Chapter 2 Literature Review: Learning and management

2.1 Introduction

Chapter One provides a better understanding of the research aspects of this study. Chapter Two attempts to sketch various theories that inform innovation in higher education.

Because this is a descriptive and interpretive qualitative case study, it is necessary to have a theoretical underpinning that feeds into the research questions.

Some of these theoretical fields overlap, making it difficult to separate this review into discrete sections linked to the relevant research questions.

An interdisciplinary approach is required to understand *process, product and service innovation*. It also serves to qualify the research methodology chosen for this study.

Due to the interdisciplinary nature of this study, it is necessary to call attention to systems theory as briefly referred to in Chapter One. The systems perspective emphasises the importance of considering phenomena in their totality. It is therefore a holistic view that values context (Hanson, 1995).

Figure 2.1 illustrates how this Chapter fits into the structure of this thesis. Chapter Two describes theories that are relevant to educational innovation and that are applied to the case of the virtual campus in Chapter Four.

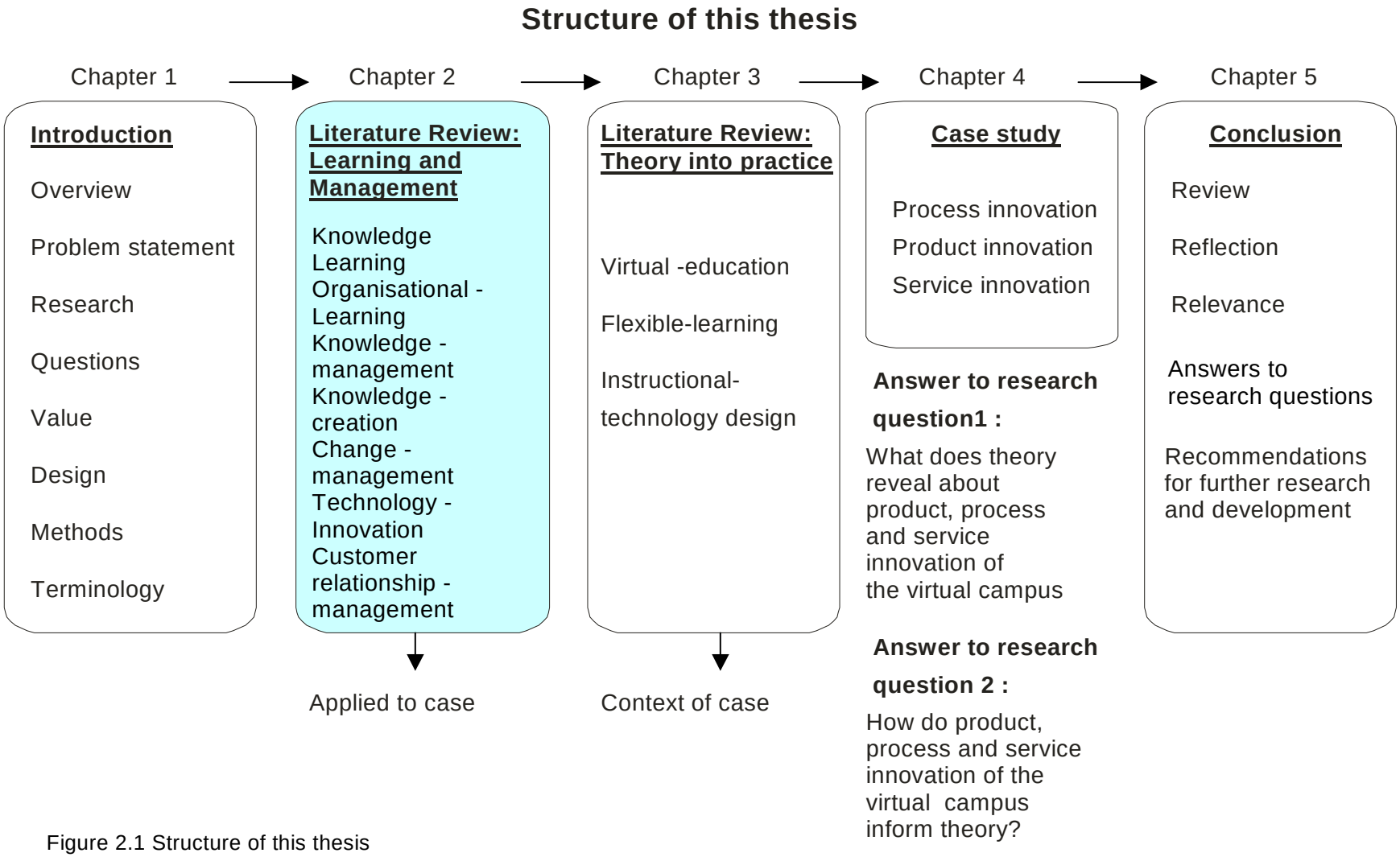

Figure 2.1 Structure of this thesis

The following section starts at the core of this study, i.e. the nature of knowledge, or epistemology.

2.2 Knowledge

The core business of higher education institutions relates to knowledge. Knowledge plays a key role in teaching and learning, in research, in organisational learning and in management and administration. Knowledge in its various permutations therefore forms the basis of the theoretical approaches that are used in this study.

A philosophical explanation of knowledge is required, since Western philosophy shaped what is considered to be knowledge in the disciplines of, amongst others, management, learning and organisational theory. Concomitantly it is important to also explain knowledge in the context of Japanese philosophy. Taking Japanese philosophy into account provides a holistic understanding of knowledge and brings a different approach altogether to Western philosophy. It also strengthens the notion of an organisation as a synergistic system. Both Western and Eastern (or Japanese) philosophies are therefore explored in this chapter and are later returned to in the case study of the creation and evolution of the virtual campus in Chapter Four. The researcher chose to include Japanese epistemology and knowledge creation theory due to its relevance to this study. The Japanese view of knowledge resonates with constructivism – a learning theory that will be discussed in Section 2.3.5 on knowledge creation by Nonaka, Takeuchi, Von Krogh and Ichijo (1995, 2000) mirror innovation processes. African epistemology is excluded in this study due to its limited scope.

2.2.1 Western philosophy

The philosophical inquiry of knowledge is known as epistemology. The dominant Western epistemologies are rationalism and empiricism (Russell, 1991:101-584).

- Rationalism essentially says that knowledge can be obtained deductively by reasoning, whereas
- empiricism holds that knowledge can be attained inductively from sensory experiences.

Plato laid the foundation of rationalism by claiming the existence of a perfect world of ideas that cannot be known through sensory experience. He therefore believed in absolute truth that cannot be known by man and that man attempts to know the absolute truth through his senses and that senses simply lead to an imperfect world, reminiscent of the ideal world. Aristotle stressed the importance of observation and the verification of individual sensory perception. Thus Western philosophy is based on a dualistic split between mind and body.

Two mainstreams in epistemology emerged, namely:

- Continental rationalism and
- British empiricism.

A well-known Continental rationalist, Descartes, coined the famous phrase *Cogito, ergo sum* (I think, therefore I am) and posed that humans possess a-priori mental structures that contain innate ideas and concepts. He was opposed by Locke, who argued that only experience provide the mind with ideas (Venter, 1990:3-49). Both Descartes and Locke built on the basic ideas of Plato and Aristotle respectively, but it is beyond the scope of this study to explore their theories in depth.

Towards the eighteenth-century Kant and Hegel attempted to synthesise the two streams of rationalism and empiricism. Philosophers such as Husserl, Heidegger, Sartre, Merleau-Ponty, Wittgenstein, James and Dewey continued it in the twentieth-century. During this period knowledge became associated with action and the separation between theory and practice gradually fell away (Russell, 1991:651-783). This synthesis has important implications for this study and will be explained later in this chapter.

2.2.2 Japanese philosophy

Nonaka and Takeuchi (1995:27) make it clear that no distinct Japanese philosophy exists, but that the Japanese have a very definite approach to knowledge. They list these distinctions of intellectual tradition as follows:

- Oneness of humanity and nature.

- Oneness of mind and body.
- Oneness of self and other.

A Japanese approach to knowledge is holistic and has always been that way. On the other hand the Western approach was initially dualistic and grew to become more holistic.

The Japanese live very closely with their environment, which is evident in their language. Their language is not arbitrary symbols as in the case of Western languages, but consists of concrete images of objects that are contextualised when used. It is echoed through their art in that they don't have a fixed perspective of time and space, but rather see it as being in constant flux and transition – hence more circular. As a result Japanese drawings do not fix the artist's viewpoint and therefore there is no need to draw shadows (Nonaka & Takeuchi, 1995:28). They also have a holistic view of the human, i.e. the concept of the oneness of mind and body found in Zen Buddhism. In Zen Buddhism, "true knowledge cannot be obtained by theoretical thinking but only through one's total mind and body" (Nonaka & Takeuchi, 1995:30). Finally, oneness of self and other is expressed by the collective, intuitive and organic worldview of the Japanese. Everything and everyone is interrelated. The implication is that for the Japanese, to work for others means to work for oneself (Nonaka & Takeuchi, 1995:31).

The implication for epistemology is that Japanese philosophy integrates what is referred to in Western philosophy as *rationalism* and *empiricism*. Hence knowledge is acquired from experience and generated from the mind. Mind and body is one. Furthermore, the oneness of self and other implies a social element of knowledge. The relevant question is what Western and Japanese epistemology holds for knowledge in various theoretical fields.

The following theories will be explored in this study:

- Learning and design theory
- Organisational learning
- Knowledge creation
- Knowledge management
- Change management
- Technology innovation and management
- Customer Relationship Management (CRM)

The basis of these theories is epistemology – the science of knowledge/knowing.

2.2.3 Epistemology in education (learning and teaching)

A distinction is made between endogenic and exogenic epistemological traditions of knowledge (Gergen,1995:18). The former could be described as 'mind centred' and the latter as 'world centred'. Brought into context of the Western distinction between rationalism and empiricism, the similarity can be illustrated as follows:

Knowledge constructed from within	Knowledge experienced from without
Rationalism	Empiricism
Endogenic epistemology	Exogenic epistemology

Table 2.1 Rationalism versus empiricism

- Endogenic thought separates the mind and the world, but holds that the mind as a reasoning capability, attributes certain elements to the external world.

