Knowledge age the sources of wealth and competitive advantage of organisations change rapidly. Primary capital assets needed to create wealth are no longer land, physical labour, machine tools and factories, but the "application of knowledge" [11]. Stewart is of the opinion that: "*Knowledge has become the most important factor in economic life. It is the chief ingredient of what we buy and sell and the raw material with which we work. Intellectual capital has become the one indispensable asset of the corporation.*" [32]

The resource-based economy (agriculture, production, and mining) is still subject to the principle of diminishing returns, whereas those parts of the economy that are knowledge-based appear to result in increasing returns. These include products such as computer hardware and software, pharmaceuticals, telecommunication equipment, and fibre optics, which are complex to design and to manufacture.

The development cost of knowledge-intensive goods is heavily front-loaded, as the cost of creating the first product is disproportionately higher than the last. Consequently, it is fairly difficult to estimate the end-value that will be gained from the knowledge-intensive value offerings compared to the cost of acquiring it. These

solutions require large initial investments in research, development, and tooling, but once sales begin, incremental production is relatively cheap. When one brand gains a significant market share, people have a strong incentive to buy more of the same product as to be able to exchange information with those that are using it already [18].

At present the cost of developing a product, is largely due to R&D expenditure, intellectual assets, and services. However, the traditional accounting system focuses on measuring the cost of material, labour and fixed assets mainly used in Industrial Age companies. Consequently, business tends to focus on managing the cost implications rather than the value addition for the customer.

Inevitably, the transformation from the Industrial to the Information Age and recently the Knowledge Age implies a change in rules governing business. This skills-based economy requires that organisations develop and compete on their knowledge-based assets, which in turn requires an ability to manage and measure the organisation's knowledge or intellectual assets.

2.1.2 *Economics of Cyberspace*

The cost and time involved with acquiring a new product, i.e. the research cost involved with finding the right product and comparing the different prices as well as the logistical cost involved with obtaining the physical product, are known as transaction cost.

Service organisations came about in the Information Age to *optimise transaction cost*. Their competitive advantage is to develop an infrastructure that meets the clients need and that optimises the client's transaction cost of purchasing their product. This includes having the best site, sufficient resources and stock to facilitate the purchasing process.

However, due to the *economies of cyberspace* [10], transaction cost has significantly been reduced. The process involved with buying a book in cyberspace is an example of this. This involves using a website (e.g. Amazon) to find the suitable book, at the best price and then performing the transaction at a convenient time and place, irrespective of physical location.

The cost involved with establishing an infrastructure to optimise transaction cost is regarded as an asset and is reflected on the traditional balance sheet. Unfortunately, these assets become obsolete in the market-space of the knowledge era because of the reduced transaction cost introduced by the economics of cyberspace.

This brings about the *law of diminishing firms* where reduced transaction cost implies a decrease in the organisation's size. The organisation requires fewer resources to process transactions and to provide an interface to the client because the client handles the processing of the transactions online.

An additional factor that influences customers' decision when purchasing in the Knowledge Age is the *switching cost* involved with changing from one knowledge intensive product or service to another, e.g. the cost involved for an organisation to switch from Microsoft to Lotus.

The *economics of cyberspace* facilitates business in a new way. It requires a transition from competing in a physical space to performing business in the virtual domain of cyberspace. Such a transition implies change, requires new enabling infrastructure as well as a knowledge economy paradigm, which is all addressed in the knowledge management business philosophy.

2.1.3 Globalisation

Metcalfe's law states that once an open system or a network reaches *critical mass* its value for its users increases exponentially due to the amount of people that uses it, because the network utility is described as the square of its number of users [10].

Due to its openness, the Internet's Communication Protocol reached critical mass in 1993. Thus the Internet became the standard as it increased exponentially in value per additional user. The Internet has become an open market for the sharing, using, and adding of information to the global information base and has a direct influence on the virtual organisation as introduced by the Knowledge Age.

A knowledge management initiative considers the utilisation of these information sources to the benefit of the organisation's knowledge worker and applies this means to facilitate learning within the organisation as well as with external parties.

2.1.4 Digitisation

Moore's Law indicates that digital technology becomes increasingly cheaper, smaller, and faster [10] over time. This rapid change in the capacity of technology has implications for the functional systems operational in society, as well as for the human resources of the organisation.

2.1.4.1 *Functional Systems*

The *law of disruption* states that the exponential increase in the functionality of technology is responsible for major secondary effects on other unrelated systems, e.g. the effect that e-mail has had on the postal services.

2.1.4.2 *Human* Resource

Until recently, the processing power and memory capacity of information technology (IT) was perceived as expensive. For this reason the organisation's IT system was managed to ensure optimal utilisation and was regarded as the critical resource. As the processing and memory capacity becomes less expensive though, the users of the system and the IT personnel that need to maintain the system, becomes the critical resource.

Dave Ulrich, when questioned on why the knowledge worker has become so critical, replied as follows: "*One, business changes faster than ever, and the response to change requires a different level of workforce and a talented workforce. Two, I think talent is scarce. Any scarce resource becomes the most critical resource. I also think expectations for companies to respond globally and to respond to customers are higher than they have ever been*" [36]. The only factors that could change this scarcity is globalisation, the ability to distribute talent all over the world, and the fact that people are quickly developing new skills as the market adjust to supply and demand.

Knowledge management recognises the scarcity of the knowledge worker. It considers the importance of capturing (digitising) information as part of the knowledge worker's daily activities at the source, so that no extra time or resources are required to feed information into the system. It is critical to get people to use these systems and to capture as much information as possible by providing the means to capture the various types of information easily. Only once information is digitised can it be manipulated so that various users can receive benefit from it.

2.1.5 Customer Intimacy

The primary *value discipline* has changed from operational excellence to customer intimacy. In the Knowledge age customers require faster problem solving and an ability to adapt faster [31]. Through Internet technology, mass-customisation has become possible. This implies that customers interact with a personal interface according to their personal preferences that gives the company, in return, valuable marketing information on customers' behaviour. Through a knowledge management

initiative the organisation can establish the infrastructure to extract and provide client preferences.

2.1.6 *Free Information*

The Internet value proposition is to provide users with as much information as possible. As users can easily find public information somewhere else when not sufficiently supplied. For this reason information is regarded as public goods and should be given away for free.

Value-added information that is not freely available is regarded as a prominent product in the knowledge economy and can be sold given that there is a market for the information and that one can attract the market (by first supplying sufficient information).

Thus, knowledge management initiatives need to weigh the value that it generates from attracting customers against the risk involved in giving all of its information away.

2.1.7 *Role of Information Technology (IT)*

The over-emphasis on the role of Information Technology (IT) creates a real danger for companies that delegate the responsibility for their knowledge asset and the ability to think to traditional IT 'databases'. Despite technological advances, the company meeting point (coffee bar) – where team members share ideas – still surpass the information technology system when it comes to harnessing the knowledge that gives business its competitive edge.

While it is true that technology infrastructure allows information sharing in the modern organisation and, in fact, is essential in the codification, distribution and storage of information, IT falls short in the creative application of knowledge. Knowledge is about how information is applied to leverage the core competencies of the organisation whereas technology is only an enabler to the knowledge creation process.

The application of knowledge still relies on the organisation's knowledge worker and emphasises the critical role of the human element in the knowledge management philosophy.

2.1.8 *Costly Knowledge Reinvention*

Organisations are currently very ineffective at managing their knowledge assets. Organisations neither measure nor protect their knowledge or their knowledge workers and do not realise the value of knowledge sharing within the organisation. Organisations cannot afford to 'reinvent the wheel' and need to retain knowledge that is lost during downsizing, restructuring and the poaching of knowledge workers.

Knowledge management aims at utilising the knowledge of expert performers and applying it in similar situations in order to develop the company's competence, to retain its knowledge and to avoid timeous reinvention.

2.2 The Implications of Knowledge Management in South Africa

There are a number of factors in the South African context that articulate the need for knowledge management with regards to retaining companies' knowledge capital as well as emphasize the implications of a lack of knowledge management:

- A high number of professional workers have left the country ('brain drain') or consider *emigration* due to the political uncertainty and the weakening economy of the country as well as the international demand for knowledge workers. This impacts companies' intangible assets, the impact of which is currently not being measured.
- The high level of *illiteracy* accentuates the scarcity and value of the knowledge worker as well as the need to leverage their knowledge to the benefit of the whole organisation.
- The *employment equity* act demands high cost to develop previously disadvantaged employees at the cost of valuable knowledge workers.
- The tacit *knowledge lost* in unsuccessful business re-engineering projects and in downsizing attempts has left the company in a state of knowledge anorexia.
- Cultural mindset of *knowledge-hoarding* instead of knowledge-sharing that exists in the traditional organisations reduces the opportunity to retain employees' knowledge and broaden the knowledge base.
- *Information management* competence that acts as a qualifier for successful knowledge management is still immature in most companies.

2.3 Conclusion

The white waters of change introduced by factors like the knowledge economy and globalisation together with the unique South African context necessitate local organisations to develop their ability to retain and leverage the knowledge of the knowledge worker to the benefit of the organisation. In addition, digitalisation and the economics of cyberspace require the codification and effective management of the organisation's information to enable a higher level of customer intimacy.

Subsequently, without the effective management of the organisation's knowledge the cost of 'reinventing the wheel' will leave organisations lagging behind a fast changing world and thereby render the organisation unable to compete effectively or sustainable.

CHAPTER 3

THE THEORY OF KNOWLEDGE MANAGEMENT

3. THE THEORY OF KNOWLEDGE MANAGEMENT

The limited number of implemented knowledge management initiatives contributes to strong theoretical arguments in literature with few practical examples. This chapter provides an overview of existing theory in an attempt to define the key aspects of knowledge management namely the *knowledge asset*, the *knowledge organisation*, *intellectual capital* and *knowledge management*.

3.1 The Knowledge Asset

'The knowledge and skills of employees is what really differentiates a firm from its competitors.'[35]

This section discusses the relationship between data, information, traditional assets and the different organisation forms in order to define the knowledge asset.

3.1.1 Knowledge vs. Information

It is essential to differentiate between data, information, and knowledge before defining knowledge management. The relationships between these entities are illustrated in the knowledge creation process (*Figure 4: Knowledge Creation Cycle*) where knowledge is seen as the product of the transformation of data and information.

Knowledge, in theory, is a product of a continuous cyclical process that starts by organising ubiquitous facts through specific stimuli into structured data and then developing information through a process of aggregation. Once information is internalised by a knowledge worker it is used to create knowledge and understanding. Once the knowledge worker externatilise and express this understanding in a structured form it becomes information, e.g. advice, which is then disseminated to yet again form data and is finally dissipated to become mere facts.

Knowledge is what is learned or retained after the data or information is forgotten or the product is sold. Examples of knowledge include knowing where things are, how they can be found, understanding and comprehending as well as developing believes and values that are used to facilitate decision making. Knowledge promotes understanding and proposes action whereas intelligence is the efficient use of information to produce the knowledge as well as the efficient combination of knowledge to produce more knowledge.

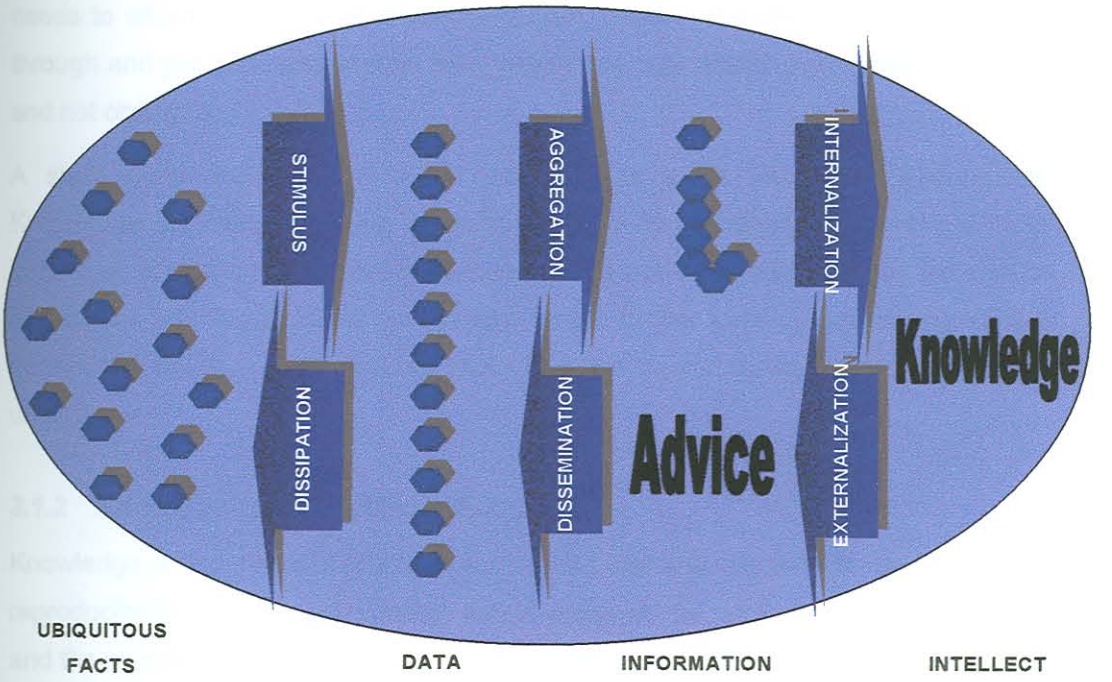

Figure 4: Knowledge Creation Cycle

A major difference between knowledge and information is in the degree of dependence on an individual's perception. Knowledge is created mentally once a person establishes a link between two pieces of information from his unique perspective. *"Knowledge depends less on the amount of information than on the number of connections that link the information. A knowledge base allows you to navigate and make sense of these connections easily"* [40].

The replication of knowledge is harder than that of information due to the connections that it contains. Knowledge links can exponentially increase the possible interpretation of any single document. Thus, documents must be updated and changed as the knowledge changes. An example of this where a system contains the content of a knowledge source, e.g. a document as well as the context surrounding that source, e.g. the name and contact details of the author, the date it was created, the location and the application of it.

In order to manage knowledge one needs to understand that through learning knowledge is in a constant process of change. Margaret Wheatley, president of the Berkana Institute - a scientific research foundation supporting the discovery of new organisation forms - explains that in a 'state of chaos' we experience a state of maximum information and that once we try to control information we minimise it. She continues to say that self-organised systems have the ability to constantly change according to the intelligence that it contains [2]. In the same way, the organisation

needs to sit on the 'edge of chaos' to quickly capture the information that passes through and put it to use, as new information can only disturb the constructed world and not change it.

A static corporate memory is not sufficient in a fast changing environment. Knowledge provides the ability to learn from previous experiences and to change behaviour according to current situations. This involves moving beyond experience of the past, which only gives perspective on the future, towards developing skills to handle the future. This includes skills to learn new techniques and to thrive in uncertainty.

3.1.2 *Knowledge vs. Traditional Assets*

Knowledge is the critical resource of the current age and due to its leveragability and reproducibility, no clear relationship exists between the cost of creating knowledge and the number of users that could receive value from it. The four *characteristics* that make knowledge different from any other resource [4] are that:

- knowledge is unlike other factors - infinite, expandable, and self-generating;
- knowledge can substitute for land, labour, and capital;
- knowledge is transportable at a dramatic speed; and
- knowledge increases on sharing.

Knowledge can be used without being consumed, it is non-subtractive, infinite and exists independent of space, but are sometimes more dependant on time that on any of the other resources.

"In order for a thought to become knowledge, it must be shared, distributed and challenged. Knowledge is not personal, it is the shared communal font from which each successive human generation drinks, eventually adding back more than it takes" [4]. When knowledge is captured in a way that allows it to be described, shared, and exploited; when it can be deployed to do something that could not be done if it remained scattered around; and thus if knowledge is packaged appropriately, it becomes intellectual capital.

3.1.3 *Knowledge in the Organisation*

Different levels of complexity exist for different types of organisational structures and forms. This ranges from elementary structures that operate with real facts to very complex organisation structures that operate in the ethereal domain (*Figure 5: Different Organisational Forms*).

The most elementary form of organisation structure is the one-man business that uses assets to create value for the customer, whereas the medium-size company obtains capital and uses supportive data to enable its operations. An enterprise or holding company utilises information to operate its power-base, whereas virtual organisations influence the market place and depend on knowledge to accomplish it. This does not imply that knowledge is not required in smaller organisation structures, but illustrates that increased organisational complexity requires a greater ability to leverage the knowledge asset in order to be successful.

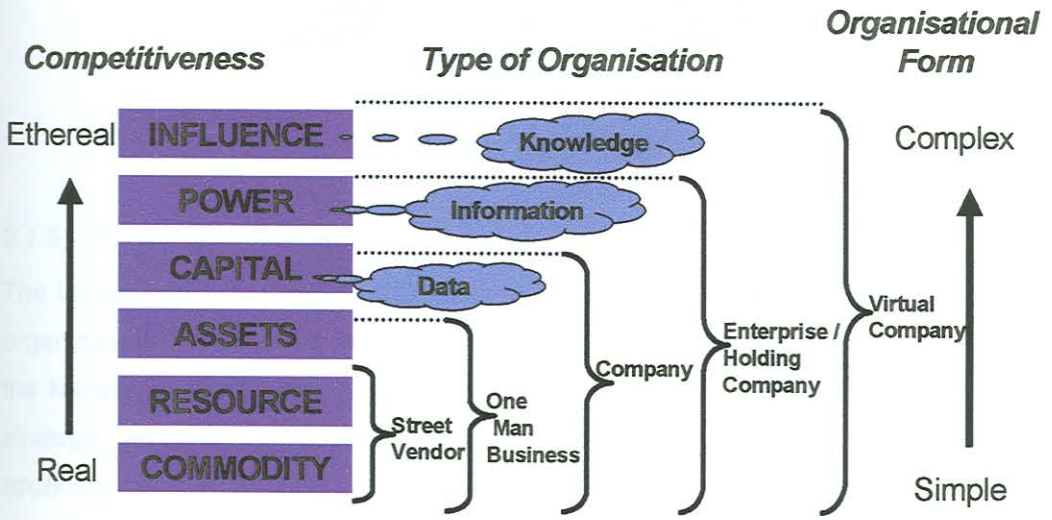

Figure 5: Different Organisational Forms

3.1.4 Knowledge Forms

Knowledge occurs in tacit and explicit forms in the organisation. Knowledge that exists in a person's mind is referred to as tacit knowledge or the ability to respond to change, whereas explicit knowledge is knowledge that is defined and available in a codified form [20].

The competitive advantage of the organisation is not situated in its explicit knowledge, because it is accessible by competitors, but rather in the organisation's tacit ability to make decisions, whilst considering a great wealth of information from various sources (*Figure 6: Sources of Information*).