- Exogenic thought believes in an external world, which is considered to be the truth, and divides that reality from the psychological world, whose task it is to know the external world. The arrangement of environmental inputs builds internal representation.

In an educational context, an exogenic view of a learner would be an empty slate that should be filled with the essential features of the world. Clearly, this is an outside-in approach with the Aristotelian understanding that knowledge is a commodity that can be transferred from the knowledgeable to the novice. It is also situated in a logical positivist tradition, which emphasises the importance of being able to measure and prove concepts. Under this view, *knowing* is based on a structured collection of connections among basic mental and behavioural elements, i.e. stimulus and response (Greeno, Collins & Resnick, 1996). The following are practical examples of an exogenic epistemological approach in an educational context that are provided by Gergen (1995:18):

- Enrichment of experience takes place through, for example, the collection of species or specimens, participant observation, laboratory experiments and field trips.

- Examinations are favoured to assess individual knowledge acquisition and exposure to books.
- Lectures are complementary to direct information, providing amounts of information not otherwise available.
- Reliable, objective testing is favoured. Multiple-choice questions, test standardisation, and statistical normalisation all help determine ”to what degree the slate has been filled”.

Conversely, the endogenic perspective in education places emphasis on the rational capacities of an individual’s thought processes – it is not so much the quantity of information in one’s mind, but the way the mind processes and deliberates about it that is important. According to this view *knowing* is based on internal mental representations (Inhelder & Piaget, 1958). Gergen (1995:18) gives the following practical examples of an endogenic epistemological approach in an educational context:

- Subjects such as philosophy, mathematics and foreign languages best facilitate quality and clarity of thought.
- Co-operative social learning environments are favoured above lectures, because it is through active engagement that cognitive skills are optimised.
- Essay exams and term papers, which are more subjective means of assessment, are preferred.
- Language and social context are the vehicle through which meaning is constructed, thus external and internal knowledge are continually constructed within specific real-life contexts.

If one weighs the exogenic and endogenic views explained previously, one is once again caught up in a dualistic way of thinking, either believing in an empty slate that is filled through experience, or believing in *a priori* (inborn) mental ability or preliminary scaffolding of concepts that determines any particular configuration of conceptual categories. Exogenic thought cannot explain exactly how transfer of knowledge from the external world to the empty mind takes place and endogenic thought cannot explain how new concepts are integrated in an *a priori* set of categories to locate and incorporate uncategorisable events.

Section 2.3 discusses the relationship between knowledge and learning.

2.3 What is learning?

The concise Oxford dictionary definition of learning is “the acquiring of knowledge or skill” (1989:571). Brody (1997:11A) states that “Knowledge is content that is assimilated, collated and interpreted to provide a unique perspective that helps us perform a task, solve a problem, or stimulate our intellect”. In order to understand knowledge it is important to understand learning. Thus learning entails the acquisition of skill or know-how, and the acquisition of know-why, which means the ability of, *informed action*. If we return to the synthesis achieved in Western epistemology in the twentieth century, it is clear that ‘informed action’ denotes an integration of theory and practice – hence the separation between theory and practice has disappeared. It is also a reflection of the Japanese philosophy of oneness of mind and body. Building on the synthesis, Kim (1998:43) defines learning as “increasing one’s capacity to take effective action”. Kolb (1984:21) defines it as “the process whereby knowledge is created through the transformation of experience”. Brown and Duguid (2000:124) argue that it is learning that makes intellectual property, capital, and assets usable. To understand learning it is helpful to revisit the earlier point that synergy eventually formed between theory and practice, knowledge and action (i.e. mind and body). Pragmatically speaking, talk without action is worthless. The age-old adage of the difference between ‘knows that’ and ‘knows how’ comes into play.

This is emphasised by Senge *et al.* (1999:24) who define learning as enhancing capacity through experience. They state “learning always occurs over time and in ‘real life’ contexts, not in classrooms or training sessions”.

The phenomenon of human learning has been studied for centuries and it is generally agreed that two main streams exist in learning research, namely:

- Learning as behaviour and
- learning as cognition.

Section 2.3.1 explains the theoretical underpinning of *behaviourism*, which emphasises overt behaviour, versus *cognitivism*, which emphasises mental operations.

Both schools are relevant and should be viewed on a continuum, where, in any given learning environment, the appropriate strategy is chosen depending on the expected

learning outcome. Once again if it is brought into context of epistemology it can be illustrated as follows:

Knowledge constructed from within	Knowledge experienced from without
Rationalism	Empiricism
Endogenic epistemology	Exogenic epistemology
Cognitivism	Behaviourism

Table 2.2 Cognitivism versus Behaviourism

2.3.1 Behaviourism

Behaviourism is based on a stimulus-response approach in which contiguity, reinforcement and practice are imperative, whereas *cognitivism* holds that learning is a set of processes with the function of information processing (Gagné & Glaser, 1987:51-56). Behaviourist theory was prevalent in the first half of the twentieth century and led to the practice of rote-learning and content-driven instruction, which is still prevalent in educational systems. Skinner (1938) is regarded as the creator of this theory.

Behavioural theorists posit that learning takes place through reinforcement, in other words – practice makes perfect. In a learning environment this would translate into a question and response, where a right answer is rewarded and a wrong answer is not reinforced. Hence learning is regarded as a set of stimulus-response associations, induced by repetition and reinforcement. To return to epistemology, this paradigm states that knowledge is experienced from without. Very little, if anything, is said about how the learner constructs and processes the associations. Rather, the emphasis is on representation through repetition.

A related theory, *Objectivism*, holds that learning consists of assimilating an objective reality that exists apart from learners. Jonassen (1991a:28) describes it as follows: "Objectivists believe in the existence of reliable knowledge about the world. As learners, the goal is to gain this knowledge; as educators, to transmit it…the role of educators is to help students learn about the real world. The goal of instructional designers or teachers is to interpret events for them. Learners are told about the world and are expected to replicate its content

and structure in their thinking". *Objectivism* is applicable to relatively fixed knowledge constructs such as Anatomy. Like *behaviourism* it focuses on replication.

Behaviourism and *Objectivism* fall into the empirical philosophy which believes that learners must be instructed to replicate an objective reality that does not make provision for the learner's prior experience, understanding, beliefs and interpretation. Learning is measured by testing the accuracy of the representation by the learner of the objective reality/knowledge.

Although the scope of this study does not allow for a deeper exploration of *behaviourism*, it is necessary to briefly mention *Instructionism* and *Reductionism*. Both schools of instruction fall in an empirical category. Instructionist theorists posit that knowledge and skill requirements can be articulated and measured. Further, a pragmatic stance is taken in the sense that information and skills should be presented on a need-to-know basis (Hannafin *et al*., 1997, Jonassen, Campbell & Davidson, 1994, Schoenfeld, 1993). *Reductionism* attempts to simplify complex phenomena on behalf of the learner by means of linear models.

Commonalities of behavioural approaches to learning are as follows:

- The learner takes on a predominantly passive and reactive role.
- Instruction is structured and systematic.
- Instructional processes are aimed at learners in general and not on the individual learner.
- Learning can be measured.
- It assumes that a well-planned instructional intervention can result in a desired learning outcome.

It is important to note that this view of learning lies on a continuum and is suitable for certain learning environments.

Section 2.3.2 covers cognitive learning theory, which became prevalent in the late 1960s.

2.3.2 Cognitivism

From a cognitive perspective, learning takes place when a person integrates new knowledge into an existing mental model. Cognitivists encourage the development of metacognitive skills in learners. Cognitive science theories view learning as the execution of internal cognitive processes, such as *remembering*, *thinking*, *conceptualisation*, *application* and *problem solving* (Reigeluth, 1999 & Moore, 1999).

It further views learning as a reorganisation of internal knowledge structures, in other words the creation of *mental models* (such as *mind maps*) and *schemata* and the way in which information is retrieved from these structures.

Psychological research makes a distinction between learning and memory. Kim (1998:44) notes that learning relates more to acquisition and memory to retention. However the two are interconnected because what we retain in our memory has an effect on what we learn and what we learn affects our memory. A cognitive paradigm focuses on the use of critical thinking skills, conceptualization and problem solving.

Problem solving gained attention when Newell and Simon (1972) postulated that problem solving takes place through information processing – similar to a computer. A distinction is made between short-term memory and long-term memory. The process of cognition consists of the following series of operations:

- Sensation from a stimulus,
- perception,
- encoding in short term memory,
- association,
- encoding in long term memory, and
- retrieval.

The researcher interprets cognitivism as an extension of *behaviourism* and *objectivism*. It retains the construct that an external reality is represented, but focuses more on how external information is processed and stored. It brings us closer to an integrated epistemology, but does not explain how knowledge translates into action.

Bloom's (1956) *Taxonomy of Educational Objectives* ranks types of learning from lowest to highest:

Knowledge – according to Bloom the lowest learning type and he views it as the ability to remember previously learned material.
Comprehension – understanding the meaning of constructs.
Application – using knowledge in real life situations.
Analysis – breaking down constructs into smaller components to understand its structure.
Synthesis – creativity is required to group components to form new wholes.
Evaluation – value judgments are involved and according to Bloom this is the highest learning type on the cognitive hierarchy.

The researcher does not agree with Bloom's view of knowledge, because its definition relates to memory. As was discussed in Section 2.3, knowledge is more than memory. Section 2.5 will show that knowledge is actually on a high level of cognition.

Henri (1992) provides an analytical model of information processing:

Surface processing	**In-depth processing**
Repeating the information contained in the statement of the problem without making inferences or offering an interpretation.	Linking facts, ideas and notions in order to interpret, infer, propose and judge.
Repeating what has been said without adding any new elements.	Offering new elements of information.
Stating that one shares the idea or opinions stated, without taking these further or adding any personal comments.	Generating new data from information collected by the use of hypotheses and inferences.
Proposing solutions without offering explanations.	Proposing one or more solutions with short-, medium or long-term justification.
Making judgments without offering justification.	Setting out the advantages and disadvantages of a situation or solution.
Asking questions which invite information not relevant to the problem or not adding to the understanding of it.	Providing proof or supporting examples. Making judgments supported by justification.
Offering several solutions without suggesting which is most appropriate.	Perceiving a problem within a larger perspective.
Perceiving the situation in a fragmentary or short-term manner.	Developing intervention strategies within a wider framework.

Table 2.3 Surface processing versus deep processing (Henri, 1992:73)

From this view of learning, *component display theory* arose (Merrill, 1983; 1987) in which relationships between content to be taught and performance are categorised. Four types of content are identified, i.e. *fact*, *concept*, *procedure*, and *principle*. These define the different types of knowledge that comprise a domain to be learned. The three performance levels are: *remember*, *use* and *find*.

This theory incorporates both behavioural (reinforcement) and cognitive (analogies) strategies and supports a more integrated approach *of learning as informed action,* but neglects the social dimension of learning. It therefore holds that each learning outcome is attached to a corresponding condition to achieve the required outcome.

Sometimes, information processing is done incorrectly, leaving gaps in the understanding of a concept. Metacognition is viewed as a means to address these gaps. Moore (1995) states that metacognitive knowledge is characterised by three interrelated components:

- Awareness of one's own cognition and the degree to which one's own cognitive efforts are successful.
- Knowledge about the different cognitive demands of different learning tasks.
- Procedural knowledge of strategies to employ when the status quo is not successful.

Metacognition (thinking about thinking) is the ability of learners to plan, monitor, and control their own cognitive processes and performance, and to select learning strategies for themselves (Winn, 1990).

An important construct that emerged from cognitivism is that of mental models, which is discussed in Section 2.3.3.

2.3.3 Mental models

The concept of mental models is an important element in trying to understand learning. Jensen (1995:33) affirms this by stating "we never really understand something until we can create a model or metaphor derived from our unique personal world ". This statement is contrary to the objectivist attempt to create a model on behalf of the learner. In both approaches, though, a model promotes a better understanding of phenomena. Cognitive

instructional strategies, for example, include the use of concept maps, metaphors and analogies and chunking. Nonaka and Takeuchi (1995:60) define mental models as "working models of the world by making and manipulating analogies in [their] minds". Mental models "represent a person's view of the world, including explicit and implicit understanding" (Kim, 1998:45). People use mental models such as paradigms, perspectives, beliefs and schemata to interpret their world (Merrill, Li and Jones, 1990). Mental models provide the context in which to view and interpret new material, and they determine how stored information is relevant to a given situation. There is therefore an individual or personal element inherent in cognitivism and in mental models, i.e. that an individual constructs mental models based on memory and relevant to a given situation.

Section 2.3.4 describes constructivism and constructionism and arrives at a praxis in which knowledge is informed action in a social context – reminiscent of knowledge creation theory that is discussed in Section 2.5.2.

2.3.4 Constructivism and constructionism

Learners may neglect to use related prior knowledge to integrate new knowledge, or worse, they draw on incomplete or inaccurate prior knowledge. For this reason dialogue and/or interaction is critical because negotiation of meaning leads the learner to discover inaccuracies and/or gaps in his or her mental model. It could be reasoned, however, that this view embraces a behavioural assumption that there is one objective reality or knowledge.

Wittgenstein (1958) stated that knowledge is in the eye of the beholder, and that you give meaning to the concept through the way you use it. A generation later than the cognitive science and philosophy, the "constructivist perspective" emerged. It holds that cognition is a creative act of construction or creation. *Constructivism* places emphasis on the mental processes involved in establishing meaning. Moving away from representation of external constructs. Cognitive constructivists regard knowledge as internally represented in the mind of the learner, built in interaction with the surrounding environment (Bonk & Wisher, 2000:7). It requires self-regulation and the building of conceptual structures through reflection and abstraction and is known as *cognitive constructivism* (Dick, 1991:41).

Constructionism is a theory that locates meaning in language and the implied socio-cultural context and is also referred to as *social constructivism* (Steffe & Gale, 1995). Both theories

are learner-centred and endorse problem-based experiential learning to promote critical thinking. *Constructionism* is the concept that it is through language, communication and social constructs that meaning is derived. It emphasizes the social aspects of learning and cognition such as collaboration, negotiation and dialogue. In short, if people privately determined what words meant, communication would become very difficult, because we rely heavily on words, whether it be written or spoken, to establish meaning within specific contexts. It is largely through language that transmission of knowledge has traditionally taken place in education. Whether it is through a lecture, courseware, experiments or discussion, the lecturer can never construct meaning on behalf of the learner. This will be explained in more detail.

Slabbert (1996:63) explains this concept as follows: "The learner establishes a relationship with objects in terms of nature and events, or with subjects in terms of him/herself or others. From this relationship meaning is constructed by the same learner".

The social aspect of constructive learning is important because of the fact that collaborative methods of learning are purported to develop critical thinking through directing learners towards discussion, clarification of their own ideas and evaluation of others' ideas (Pulkkinen & Ruotsalainen, 1997).

The basic idea of constructive learning is that learners must construct knowledge and skills through their own experiences. This takes place best in situations and learning environments arranged for the purpose, putting an emphasis on the process goals and ensuring that support and guidance are available.

Piaget formulated the concept of constructionism because of his dissatisfaction with the theories of knowledge in Western philosophy (Steffe & Gale, 1995). He concedes that the lecture and textbook are still the most commonly used way of presenting a large array of material rapidly and efficiently. Furthermore that rote learning and drill-and-practice which are both strongly based on short-term memory; are valuable in transforming understanding into automated skill, making the information and procedures available without conscious effort. The disadvantage of rote learning and drill-and-practice is that both are weak in motivation (engagement) and in providing conceptual aids to understanding.

According to Cennamo *et al*. (1996) learning environments should take into account the following important characteristics of adult learning.

- Learners often have plenty of experiences of the things to be learned, especially in adult education.
- Learners can concentrate on different types of tasks in their studies.
- Learning is a process.
- Learning is a social event.

The following is a synthesis by Bonk & Wisher (2000:6) of the characteristics of constructivist learning:

- Learning is constructed from the experience of the learner and builds on the learner's prior knowledge in order to make it relevant and meaningful.
- Interpretation is personal.
- Meta skills to manage one's learning are reflected upon to address misconceptions in thinking.
- Learning is an active process whereby experience is converted into knowledge and skills.
- Learning is collaborative and social, thus allowing for multiple perspectives.
- Knowledge is situated in real-life, which is ideally where learning should take place.
- Assessment should be integrated with the task.

The value of a constructionist approach to learning and knowledge is illustrated by research that indicates that children learn vocabulary fast and successful by everyday immersion, whereas "learning words from abstract definitions and sentences from dictionaries is far slower and less successful" (Brown & Duguid, 2000:130). Making it relevant for the work environment, the authors use the example of the eager young intern with all the right information but none of the practical knowledge that makes the job doable.

From an instructional point of view, constructivist-learning environments are open in the sense that it allows the learner freedom to engage with a variety of resources and build on prior knowledge and experience to solve a problem or do a project. The researcher is of the opinion that learners do this intuitively, i.e. they improvise in any given learning situation and involve mental schemata, experience, intuition, other people and a variety of resources to solve problems. This does not apply, of course to memorizing information or solving textbook problems, where the answers can often be constructed from sections in the textbook. It refers to solving unstructured problems.

Winn (1990) refers to *situated cognition*, meaning that learning should take place in real world environments as opposed to isolating instruction in artificial educational contexts. *Cognitive apprenticeship* relies heavily on the lecturer in the role of guide and mentor, i.e. not designing the learning environment on behalf of the learner, but giving problems situated in real life (like case studies) and scaffolding/guiding the learner in the process of solving the problem (if necessary) (Jonassen, 1991b).

Applied to instruction the concept of open endedness relates to the ability of the learner to manipulate the learning environment.

In the following section motivation in adults is briefly explored to understand what elements are important when adults learn.

2.3.5 Motivation in adult learners

It is generally agreed that motivation can make more of a difference between success and failure in learning successfully than any other factor (Wlodkowski, 1999).

Intrinsic motivation is closely linked to emotions, and in turn, our emotions are governed by many factors. General intrinsic motivational principles are provided by Fleming & Levie, (1993:6):

- variation
- curiosity
- relevance (need stimulation)
- challenge and
- control

Variation in the learning environment relates to different modes of instruction (e.g. multimedia, web and face-to-face) and incorporating a variety of appropriate learning strategies into the learning environment. It is further explained under instructional technology design.

Curiosity relates to **problem-based** assignments or tasks that stimulate the learner's need to solve a problem. It is inherently creative.

Relevance plays a major role in adult motivation. Especially adults need to identify with what they learn in the sense that what they learn must make them feel more competent.

Challenge is important in order to stretch a learner. If solving a problem falls below a learner's competence, no learning takes place. On the other hand, the challenge must not exceed the learner's capacity too much. Land & Greene (2000:46) warn that novice learners approach complex tasks in superficial ways and unless they are guided, may not respond to the complex tasks with increased use of learning strategies.

Control relates to choice – choice or control over how, what, where and when a person learns. For their motivation to be sustained, adults must experience choice or willingness in the learning activity. Generally, adulthood is associated with responsibility. In this sense responsibility is also key to adult motivation in learning and it is difficult to feel responsible unless one has a choice to hold oneself accountable for.

In this regard Wlodkowski (1999:12) adds the following factors that contribute to motivation:

- success
- value and
- enjoyment

2.3.6 Adult learning

Success is an important motivational factor, because success is associated with competence. Success also feeds back into the loop of motivation – once a person is successful, it fosters motivation once again.

Tapscott (1996:204) notes that research at the MIT media lab is finding that the best learning comes from passion.

According to Duke (1996) the largest growing continuing education sector is that of employed adults who want to upgrade their skills and knowledge in order to equip them better for their jobs. This trend is endorsed by Merriam and Cafarella (1991) who note that the vast majority of adults choose vocational and practical education that leads to knowledge about how to do

something. This is significant as a return to epistemology in which *learning is informed action*.