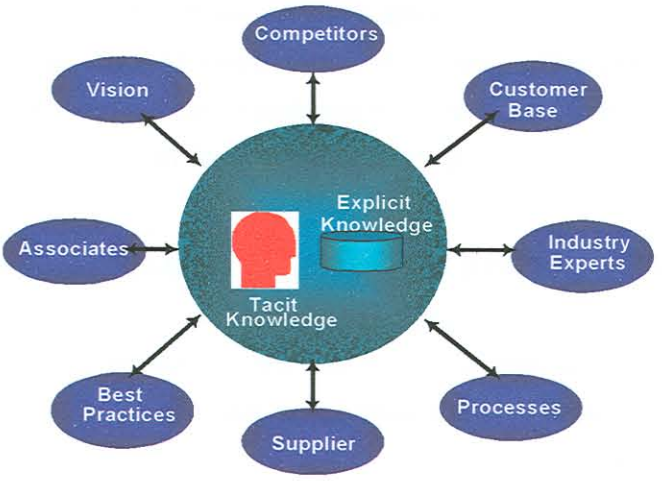

Figure 6: Sources of Information

3.1.5 Knowledge Process

The knowledge value chain in the organisation starts with an understanding of the organisation's mission, vision, objectives and strategy. The next step is to determine the knowledge needs and knowledge availability in the organisation to support the strategy. This leads to a knowledge process that focuses on knowledge sharing, application and evaluation processes aimed at creating new knowledge. (*Figure 7: Knowledge Value Chain*).

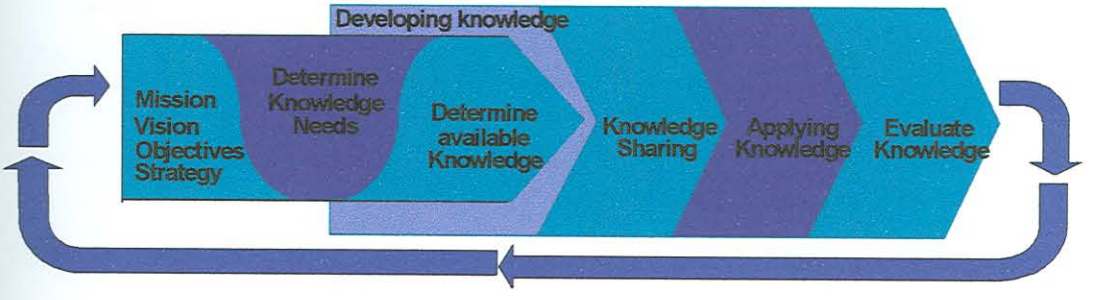

Figure 7: Knowledge Value Chain

3.2 The Knowledge Organisation

The *Knowledge Organisation* is a specific type of organisation within the service industry (see *Figure 8: Knowledge Organisations in the Service Industry*) [33].

The service industry consists of a spectrum of companies ranging from those totally adapted to their customers (customer intimate leadership) to companies that package their products as a predictable service to the mass-market (product leadership).

The main difference between these opposite sides of the industry is in the level of customisation of the services delivered to the client. The former type service organisation focuses on problem solving between the customer and a team whereas the packaged service solution focuses on delivering the same service continuously and reliably.

The former is called a *knowledge organisation* and provides a customised-service. The knowledge organisation develops unique and customised solutions for the client's problems. The rapport between the client and team becomes critical during the creation of a unique solution, due to the close relationship between the customer and the service provider. The team members of a *knowledge organisation* are knowledge workers and are usually highly developed or educated with experience in professions related to information technology.

Knowledge organisations are usually small in size, flexible and creative with open management styles. They are knowledge intensive and operate on economy of scope, whereas the *service company* operates on economy-of-scale by functioning as a big, productive organisation. Consequently the service organisation operates in a hierarchy with a high number of low educated staff.

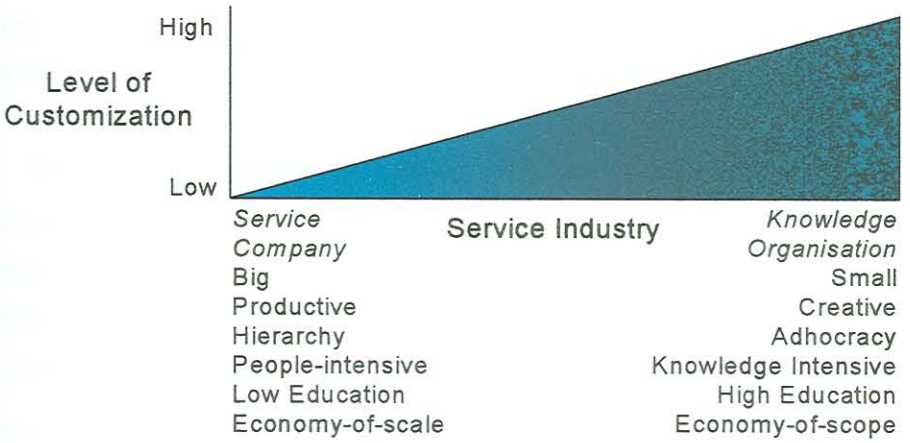

Figure 8: Knowledge Organisations in the Service Industry

Unlike the opposite end of the service industry that focuses on efficient, timeous expected service, *knowledge organisations* focus on how to manage the relationship between employees and customers in the development of unique solutions. These companies need to attract the right personnel and customers and match the capacity and chemistry between these parties. Another distinct feature of the *knowledge organisation* is that it usually owns few tangible assets, yet displays a high market value in relation to their book value due to their intangible assets (discussed in paragraph 3.4).

3.3 Knowledge Management

Professionals can no longer know everything they need to know in order to do their jobs well and compete in the marketplace. They require instant access to critical information. In the future, organisations able to provide their members with rapid access to the full repository of knowledge are the organisations that are most likely to succeed.

3.3.1 Knowledge Management Purpose

Every employee builds a wealth of knowledge through learning, skill development, and daily behaviour. Every employee possesses knowledge of beneficial value to the company, yet most of this knowledge is not leveraged to the collective benefit of the organisation.

The purpose of knowledge management is to integrate the collective knowledge of employees in such a way that the whole is greater than the sum of the parts. This information must then be made accessible to all relevant individuals within the organisation so that it may be utilised and applied to enhance the competence and competitive advantage of the organisation as a whole. In addition, knowledge management aims to provide the organisation with the ability to learn, and thus, undergo a continual process of change. With this change process comes the opportunity to improve and enhance the performance of the organisation.

3.3.2 Knowledge Management Objectives

The objective of knowledge management is *to develop a knowledge base* equal to all the employees' knowledge, skills, behaviours, perceptions, values, principles, and education within the organisation's specific culture (leadership style, management style, communication and organisational behaviour), strategy, and structure.

Following an integrated approach to identifying, capturing, retrieving, sharing and evaluating the enterprise's knowledge assets, enables the organisation to develop a knowledge base. These assets may include databases, documents, policies and procedures as well as uncaptured, tacit expertise and experience resident in the individual workers' minds.

Ernst & Young's approach is to develop generic 'knowledge objects' by removing customer sensitive information from knowledge, e.g. interview guidelines, and storing it for employees to use without having to contact the creator of the knowledge – thus achieving scale in terms of knowledge reuse [37].

Knowledge management must allow the organisation to *continually update and renew* organisation-specific assets. In order for this asset to be utilised so that it adds value, employees must be able to continually add to and update the information and knowledge. Information sources must be made available to all the relevant individuals so that it can be accessed and utilised appropriately. In turn, it will enhance the knowledge and skills of employees, which will have an impact on the performance of the organisation as a whole. Building and maintaining the knowledge base requires money, time and personnel as well as a long-term commitment to change the way in which employees work.

Another objective is to enable the organisation to *keep track of the skills and knowledge* available internally, so that the appropriate individuals are involved in decision-making and in projects that will utilise their individual skills and talents. In general this will not only add to the efficiency and performance of the organisation, but also to the sense of worth felt by individuals due to an opportunity to contribute, resulting in job satisfaction and improved individual performance.

3.3.3 Knowledge Management Defined

"Knowledge management is not about technology but is a 'multi-disciplinary' concern encompassing important aspects of cognitive science, information design, interpersonal communication, organisational dynamics, library science, motivation, training, heuristics, publishing, and business analysis as well as many technologies" [9]. Before one can define knowledge management though, one needs to differentiate between the following:

- *Information Technology* that utilise technology to transports and manage data;
- *Information Management* that adds value to data and transforms it into information;
- *Knowledge Management* that enables the use and reuse of knowledge created and developed in the tacit thoughts of employees to generate solutions for the client.

Knowledge management is the explicit and systematic management of vital knowledge and its associated processes of creating, gathering, organising, diffusing, using and exploitation. It requires turning personal knowledge into corporate knowledge that can be shared widely throughout an organisation and applied appropriately.

In short it is an integrated approach *to* facilitate the knowledge creation and retention process *by* providing infrastructure *to* make knowledge available:

- at the right time,
- to the right person,
- in the right format and,
- within the right context

In summary, knowledge management is:

1. the practise of adding actionable value to information by capturing, filtering, synthesising, summarising, storing, retrieving and disseminating tangible and intangible knowledge;
2. the development of customised profiles of knowledge for individuals so they can obtain the right kind of information when they require it; and
3. the creation of an interactive learning environment where people transfer and share what they know and apply it to create new knowledge.

3.3.4 Knowledge Base

As mentioned in paragraph 3.3.2, one of the objectives of knowledge management within an organisation is to create a knowledge base which:

- contains organisation-specific (appropriate) information;
- is up-to-date;
- is accurate (integrity of data) and secure;
- is organised to simplify search and maintenance (ease of accessing, editing, and updating the knowledge base content);
- is cost effective;
- supports employees by providing for lessons learned and knowledge of things to avoid;
- provides the opportunity for the sharing of information, ideas and opinions.

This database will consequently speed up the recognition-, capture-, and distribution process of knowledge so that effective learning and innovation can take place throughout the enterprise, thereby enabling the rapid deployment of high-quality solutions. Practically, in a geographically dispersed enterprise, it provides the infrastructure that supports the capturing and leveraging of solutions.

Finally, such a knowledge base should not be measured in terms of cost reduction, but rather in terms of the investment made in the organisation's intellectual assets. The emphasis is thus changing from internal competition to sharing, and from revenue generation to knowledge generation.

3.4 Intellectual Capital

"Intellectual capital is the sum of everything everybody in a company knows that gives it a competitive advantage." [32]

Intelligence becomes an asset when some useful order is created out of free-floating brainpower - that is, when it is given coherent form, e.g. a mailing list, a database, and an agenda for a meeting, a description of a process. When it is captured in a way that allows it to be described, shared, and exploited as packaged useful knowledge; and when it can be deployed to do something that could not be done if it remained scattered around, it is referred to as intellectual capital [32].

The difference between the book value of a company, according to it's balance sheet, and it's market value, usually exists due to its intellectual assets, such as expected revenues from patents, customer relationships, brand names and the ability to exert management control. The reality is that the stock market values organisations much higher than their book value shows, i.e. the value of tangible, measurable, hard assets versus the intangible, people, name and management assets. Unfortunately, companies still have the tendency to invest more in tangible assets than intangibles, because the returns on the intangible assets are more difficult to measure.

Sveiby distinguishes between the tangible and intangible organisation's assets and the visible and invisible finances as illustrated in *Figure 9: Balance Sheet of the Knowledge Organisation* [28].

Sveiby explains that the tangible assets of the organisation directly relate to the visible finances of the organisation, i.e. the cash flow, accounts receivable, equipment and office space and are accounted for through the short- and long term debt and shareholders' equity of the organisation, as reflected in its financial statements.

The invisible finance of the company refers to the difference between the market value and the book value of the organisation and is reflective of the external and internal structures of the organisation – also called the intangible assets. The competence of the employees is not regarded as part of equity because it is not

owned by the organisation and only forms part of the intangible assets due to employees' obligation and commitment towards the organisation.

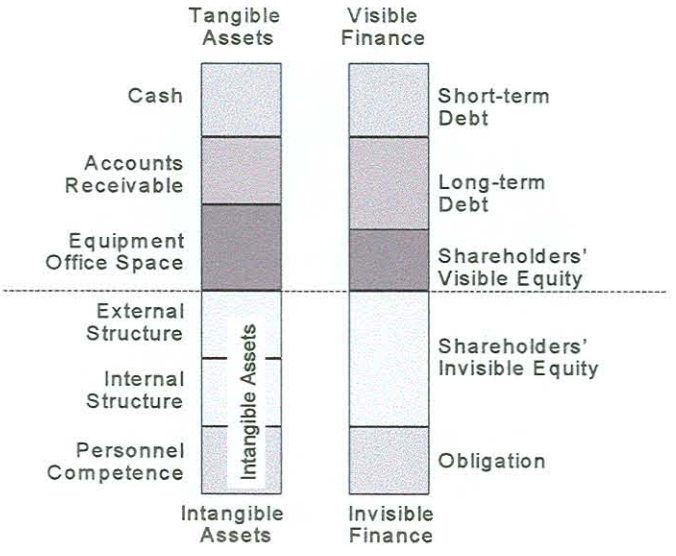

Figure 9: Balance Sheet of the Knowledge Organisation

If intangible assets are responsible for the invisible equity of the organisation and knowledge management aims at developing the intangibles rather than the physical assets of the organisation, the return on investment of knowledge management should be measured against an increase in the value of the intellectual capital of the organisation, rather than in terms of the traditional accounting measures.

Sveiby continues to say, *"if we measure the new with the tools of the old, we will not see the new"* and that intangible assets are essentially non-monetary and cannot be measured with traditional financial measure but should rather be measured with non-financial indicators.

3.4.1 Classification of Intellectual Capital

Similar standards have emerged for the classification of intellectual assets. These include the classifications of the balance scorecard as defined by Kaplan and Norton [17], Sveiby's intangible asset monitor [34] as well as Edvinsson's [13] intellectual capital components (see Table 1).

Table 1: Different Classifications of Intellectual Capital

Sveiby	Kaplan & Norton	Edvinsson
Internal Structure	Internal Processes Perspective	Organisational Capital
External Structure	Customer Perspective	Customer Capital
Competence of Personnel	Learning & Growth Perspective	Human Capital

If we follow Sveiby's descriptors, the intellectual assets of the organisation are categorised into the organisation's internal structure, external structure, and personnel competence (see *Figure 10: Intellectual Capital*).

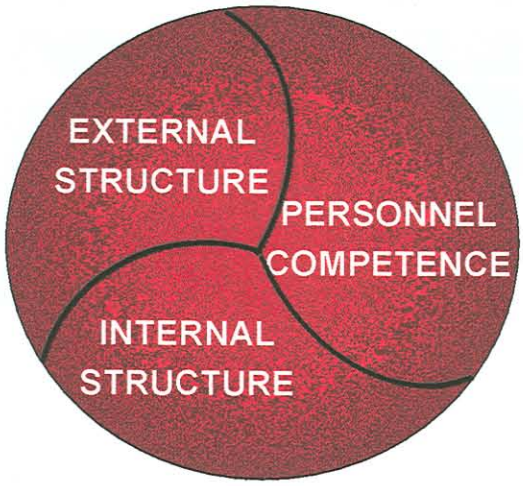

Figure 10: Intellectual Capital

- *Internal structure* - includes the tools that are used to package knowledge and permit it to be used time and again in the creation of value. It also includes the organisation's culture (corporate practice), core processes (operating guidelines), data and information (documented expertise, technical designs, R&D results), standards and procedures (corporate procedures), methodologies (manufacturing technologies), business plans and strategies (knowledge of the firm);
- *People Competence* - is the knowledge embedded in the people of the organisation, and include skills (professional, management and operational expertise), know-how (technical know-how), experience (lessons learnt, knowledge-based systems), and education; and
- *External structure* - refers to the relationship that the organisation has with its external environment, e.g. the organisation's image in the market and relationship with the its stakeholders that enhance the likelihood that the organisation's customers will keep doing business with it. It also includes market centred assets (knowledge of the market), supplier related assets, stakeholder relations, society related image, brand names and trade marks.

These organisational assets in the knowledge age can be classified as summarised in *Figure 11: The Classification of Corporate Assets* and are described in the remainder of this section.

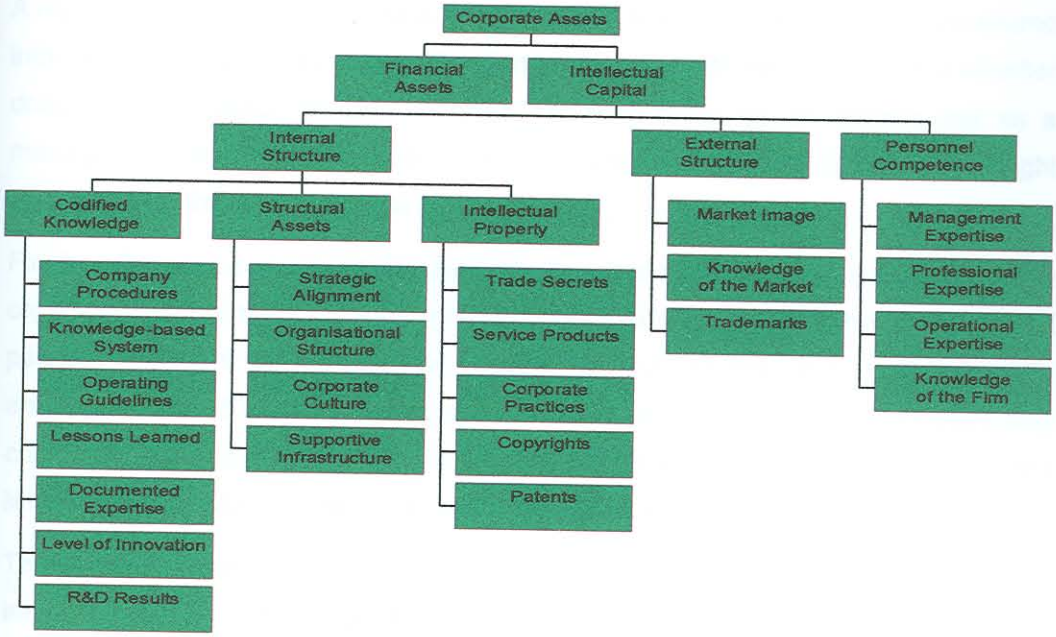

Figure 11: The Classification of Corporate Assets

3.4.1.1 Internal Structure

"Even the smartest people in the world need a mechanism to assemble, package, promote, and distribute the fruits of their thinking."

Studies show that management spend between 15% and 20% of their time looking for information that already exists in the organisation and that a company with a 10% annual turnover of employees will lose half of their experienced workers within five years. If one considers the cost involved with searching for information and 'reinventing the wheel' due to limited captured knowledge sources, then the return on an investment made in the internal structure of the organisation should be high.

An internal structure establishes links to relevant information and provides the means to find information without difficulty. This includes the structuring and packaging of competencies by using technology, manuals and process descriptions. This ensures that knowledge remains in the organisation and is utilised through the continuous recycling of shared knowledge and experience. Internal structure also includes the strategy, culture, real-time networks, structures, systems, organisational routines and procedures which are far more extensive than just a codified knowledge assets.

The organisation's internal structure shortens the lead-time to knowledge sharing and increase productivity. For this reason, a knowledge repository and corporate yellow pages are required to locate knowledge in the organisation and connect enquirers with experts.

A repository facility provides users with the ability to collect and manage unstructured information taking factors in consideration such as the Internet, Intranet, and whether document orientated, or not. It does not only serve as an archive but as a management tool that has the ability to intelligently supply (publish) the right information to the right person in the right format.

Finally, the internal structure support the transformation of knowledge into organisational property, i.e. the organisation's legal right of ownership in the form of patents, copyright of technologies, inventions, publications, and processes. As employees record their lessons learned the internal structure strengthens the whole company can do the job faster next time, without "losing the recipe", resulting in the leveraging of the knowledge asset to improve the turnaround.

There are different ways to develop the organisation's internal structure, which include knowledge acquisition and -renting, dedicated knowledge sources, as well as knowledge networking and –codification.

a) Knowledge Acquisition

A prominent feature of the knowledge asset is the difficulty of transferring it across organisational boundaries. It is dependent on time, investment, culture, political issues, and on a specific ecology for its existence. The organisation can hire employees and establish joint ventures to acquire knowledge, but the acquisition depends on the recipient's ability to internalise the knowledge. Other reasons for transfer failure include stubbornness of the recipient, resistance to change, pride, lack of time, and lack of trust in the source of knowledge as well as the medium that influences the speed of transfer and the quality or depth of knowledge.

b) Knowledge Renting

Another way to generate more knowledge stock is by renting a knowledge source, e.g. by outsourcing research and development activities, by contracting a consultant, or by licensing specific knowledge assets. This is a temporary knowledge source that requires effective knowledge transfer for successful knowledge retention.

c) Dedicated Knowledge Sources

A dedicated group of people with a specific knowledge responsibility, such as the Research and Development department or the library, generates knowledge stock. Their challenge is to transfer or diffuse their tacit, internal, and know-how type of

knowledge to the rest of the organisation, e.g. through mentoring, in order to retain and preserve individuals' knowledge.

d) Knowledge Networking

The larger the organisation, the greater the probability that required knowledge exists within the organisation, but the lower the probability of finding it. This calls for strategies to initiate knowledge fairs where 'sellers' and 'buyers' can meet to discuss the knowledge available, with sufficient time and space to collaborate and generate knowledge. The channel for knowledge transfer depends on the type of knowledge. Tacit knowledge only transfers within a relationship and sufficient personal contact such as face-to-face meetings and informal conversation, because it is only through conversation that the knowledge worker discover what he knows, that he shares it, and that he gains new knowledge for the organisation.

e) Knowledge Codification

Codified knowledge is a portable, organised, explicit, and easy-to-manage entity. However, before codification, it is important to consider the sources of this knowledge, the appropriate form of codification, and the means of distributing the knowledge entity.

3.4.1.2 Personnel Competence

Companies' intelligence depends on how well they use the mind power of their employees (knowledge creation resource). A person's mental model is the representation of his reality, frame of reference, as well as the mental processes that is used to think and solve problems. The combined result of the employees' mental models determines the company's thinking ability, whereas the quality of the decision making is determined by how well employees understand the company.

The competencies of the employees, i.e. their attitudes, skills, knowledge, and experience, are the key ingredients for success in the knowledge age. In a knowledge organisation, an employee' competencies need to be highly developed and he probable needs to be highly educated as well. These employees want to grow in competence and prefer to gain experience while working in challenging environments. The competence of the employees is not owned by the organisation and companies need to retain key personnel by developing a culture that cultivates a bond of loyalty.

There are various strategies for developing the people competency in the organisation, but as with any strategy that effects the human element of the organisation, one has to take caution to retain the trust of employees. These strategies include to:

- 'buy' – get new talent from outside;
- 'build' – develop employees by training;
- 'borrow' – consultants or joint venture;
- 'bounce' – get rid of poor performers;
- 'bind' – keep the best employees.

Finally, the traditional command-and-control management model becomes less important, diminishing the middle manager's job, because knowledge workers need to work without constant supervision and must primarily be measured on the results they achieve.

3.4.1.3 External Structure

Companies need to invest in their customers just like they invest in their employees and their internal structures, by establishing connectivity, by providing online support, and by creating sound relationships with their customers. The organisation's primary source of knowledge in the process of creating innovative products is it's own customers. Empowered customers provide information about the market so that companies can respond to and thus provide a more customised service.

The company, on the other hand, develops a reputation by solving the customer's problems successfully. This reputation depends on the company's name and customer network and is ultimately determined by the customer. The reality is that the success of the customer feeds the organisation's success and at the end, monetary value is placed on the customer loyalty and value of your brand name.

3.4.2 Managing Intellectual Capital

Finally there are a number of critical aspects to consider when managing the intellectual capital of the organisation, which include [24]:

- Leveraging the organisation's information and knowledge to substitute expensive physical and financial assets.

- Focusing on the new enablers of business, i.e. the flow of information, and considering the importance of the information imbedded in the entire value chain's, especially where it interfaces with the customer.
- Recognising that organisational wealth and customer value is created around the skills of a selective group of employees that need to be invested in.
- Sharing the ownership of the organisation's intellectual capital with the employees, suppliers, and the customers, whilst protecting it with sound relationships.
- Enabling knowledge work, which implies permitting the creation of customised products as a result of sound relationships.
- Recognising the interaction between the internal and external structures as well as personnel competence.
- Developing the internal structure of the organisation to enable the flow of the knowledge stock inside the company, in order to provide for the easiest access to the most useful information on a just-in-time basis.
- Ensuring that effective connectivity exists between the customers and employees.
- Utilising the people competence effectively by using techniques such as teamwork, communities of interest, and collaborative learning to make knowledge less dependant on one individual.

3.5 Knowledge Management Concepts

A number of supporting concepts have been developed in the knowledge management domain including the learning organisation, learning process and the new organisational roles and responsibilities related to managing knowledge.

3.5.1 Learning Organisation

'The only sustainable source of advantage is the ability to learn faster than your competitors.' [3]

"A learning organisation, systematically defined, is an organisation which learns powerfully and collectively and is continually transforming itself to better collect, manage, and use knowledge for corporate success. It empowers people within and outside the company to learn as they work and to utilise technology to optimise both learning and productivity." [19] "Sharing and transfer is also tangible evidence of a 'learning organisation', one that can analyse, reflect, learn, and change based on experience." [22]

These definitions are a direct reflection of the organisation that knowledge management aims to cultivate. In the same way that the theory surrounding the learning organisation explains that the interaction between the organisation, technology, learning, people, and knowledge enables a learning organisation (see *Figure 12: Components of a Learning Organisation*), knowledge management considers the integration between strategy, people, process and technology (refer to page 38).

The learning organisation model is the result of the quality of five interrelated sub-systems of which the core sub-system is the organisation's learning ability. Knowledge Management facilitates and enables this learning capacity (process) within the organisation.

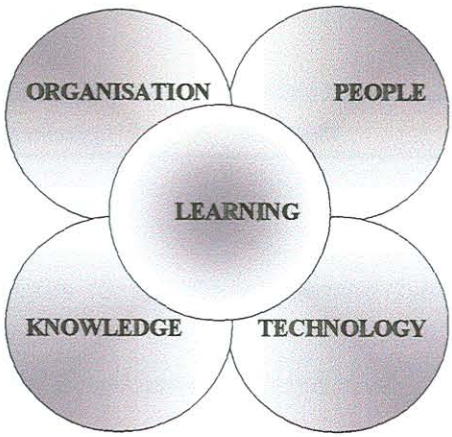

Figure 12: Components of a Learning Organisation

3.5.2 Learning Process [25]

The difference between training and learning is often compared with the difference between feeding an animal or encouraging an animal to find food for itself. Learning enables individuals to create their own solutions, which results in long-term breakthroughs rather than just small improvements. This becomes possible as the company develops the meta-cognitive skills of their employees, i.e. their ability to learn how to learn.

The social learning cycle (*Figure 13: The Social Learning Cycle*) emphasises that personal knowledge has to be codified before the collective learning cycle can take place [1]. Personal uncodified knowledge is codified into taxonomies and becomes propriety knowledge, owned by the organisation. This is then distributed and becomes textbook knowledge in the organisation, which is accessible to all. Once employees absorb it, it becomes common sense that is applied to acquire new skills to yet again create personal knowledge.

Through knowledge management, the organisation's ability to learn is enhanced, because it improves the codification-, distribution- and knowledge-access processes in the organisation. It also improves the organisation's ability to change and develop the competencies that are needed to maintain its competitive advantage.

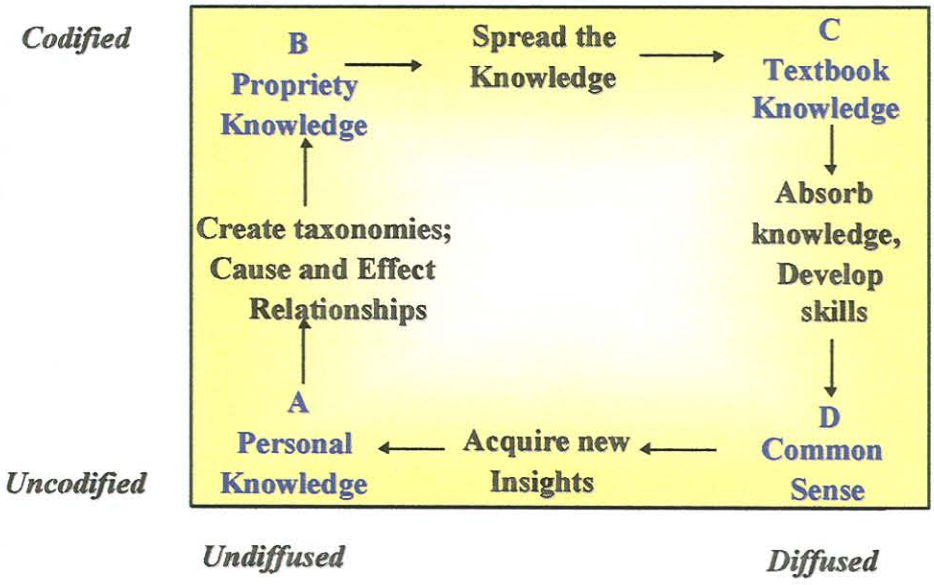

Figure 13: The Social Learning Cycle

3.5.3 *The Organisational Development Perspective*

It is important to understand the intent of knowledge management, and more importantly, knowledge sharing. Organisational development disciplines have inadvertently been providing knowledge sharing opportunities within the organisations for a long time, albeit focussed on sharing between individuals for a specific "other" purpose. These activities include:

- Mentoring
- Coaching
- Formal training and skill development
- Formal and informal induction processes
- Succession planning
- Formal and informal communication

In developing knowledge management within an organisation, these activities must form an integral part of the process, because these form the basis for knowledge sharing.

3.5.4 Knowledge Management Roles and Responsibilities

A number of new roles are emerging in organisations as knowledge management initiatives are introduced, e.g. knowledge workers, chief knowledge officer (CKO), chief intelligence officer and knowledge managers.

3.5.4.1 Knowledge Worker

Although there are different definitions for knowledge workers, one definition is that a knowledge worker is - 'one who uses information technology as a primary means to perform work'. Research shows that the industrial worker will form 13% of the work force and that knowledge workers as defined here, will constitute as much as 30% of the US's work force in the year 2000. The latter percentage will even increase when one defines knowledge workers more broadly as 'all those who create, document, transform, and share knowledge' [42].

3.5.4.2 Chief Knowledge Officer and Knowledge Managers [12]

Those in management positions' responsibilities are to initiate, drive and co-ordinate the knowledge management initiative and to manage the knowledge resource, by:

- developing techniques to create, protect and use knowledge;
- creating environments that are conducive to the development of new knowledge; and
- translating knowledge management objectives into implementation programs.

The CKO are ultimately responsible for addressing the following "perceived corporate deficiencies:

- inattention to the explicit or formal management of knowledge in ongoing operations;
- failure to leverage the hidden value of corporate knowledge in business development;
- inability to learn from past failures and successes in strategic decision-making; and
- not creating value or 'making money' from knowledge embedded in products or held by employees." [12]

The primary tasks of the CKO and knowledge managers are to advance the concept of knowledge management and to create buy-in across the different levels of the organisation. They perform a dual function in that they initiate investments in

information technology as well as in the social environment. Thus they must be equally comfortable as technologists and environmentalists.

The CKO, as a *technologist*, has to be informed about available technology and its functionality, understand the implementation requirements of alternative technology solutions and must be comfortable to work in a close relation with technology partners in implementing IT applications.

As an *environmentalist,* the CKO must be able to create an environment that is conducive of knowledge creation and exchange. This entails designing the space, e.g. open-space offices, chat rooms, learning centres, and creating the opportunities, e.g. knowledge fairs and markets for conversation as well as joining people with the same interest, to exchange knowledge and gossip. This area of responsibility also includes influencing human management related strategies, e.g. performance management, human development initiatives, etc. that will contribute to developing a knowledge-friendly environment in the organisation.

In addition to being a technologist and an environmentalist the CKO must own another critical skill - *entrepreneurial* ability. This is the ability to create a vision and to see the 'big picture' but also to translate it into a workable plan, i.e. the determination to create something new and to see it through. Another ability required of a CKO is that of *consultant* that can extract new ideas from various parties and persuade others of the value of it.

An aspect that contributes to a CKO's success is a broad career experience, a high level of credibility in the organisation and preferable a few years of employment at the relevant organisation.

The personality traits expected from a CKO are *emotional stability,* which relates to qualities such as being evenly tempered and optimistic as well as to the ability to handle stress. *Extroversion* seems important due to the high level of people interaction and relationship building required from the position. This links with a required *openness* that suggests a willingness to try a different approach. Lastly, studies show that a CKO also needs to be *goal-driven* but *sociable,* display a high *interest in change* yet show *tolerance,* and must be able to operate on a steep *learning curve* with limited resources.

The above-mentioned competencies and personality characteristics form a unique combination, but appointing the right person can have a direct influence on the end result of the organisation's knowledge management initiative.

The new knowledge management roles are still immature and no specific job descriptions exist, only various expectations from different organisations.

3.6 Conclusion

Theory on knowledge management argues that *knowledge* results from the knowledge worker's transformation of data and information, that the knowledge asset displays different attributes than the traditional assets of organisation and that the explicit as well as the tacit forms of knowledge are critical for managing the uncertainty of complex organisation forms.

The discipline of *knowledge management* focuses on the facilitation of the knowledge creation- and retention- as well as learning processes in the organisation and introduces new roles and responsibilities in the organisation. This new organisation form in the knowledge age, the *knowledge organisation,* refers to a service type organisation that provides customised solutions and consists primarily of knowledge workers.

Finally the primary objective of a knowledge management initiative is to increase *intellectual capital*, which include the organisation's personnel competence, relationship and structural capital.

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*).

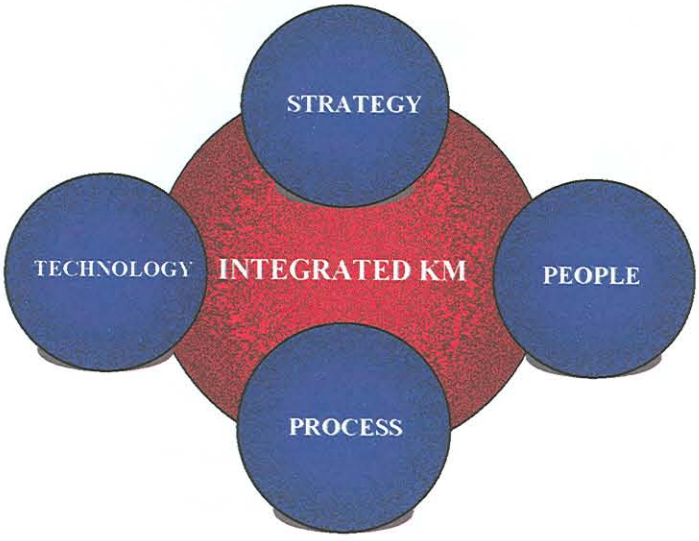

Figure 14: Knowledge Management Framework

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.

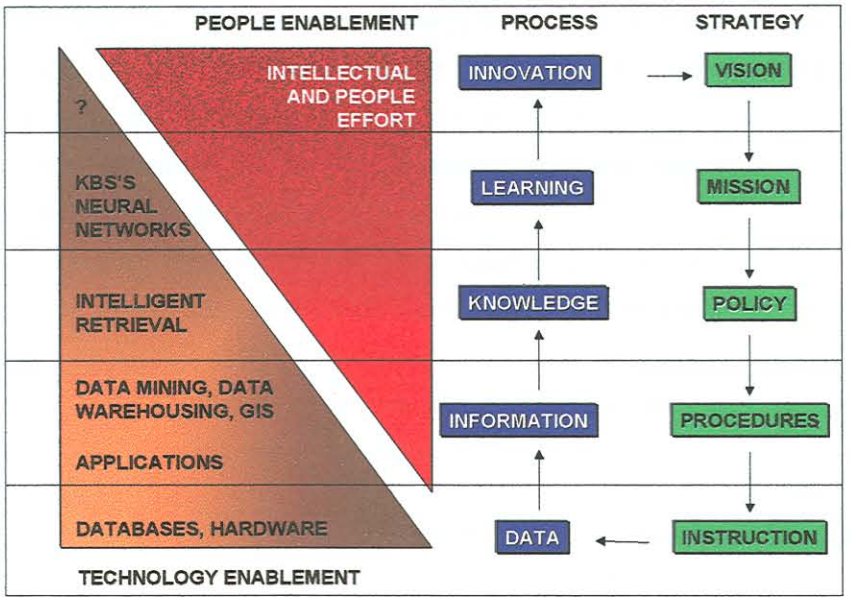

Figure 15: Interaction between Technology, People, Process and Strategy

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*).