It is important to note that the concept of adulthood is culturally and historically relative. Wlodkowski (1999:10) explains that some cultures regard puberty as entry into adulthood, whereas others use legal codes to permit adult behaviour.

According to Knowles (1989:83-84):

- Adults are self-directed
- Adults prefer to learn things that help them cope with real-life situations

These assumptions reflect a largely individualist and pragmatic culture. Contrary to the idea that adults are self-directed, Triandis (1995) points out that people from collectivist cultures may experience difficulty with self-directed learning, because they value assistance from others and focus more on harmonious relationships within the group. This concept is reminiscent of Japanese philosophy in which oneness of self and others are one of the fundamental principles. Similarly, Merriam (1998:56) notes that data-based studies of adult learners have revealed that some adults do not want responsibility or do not want to take responsibility for their own learning.

Because of the difference culture brings to the learning situation, Wlodkowski (1999:11) recommends that self-directed learning strategies in teaching should be negotiated with learners and not simply mandated.

Interaction should involve complex activities by learners, such as engaging and reflecting, annotating, questioning, answering, pacing, elaborating, discussing, enquiring, problem-solving, linking, constructing, analysing, evaluating, and synthesizing. Pea & Gomez (1992:5) argue that the lecturer and learner engage in a learning conversation " in which both parties clarify messages, test for understanding, compare and contrast with previous understandings and are both transformed by the experience".

Tennant and Pogson (1995:42) talk of practical intelligence, which they describe as

"practice as opposed to theory, direct usefulness as opposed to declarative knowledge, and commonplace, everyday action or thought with immediate, visible consequences".

Intelligence is therefore multidimensional, and not fixed. Although it definitely plays a role in learning, this study does not provide for an in-depth exploration of the correlation between intelligence, types of intelligence and successful learning.

Experiential learning is relevant to discuss in Chapter Two, because it combines aspects of constructivism and learner centred approaches to learning.

2.3.7 Experiential learning

Experiential learning is a way of learning that is facilitated by the practice of co-operative education. Qualifications are awarded upon successful completion of practical experience in particular industries, as well as theoretical components, either through full-time study or through distance education. Experiential learning recognises three different epistemologies or ways of knowing things:

- Propositional knowledge: Learning that which is purely based on the philosophy of positivism.
- Practical knowledge: This is based purely on the utility point of view.
- *Experiential knowledge: This is based on the philosophy of constructivism.*

Hence experiential learning combines an endogenic and an exogenic epistemology of knowledge and reflects the synthesis that emerged in the twentieth century when the separation between theory and action fell away.

Teaching methodologies within this system include:

- Self-regulated and peer-assisted learning,
- experiential and real-world learning,
- resource based and problem-based learning, and
- reflective practice and critical self-awareness (Kannaiyan, 1997:26).

In the experiential learning system, workshops, group meetings and discussions, co-operative learning and the use of appropriate technology-applications are considered innovative methods to facilitate effective learning.

The basic issues of true **experiential learning** can be described through such keywords as **constructivism**, **learner-centred**, and **problem-based**. Essentially the main idea is that people learn best when engrossed in the topic and motivated to seek out new knowledge and skills because they need them in order to solve the problem at hand (Kannaiyan, 1997:27). The major theme is one of focusing education around a set of realistic, intrinsically motivating problems (Cunningham, 1991:13-17). Learners work to solve these problems, often in groups, often in overextended periods of time. Problems should be structured carefully so that in the course of finding a solution, learners naturally pass through and acquire all topics of relevance. The learners might not even notice they are undergoing instruction and learning, for the education occurs naturally in the course of activity.

The following are features of learner-centred learning (Brown & Duguid, 1996:10).

- Learners discover knowledge rather than faculty simply transferring information.
- Continuous learner and course assessment, not just learner achievement, is used as tools to analyse teaching.
- Learning includes learner-driven episodes, not just scheduled lectures.
- Learner performance is observed by others versus only private assessment by instructor.
- Learners help define the questions rather than instructors simply handing out facts.
- Learners take active and proactive roles in learning versus being a passive audience or just listening to lectures.
- Learners learn collaboratively versus being rewarded for individual, competitive performance.

Because of the fact that co-operative learning is such an important component of constructivism, it is further explored.

2.3.8 Collaborative and cooperative learning

Collaborative learning in a problem-based context emphasises interaction among group members to solve a problem as a group. This type of learning can be facilitated by a virtual learning environment, as will be illustrated later. Blumenfeld *et al*. (1991) note that not only problem-specific learning goals, but also cognitive and social goals, are involved in a collaborative learning environment.

Co-operative learning has a very specific meaning in the field of education. Slavin (1983) describes it as a method in which small groups of students incorporate a co-operative task structure, a co-operative incentive structure and a co-operative motive to produce co-operative behaviour. Thus a small group of learners has a joint problem to solve or a task to perform, and every person in the group is responsible for contributing to the outcome. Empirical research indicates that co-operative learning promotes higher achievement than do competitive and individualistic learning (Johnson & Johnson, 1985:112). The characteristics of true co-operative learning environments are:

- positive interdependence,
- individual accountability,
- heterogeneous grouping,
- shared leadership,
- shared responsibility for others and for self,
- task and maintenance emphasised,
- social skills directly taught,
- lecturer observes and intervenes, and
- groups process their effectiveness.

The other very important component of constructivism is that knowledge is situated in real-life. In this light ill-structured knowledge domains are discussed.

2.3.9 Ill-structured knowledge domains

Ill-structured knowledge domains are prevalent in advanced concepts and their complexity arise from the fact that they closely resemble real-life. Constructivism is appropriate for learning in ill-structured domains where there is room for personal interpretation. However, in knowledge domains where concepts are well defined (for example linguistics and mathematics) the objective reality is absolute reality.

Spiro *et al*. (1995:92) note that “Various forms of conceptual complexity and case-to-case irregularity in knowledge domains (referred to collectively as ill-structuredness) pose serious problems for traditional theories of learning and instruction”. The authors continue to elaborate on the two properties found in ill-structured knowledge domains, namely:

- "each case or example of knowledge application typically involves the simultaneous interactive involvement of multiple, wide-application conceptual structures (multiple schemas, perspectives, organisational principles, etc.) each of which is individually complex; and
- the pattern of conceptual incidence and interaction varies substantially across cases nominally of the same type (i.e. the domain involves across-case irregularity)" (Spiro *et al*., 1995:93).

An important implication is that ill-structured knowledge domains cannot be facilitated in a logically structured linear way. The implication for learning facilitation is to find a way to present the same concepts or knowledge constructs in different ways and at different times, in rearranged contexts and for different purposes, since different conceptual perspectives and multiple, adaptive and flexible interpretations are essential for attaining advanced knowledge acquisition.

This type of learning facilitation requires considerable planning and time from a lecturer.

The importance of interaction and feedback in learning is discussed below.

2.3.10 Interaction and feedback

Interaction means that the environment changes when the learner manipulates it, and the feedback the learner receives continues the negotiation process. This rich learning environment is found especially in artificial intelligence programs and intelligent expert systems, which provide cognitive scaffolding and diagnostic feedback. Diagnostic feedback is based on an adaptive learning process and means that the complexity of tasks can be adjusted according to the individual learner's knowledge level, his/her personal abilities and history of learning in the subject. It consequently provides for a flexible and adaptive learning environment (Baniulus & Tamulynas, 1997). Within the South African context few, if any, institutions can afford the development of such sophisticated software. Sponsorship by industry and sourcing from institutions abroad are better options.

Interaction is a dominant factor in effective learning, because it leads the learner to be active in the learning process and encourages him/her to make decisions and question acquired

knowledge. Interaction with people often offers the same or even better benefits than artificial intelligence programs.

Yacci (2000:6) lists the following four major attributes to the concept of interactivity:

- Interactivity is a message loop.
- Instructional interactivity occurs from the learner's point of view and does not occur until a message loop from and back to the student has been completed.
- Instructional interactivity has two distinct classes of outputs: content learning and affective benefits.
- Messages in an interaction must be mutually coherent.

Cronjé (1997) gives the following explanation of interactivity: "Interactivity has to do with simulating the interchange between two people who are communicating meaningfully. When this interactivity is mediated by technology, two factors come into play. The first is the level or intensity of the interaction, which might be measured in terms of the interdependence of the participants. The second is the mode in which the interactivity takes place, that is the number of participants, the time frame and the level of technological sophistication".

Oliver and Macloughlin (1996) recognize five different kinds of interactions:

- Social interaction.
- Procedural interaction – dialogue between learner and lecturer.
- Expository interaction – answering questions.
- Explanatory interaction – using the learner's reactions to explain new information.
- Cognitive interaction – giving a constructive answer to learners so that they reconsider their own ideas.

This is based on early work by Vygotsky (1978) who posits that social interaction and discourse foster cognitive development and higher order thinking.

Recent literature typifies three categories of interaction:

- Learner-content interaction.
- Learner-instructor interaction.
- Learner-learner interaction.

From a socio-cultural point of view, interactions like articulating, exploring, testing and refining and debating ideas augment critical thinking and cognitive and metacognitive understanding.

Knowledge construction is therefore facilitated by using interactions to achieve the following outcomes listed by Wagner (1997), cited in Bonk and Wisher (2000:22):

- To increase learning.
- To increase participation.
- To develop communication.
- To receive feedback.
- To enhance elaboration and retention.
- To support learner/self-regulation.
- To increase motivation.
- For negotiation of understanding.
- For teambuilding.
- For discovery.
- For exploration.
- For clarification of understanding.
- For closure.

Wlodkowski (1999:244-249) provides the following characteristics of effective feedback:

Effective feedback

- is informational rather than controlling,
- provides evidence of the learner's effect relative to the learner's intent,
- is specific and constructive,
- can be quantitative,
- is prompt, frequent and positive,
- is related to impact criteria,
- is usually personal and differential.