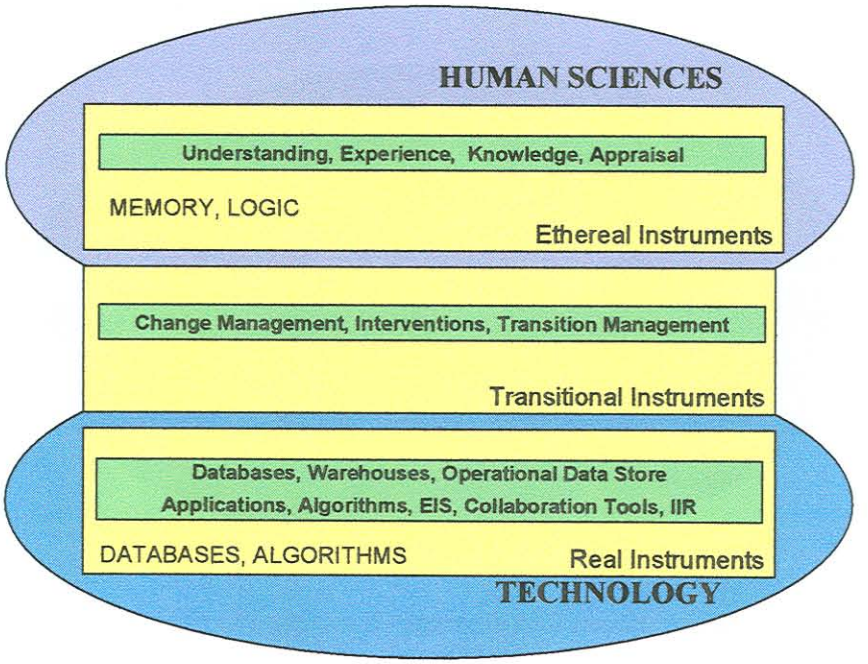

Figure 17: Soft vs. Hard Factors of Knowledge Management

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.

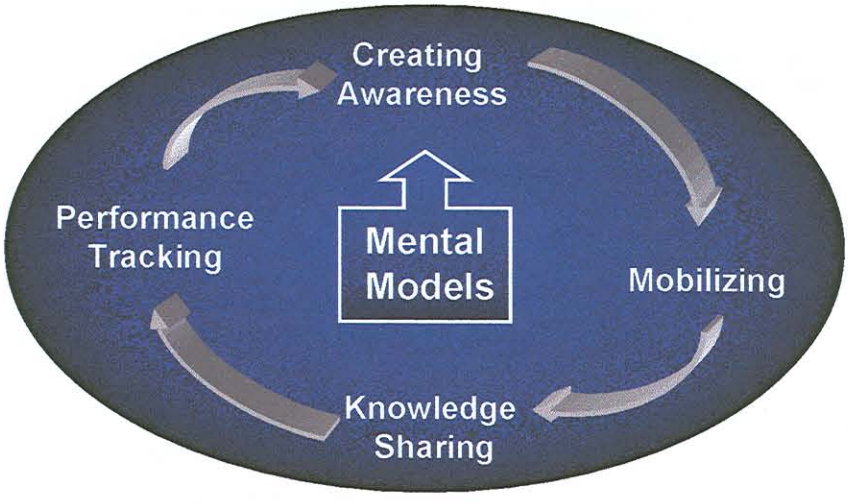

Figure 18: Change Management Approach for Knowledge Management

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
Understanding	goals are conducive for Knowledge Management	enterprise strategies
Management	Proactive management reacting to a changing environment	People provide their best work when under pressure
Operational	Cross-functional team culture for the exchange of ideas	Innovation is highly valued but using another's knowledge is unoriginal
Culture drivers	Openness, honesty, and a high trust culture for sharing knowledge	Knowledge hoarding for personal and professional gain
Preparedness for Change	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 excepts 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
People	Cost generators or resources	Revenue generators
Power Base	Position in the organisation's hierarchy	Level of knowledge
Business Struggle	Physical labourers vs. managers	Professionals vs. managers
Management's Responsibility	Supervising subordinates	Supporting knowledge workers
Information	Means for control	Source for communication
Value Offering	Labourers transforming physical resources into tangible products (e.g. hardware)	Knowledge workers transforming knowledge into knowledge embedded products (e.g. software)
Sources of Revenue	Tangible (money)	Intangible (learning, R&D, new customers)
Business Scarcity	Financial capital	Time and knowledge workers
Organisation Size	Economy of scale	Economy of scope
Stock Market Value	Measure of tangible Assets	Reflection of intangible assets
Economy	Principle of diminishing returns	Possible increasing returns
Customer	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.

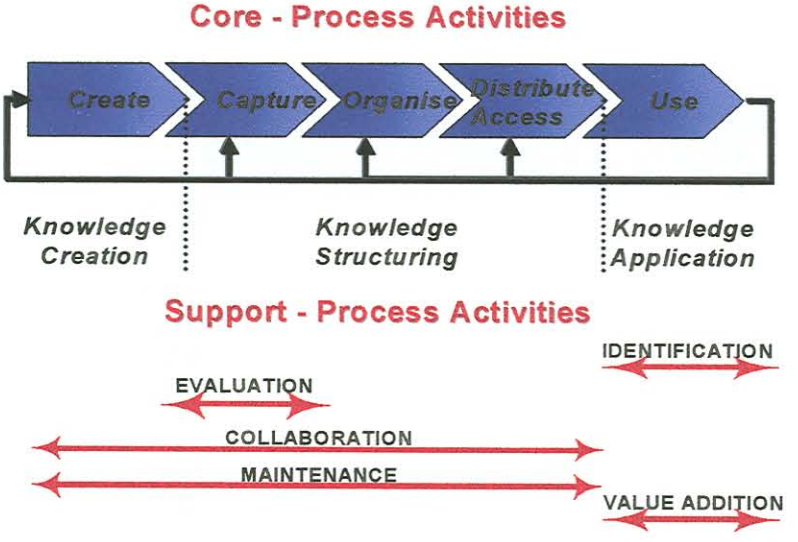

Figure 20: Knowledge Management Process Diagram

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 sympathised 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.

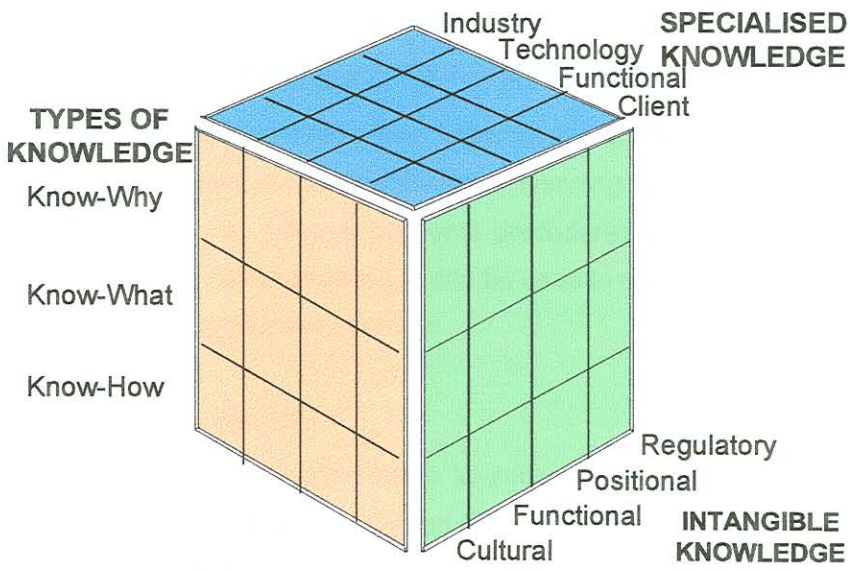

Figure 22: Business Object Knowledge Cube

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?

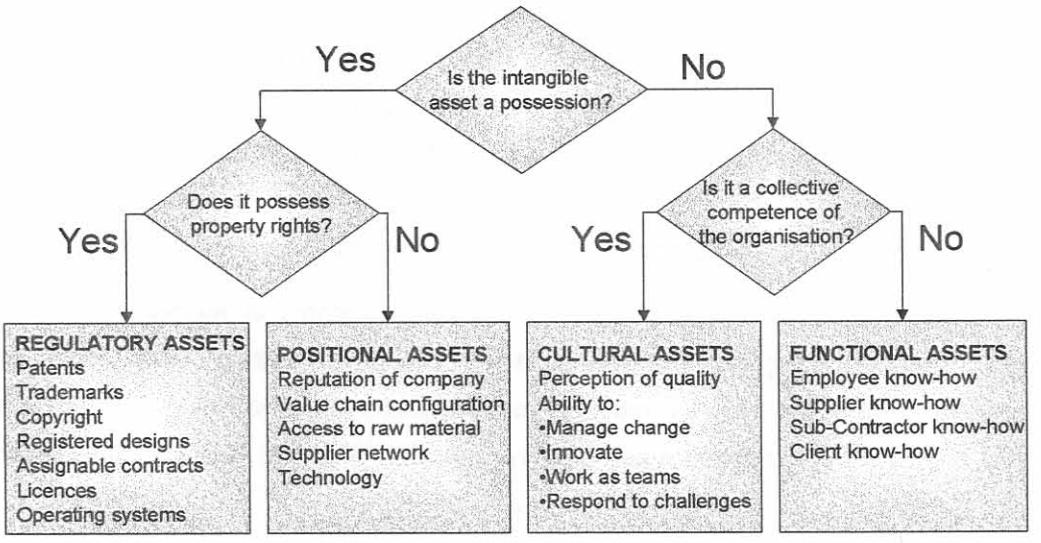

Figure 23: Knowledge Categories on Intangible Assets

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.

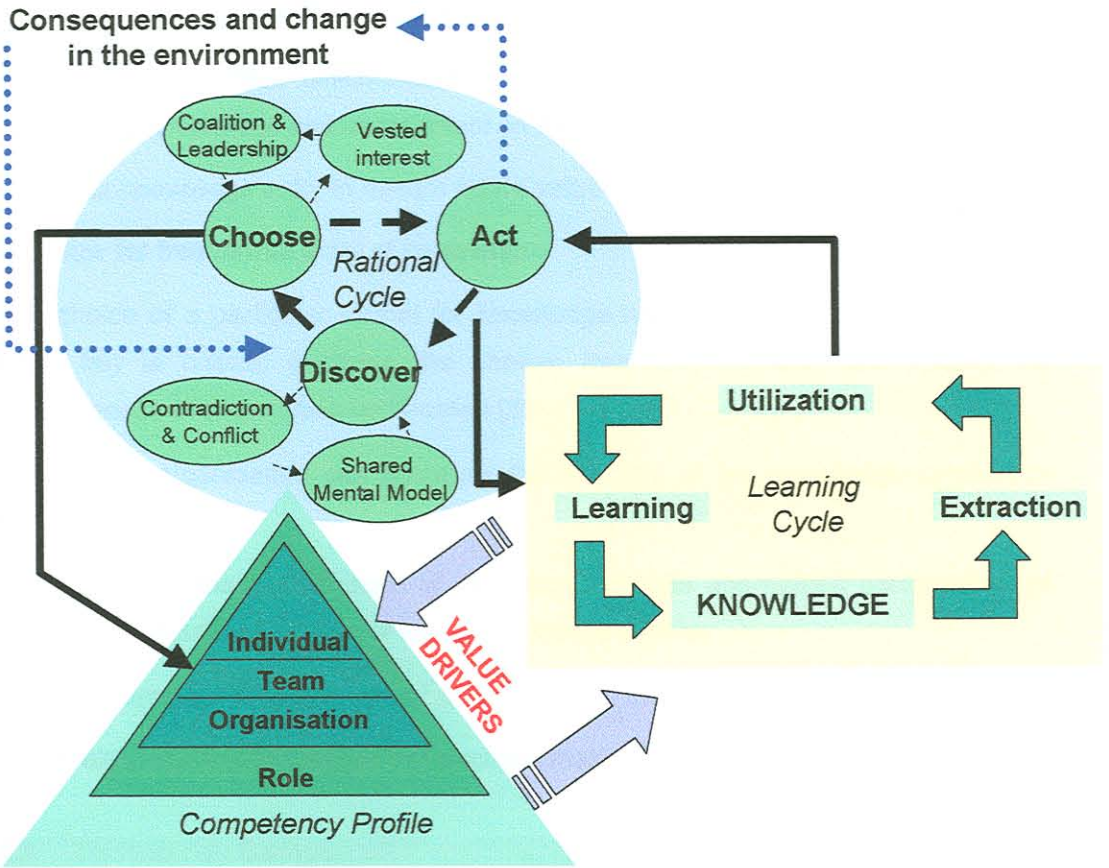

Figure 24: Application of Knowledge

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.

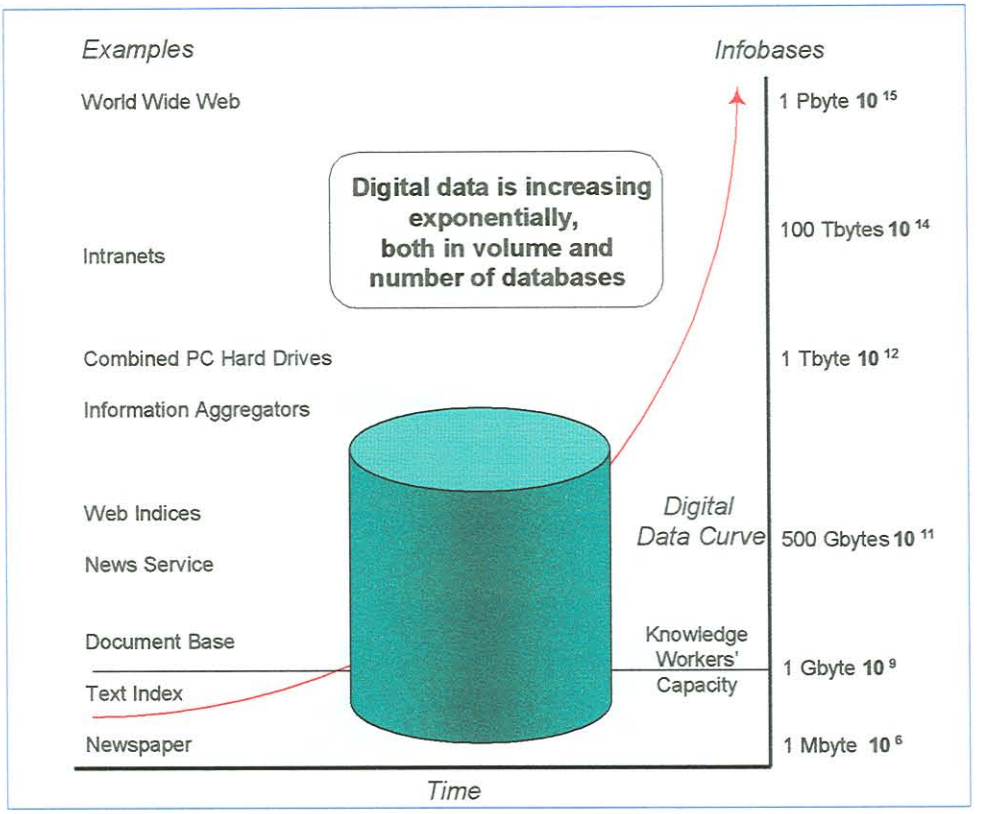

Figure 25: Information Overflow

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.

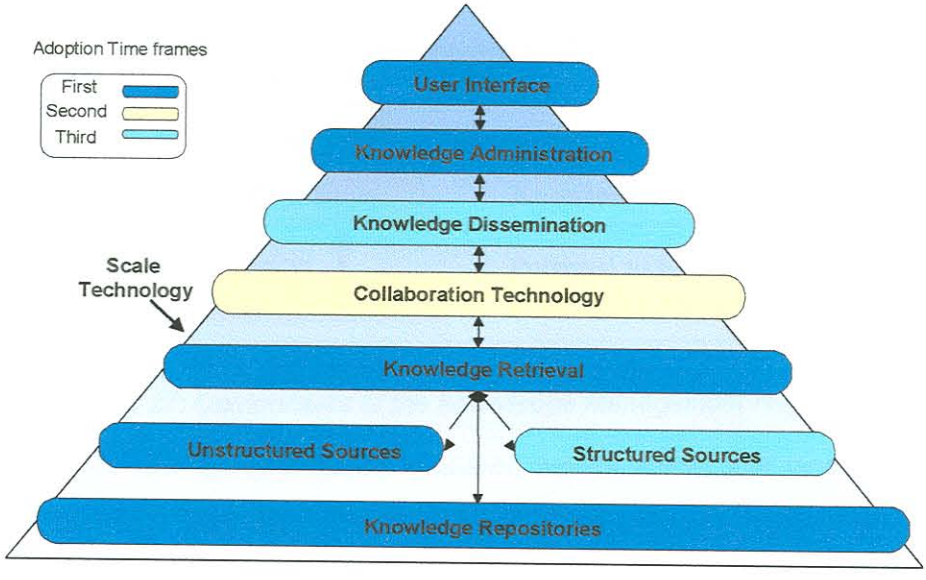

Figure 26: Conceptual Knowledge Management Technology Architecture

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.

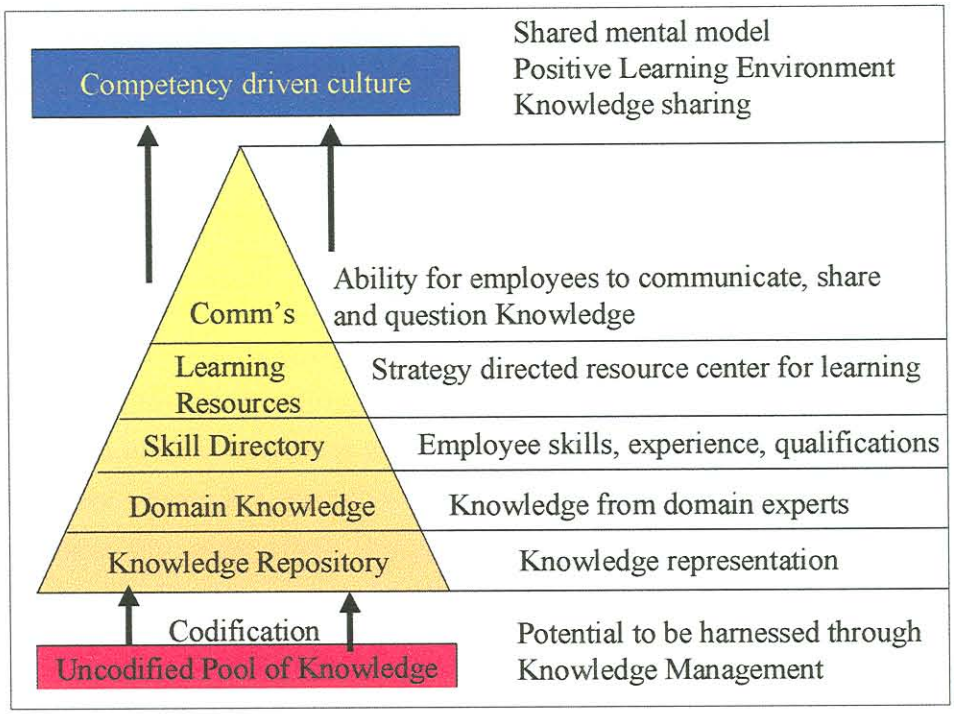

Figure 27: Components of the Knowledge Management Repository

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.

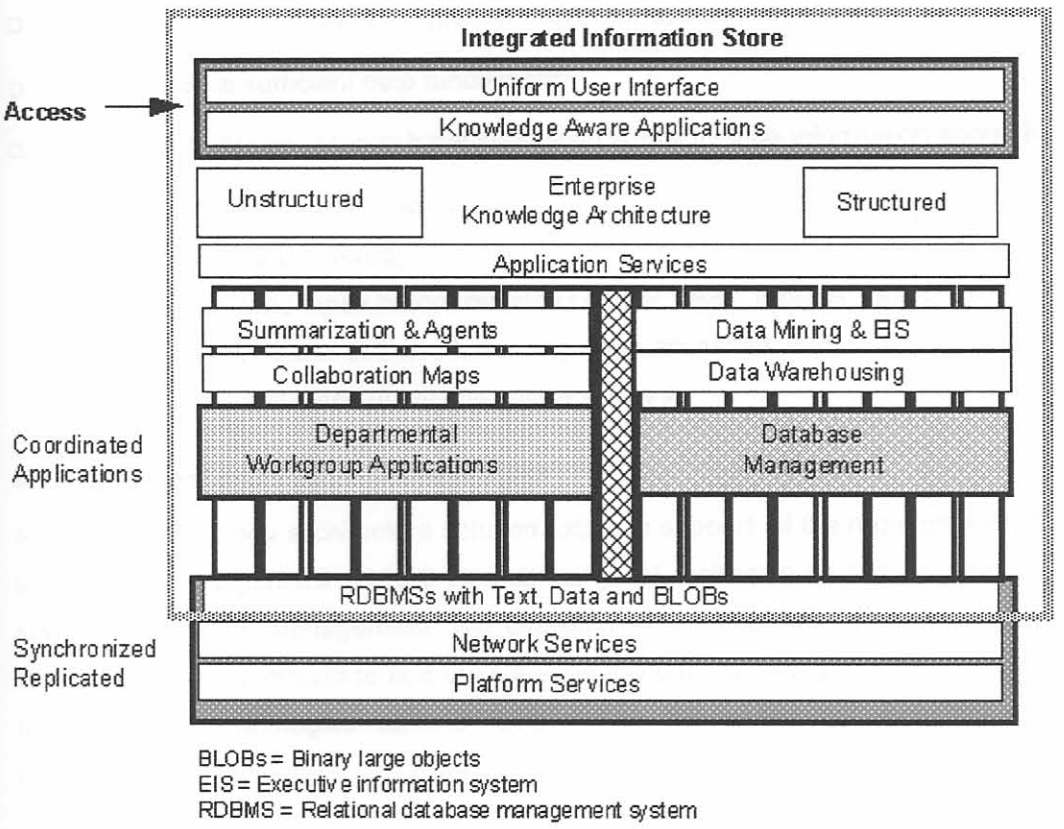

Figure 28: Physical Knowledge Management Technology Architecture

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 effective 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.

- **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.

CHAPTER 5

KNOWLEDGE MANAGEMENT IMPLEMENTATION

5. KNOWLEDGE MANAGEMENT IMPLEMENTATION

This chapter describes a basic approach to the implementation of a knowledge management initiative. A number of aspects are discussed on the success factors of a knowledge management project, an implementation approach, and a futuristic view on knowledge management. In conclusion, a phased implementation plan for a knowledge management project is presented.

5.1 Successful Knowledge Management Projects

During the concept phase of a knowledge management project, management has to anticipate the desired outcome of a knowledge management initiative.

Visible short-term success indicators of knowledge management initiatives are [5]:

- an increase of organisational capital, i.e. intellectual or financial;
- growth in the resources involved with the project, e.g. people;
- growth in and higher utilisation of organisational knowledge sources;
- the degree to which the project is an organisation wide initiative; and
- the degree to which the project is independent of a few individuals' contributions.

Possible long-term benefits of knowledge management initiatives could include:

- staff retention and attraction;
- higher productivity of knowledge workers;
- reduced cost;
- better decision making;
- faster response times;
- accelerated rate of innovation;
- shared best practice – across different business units; and
- higher knowledge retention.

The project sponsor of the knowledge management project should steer and motivate initiatives with these indicators and results in mind.

5.2 Knowledge Management Implementation Approach

The preferred approach to a knowledge management implementation is that of a phased approach (see *Figure 29: Knowledge Management Implementation Approach*) which includes the following growth phases:

- *Initiation Phase:* Start the initiative on a small scale as a pilot project in an environment with a high success potential. The project success will earn project facilitators the right to continue and provide the energy for a bigger scale initiative.
- *Contagion Phase:* The success of one environment will influence the acceptance of other environments as the word spread.
- *Cultural Transformation Phase:* As employees start to perceive the benefits of sharing knowledge and using the knowledge base, the culture and values drivers of the organisation will start to change in favor of the knowledge management paradigm.
- *Maturity Phase:* As employees show a widespread adoption of the new philosophy, the organisation reaches maturity, prepared for a full-scale knowledge management project.

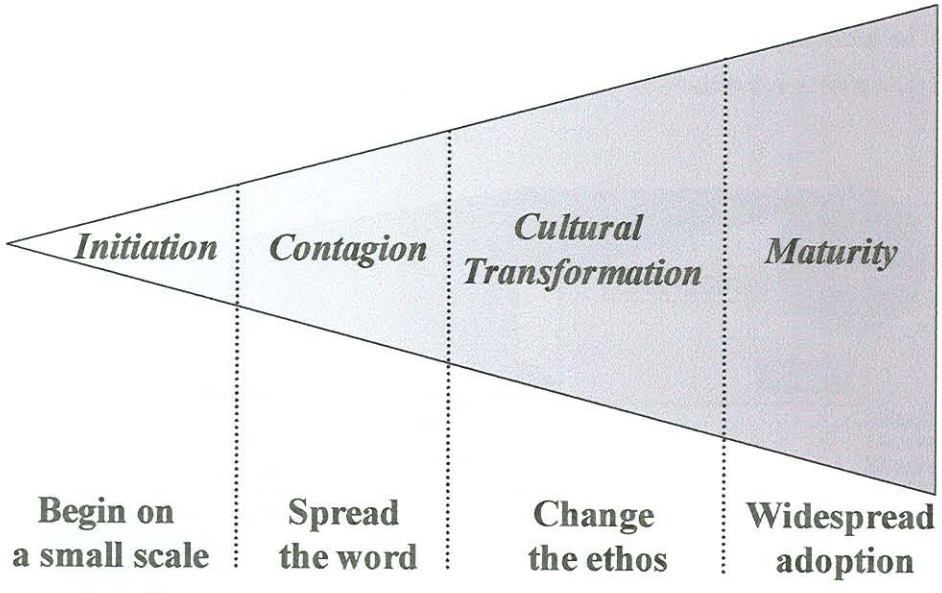

Figure 29: Knowledge Management Implementation Approach

5.3 Future Development of Knowledge Management

Even though current knowledge management technologies are low in maturity the accelerated development cycles of these technologies project tremendous future opportunities for knowledge management initiatives. The Gartner Group predicts that the change in the focus of knowledge management initiatives, as illustrated in *Figure 30,* will take place in three different dimensions [3]:

- the user's perception of the *relevance* of available knowledge;
- the degree of *dynamism* and *flexibility* of the knowledge base; and
- the level of *interaction* within the community during knowledge creation.

The Gartner Group continue by indicating that three different phases will transpire during the next few years.

- The *retrieval phase* focuses on the organisation's explicit knowledge and on creating static repositories with document lists, which are owned by individuals.
- The *knowledge connectivity phase* focuses on developing a higher degree of connectivity between people and focuses on retaining the tacit knowledge owned by and created in the organisation. This will increase the relevance of the knowledge contained in the systems.
- The *co-ordinated enterprise phase* aims at integrating all the aspects of the organisation, i.e. the people, processes and objects, to enable the active sharing of answers within the entire organisation.

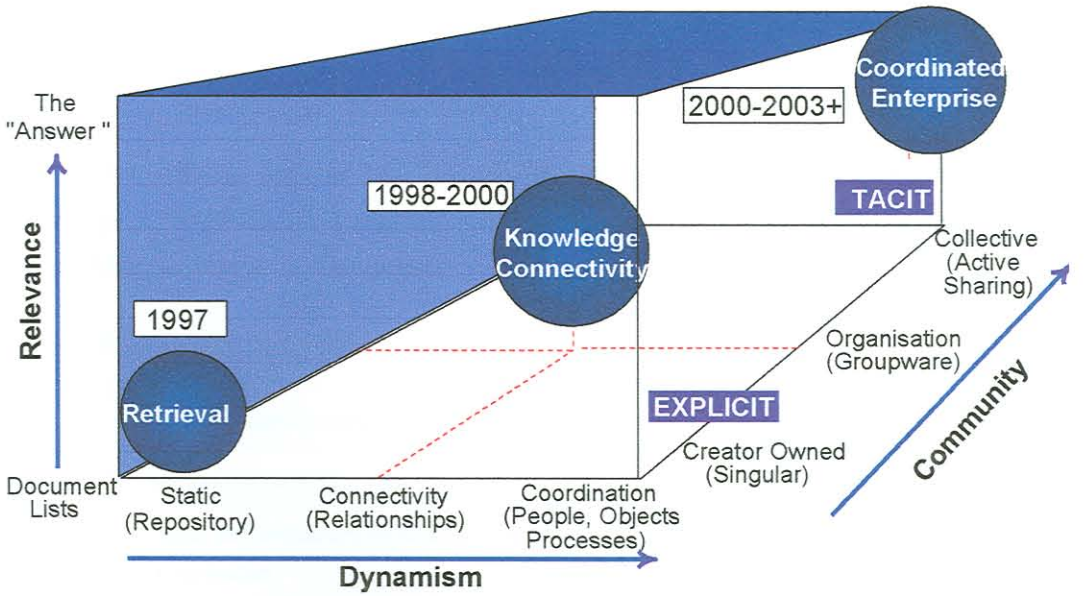

Figure 30: Knowledge Management Development Phases

The implementation steps and deliverables of each of these phases depend on the development and availability of enabling technology.

Phase 1: Retrieval

The most important activities involved with the retrieval phase are to **store**, **access** and **maintain** knowledge. *Table 5: Retrieval Phase* gives the different tasks and deliverables relevant to this phase.

Table 5: Retrieval Phase

Implementation	Deliverables
Identify the knowledge requirements of the organisation	Knowledge requirements identified
Investigate the current technology architecture of the organisation	Current technology architecture defined and modelled
Investigate, choose and implement available enabling technology (e.g. DMS, Search engine, agents)	Implemented software
Identify the different Centres of Excellence (COE) and communities of interest to establish ownership, knowledge maps, development responsibilities and communication procedures	COE and experts' area of responsibility defined
Identify sources of knowledge and populate the repository	Populated knowledge repository
Map the knowledge cube	Company's knowledge cube mapped
Establish maintenance process of knowledge base	Maintenance process in place
Implement measures to monitor the effectiveness of the Knowledge Base (KB) and implement incentives	Measurement System

Phase 2: Knowledge Connectivity

The most important activities of this phase are to **identify**, **distribute** and **share** knowledge. *Table 6: Knowledge Connectivity Phase* gives the different tasks and deliverables applicable to this phase.

Table 6: Knowledge Connectivity Phase

Implementation	Deliverables
Enhance the connectivity between employees	Connected employees
Investigate, choose and implement technology to enable tacit sharing in the organisation	Implemented collaborative tools
Develop a skills template and yellow pages of employees	Yellow pages

Implementation	Deliverables
Develop training strategy and material according to the organisation's knowledge needs and knowledge cube	Training procedures and material in place
Enable the sharing within the communities of interests	Effective communities of interest in place
Develop measures for the intellectual capital of the organisation and incorporate into financial measures	Measured Intellectual Capital

Phase 3: Coordinated Enterprise

The most important activity involved in this phase is to **integrate** the objects, processes, and people within the organisation. *Table 7: Coordinated Enterprise Phase* gives the different tasks and deliverables applicable to this phase.

Table 7: Coordinated Enterprise Phase

Implementation	Deliverables
Establish the integration requirements of the organisation in terms of the objects, people and processes	Integrated enterprise requirements
Develop the business architecture by identifying the objects and mapping the business processes	Organisation's business architecture
Investigate, choose and implement an object-based knowledge base	Implemented integration software
Populate the objects and processes of the organisation (business design)	Populated knowledge base
Monitor the level of integration between the objects, people and processes of the organisation	Integrated enterprise

5.4 Knowledge Management Implementation Phases

Currently, there are a number of companies mentioned for their unique approaches to knowledge management, e.g. British Petroleum, Ernst & Young, Xerox and World Bank (see Appendix A4 for case studies on these organisations).

Not withstanding the fact that various knowledge management initiatives emerge, no best practise, standard methodology, or 'plug and play' solution will solve every organisation's knowledge management needs. Knowledge's uniqueness within different organisations and the novelty of the knowledge management discipline, demand a steep learning curve from organisations to refine the art of managing the intangibles.

This section suggests and discusses a few generic phases for a knowledge management implementation initiative as stated in *Figure 31: Knowledge Management Implementation* Phases.

Phase 1 - Establish a common KM vision
Phase 2 - Create a common language/ understanding (top-down)
Phase 3 - Gather info on company's knowledge needs (bottom-up)
Phase 4 - Develop and execute the KM strategy
Phase 5 - Develop measures to indicate the success of the initiative
Phase 6 - Develop an infrastructure to enable KM
Phase 7 - Establish a process to renew knowledge

Figure 31: Knowledge Management Implementation Phases

The first few steps focus on gaining acceptance on the concept of knowledge management from all the employees of the business area concerned. From this an assessment of the organisation's knowledge requirements flows serving as an input to the knowledge management strategy. The measurement of the organisation's intellectual asset worth is used to measure the success of the initiative. The final phases include developing and establishing infrastructure and processes according to the knowledge management strategy, after which the implementation cycle is repeated.

5.5 Phase 1 – Establish a Common Knowledge Management Vision

The initial phase of the knowledge management initiative includes defining the organisation's knowledge management requirements. During this phase management has to:

- gain a sufficient understanding of the business philosophy of knowledge management;
- buy into the new initiative;
- define new roles and responsibilities in the organisation, e.g. Chief Knowledge Officer (CKO) and knowledge managers, who can drive the knowledge management strategy and facilitate the change process;
- accept the challenge to establish a knowledge sharing culture; and
- develop a common understanding and expectation around the benefits and outcome of knowledge management.

Unless the management team fully accepts the knowledge paradigm and adjusts their management style and culture in favour of the knowledge age perspective, they will be unable to instil a culture conducive to knowledge management.

Once ownership has been established for such an initiative, the responsible parties have to conceptualise each component of the knowledge management framework, i.e. the strategy, process, people and technology and develop a plan to communicate and establish the framework within the company.

5.6 Phase 2 - Create a Common Language / Understanding (top-down)

In the second phase, the team responsible for the knowledge management initiative has to establish a common language and understanding among all the employees of the business unit around the terms and paradigm of the knowledge age.

This phase requires a huge amount of commitment and energy from *change agents* to facilitate a change in the way of thinking throughout the company. In their attempt to emphasise the priority of knowledge management, the change management team needs sufficient top-management support as well as simple tools to educate employees and create participation across the different levels of the company. This includes various techniques such as story telling, metaphor development, education programs, simulation (e.g. games), and various types of communication media. It involves a process of 'propaganda' where change agents are trained to teach the company knowledge management principles.

The potential for unrealistic expectations and the possible occurrence of fear among employees make this the most critical phase in the life cycle of the knowledge management initiative. The best way to gain a high rate of adoption is to ensure buy-in from the *influencers*, i.e. employees on different levels of the organisation that have a strong influence on employees' opinions. Often, these influencers are used as change agents to influence others to the benefit of the knowledge management project and to ensure that employees understand the principles and benefits of knowledge management.

Communication plays a significant role in the attempt to change employees' behaviour from the hoarding of information to the sharing of information. This includes establishing an open-door environment, breaking down of traditional information barriers and opening-up large amounts of information to a broader audience.

The implementation of knowledge management calls for *new roles* and responsibilities across the organisation to support the new processes on individual and team level, e.g. the codification and usage of knowledge sources. Training is a large influencing factor in any successful initiative as it supports the new skills, roles, and responsibilities that are required for the learning organisation. Management should consider training as an investment in the long-term success of a knowledge management implementation [18].

5.7 Phase 3 - Gather Information on Company Knowledge Needs (bottom-up)

The aim of the information-gathering phase is to determine what knowledge assets exist in the organisation, in what form it exists, where it is situated, and who owns it. One approach to this phase is to perform a knowledge audit in order to:

- measure the current performances of the organisation in terms of knowledge management and the need for such an initiative;
- identify the available sources of knowledge and the current knowledge needs;
- map the different employees and their knowledge needs in the company;
- gain an awareness of the competitive knowledge of the company;
- measure the organisation culture according to learning and growth;
- measure the organisation climate for knowledge sharing and job satisfaction;
- evaluate the level of empowerment and enablement in the company;
- evaluate the use of current knowledge communication structures and the effectiveness of these; and to
- identify the communities of interest active in the company.

Conducting interviews across the organisation using knowledge disclosure techniques can provide very valuable information. A knowledge audit includes techniques such as:

- *extraction / listening* – to establish what type of decision are made and problems are faced as well as learning and judgement are required in a particular position;
- *critical incident questioning* – to determine the low- and highlights of a position;
- *network analysis* – to determine the knowledge connections in the organisation; and
- *anonymous virtual community* – to provide the opportunity for anonymous contributions to the knowledge management process.

A knowledge assessment interview (see Appendix A1 for an example of an interview) and survey (see Appendix A2 for an example of a survey) provide valuable information and can include questions on the:

- degree to which knowledge seeking is part of the job;
- activities that require knowledge;
- extent to which the user applies knowledge;
- type of decisions an employee makes in the organisation;
- sources of knowledge used and the effectiveness thereof;
- frequency of the use of the knowledge;
- degree of difficulty to access appropriate knowledge;
- knowledge resource needs; and
- availability of best practise, methodologies, trends and opportunities.

It is important to continuously manage the expectations of employees created throughout the process and to facilitate participation across all the levels of the organisation. Finally, the results of the knowledge audit have to be analysed and fed back to the participants before the development of a knowledge management strategy can follow.

5.8 Phase 4 - Develop and Execute the Knowledge Management Strategy

The chief knowledge officer and other knowledge managers are responsible for the development of a knowledge management strategy from the knowledge audit results.

5.8.1 Knowledge Management Strategy

The primary consideration for a knowledge management strategy is to differentiate between the application of a knowledge retention or knowledge creation strategy within the business unit (see paragraph 4.1.1 on page 39). This decision depends on the profile of the environment and will, to some degree, dictate the rest of the knowledge management strategy.