Some studies indicate that online discussions remain on a level of information sharing and comparing, instead of rising to knowledge negotiation, construction (new knowledge), testing and application (Kanuka & Anderson, 1998; Bonk & Wisher, 2000).

Creativity in the learning environment relates to motivational aspects such as engaging the learner and exceeding the learner's expectations. It includes a focus on the client's needs.

2.3.11 Synthesis

If one views this exposition of learning theory from an epistemological perspective, it is clear that both rationalism and empiricism underlie the continuum of learning theories and paradigms. Ideally, an integrated and holistic view of learning combines knowledge constructed from within and experienced from without and goes a step further toward social interaction and action, as is the case with constructivism.

It is the contention of the researcher that behavioural learning strategies are suitable for basic and relatively fixed knowledge domains; that cognitive learning strategies are suitable for deep information processing, long-term memory and more complex knowledge domains; and that constructivist learning strategies are complementary to complex knowledge domains and problem- based educational models. It is also possible to combine these strategies within a given learning environment, as proposed by Cronjé (2000:4).

If we understand individual learning, it is easier to understand group learning. In the words of Tapscott (1996:47), "in the race to the finish line, lifelong organisational learning becomes the only sustainable competitive advantage".

From this perspective the researcher deemed it necessary to investigate organisational learning.

In this light Teece (1998:55) notes that economic historians have long emphasised the role of the **learning organisation** and **technological innovation** in economic development.

2.4 Organisational learning

A movement called 'scientific management' which was founded by Frederick W. Taylor; attempted to increase efficiency in production by prescribing scientific methods and procedures to organise and operate work (Nonaka & Takeuchi, 1995:35). In response, a group of management scholars at Harvard University, headed by George Mayo, created a theory on human relations in which they emphasised the importance of human factors in management (Nonaka & Takeuchi, 1995:36). Subsequently, Chester, I Barnard tried to synthesise the mechanistic and humane management models and contended that

knowledge consists not only of logical, linguistic content, but also of behavioural, nonlinguistic content. Hence leaders should create values, beliefs and ideas in order to maintain the soundness of knowledge systems within the organisation.

According to Nonaka and Takeuchi (1995:37) the Barnardian attempt laid the foundation of organisation theory.

Some definitions of organisational learning are as follows:

- Organisational learning means the process of improving actions through better knowledge and understanding (Fiol & Lyles, 1985).
- An entity learns if, through its processing of information, the range of its potential behaviours is changed (Huber, 1991).
- Organisations are seen as learning by encoding inferences from history into routines that guide behaviour (Levitt & March, 1988).
- Organisational learning is a process of detecting and correcting error (Argyris, 1977).
- Organisational learning occurs through shared insights, knowledge and mental models … [and] builds on past knowledge and experience – that is, on memory (Stata, 1989).

Studies of organisational culture have been able to illuminate the organisation as an epistemological system.

Drucker (1985) was one of the earliest to realise that knowledge would become the corner stone of the new economy. He argued that an organisation should be prepared to abandon knowledge that has become obsolete and to **create new things** through:

- Continuing improvement of every activity.
- Development of new applications from its own successes.
- Continuous innovation as an organised process.

It is clear from this description that organisational learning and innovation have the creation of new knowledge in common.

In organisation learning theory, it is generally accepted that learning consists of two types of activity. These two types of learning have been termed ‘single-loop’ and ‘double-loop’ learning (Argyris, 1977). The former is obtaining knowledge in order to solve specific

problems based upon existing premises and the latter is establishing new premises (i.e. schemata, mental models, paradigms or perspectives) to override the existing ones. Kim (1998:60) states “I believe that the process of surfacing individual mental models and making them explicit can accelerate individual learning. As mental models are made explicit and actively shared, the base of shared meaning in an organisation expands, and the organisation's capacity for effective coordinated action increases”.

Now that we have a better understanding of organisational learning, the following section focuses on knowledge management and knowledge creation. These fields have emerged from organisational learning.

2.5 Knowledge management

The new era of dynamic and discontinuous change requires continual reassessment of organisational routines to ensure that organisational decision-making processes, as well as underlying assumptions, keep pace with the dynamically changing business environment.

(Malhotra, 2000:3)

Duderstadt (2000:14) contends that there is an increasingly strong correlation between the level of one’s education and personal prosperity and quality of life.

Extending this to an organisational context, Tapscott (1996:43) notes “the new economy is all about competing for the future, the capacity to create new products or services, and the ability to transform businesses into new entities that yesterday couldn’t be imagined and that the day after tomorrow may be obsolete”.

Towards the end of the twentieth century, economists started to focus on knowledge as a contributor to economic wealth. Hayek was one of the first to emphasise the importance of implicit, context-specific knowledge (Nonaka & Takeuchi, 1995:33). He did not, however, succeed in defining a model that could make implicit knowledge explicit, but simply argued for the efficient utilisation of existing knowledge.

Schumpeter (cited in Pisano, 1997) emphasised the combining of explicit knowledge to create new products and services. Both were pioneers in terms of knowledge creation, as will be explored later in this chapter. Inherent in the shift towards the role of knowledge was a shift from mechanistic economic approaches to more human-centred approaches.

McGregor (1991) makes the point that when the primary asset of an organisation is stored in people rather than physical assets, the executives who guide the overall strategy of an organisation must include personnel factors in their decisions.

Von Krogh *et al.* (2000:31) argue that both the constructionist and cognitivist perspectives on knowledge have influenced management theory and practice.
They are particularly excited about the fact that constructionist studies focus on tacit aspects of knowledge in addition to its explicit forms.

Leonard and Sensiper (1998:113) note that:

"In the business context, we define knowledge as information that is relevant, actionable, and based at least partially on experience. Knowledge is a subset of information; it is subjective; it is linked to meaningful behaviour; and it has tacit elements born of experience". Therefore knowledge is more closely related to learning than information.

Knowledge is not quite the same as information. Nonaka and Takeuchi (1995:57) illuminate this point by arguing that knowledge, unlike information, is about **beliefs, commitment and action**. Yet knowledge, like information, is about meaning – it is context-specific and relational.

Brown and Duguid (2000:119) make the following distinctions:

- Knowledge entails a knower, i.e. knowledge is usually associated with a person.
- Knowledge seems harder to detach than information – information is viewed as more self-contained than knowledge.
- Knowledge is digested rather than held and entails the knower's understanding and commitment.

The first point is endorsed by Tapscott (1996:44) who notes that human beings create knowledge and that it implies an inherent shift to knowledge work.

The thought-provoking point is made that "while one person often has conflicting information, he or she will not usually have conflicting knowledge" (Brown & Duguid, 2000:120).
Von Krogh *et al.* (2000:6) delineate the different faces of knowledge as follows:

- Knowledge is justified true belief – personal beliefs are justified based on individualised observations of the world.
- Knowledge is both explicit and tacit.
- Knowledge is contextual – it depends on the situation and people involved rather than on absolute facts and hard data.

The authors continue to argue that effective knowledge creation depends on enabling contexts, i.e. "a shared space that fosters emerging relationships" (Von Krogh *et al.,* 2000:7).

In this light what becomes most important is an institution's ability to attract, retain, and continually grow the capabilities of knowledge workers and provide the environment for innovation and creativity (Tapscott, 1996:47). Knowledge workers require motivation and trust in team relationships to be effective (Tapscott, 1996:47).

The most valuable asset of a 21st- century institution will be its knowledge workers and their productivity (Drucker, 1999:41).

Tissen *et al.,* 2000:3 add, "For in the knowledge economy it will be essential to act with the utmost speed to respond to unexpected and unusual market demands, while at the same time having to juggle the conflicting interests of increasingly irreconcilable parties".

Quinn (1992:181) point out that "A corporation's success today lies more in its intellectual and systems capabilities that in its physical assets. Managing human intellect – and converting it into useful products and services – is fast becoming the critical executive skill of the age".

Brown and Duguid (2000:121) provide the following definitions:

"Knowledge management is the use of technology to make information relevant and accessible wherever that information may reside. To do this effectively requires the appropriate application of the appropriate technology for the appropriate situation".

"Knowledge management incorporates systematic processes of finding, selecting, organising, and presenting information in a way that improves an employee's comprehension and use of business assets".

This notion is echoed by Malhotra (2000) who exposes two myths about knowledge management technologies:

Myth 1: Knowledge management technologies deliver the right information to the right person at the right time.

Myth 2: Knowledge management technologies can store human intelligence and experience.

Although the abovementioned statements are regarded as myths, some extent of the first statement could be achieved through, for example information portals, which will be discussed in Chapter Four.

The researcher believes that knowledge management is also a mechanism to improve customer satisfaction and therefore it has internal and external value added qualities.

Brown and Duguid (2000:123) note: "…investors see the value in people and their know-how – people with the ability to envisage and execute adventurous new business plans and to keep reenvisaging these to stay ahead of competition".

The world has entered into the knowledge economy by the increase in the availability of information. The problems of the future will be open-ended, complex, global and adaptive in nature (Gibbons, 1998). As a result, *knowledge management* has emerged as a critical field of study and as an important strategy in organisations. The growth of information technology has also amplified the importance of intellectual property and consequently intellectual property laws and systems. Unfortunately the scope of this study does not allow for an investigation of intellectual capital.

Economic prosperity rests upon knowledge and its useful application. The reason is the obvious: intellectual capital in the information age is directly linked to an increase in returns. Intellectual capital comes in two basic forms i.e. human capital and structural capital:

" Human capital includes all individual capabilities – that is, the talents, knowledge, and experience of the company's employees and managers. Structural capital consists of everything that remains when the employees go home – that is, the infrastructure that supports the company's human capital, including the information technology and physical systems used to transmit intellectual capital" (Von Krogh *et al.,* 2000:92).

The combined knowledge and intellectual capacity of employees are directly related to productivity and competitive advantage, making society dependent on knowledge workers. Universities with the most intellectual capital will have a new and powerful source of competitive advantage. Concomitantly the provision of relevant knowledge to workers, the retooling of people for new careers and catering to the need for mental stimulation are becoming economically viable markets (Blustain *et al*, 1999:51).