5.8.2 Knowledge Management Project Strategy

Develop a plan for the rollout of the initiatives within the knowledge management project, including decisions on the required outcomes, responsible parties, time frames, and budgets. The project strategy should address all the aspects of the knowledge management framework (see chapter 4 on page 38).

5.8.3 *Intellectual Capital Driven Strategy*

An effective framework to use in the development of a knowledge management strategy is that of the intellectual capital model (see section 3.4 on page 25). The ultimate objective for a knowledge management project is to increase the intellectual assets of the organisation. MTN is a good example of an organisation that has developed and communicated their organisation's knowledge management strategy around such a structure [21]. A few examples of the components of their strategy are displayed in Figure 32: MTN Intellectual Capital Strategy.

- MTN's strategy in terms of the organisation's *external structure* was to develop profiles of all their different types of clients and to develop products to serve each type of client.
- In order to develop the *external structure* and *personnel competence* of the organisation they decided to leverage their relationship with international cell phone suppliers to develop their employees through an exchange program.
- MTN's *personnel competence* was addressed by establishing connected knowledge management teams and incorporating job rotation as well as by creating awareness through knowledge management games, e.g. Tango.
- Intellectual capital measures and incentives as well as knowledge forums were introduced to facilitate the interaction between the *personnel competence* and *internal structures* of the organisation.
- The *internal structure* of the organisation required an Intranet site, accessible by all the employees.
- The *internal* and *external structure* interfaces necessitated easy accessible customer related information.

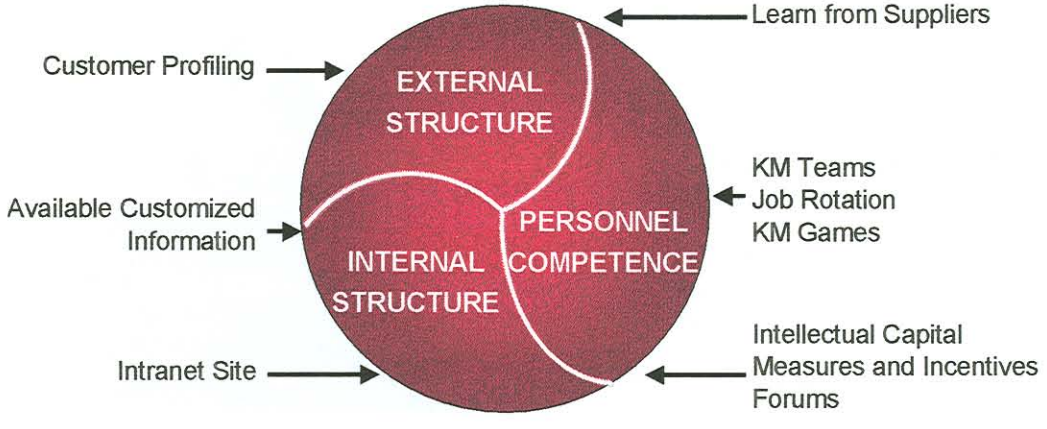

Figure 32: MTN Intellectual Capital Strategy

5.9 Phase 5 - Develop Measures to indicate the success of the initiative

Although it may be difficult, it is vital to measure the intangible assets of the organisation. Growth in an organisation's intellectual capital is an indication of the degree to which the knowledge management initiative has been successful. In addition, these results assist in the identification of problem areas and give management an indication of the return on investment.

Possible measures for a knowledge management initiative include:

- measures of the intellectual assets of the company in terms of the organisation's personnel competence and its internal and external structures (see Appendix A3);
- metrics on the effectiveness of the knowledge management system, e.g. measuring the frequency with which the system is used and the degree of user satisfaction; and
- evaluation of the organisation's mapped knowledge cube (see paragraph 4.3.1.2 on page 56) in order to identify knowledge gaps for future development and training.

The results of the different measures can be used to incentivise employees and in so doing reinforce knowledge-related behaviour.

5.10 Phase 6 - Develop Infrastructure to Enable Knowledge Management

A variety of technologies and products exist that can support parts of a knowledge management infrastructure solution for each specific environment (as discussed in section 4.4 page 61). The different types of knowledge management technologies are illustrated in *Figure 33.*

Figure 33: The Classification of Knowledge Management Technology

Lotus Notes's Domino server is currently a preferred supplier of integrated solutions in relation to these different types of technologies, i.e. messaging-, co-ordination-, collaboration-, and specialised knowledge management technology. These different types of technologies build on each other and are discussed in the following paragraphs.

5.10.1 Messaging Technology

Messaging technology is the most familiar of the four types of technologies and refers to technology that enables unsynchronised communication among employees in the form of group scheduling and Intranet software. The foundation of a knowledge management infrastructure, i.e. an intranet, is implemented on three different levels of impact.

1. *Company wide intranet* that provides generic organisational information that is very structured, almost rigid and strictly maintained. This is to ensure that high quality information is available to everybody and where required even to the client.
2. *Competency centre intranet* contains domain specific knowledge that is accessible by all the participants of a specific competency or body of knowledge. The information is less structured and controlled, may have a level of replication and consist of the group's unique terms and language.
3. *Trusted community intranet* refers to an intranet for a small and close community of experts that share a common understanding, a high level of trust and honesty as well as a willingness to share their mistakes. This infrastructure requires a higher level of flexibility that enables experts to share their ideas and concepts in an unstructured format.

5.10.2 Co-ordination Technology

The 'pointer to people'-concept in a knowledge base refers to the documentation of just enough information about a practise to facilitate the contact between an interested reader and the person with the details by providing the latter's contact details, e.g. organic people finder.

In addition, this so-called co-ordination technology gives an indication of available knowledge through, for example, document management systems, search engines and knowledge locators. Finally, it not only refers to the co-ordination between people, or people and knowledge, but also to the co-ordination of activities through automated workflow capabilities.

Co-ordination technologies, also referred to as Document Management solutions, are discussed in more detail in Appendix A5.

Alternative approaches to initiate the implementation of co-ordinating technology are to:

- start with an empty document management system, make it available to all the employees, train them in using it and allow them to enter their knowledge;
- contract a few key players to establish a base of knowledge that can be used as benchmark for critical knowledge and information;
- appoint a dedicated team to take ownership of the population of the knowledge base; or to
- appoint certified practise experts who will be responsible for the knowledge base content and for the gathering of knowledge from other people in the organisation within their specific domain.

5.10.3 Collaboration Technology

Collaboration technology refers to the *socialisation* - knowledge creating process, where knowledge is created due to the sharing of tacit knowledge (see paragraph 4.3.1.1 on page 54). This includes verbal, written and face-to-face communication.

The following matrix identifies a few alternative infrastructure decisions to enable this socialisation process (see *Figure 34: Socialising Matrix*). It illustrates the different degrees of interaction that exist within the organisation, i.e. communication between individuals, collaboration between different groups, collective learning across the organisation, and connectivity with the external environment.

First, identify the alternative means to facilitate the interaction between different entities. Secondly, prioritise between the alternative means to decide on the implementation of required technology over a specified time frame. This includes:

- deciding with what means the organisation will interact with the internal and external environment;
- investigating alternative means for such an interaction, e.g. through an interactive webpage; and
- prioritising between the alternative methods of interaction.

The objective of collaboration software is to establish total connectivity between the different entities within and outside of the organisation to facilitate effective knowledge transfer.

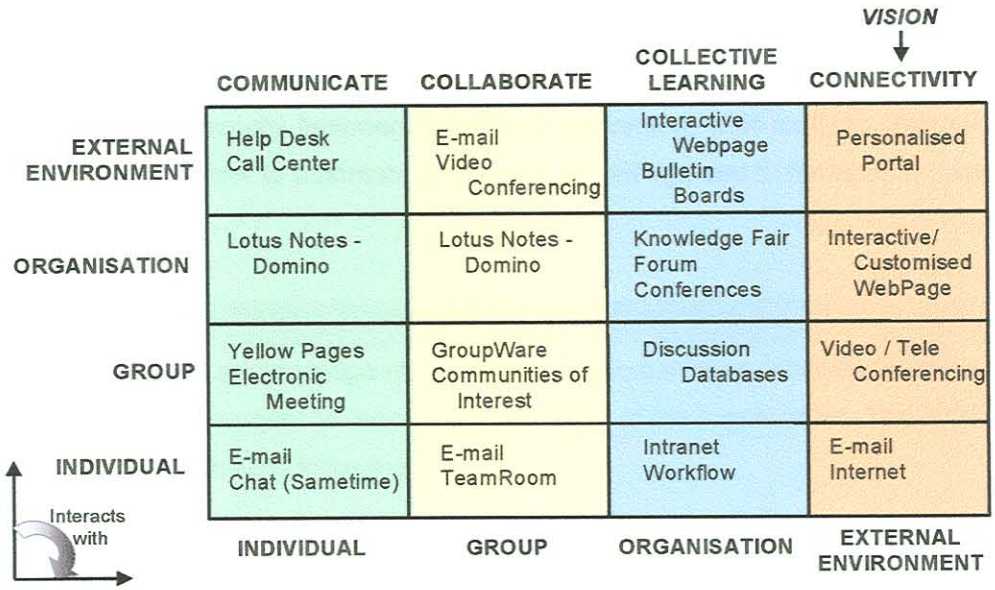

Figure 34: Socialising Matrix

5.10.4 Knowledge Management Technology

Specialised knowledge management technology can only operate effectively if the rest of the infrastructure components are in place. Most of these specialised technologies are still in the development phase of their product life cycles. An example of these includes *innovative systems* that support the development of knowledge. *Intelligent agents or push technologies* support users by searching available knowledge sources and informing employees of new additions to the knowledge base or to the internet that correlate with their interest.

5.10.5 Infrastructure Implementation Requirements

To conclude, a few points on the implementation of a knowledge management infrastructure:

- implement an infrastructure with a *knowledge repository* for the storage of knowledge in an organised way, linked to its original source;
- establish *enterprise application integration* (EAI) across the organisation systems and standardise IT accordingly;

- develop a strategy to *maintain and protect the knowledge store* and enhance the use of it by developing and customising the system according to the users' needs;
- provide users with *sufficient training* to ensure the effective use of the system; and
- establish connectivity between users and the system with *multiple channels of knowledge transfer* to automate the flow of knowledge and to facilitate innovation and learning.

5.11 Phase 7 - Establish a Knowledge Renewal Process

The final phase of a knowledge management implementation initiative involves the establishment of a process to renew the knowledge of the organisation. The activities of this phase includes the following:

- managing the implementation of the knowledge management system and the establishment of an effective knowledge creating process;
- integrating knowledge capturing and knowledge management related activities into the employee's daily tasks;
- providing sufficient support in terms of the knowledge base with an online help facility, research personnel and people to connect knowledge needs to experts;
- imbedding a discipline of quality knowledge management among knowledge workers, e.g. to codify their knowledge into an explicit form for others to re-use;
- involving employees in the development of their personal profiles (yellow pages);
- establishing a customised standard process for managing the knowledge capital, based on best practice;
- co-ordinating the mapping of the business processes for possible automation and increased knowledge capital utilisation; and
- overcoming resistance to change by developing self-directed teams and communities of interests to facilitate opportunities for knowledge transfer with a high level of face-to-face contact between employees.

The final phase triggers the reiteration of the total implementation process. This forms a continuous implementation cycle, whilst every successive implementation grows in focus area and in level of impact on the organisation.

5.12 Conclusion

The implementation approach suggested in this chapter is an example of the phases involved with conducting a knowledge management initiative. Embarking on a knowledge management initiative implies that management has identified the need for and defined the benefits of establishing a knowledge management capability in the organisation.

It necessitates that employees on all organisation levels be informed of the new knowledge-sharing paradigm, as knowledge sharing is not a natural behaviour in traditional organisations. It requires initiatives to get people interested in using available knowledge enablers through training, demonstrations and promotional events.

Management should as part of their business strategy, identify the knowledge needs of the organisation. They should identify knowledge domains and appoint specific employees to conduct research in these domains as well as populate the knowledge repositories.

Creating a positive learning environment, in which knowledge management will take place, is as important as having the best technology available to support the capturing, representing and extracting of knowledge. A positive learning environment manifests where:

- the need for continuous learning is recognised;
- a culture is established that encourages learning and the sharing of knowledge; and
- opportunities and means are available to support learning activities, knowledge sharing and the reinforcement of new knowledge and skills.

CHAPTER 6

CONCLUSION

6. CONCLUSION

The proposed Framework for Knowledge Management challenges the success rate of knowledge management over its adoption life cycle as projected by the Gartner Group (refer to Figure 1: Projected Knowledge Management Life Cycle, page 3).

The framework, i.e. the strategic-, people-, process-, and technology components addresses the critical success factors of such an implementation over the project life cycle in such that (Figure 35: Proposed Knowledge Management Life Cycle):

- the *knowledge management strategy* interprets the technology and environmental triggers that necessitates the need for knowledge management according to the organisation's unique requirements;
- the establishment of a *knowledge sharing culture* prevents unrealistic expectations during the contagion phase, creates a common language among employees, ensures senior management support and prepares employees for the implementation phase;
- *knowledge creation & retention process* initiatives form a critical part of the implementation phase;
- adequate *technology infrastructure* supports the successful implementation of the various knowledge management initiatives; and
- the *intellectual capital measurement capability* indicates the level of success of the knowledge management implementation and consequently provides an input for the reassessment of the knowledge management strategy.

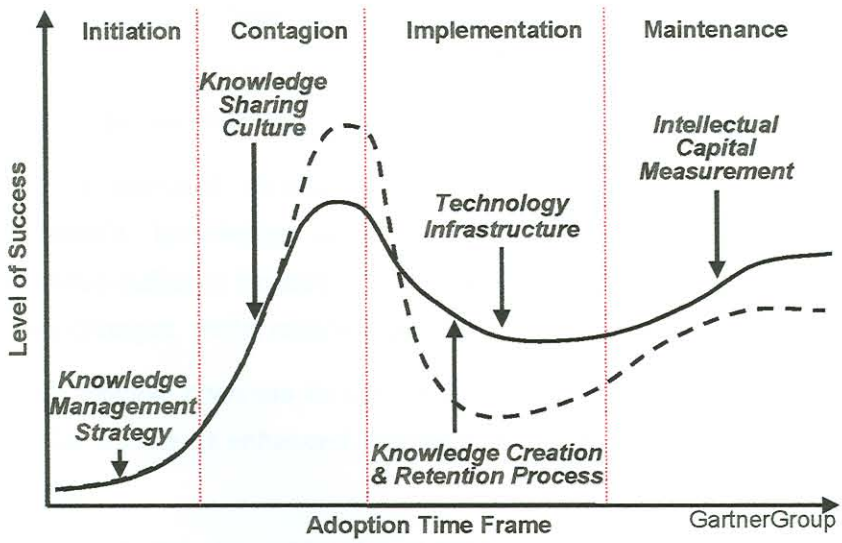

Figure 35: Proposed Knowledge Management Life Cycle

In conclusion the following paragraphs summarise the critical success factors and risks involved with implementing knowledge management in an organisation as well as provide recommendations in this regard.

6.1 The Critical Success Factors of Knowledge Management

The critical success factors to the implementation of a knowledge management initiative and the development of a knowledge organisation in the knowledge age are:

- Focus on managing the organisation's *intellectual capital,* i.e. knowledge-based assets, as the critical business resource and communicate the value of these knowledge-based assets to the stakeholders.
- Continuously increase the *knowledge content* of products and services.
- Create a budget for knowledge management projects and link the results of such initiative to *economic performance* or industry value, i.e. money saved or earned.
- Gain *senior management support*. Develop top management's commitment by showing them the successful knowledge management attempts of other companies. The organisational executives and senior management team set the tone for a knowledge-orientated culture by championing knowledge initiatives.
- Appoint a *chief knowledge officer* to create a knowledge-management strategy that is linked to the company's objectives.
- Define new *roles and responsibilities* for knowledge managers. A specific group has to take responsibility for the management, i.e. the collecting and categorising of knowledge, for the establishment of an infrastructure, and for monitoring knowledge in the organisation.
- Provide *technical and organisational infrastructure*, i.e. establishing technology and organisational structures, which enables knowledge management.
- Provide a *standard, flexible knowledge structure*. The structure of the organisation's knowledge changes continuously through learning. This necessitates sufficient flexibility in the structure of knowledge repositories to cater for these changes, whilst retaining some level of standardisation.
- Establish *multiple channels for knowledge transfer*, because the effectiveness of knowledge transfer is enhanced if multiple channels, which reinforce one another, are used.
- Ensure that *knowledge retrieval and capturing activities* are closely integrated with the core work-processes of the employee.

- Create a *discipline* among employees that values high knowledge quality in the organisation.
- Establish a strategic focus on *core, value-added processes*, whilst elimination or outsourcing others.
- Establish a *clear purpose,* i.e. clearly defined and effectively communicated objectives for knowledge management by linking learning and knowledge transfer to the organisation's vision.
- Establish a clear *enterprise-wide vocabulary and language* to ensure mutual understanding of knowledge management concepts.
- Address cultural issues with change management interventions to develop a *knowledge-sharing culture,* i.e. a culture that values learning, knowledge transfer and knowledge sharing, where experience and expertise supersede hierarchy.
- Change the *motivational practices*. Incentives to encourage the creation, sharing and usage of knowledge are required to promote and reward the correct behaviour. These should be long term and tied in to the general evaluation and compensation structure in the organisation.

6.2 Risks of Implementing Knowledge Management

There are numerous risk factors involved in the implementation of knowledge management, a few of which are listed below:

- *Intellectual property mindset* - where the employees of the organisation believe that 'knowledge is power' instead of that 'sharing knowledge is power'.
- *Not invented here* - environment where the generating of new ideas are promoted and not to re-use on old ones.
- *People introversion* – the fear to learn from outsiders or expose one's thoughts to others.
- *Quick fix approach* to the implementation of knowledge management instead of a long-term commitment to establishing the new management principles.
- Performance measures that is only linked to *traditional financial measures.*
- The fact that the quality of knowledge transfer is directly related to the *degree of face-to-face contact* between the individuals.
- *Information overload* – where information is scattered around, unstructured, not digitised and not managed in the organisation.

- The management of knowledge requires a balanced approach to *people and technology.*
- The *nature of knowledge* in the organisation place a constraint on the management of knowledge because:
  - knowledge has the notion of continuously increasing, expanding and changing;
  - knowledge creation is highly subjective, opinionated and interpretative, relative to each knowledge worker;
  - The duality of created knowledge, i.e. the tacit and explicit dimensions, complicate the codification of knowledge from:

Tacit	*to*	*Explicit*
Not teachable	to	Teachable
Not articulated	to	Articulated
Rich	to	Schematic
Complex	to	Simple
Undocumented	to	Documented

- *Knowledge management is expensive,* because the traditional accounting system based on industrial age standards regards the investment in knowledge-related-activities as an expense rather than an investment. Knowledge is an intangible asset and requires different types of investments, e.g. training of employees as well as different software and hardware to enable the capturing, packaging, and categorising of knowledge.
- Knowledge is a *highly political* asset. If this is not the case then nothing of value is at stake.

6.3 Further Research Possibilities

Numerous initiatives have been initiated across the world of which most are still in the initial phases of development. Results from these initiatives will provide new insight to the evolving discipline of knowledge management and the implications of the knowledge era.

Further research possibilities in the field of knowledge management include:

- identifying the critical success factors of and lessons learned from implementing a knowledge management initiative;

- developing measurements to assess the impact of organisation culture on knowledge management and techniques to cultivate a sharing culture in an organisation;
- investigating the most suitable technology architecture for a knowledge management initiative and the impact of technology developments on knowledge organisations; and
- developing an intangible balance sheet to measure market value of knowledge companies in the knowledge age.

6.4 Recommendations

The *key differentiation* between new generation organisations will be the ability to leverage the knowledge resources of the organisation. The s*oft factors* will prove to be a greater problem for implementation than technology. The next century will also introduce *customer demands* for more complex products and services, and will imply closer relationship to support their needs. The value addition of a service provider will involve the ability to assemble complex solutions for the customers, which would require *highly skilled resources.* However, the scarcity and geographical dispersion of these skilled resources in a rapid changing environment will necessitate appropriate *infrastructures, training and knowledge management.*

Knowledge management develops the organisation's ability to manage the intangible and tangible information assets of the corporation. In most enterprises the greatest part of the knowledge asset is never translated in digital form or documented. Big information systems cannot contain the valuable expertise of the employee who creates the knowledge. The purpose is thus to facilitate a human knowledge network that is supported by the necessary information technology.

There is no best practise in implementing knowledge management, but a good approach is to use different experts in the company to participate in the development and implementation of the knowledge management strategy:

- *Librarians and information managers* for their knowledge on the classifying, indexing, and organising of information.
- *Information technologists* for their understanding of and ability to development a supportive infrastructure.
- *Human resource managers* and change agents for their skills of gaining acceptance from personnel.

- *Quality professionals and process engineers* for their knowledge of the business processes.
- *Business analysts* for their ability to development metrics to estimate the intellectual capital of the organisation and assess employees' performance levels.

The principles of knowledge management is to some extent common sense and resolves around the basic values of sound relationships between people that enable the flow of knowledge. It begins by establishing a sharing culture and then providing an infrastructure for scalability across the organisation to support employees.

The implementation of a knowledge base will only prove effective if people rely on its collective knowledge, interact with it and add knowledge to it. Initially individuals will need to be encouraged to continuously interact with the knowledge base. This requires that all the employees of the organisation understand the underlying paradigm of sharing knowledge to the benefit of the organisation.

Knowledge management predicts contradictions and incoherent information, because different people have different emotions, perspectives and insights and even within one person there exists inconsistencies and uncertainties. The aim of knowledge management is thus not to limit knowledge, but rather to encourage diversity of opinions and to allow learning to take place.

Finally, the prime directive of knowledge management is to create and maintain superior knowledge, make it available at point-of-action and to enable a learning organisation culture for the future.

CHAPTER 7

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7. BIBLIOGRAPHY

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APPENDIX

APPENDIX

A. 1 Knowledge Audit Interview

PART A : KNOWLEDGE MANAGEMENT

1. a. Do you believe that there is a significant difference between information and knowledge?

☐ Yes ☐ No ☐ Unsure

b. If yes, how would you define the difference?

Information is _____

_____

_____

Knowledge is _____

_____

_____

2. In your opinion what knowledge assets exists in the organisation?

_____

_____

_____

_____

_____

3. Where are the sources of these knowledge assets situated?

_____

_____

_____

_____

_____

4. What tools enable employees to identify the sources of knowledge within the organisation?

5. Is your organisation creating new knowledge? How? Is it being capture and shared?

6. Is your organisation systematically transferring knowledge inside the organisation? How?

7. Is your organisation systematically acquiring knowledge from outside the organisation? How? From whom? Is it being used?

8. Is your organisation leveraging its knowledge? How?

9. What do you understand by the term "knowledge retention"?

10. Does your organisation have a strategy for retain knowledge? (Explain)

11. Are you and other employees encouraged to share knowledge? Why?

12. Does senior management understand and support the management of knowledge as a business strategy?

PART B : METHODS AND TOOLS USED TO PRESERVE KNOWLEDGE

1 What methods or tools are used for the following:

Capture knowledge (within the organisation) _____

_____

Access, search and find organisational knowledge _____

_____

Distributing relevant knowledge in the format that the user require _____

_____

Maintain the organisations knowledge sources _____

_____

Protect knowledge assets of the organisation _____

_____

2 Does your organisation make use of restraints of trade as a means to protect organisational knowledge from being used by competitors, explain?

_____

_____

_____

_____

_____

PART C : KNOWLEDGE MEASUREMENTS

1 Are there formal procedures/methods for measuring knowledge within your organisation? (Explain)

2 How does the organisation measure the return on the investment made in knowledge?

3 Does the organisation measure the competence of the employees?

4 Does the organisation measure the organisations intellectual property?

5 Does the organisation measure their image in and relationship with the market?

6 Does the organisation measure their effectiveness of their culture and infrastructure in terms of knowledge creation and retention?

PART D : THE FUTURE

1 Do you think that a lack of knowledge management contains high risk for the organisation? (Explain)

2 In your opinion what are the opportunities and threats facing the organisation in terms of knowledge management in the future?

3 What changes, if any, would you suggest, in terms of knowledge management, to survive into the new millennium?

A. 2 Knowledge Audit Questionniare / Survey

PART A : PRESERVATION OF KNOWLEDGE ASSETS

Please indicate which of the following knowledge assets are being MANAGED within your organisation.

KNOWLEDGE ASSET	MANAGED ?	
A1. Trademarks	Y	N
A2. Patents	Y	N
A3. Copyrights	Y	N
A4. Trade secrets	Y	N
A5. Organisational policy	Y	N
A6. Organisational procedures	Y	N
A7. Organisational standards	Y	N
A8. Operating guidelines	Y	N
A9. Business plans	Y	N
A10. Organisational strategies	Y	N
A11. Industry profiles	Y	N
A12. Client profiles	Y	N
A13. Competitor profiles	Y	N
A14. Expertise profiles (expert networks)	Y	N
A15. Skills profiles	Y	N
A16. Experience (lessons learned)	Y	N
A17. Methodologies and consulting practices	Y	N
A18. Project specific details	Y	N
A19. Project designs and plans	Y	N
A20. Tenders	Y	N
A21. Proposals	Y	N
A22. Presentation	Y	N
A23. Documents	Y	N
A24. Training material	Y	N
A25. Best practices and benchmarks	Y	N

Please list any other knowledge assets which are being managed and not included in the list above.

PART B : METHODS AND TOOLS USED TO PRESERVE KNOWLEDGE

How *IMPORTANT* you perceive the item to be in preserving your organisation's knowledge on the following scale:

1 = very unimportant *2 = important* *3 = very important*

How *EFFECTIVE* you believe the item to be in preserving your organisation's knowledge on the following scale:

1 = extremely ineffective *2 = very ineffective* *3 = effective*

4 = very effective *5 = extremely effective*

IMPORTANCE			METHODS/TOOLS	EFFECTIVENESS				
1	2	3	B1. Knowledge consultant resource pool	1	2	3	4	5
1	2	3	B2. Knowledge champions/Chief Knowledge Officer	1	2	3	4	5
1	2	3	B3. Role models	1	2	3	4	5
1	2	3	B4. "Knowledge" based job functions e.g. knowledge manager, knowledge network facilitator	1	2	3	4	5
1	2	3	B5. Coaches and mentors	1	2	3	4	5
1	2	3	B6. Knowledge bases	1	2	3	4	5
1	2	3	B7. Corporate Knowledge maps and knowledge inventories	1	2	3	4	5
1	2	3	B8. GroupWare	1	2	3	4	5
1	2	3	B9. Intranet and Internet	1	2	3	4	5
1	2	3	B10. Expert systems	1	2	3	4	5
1	2	3	B11. Knowledge navigation tools	1	2	3	4	5
1	2	3	B12. Knowledge sharing system	1	2	3	4	5
1	2	3	B13. Document repositories	1	2	3	4	5
1	2	3	B14. Training programs	1	2	3	4	5
1	2	3	B15. Enterprise wide lessons learned program	1	2	3	4	5
1	2	3	B16. Mentoring and coaching programs	1	2	3	4	5
1	2	3	B17. Special focus meetings	1	2	3	4	5
1	2	3	B18. Knowledge related incentive schemes	1	2	3	4	5
1	2	3	B19. Funds for conferences and consultant meetings	1	2	3	4	5
1	2	3	B20. Cross functional execution of business initiatives	1	2	3	4	5

Please add any additional methods or tools which are being used within your organisation, and which have not been identified above

3	2	1		1	2	3	4	5
3	2	1		1	2	3	4	5
3	2	1		1	2	3	4	5
3	2	1		1	2	3	4	5

PART C : CRITICAL SUCCESS FACTORS FOR KNOWLEDGE MANAGEMENT

How *IMPORTANT* you perceive the factor to be for the success of knowledge preservation within your organisation, rated on the following scale:

1 = extremely unimportant *2 = very unimportant* *3= important*

4 = very important *5 = extremely important*

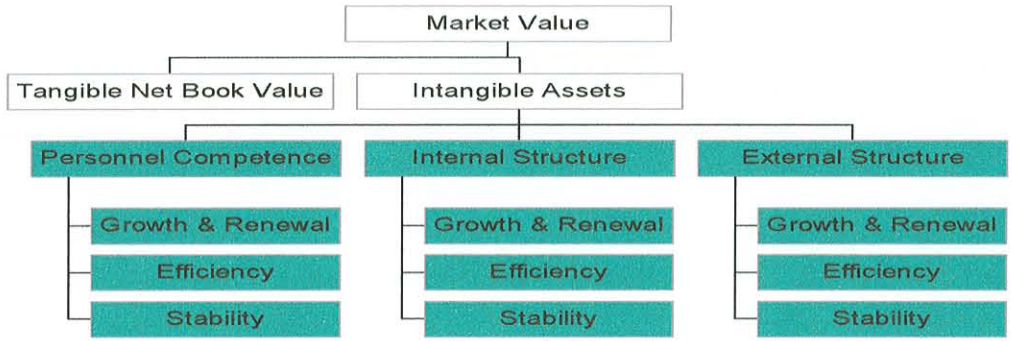
CRITICAL SUCCESS FACTOR	IMPORTANCE				
C1. Alignment of knowledge management to the organisational strategy	1	2	3	4	5
C2. Linking the organisation's knowledge assets to organisational economic performance	1	2	3	4	5
C3. Support of knowledge management by senior management	1	2	3	4	5
C4. Implementing knowledge management enabling technologies and processes	1	2	3	4	5
C5. Implementation of measures of the knowledge assets	1	2	3	4	5
C6. Adoption of a knowledge-sharing culture	1	2	3	4	5
C7. Use of multiple channels for knowledge transferal	1	2	3	4	5

Please add any additional factors which you perceive to be critical to the success of knowledge preservation within your organisation, and which are not listed above.

	1	2	3	4	5
	1	2	3	4	5
	1	2	3	4	5
	1	2	3	4	5

A. 3 Intellectual Capital Measures [1]

This section gives an example of the Intangible Asset Monitor, as proposed by Sveiby, which is used to measure intangible assets:



Dimension	Measure	Purpose	Formula	Unit
COMPETENCE OF PERSONNEL / HUMAN CAPITAL [2] / LEARNING & GROWTH PERSPECTIVE [3]				
Growth / Renewal	Number of Years in the Profession	Indicates the average number of years that the consultants have worked in their profession and the level of skill and experience of consultants	(Total # of Consultant Years) / (# of Consultants)	Avg. # of years

[1] Sveiby, Karl Erik, "*The New Organizational Wealth – Managing & Measuring Knowledge-Based Assets*", Berret-Koehler Publishers, Inc., USA, 1997

[2] Edvinsson & Malone, "*Intellectual Capital – Realizing your company's true value by finding its hidden brainpower*", Harper Collins, New York, 1997

[3] Kaplan & Norton, "*The Balanced Score Card*", HBS Press, Boston, 1996

Dimension	Measure	Purpose	Formula	Unit
	Level of Education	Consider the level of formal education of the organisation's knowledge workers, their learning capacity and their flexibility	(Total # of Education Years) / (# of Consultants)	Avg. # of years
	Training and Education Cost	Measure the formal investment in the competency development of personnel	(Training cost + cost of time spent) / Turnover * 100	% of turnover
	Grading	An indicator of the competence of consultants is to grade individuals on a five point scale in terms of their competence and to analyse results across the various fields of the organisation and to evaluate the impact of personnel turnover on these levels	(# of competency grades) / (# of consultants)	Avg. grade (out of 5)
	Competence Turnover	Indicates the difference between competency lost due to personnel leaving the company and the competency gained due to replacements and recruitment	((Years of experience gained) – (Years of experience lost)) / (Total # employees) *100	% loss / gained competence
	Competence-Enhancing Customers	Measure the proportion of customer projects that contribute to the competency development of the employees	(Revenue of competence development customers) / (Total Revenue) * 100	% of revenue
Efficiency	Proportion of Consultants in the Company	Gives an indication of the proportion of consultants to other employees in the organisation	(# of Consultants) / (# of Employees) * 100	% of employees
	Value Added per Consultant	Because the consultants' salaries are usually the largest cost item on the budget, one needs to measure the value produced by them	(Profit before depreciation and interest + salary + wages + all fringe benefits) / (# of consultants)	Currency Value compared to previous years
Stability	Average Age	This measure indicates the balance between seniority that older consultants ensure vs. the dynamics and drive that the younger employees guarantee	(Total of employees' ages) / (Total # of employees)	Avg. age
	Seniority	This indicates the number of years that employees have been employed by the same organisation and of the stability of competence	(Total # of years employed) / (Total # of consultants)	Avg. period of employment
	Relative Pay / Position	Index of the relative salary paid to employees compared to the competition and indicates weather employees are likely to look for work elsewhere	Salaries compared to Industry standards	Index Value

Dimension	Measure	Purpose	Formula	Unit
	Consultant Turnover Rate	A low turnover of consultant staff indicates a stable yet static situation whereas a high turnover indicates dissatisfaction among employees. The company needs to establish a balance	(# of employees that left the organisation) / (Total # of employees in the beginning of that period) *100	% turnover of consultant staff
INTERNAL STRUCTURE / ORGANISATIONAL CAPITAL / INTERNAL PROCESSES PERSPECTIVE				
Growth / Renewal	Investment in Internal Structure (R&D)	Investments in new subsystems and methods are considered as costs but serve as an investment in the internal structures of the organisation	(Total investment in organisation) / (Total value of sales (or value added) * 100	% investment
	Investment in Information Processing Systems	The investment in IT influences the effectiveness and efficiency of the internal operations of the organisation and indicates progress and development	(IT investment) / (Total value of sales) * 100	% investment
	Customer Contribution to Internal Structure	The proportion of customer projects that is innovative, allow large teams for tacit knowledge sharing and learning and contributes to the development of the organisation's internal structure is an indicator of internal growth	(Total revenue of organisation development customers) / (Total revenue)	% of revenue
	Gross Margin from New Products vs. Old Products	This measure shows the level of innovation taking place in the organisation	(Profit generated from new products) / (Total profit) * 100	% of profit
Efficiency	Proportion of Support Staff	The efficiency of the internal structure is reflected in the proportion of support staff relative to the total number of staff employed	(# of support staff) / (Total # of personnel employed) * 100	% of employees
	Sales per Support Person	Another efficiency indicator is the relation of sales volume to the number of internal staff that is needed to process it	Change in (Total revenue) / (Avg. number of admin staff)	% change from previous year
	Values and Attitude Measurement	The measure of the 'esprit de corps' and corporate culture of the organisation shows the conscious and unconscious attitudes of the employees towards the company among the customer	Employee morale / attitude survey	Employee Satisfaction Index
Stability	Support Staff Turnover	The support staff and management of the organisation provide the backbone of the internal structure and should reflect a low turnover rate	(# of admin staff that left the organisation) / (Total # of admin staff in the beginning of that period) *100	% turnover of support staff

Dimension	Measure	Purpose	Formula	Unit
	Rookie Ratio	The number of personnel with less than two years experience is called the rookies and usually maintains a high turnover, is inexperienced and requires a high investment in training. A high rookie ratio indicates less effectiveness and stability	(# of rookies in the organisation) / (Total # of employees) * 100	% of employees
EXTERNAL STRUCTURES / CUSTOMER CAPITAL / CUSTOMER PERSPECTIVE				
Growth / Renewal	Profitability per Customer	This measurement that compares the cost vs. the revenues of each customer should be monitored frequently	((Customer revenue) – (Customer expenses)) / (Customer revenue * 100	% profitability vs. revenue
	Organic Volume Growth	An indicator of the growth and success rate of the organisation as well as the market acceptance of the business concept (disregarding any growth due to acquisitions)	((Current revenue) – (Previous revenue)) / (Previous revenue) * 100	% growth in revenue
	Growth in Market Share	Indicates weather the organisation is growing in terms of the market growth and in terms of its competition	((Current market share) – (Previous market share)) / (Previous market share) * 100	% growth in market share
	Image-enhancing customers	Customers that contribute to the image of the organisation are usually large, well-known corporations, with high potential growth rate and this metrics indicates the percentage of revenue generated by type of customers	(Revenue of image-enhancing customers) / (Total revenue) * 100	% of revenue
Efficiency	Customer Satisfaction Index	The measure of the customers' satisfaction indicates the perception and attitude of the customer towards the company	Customer perception on quality and attitudes survey	Customer Satisfaction Index
	Win / Loss Index	If the organisation's business is generated through a tendering process, the success rate of submitted tenders gives an indication of various aspects, e.g. the organisations market knowledge, pricing strategies, market image, etc.	(Number of successful bids) / (Total number of bids) * 100	% success rate
	Sales per Customer	This metric shows the increase / decrease in sales generated per customer and the effectiveness of the current customer base. It also encourages on-sale opportunities because selling to the same client is usually less costly and easier	Change in (Total revenue) / (Avg. # of customers) * 100	% change in sales per client
	Sales per Consultant	The revenue generated per consultant in the organisation gives an indication of their efficiency and effectiveness	Change in (Total revenue) / (Avg. # of consultants) * 100	% change in sales per consultant

Dimension	Measure	Purpose	Formula	Unit
Stability	Proportion of Big Customers	There is a risk factor in being dependant on a few large customers and the organisation needs to address it	(Revenue generated from the five biggest customers) / (Total revenue) * 100	% business dependant on 5 big customers
	Age Structure	The customer longevity suggests a certain level of relationship, and probability of retention. Unfortunately the measure doesn't change frequently	(Total accumulated relationship period with clients) / (# of clients)	Avg. client relationship period
	Frequency of Repeated Orders	The number of repeated orders with a customer indicates customer satisfaction and loyalty, high perceived quality, the right customer base and higher profitability because it is less costly to sell to new than to old customers	(Total revenue of Old customers [4]) / (Total revenue) * 100	% repeated orders vs. new orders

[4] An old customer is a customer that has given at least one previous assignment

A. 4 Knowledge Management Case-Studies

The following is an extract from an article that discusses knowledge management initiatives at British Petroleum, Ernst & Young, Xerox and the World Bank.[5]

BRITISH PETROLEUM

Philosophy: Every knowledge initiative must be targeted at a real business need and aim to improved business performance.