In a service organisation such as a university, the provision of relevant information and knowledge to customers is an equally strong competitive advantage.

As mentioned in Section 2.5, knowledge is tacit and explicit. This concept is further explored in Section 2.5.1.

2.5.1 Tacit and explicit knowledge

To better understand knowledge creation, it is necessary to provide a clearer explanation of the difference between *tacit* and *explicit* knowledge. As noted, knowledge can be tacit rather than explicit. "Tacit knowledge is that which is difficult to articulate in a way that is meaningful and complete" (Teece, 1998:63). Tacit knowledge involves physical skills and perception skills (Von Krogh, 1998:134). According to Teece (1998:63) this is the reason why it is hard to codify tacit knowledge – what we can do, think and know are more than what is easily put into words. Leonard and Sensiper (1998:121) contend, "Collective tacit knowledge is developed communally, over time, in interactions among individuals in the group. …The more that tacit knowledge about operations is diffused and shared, the harder is imitation". Hence it is a competitive advantage when an organisation innovates because it will be hard for competitors to copy the innovation. Contrary to this view is the fact that it could also jeopardise the organisation if too little tacit knowledge is made explicit. The reason is that it poses a risk of being too dependent on individuals in the organisation.

This fact is illuminated by the theory of Jacques Lacan (cited in Johnson, 1989:321) in that language is inadequate to express what a person truly feels, thinks, knows and experiences. This means no one can ever speak the whole truth. Leonard and Sensiper (1998:113) echo this by stating: "Semiconscious or unconscious tacit knowledge produces insight, intuition, and decisions based on 'gut feel'. The common element in such knowing is the inability of the knower to totally articulate all that he or she knows". A statement such as this drives home the essence of innovation and creativity. Life is too complex to contain it. Innovative practice

means there is no model or recipe to follow. Insight and intuition often lead decision-making and planning.

Furthermore, whenever a person uses language by speaking or writing the listener or reader enacts with that which is spoken or written by contextualising the information in his or her own framework as was explained in Section 2.3.2. Hence added meaning, diversions and lacunae emerge which are almost impossible to capture and make visible. This factor is a constraint when implementing something completely new in an organisation. First of all most people resist change because of fear, and as explained earlier, motivation is an important factor to promote effective learning. If there is too much fear it could freeze any receptivity towards the change and could even lead to undermining change. This reaction is explored in Section 2.6. The direct link between learning and organisational change is explored again in Section 2.5.2.

A new concept is harder to fit it into a person's frame of reference and because of the complexity of meaning, it is difficult to gauge when a person has truly adopted a new concept. Wilson (1996:35) notes that tacit knowledge is "personal knowledge consisting of highly subjective insights, intuitions and hunches, rooted more in action than in reflection". Leonard and Sensiper (1998:118) enforce this by saying that "When a group of diverse individuals addresses a common challenge, each skilled person frames the problem and its solution by applying mental schemata and patterns he or she understands best. The result is a cacophony of perspectives. In a well-managed development process, these varying perspectives foster creative abrasion, intellectual conflict between diverse viewpoints producing energy that is channelled into new ideas and products".

Teece (1998:63) notes that there is a direct relationship between codification of knowledge and the cost of its transfer. An example is provided by Nonaka and Takeuchi (1995:96-113). In 1987 the Matsushita Electric Industrial Co., Ltd. developed a bread-making machine that is remarkable in that it embodies the skills of a master baker. The process of development started as early as 1984 when a team of experts was established, represented by the R&D lab, a mechanical designer and software developer whom were all familiar with bread making. After several mishaps they realised that they were overlooking an important factor. The idea that originated was to capture the tacit knowledge of a master baker in order to develop a winning bread making machine. In order to do this the entire team trained with the head baker for a year and in 1985 the team succeeded in developing a machine that could make tasty bread! This example illustrates that it could be a costly exercise to codify tacit knowledge, but in the longer term the return on investment is worth the initial investment.

Brown and Duguid (2000:123) warn against laying off or downsizing too easily, because an organisation's competitive advantage lies in its knowledge (i.e. people) and not in its information: "the sort of blind downsizing produced by business process reengineering has caused organisations to lose collective memory". Mistaking knowledge and its sources for information and its sources is therefore costly to an organisation. Adding to this, Tapscott (1996:28) emphasises that business process re-engineering (BPR) is inadequate without a changed, technology-enabled business model.

Organisations have always been oriented toward accumulating and applying knowledge to create economic value and competitive advantage. From the beginning of the 20th century, knowledge has become increasingly important as contributor to a country and individual organisation's success in industrial competition. The shift from an industrial economy to the processing of information and the creation, application and transfer of new knowledge has placed a new emphasis on knowledge and knowledge management.

It has been noted that knowledge creation is a critical success factor of the new economy. Nonaka and Takeuchi (1995:61) contend that tacit knowledge and explicit knowledge are mutually complementary entities. They call this interaction knowledge conversion. In any organisation there is a continuous and dynamic knowledge creation process of interaction between tacit and explicit knowledge. Table 2.4 shows their four modes of knowledge conversion.

	Tacit knowledge	To Explicit Knowledge
Tacit knowledge	Socialisation	Externalisation
From		
Explicit knowledge	Internalisation	Combination

Table 2.4: Four models of knowledge conversion (Nonaka & Takeuchi, 1995:62).

- *Socialisation* is the knowledge conversion model of tacit to tacit – experiences are shared and tacit knowledge such as shared mental models and technical skills are thereby created. The point is made that an individual can acquire tacit knowledge

directly from others without externalising it through, for example language or writing it down. This field facilitates the sharing of experiences and mental models.

- *Externalisation* is the knowledge conversion model from tacit to explicit and is a process of articulating tacit knowledge into explicit concepts, e.g. conceptualising an image and expressing it through language. This field is prompted by meaningful dialogue or collective reflection.

- *Combination* is the knowledge conversion model from explicit to explicit and is a process of systemising concepts into a knowledge system, i.e. combining different forms of explicit knowledge such as creating a database of existing data. The networking of new knowledge and existing knowledge that results in a new product, system or service triggers this field.

- *Internalisation* is the knowledge conversion model from explicit to tacit and is a process of embodying explicit knowledge into tacit knowledge, i.e. learning by doing. Learning by doing triggers internalisation.

2.5.2 Organisational knowledge creation

Nonaka & Takeuchi (1995:84) list five main steps that are involved in organisational knowledge creation:

- Sharing tacit knowledge (socialisation).
- Creating concepts (externalisation).
- Justifying concepts (externalisation).
- Building a prototype (combination).
- Cross-levelling knowledge (internalisation).

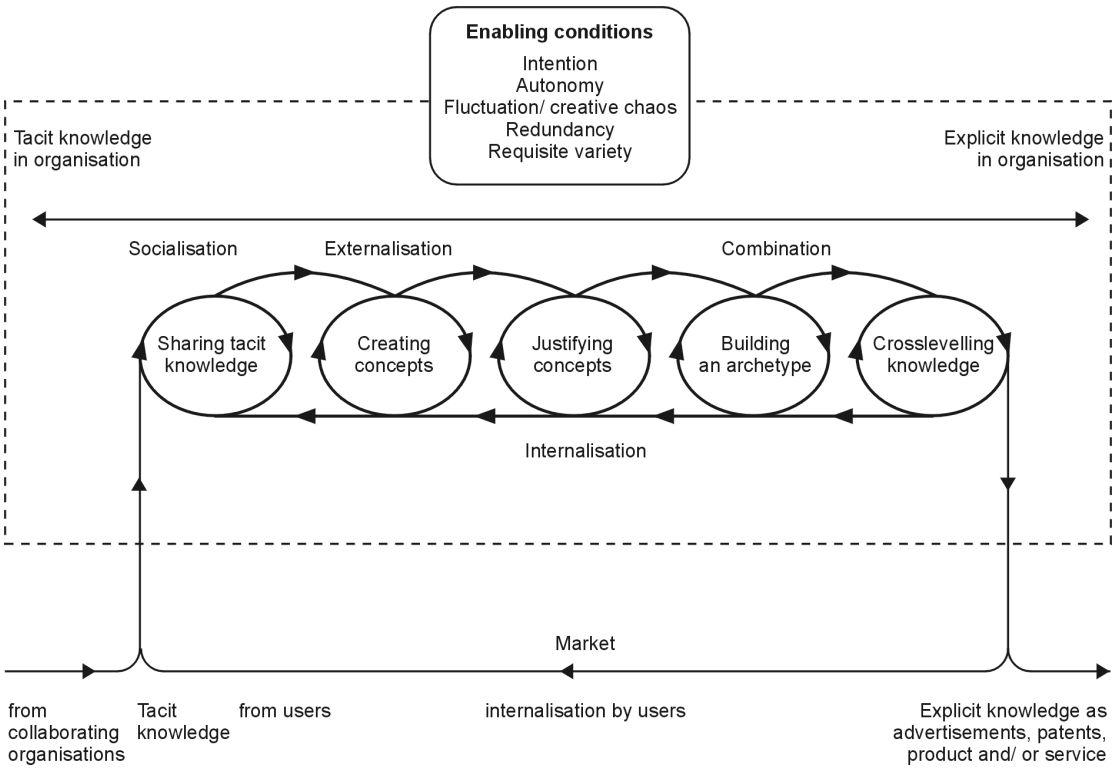

Figure 2.2: Five-phase model of the organisational knowledge-creation process (Nonaka & Takeuchi, 1995:84)

In other words if, for example, a new product needs to be created, team members come together and share their insights and experience. Part of this process is a negotiation of meaning and results in a new, or adapted concept. The best concepts need to emerge through individuals' arguments that their beliefs are more appropriate. It often requires justification, explanation and persuasion and requires delicate facilitation.

Dede (1997:4) sheds more light on the process by stating:

"Learning is social as well as intellectual. Individual, isolated attempts to make sense of complex data can easily fail unless the learner is encouraged by some larger group that is constructing shared knowledge. In addition, institutional evolution is a communal enterprise; educational innovators need emotional and intellectual support from others who have similar challenges in their lives".