Practise: Knowledge managers seek out and codify lessons learned in their business units. A community of practise distills these lessons on the corporate intranet.

Benefits: Significant cost savings in site constructions and improved efficiency in oilfield drilling and other projects

British Petroleum, among other oil and gas companies, is one of the most advanced practitioners of knowledge management in the world. The practice has resulted in significant business improvements. According to Kent Greenes, head of knowledge management, the amount of added value that can be attributed directely to the initiative is around $600 million.

One example is the reduced cost of constructing European retail sites. By sharing knowledge among project engineers in Europe, a joint venture with Bovis ended up saving $74 million. This knowledge is now being leveraged on a global scale by project engineers in the new market of Venezuela and Japan. Similar increased in performance can be found in BP's business restructuring, oilfield drilling, polyethylene production and more. The company estimates that its ongoing knowledge management efforts will add another $400 million in value to sustainable projects.

Greenes explains that these positive returns are a result of clear corporate strategy, with each knowledge management initiative targeted at a real business need. The clearly defined objectives have made the measurement of results much easier, which in turn helps convince senior management of the benefits of knowledge management

[5] Wah, L., "*Behind the Buzz*", Management Review (MRV), Vol. 88, No. 4, p.17-19, 24-26, April 1999

initiatives. Keeping track of the outcomes is extremely important in their pursuit. As Greenes puts it, "If you can't measure it, it's not worth doing it."

BP's knowledge management started in 1994 as an informal program, called "virtual teamwork," which followed on the heels of a restructuring of the organisation into smaller, more autonomous units. Under the visionary lead of top management, the program evolved into a formal one. The objectives is to make the reuse of existing knowledge a routine way of doing work, and to create new knowledge to radically improve business performance.

The company's knowledge management approach has a simple framework, encompassing a cycle of learning processes "before," "during" and "after" any event. When the learning processes result in business lessons, peers in communities of practices distill them and define the best practice. Finally, both specific and generic lessons are incorporated into "knowledge assets" on the corporate intranet.

In addition, an employee-driven yellow pages on the corporate intranet now contains information about 10000 employees, enabling everyone to find out "who knows how." Some 1500 people also have video-conferencing and application-sharing technologies on their desks to exchange knowledge with other BP associates, partners and suppliers. More than 20 of the 100 business units of the BP/Amoco merger are using these processes and tools on a regular basis. And about a quarter of BP's business units now have "knowledge guardians" who help their business teams harvest newly created knowledge.

ERNST & YOUNG

Philosophy: Existing expert knowledge should be captured and disseminated across the organisation world-wide to avoid reinventing the wheel.

Practise: Communities of interest publish best practices in "knowledge containers" for others to learn and apply

Benefits: Consultants are able to accelerate problem-solving and get results to clients faster.

Consultant services firms are another group that has gained much insight about knowledge management. Ernst & Young and Arthur Andersen are some of the

leading consulting firms that leverage their own knowledge in this are to help client companies implement the practice.

At Ernst & Young, knowledge management as an internal practice now has a dedicated team of about 300 world-wide. Meanwhile, different practice areas in the firm have started to offer knowledge management services. The knowledge-based business solution practice, for example, provides consulting services to knowledge-intensive businesses and companies that want to engage in e-commerce.

Within Ernst & Young, the management consulting practice has led the way in the firm's own knowledge management initiative, according to Ralph Poole, a director of Ernst & Young's Centre for Business Knowledge. For about six years now, it has actively engaged in experience sharing, in which consultants leverage what others learn from an engagement and apply that knowledge to the problems of other clients.

For example, after a SAP implementation in a client company, a community of interest (COIN) would look at what was learned and pick the most relevant issues to be published into "PowerPacks," a container of knowledge that has everything a practitioner would need to know to execute the work. This way, when consultant face a similar problem or work in a similar industry , they can accelerate the implementation process.

There are 30 COINs made up of teams from different industry lines and business process solutions. These are people who determine the actual content of the PowerPacks.

Over the years, knowledge sharing has been the unsung hero of much of the firm's improved business performance. From 1993 to 1998, for example, the management consulting practice grew more than 300 percent in revenues. During the same period, the head count increased only 200 percent. According to Poole, the gap represents increasing productivity: " We can at least attribute a portion of that to knowledge management – we are getting more efficient over time."

XEROX

Philosophy: It is crucial to leverage the know-how accumulated in employees' heads because the company's core business is to provide support services to customers.

Practise: Service reps contribute electronic tips on a standard knowledge-sharing platform used across the world.

Benefits: Useful tips help save the company cost in labor and parts.

At Xerox Corp., knowledge management isn't all about machines and technology, as one might expect. It's 90 percent social process and 10 percent infrastructure. According to Holtshouse, Xerox's knowledge management initiative aims to use technologies to improve service quality and productivity.

To support that objective, the company launched Eureka, a "social tactical system," in 1996. The system links 25000 field service representitives with laptops and the Internet, using a common documentation method, to facilitate lateral communication.

Eureka was developed as a result of 18 month's study by anthropologists, behavioral scientists and engineers, and the system was actually inspired by the way technicians interact with each other to share their knowledge. A study at the Xerox Palo Alto Research Centre (PARC) showed that these technicians use "war stories" to teach each other to diagnose and fix machines. Drawing on that same concept, Eureka supports Xerox's technicians in sharing their stories in the form of electronic tips.

What's unique about the system, says Holtshouse, is that it does not need a dedicated staff to collect information and write up stories or scripts – a time-consuming effort. Eureka is self-sustaining; the field service reps create and maintain the knowledge base by contributing and renewing all the tips on how to fix machines. Formal review committees then validate the tips.

The tangible results of the lateral communication made possible by Eureka include a 5 percent saving in both parts and labor. Service reps access more than 5000 tips a month and new tips are generated at the rate of about one per 1000 service calls.

What makes the system self-sustaining is the recognition employees receives for participating in the process. Each time a rep contributes a tip, his or her name goes on the system. This motivates people to take responsibility for building the common knowledge base. "Understanding what motivates them was key to get the right things going," Holtshouse says. "Money was one of the considerations, but recognition seems to [work] the best."

WORLD BANK

Philosophy: The sharing of development expertise around the globe should be boundless. The aim is to achieve the mission of alleviating poverty in developing nations faster.

Practise: Experts and task managers around the world use the Internet to share knowledge and experience in solving development problems.

Benefits: Accelerated problem-solving helps developing nations to overcome crises much faster than before.

The benefits of knowledge sharing aren't limited to the private business terrain. Non-profit organisations also can use it in achieving their missions. The World Bank, for example, is leveraging global knowledge sharing to attain its goal of becoming a clearinghouse for expertise on sustainable development.

Stephen Denning, program director of knowledge management, says, "The mission of the World Bank is to alleviate poverty and improve the living standard of the poor countries of the world. Knowledge management is helping us to accomplish the mission."

One example occurred last August, when the governor of Pakistan contacted the World Bank office in his country to ask about new technology for Pakistan's deteriorating highway system. Denning says that in the past, the bank normally would have assembled a team to visit the country and write a report on the issue, which could take months.

But what actually happened was quite different. The task manager contracted the "community of practice" within the bank that consists of highway experts, asking for urgent advice. A highway expert working at the World Bank sector in Jordan found that his country was using a technology that could be applied in Pakistan. On the same day, someone in Argentina was working on a book about a technology being

used in Asia, South America, Africa and Australia. Meanwhile, one of the World Bank's outside partners in South Africa said the country had been using the technology for decades. So he shared the pros and cons with the task manager, who was able to quickly gather global experience and apply it to Pakistan. Finally, this knowledge is being captured in a knowledge base.

Currently, the World Bank has more than 110 communities of practice around the worlds that are in the process of connecting with each other and improving the quality of the knowledge base. Denning says the organisation's vision is to share its knowledge about development externally by 2000, so that all who are interested will be able to access it via the Internet.

A. 5 Document management software [6]

The aim of this selection of software is to support the creation and dissemination of information to support the co-ordination between people and documentation and the collaboration between different groups within and outside the organisation.

It comprises of the following types of software:

- Enterprise Document Management Software (EDM)
- Full-text Retrieval software
- Viewer and Publisher Software
- Workflow
- Push Technologies
- Integrated Document and Output Management (IDOM)

1. Enterprise Document Management Software (EDM)

EDM software manages the production of, the access to, and the distribution of documents. Features like the ability to automate change, to validate the integrity of the document and to facilitate the re-use of document content are common in EDM[7] software. Because the status of a document changes as it moves through its lifecycle from 'draft' to 'in submission' to 'approved' and the access levels vary from author, to reviewer, to public access, the EDM group of software enables access and security control procedures and monitors how documents change over time. It deals with how information is created and captured as well as how critical documents are moved around according to the business rules.

Other features include:

- workflow abilities which address conditional logic;
- the ability to push relevant information to appropriate users in the right format;
- the ability to maintain document content, e.g. the company logo which is updated by a parenting ability so that the change of one logo is reflected in all the relevant documents;

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[6] White, Amie S., and Combell, Ian, (1997), "Document Management Software", *1996-2001: Market Review and Forecast*, International Data Corporation

[7] Microsoft and Documentum – Whitepaper, (1997)

- the ability to re-use document content, e.g. to easily reflect tender information that forms part of one document in other documents.

Trends

A number of trends are observed in the market, such as:

- standards like DMA (Document Management API) and ODMA (Open Document Management API) is expected from EDM software for easier application and the integration between different file formats; and
- the scalability of the application beyond a workgroup to an enterprise-wide deployment.

EDM Features

The key features of an EDM software solution include:

Configuration Control	Version Control (Revision, Data Integrity)
Security	Rendition Creation (Comment)
Check in/out	Push/Pull technology
Search ability	Virtual Project Cabinet folder
Maintainability	Web-enabled/accessible solutions
Workflow	Information reuse
Collaborative solution	OCR (optical character recognition) ability

Examples of EDM Software

There is currently a wide range of EDM products on the market and a few examples of these are:

Keyfile

Keyfile has the feature of viewing and accessing shared documents, stored in multiple folders, desktops or file cabinets. It provides full multiple revision track records of documents, with the necessary security control on pages, users, and almost any type of document and with full view ability. It interfaces effectively with the Microsoft Exchange, collaborative tools, effectively supports Keyflow as workflow software and is an easy to use integrated Microsoft Object oriented desktop solution.

Altris

Altris provides the capability of sharing images across distances (by modem, Internet, WAN, etc) and mixing very large files, images and drawings, with a business document.

2. *Full text Retrieval software (26%)*

Knowledge retrieval technology uses algorithms with Boolean and context-based search techniques to give context to a query, to sift through a huge volume of information and to return high quality 'hits'. This could include providing intuitive search, retrieval, collaboration, and push capabilities. The value addition of search engines is in their ability to save time and resources by finding relevant information faster and more accurate to the users' satisfaction.

Appropriate Information retrieval (IR) facilities solve large-scale search and retrieval needs to ultimately develop the company's ability to manage its knowledge. This requires adequate understanding of the type of data sources and data that need to be indexed and searched and the user requirements of the client. If the requirements include a search engine with extensive, accurate search ability in a fuzzy kind of environment, Excalibur is the preferred choice. It leads the fuzzy search category of search engines with its semantic search features and its effectiveness in the search of image content, foreign language and bad quality documents.

If the search engine is required to perform searches across multiple data types and sources, Excalibur outperforms the competition. It specialises in image-types of data, with its adaptive pattern recognition technology and has proven superior to competitors with search abilities limited to electronic text-based products and not the integrating paper-based knowledge assets.

Verity, on the other hand, has a strong ability to leverage its relationships, due to focused leadership and strategic partnerships. According to MetaGroup's research "Verity's strength is in its presence within the greatest variety of leading GroupWare, document management, Internet, Intranet, and database products on the market". In additions Verity's ability to create a single index across multiple information stores makes it an attractive alternative.

Other features of search and retrieval solutions include the employment of intelligent agents and web crawlers as well as summarisation and categorisation abilities. The ability of a vendor to implement and support the system, as well as cost considerations are other important criteria.

Other features of retrieval software include:

- *semantic networks* that are developed from dictionaries to distinguish among the different meanings of a word depending on its context; and
- *adaptive pattern recognition* that provides the ability to recognise query terms even when misspelled due to OCR, author, searcher' errors.

Trends

A number of trends are observed in the market, such as:

- the ability to push mission-critical data to end users;
- intuitive search and retrieval as well as collaborative technology; and
- the ability to exploit the corporate intranet.

Examples of Full Text Retrieval Software

There is currently a wide range of products on the market and *Table 8: Full Text Retrieval Ware* indicates the position of the dominant players in the market.

Table 8: Full Text Retrieval Ware

	NEW USERS (%)	REVENUES (%)	INSTALLED USERS (%)
VERITY	**53.7**	29.7	**88.2**
FULCRUM	10.8	**30.3**	1.5
EXCALIBUR	4.3	11.7	2.4
GRAPEVINE	1.3	0.6	0.3
FOLIO	3.1	7.5	1.7

3. Viewer/Publisher Software (20.5%)

This group of software provides the ability to convert paper documents into searchable Portable Document Format (PDF) files whilst maintaining all the formatting, text, graphics and signatures.

Features of Viewer/Publisher Software

The functionality of this type of software includes the following:

- ability to integrate with other business critical applications such as product development;
- reduced maintenance and administration associated with Internet-based application;
- enable the management and distribution of huge amounts of documents easier;
- provide independent platform support;
- access to remote users;
- administration of critical information is centralised; and
- scalability beyond company borders.

4. *Workflow*

Knowledge embedded in methodologies, processes, and repetitive activities can be exploited through workflow technologies that have the ability to automate business processes whilst distributing the related electronic documents. Features like ability to activate, create, monitor and modify workflow instances across the organisation makes this integrated software solution highly effective.

It is the catalyst that deploys flexible business processes, provides for continuous improvement and ties together a collaborative team. It enables faster application development at a lower cost as well as the rapid access to the accurate information.

Example of Workflow Software

There is currently a wide range of products on the market which include:

Keyflow

Keyfile's Keyflow integrate seamlessly into Microsoft Exchange environment with Outlook as user interface, thereby enabling collaborative processes. It provides for the ability to map an automated business process, to view the status of a workflow in process as well as creates a higher connectivity throughout the organisation.

5. *Push Technologies*

This type of products accesses all the internal and external sources of knowledge including broadcast media and Intranet applications to deliver relevant information timeously to a target audiences through secured channels. It enables the automation and streamlining of information dissemination across the organisation. With the ability of such an agent a user saves time on performing a search and receives any new entries via an e-mail message with a link to or the source document itself. One example of this type of software is BackWeb

6. *Integrated Document and Output Management (IDOM)*

There is another type of software in the market that provides an total solution to the challenge of document management and integrates all the above-mentioned functions. These types of products provide production imaging, workflow, information retrieval and integrated document management software. It also provides publishing and viewing technologies, hard-copy production, distributed print and distributed output management, electronic forms, database publishing, integrated documents archival and retrieval strategies, automated document factories, paper reduction and application development for production output.

Examples of IDOM Software

Herewith a few examples of IDOM software solutions currently available on the market

Open Text (Livelink)

Livelink 7 lives within an Intranet, it has a workflow capability that enables users to construct collaborative processes of any type, providing an Intranet home page as the locations for users to receive work. It manages any file, news group or object type, it provides process and project management and enables intranet-based work. Livelink Intranet includes Livelink Library (document management), Livelink Workflow, Livelink Project Collaboration, and Netscape's Enterprise web server as well as Livelink Search for search capabilities.

PCDOC's – Docs Enterprise Suite

PCDoc's enterprise suite includes Docs Open for document management, Docs Imaging for the capturing of digitised images and text and Docs Routing for a low level serial, parallel, or broadcast routing regardless of the file format. CyberDocs is a web-enabler (browser) that provides secure cost effective document management via the Internet and Intranet.

Fulcrum – Knowledge Network

Via a knowledge map and a CyberDocs interface the user can navigate a search with fulcrum ability across the different servers of information according to their security levels.

NetRight – Java based solution

This solution provides the implementation of a Java-based technology browser, without installing or maintaining document management software at every site. This approach provides without extra installation cost, the necessary secure communication, low memory requirements, low licensing costs, and limited network traffic.

Unlike the Hypertext Markup Language (HTML) and Gateway Interface (CGI) technologies that is used in most document management vendors, Java-compatible technology does not show the same limits in comprehensive document management functionality.

It provides a cost-effective, technical superior solution with enhanced features compared to HTML based solutions as defined in *Table 9: Comparison between JAVA and HTML Technology.* [8]

Table 9: Comparison between JAVA and HTML Technology

JAVA-based solution	CGI and HTML-based solution
Uses smart caching – automatically retrieves updated transaction information	Uses browser caching – user periodically reload pages to see updated info.
Decreases network traffic – uses a few short transactions optimized for DMS	Increases network traffic – large HTML pages connects and disconnect
Limited server resources – a single multithreaded program to speed up response time	Uses server resources by running CGI programs for each client request
Scalable to support huge amounts of users	Limited number of users can be supported
Security by encrypting documents and transactions	No security between server and client
Control communication link	No control over communication failures

Features of Integrated Document and Output Management Software

The functionality of this type of software includes the following abilities:

- Search ability
  - Pattern recognition (spelling mistakes)
  - Binary Pattern (scan quality)
  - Auto correct
  - Prioritising
- Security control
- Semantics
  - Language meaning
  - Clustering such as categorisation (similarity engine)
  - Semantic nets (weighted relationships)
- Indexing ability
- Internet interaction
- MiddelWare
- Knowledge mapping
  - Content abstraction (summarizing)
  - Clustering (key words)
- SAP, GIS and other integration
- Sharing (collaborative)
- Web search
- Pull Technology (Agent)

[8] Rafiq Mohammadi, (1997), "Which document management Internet/Intranet strategy is best for you", http://www.kmworld.com/newestlibrary