The next step is to develop a prototype based on the winning concept. It need not be a product, but could be a new marketing strategy for the organisation. Upon completion, the team takes the responsibility to share their new knowledge within the organisation.

Researchers stimulating implicit learning found, in fact, that forcing individuals to describe what they thought they understood about implicitly learned processes often resulted in poorer performance than if individuals were allowed to utilise their tacit knowledge without explicit explanation (Leonard and Sensiper, 1998:114). This is a catch 22 situation. In most cases, mission-critical knowledge should be codified as a risk management measure.

According to Von Krogh (1998:133-136) the company's overall performance depends on the extent to which managers can mobilise all of the knowledge resources held by individuals and teams and turn these resources into value-creating activities. Value creation can take place through creation of new knowledge comprising a least the following five phases:

- the initial sharing of knowledge, experience, and practices among team members;
- the effective creation of new service and product concepts based on this shared knowledge;
- the justification of these concepts deeply rooted in, for example, market studies, trend studies, focus interviews, benchmarking, or company strategy;
- the building of a prototype product or initial service offering;
- and the global leveraging of knowledge, concepts, prototypes, and offerings throughout the company.

These knowledge creation phases closely resemble innovation processes – as will be illustrated in Section 2.7.

Because knowledge resides in our bodies and is closely tied to our senses and previous experience, we will come to create the world in ways that are unique to ourselves. Thus knowledge is not universal and the constructionist does not pay much attention to comparing various representations. For the constructionist, the fragility of knowledge creation presents a major managerial challenge. Particularly where organisation-wide innovation is concerned, knowledge creation is a critical success factor.

Figure 2.3 illustrates the model of organisational knowledge creation (Nonaka and Takeuchi, 1995:73).

Theory of Organisational Knowledge Creation

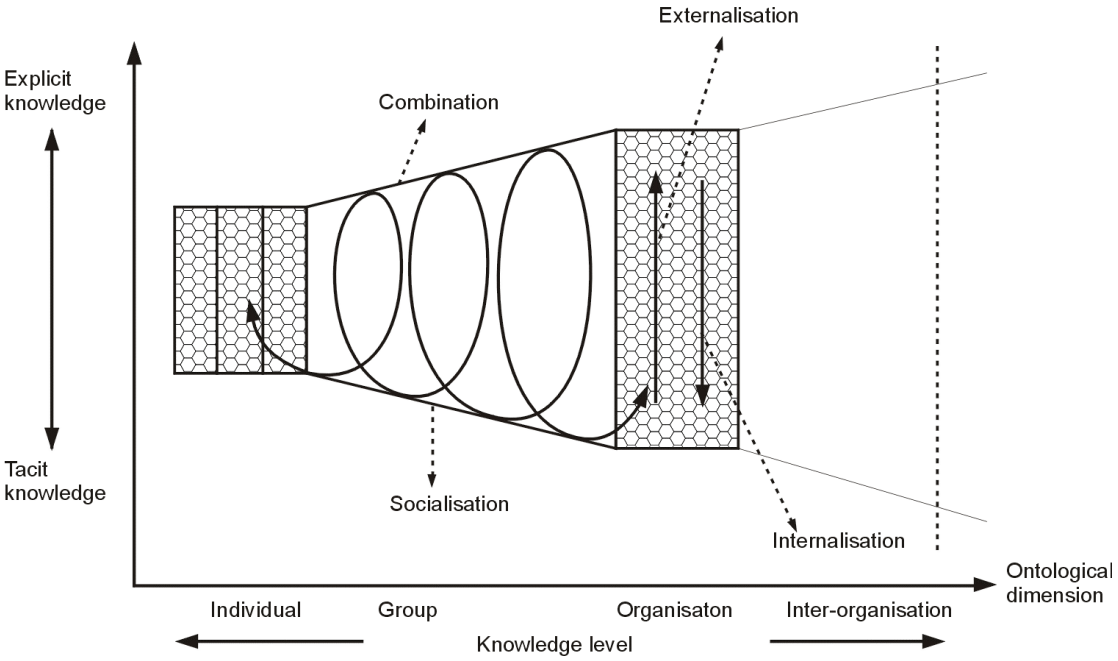

Figure 2.3: Spiral of organisational knowledge creation (Nonaka & Takeuchi, 1995:73)

Section 2.5.3 focuses on how knowledge is created in organisations.

2.5.3 Enabling knowledge creation

Nonaka and Takeuchi (1995:74-83) indicate the following conditions for enabling knowledge creation:

- intention,
- autonomy,
- fluctuation and creative chaos,
- redundancy,
- requisite variety.

- **Intention** can be defined as an organisation's efforts through various strategies to achieve its goals.
- The next condition is **autonomy** – individuals should be given sufficient autonomy as far as circumstances allowed within their working environments.
- **Fluctuation** is described as a breakdown of routines, habits or cognitive frameworks due to external forces and is believed to foster the creation of new concepts.
- **Chaos** results from crises, either real or evoked by intention.
- **Redundancy**, as the fourth condition, means that there is intentional overlap of information about business activities, management responsibilities, and the company as a whole because it helps build unusual communication channels and brings about learning by intrusion.

A different set of enablers is provided by Von Krogh *et al.* (2000). Discussing each enabler by chapter, the authors distinguish the following knowledge enablers:

- Instill a vision.
- Manage conversations.
- Mobilise activists.
- Create the right context.
- Globalise local knowledge.

Managing conversations, though is emphasised by Von Krogh *et al.* (2000:129) as an essential enabler because it connects with every step of knowledge creation:

"A creative conversation allows individuals to bring in their own ideas and insights through multiple reasoning methods like induction, deduction, and abduction. Abduction, which refers to the use of metaphors, analogies, and language games, is particularly important during this phase; it will provide the group with new terms, key words, descriptions, and meanings for the concepts they begin to define together".

Good conversations require openness, patience, the ability to listen, experimentation with new words and concepts, politeness, the formation of a persuasive argument and courage (Von Krogh *et al.*, 2000:226). The leader of conversations should act almost like conductor of an orchestra – knowing when and how to encourage active participation.

Knowledge activists have six purposes:

- Initiating and focussing knowledge creation.
- Reducing the time and cost necessary for knowledge creation.
- Leveraging knowledge-creation initiatives throughout the organisation.
- Improving the condition of those engaged in knowledge-creation by relating their activities to the organisation's bigger picture.
- Preparing participants in knowledge creation for new tasks in which their knowledge is needed.
- Including the perspective of micro-communities in the larger debate on organisational transformation.

(Von Krogh *et al.*, 2000:148).

The authors single out middle managers as the most appropriate and powerful knowledge activists, because they work closely with the teams who have the knowledge, and also live close enough to top management to maintain the bigger picture and ensure a flow through the organisation.

In this regard, Nonaka and Takeuchi (1995:127) talk about the 'middle-up-down' management model. They purport it to be more effective than either the 'top-down' or 'bottom-up' management model, because it best describes the iterative process by which knowledge is created: "Simply put, knowledge is created by middle managers, who are often leaders of a team or task force, through a spiral conversion process involving both the top and the front-line employees (i.e. bottom). The process puts middle managers at the very centre of knowledge management, positioning them at the intersection of the vertical and horizontal flows of information within the company" (Nonaka & Takeuchi, 1995:127). They believe middle managers to be "the key to continuous innovation".

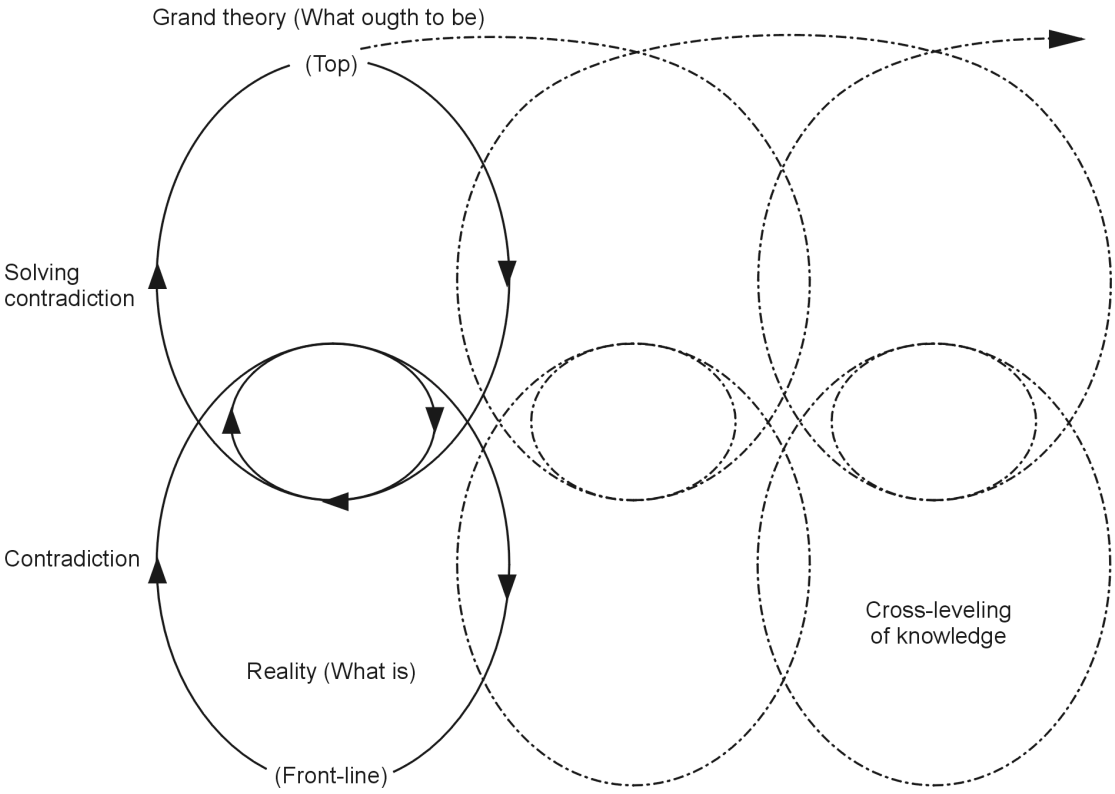

Figure 2.4: Middle-up-down knowledge creation process (Nonaka & Takeuchi, 1995:129)

The fourth enabler, *create the right context*, involves **organisational structures** that foster solid relationships and effective collaboration. They point out: “In fact, the whole process of knowledge creation depends on sensitive and aware managers who encourage a social setting in which knowledge continues to grow"(Von Krogh *et al.,* 2000:176). On this point, it is relevant to include the Japanese approach to knowledge creation. They refer to the enabling context as *ba,* which roughly translates as place (Von Krogh *et al.*, 2000:49) and has come to constitute the enabling context or place in which knowledge is shared, created and used. It does not necessarily mean physical space, but include virtual and mental space.

Ba refers to the right context (Von Krogh *et al.*, 2000:178) – one that promotes emerging relationships within microcommunities, across group boundaries, throughout an organisation. The authors suggest four ways of creating *ba*:

- *Originating interaction* (how individuals share feelings, emotions and experiences).
- *Conversing* (allows a group to share mental models and skills of individual members).
- *Documenting* (collective and virtual – involves the combination of existing explicit knowledge).

- *Internalising* (both individual and virtual)– individuals internalise knowledge that is communicated throughout the organisation via manuals, e-mail, videos or other media.

Figure 2.5 shows a comparison of Japanese-style versus Western-style knowledge creation. It is applied in Chapter Four.

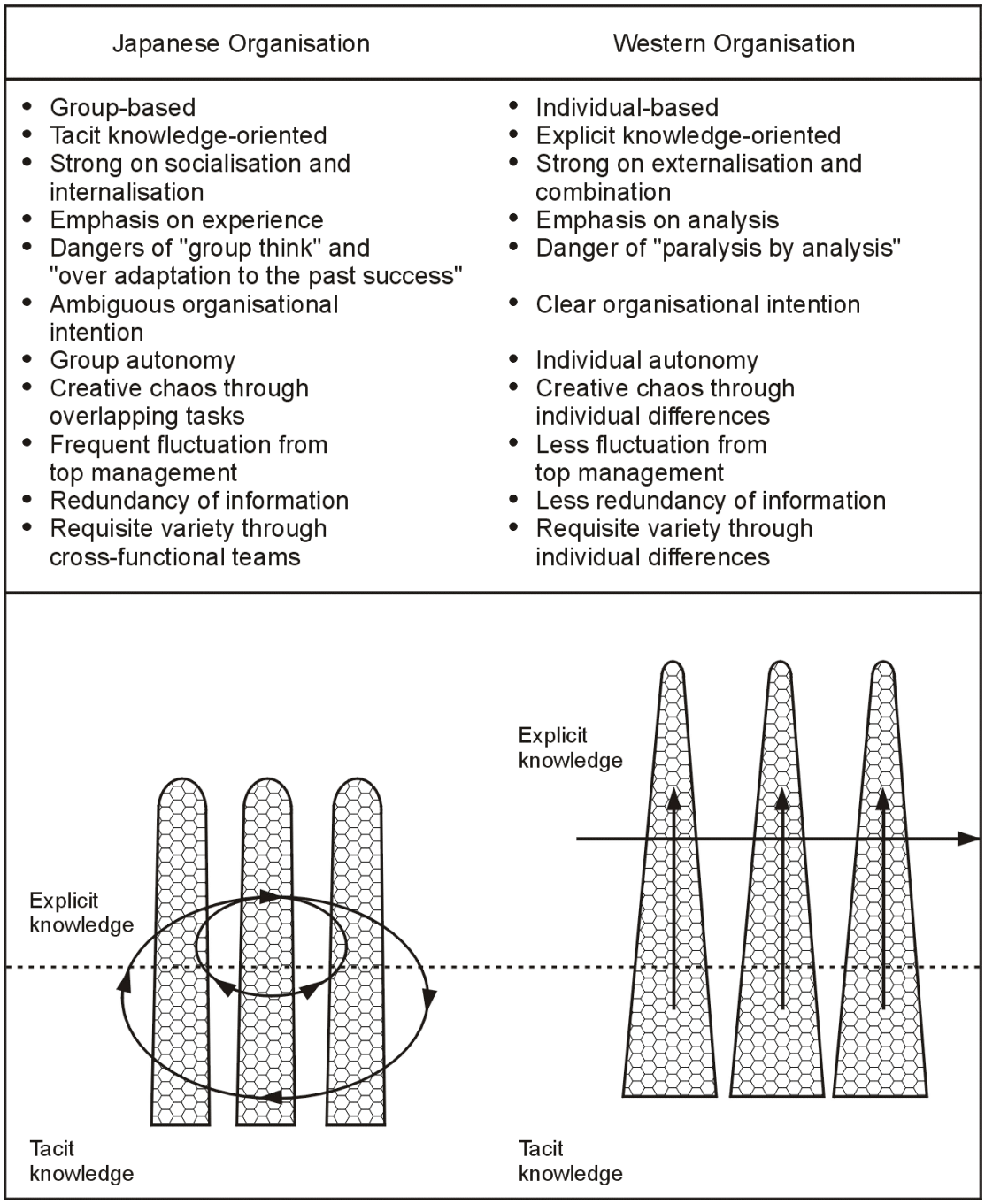

Figure 2.5: Comparison of Japanese-style versus Western-style organisational knowledge creation (Nonaka & Takeuchi, 1995:199)

Finally, *globalise local knowledge* means that "those who have created knowledge must come to the attention of those who seek knowledge creation, and vice versa"(Von Krogh *et al.*, 2000:224). Managers need to decide on what knowledge needs to be packaged and distributed. On a truly global level, knowledge exchange and competition should be typified as "Think globally and locally; act appropriately" (Von Krogh *et al.*, 2000:233).

2.5.4 Connection between knowledge enablers and knowledge creation

Von Krogh *et al.* (2000:129) give the following useful matrix in which the connection between knowledge enablers and knowledge-creation steps is indicated.

	Knowledge-creation steps				
Knowledge enablers	Sharing tacit knowledge	Creating a concept	Justifying a concept	Building a prototype	Cross-levelling knowledge
Instill a vision		✓	✓✓	✓	✓✓
Manage conversations	✓✓	✓✓	✓✓	✓✓	✓✓
Mobilise activists		✓	✓	✓	✓✓
Create the right context	✓	✓	✓✓	✓	✓✓
Globalise local knowledge					✓✓

Table 2.5: The 5x5 Grid: Conversations affect all five knowledge-creation steps (Von Krogh, *et al*., 2000:209).

Section 2.6 explores Change Management – focussing more on managerial aspects that are important during knowledge construction and change.

2.6 Change management

One of the greatest challenges for universities is to learn to encourage more people to participate in the high-risk, unpredictable, but ultimately very productive confrontations of stagnant paradigms. We must jar as many people as possible out of their comfortable ruts of conventional wisdom, fostering experiments, recruiting restive faculty, turning people loose to 'cause trouble', and simply making conventionality more trouble than unconventionality.

(Duderstadt, 2000:268)

The period of large-scale change started in the mid-1980's, driven by increasing global competition. Hambrick *et al.* (1998:5) provide the following forces that gave rise to massive change in organisations:

- The emergence of global competition.
- New technology.
- Public policy and socio-economic changes.

These changes can affect organisations adversely if no steps are taken to counteract them. As a result the field of change management emerged.

Conner (1998:100) states that change management deals with the human aspects of implementing major corporate initiatives such as **business process reengineering and the introduction of new technology** – especially on an enterprise scale. This definition shows the interface with innovation. Business process reengineering (BPR) and the introduction of new technology are closely related to technology innovation.

Nadler and Tushman (1995) postulate that in various stages of an organisation, there is relative equilibrium among the multitude of factors that shape that particular organisation. Periodically, however, organisations experience destabilising events that cause upheaval and disequilibrium. The authors suggest that these periods of disequilibrium involve discontinuous change. Discontinuous change is marked by three components or challenges that top management have to adhere to:

- Early recognition of changing forces that are likely to create disequilibrium.
- Making appropriate strategic choices to reposition the organisation as a strong competitor in the context of the disequilibrium reshaping the industry.
- Re-architecting the organisation.

If one examines recent global trends in higher education the following can be listed (Collis & Moonen, 2001:30):

- Virtualisation
- Lifelong learning
- Personalisation for the individual client
- Globalisation and internationalisation

To these one can add a shift from offering everything to market differentiation and from a one-stop service to enablement (providing access to resources rather than buying the resources). An example of the latter would be to give learners access to research databases abroad in which instance the said databases do not belong to the particular institution.

Faced with disruptive change, a change management plan is required, which spells out the following aspects (Senge *et al*., 1999):

- A broad statement of purpose that articulates the organisation's ultimate goals and portrays what kind of organisation the change is intended to create.
- A description of core values that the organisation considers most important, such as *quality*, *innovation* and *service*.
- A statement of the core strategies, including a definition of businesses, markets, and offerings and a determination of particular bases for competition.
- A general explanation of the structures and processes used to coordinate management at the enterprise level (Governance).
- A broad framework for the architecture of the enterprise – the structures, processes, and systems that will enable people to perform the work required by the strategy and vision (Organisation).
- The patterns of behaviour required of people within the organisation over time, for example *customer focussed*, *responsive* and *empowering* (Operating environment).

- The actions that will be taken to improve the effectiveness of the core operations, including process redesign, quality, cost reduction and service and product innovation (Operational performance).
- A plan for upgrading the organisation's talent pool (Talent).

The authors caution against inadequate participation and poor implementation as the two most common reasons why organisations fail to redesign themselves successfully. Other reasons include complexity and capacity of people to absorb disruption – not only in terms of time available, but also personal traits such as resilience. Volume and momentum (speed) also have considerable impact. When the demands of change on people are too high they demonstrate dysfunctional behaviour, which leads to a loss in productivity. Conner (1998:15) points out that when change continues despite indications of dysfunctional behaviour the results are three-fold:

- Morale deteriorates.
- The initiatives that are attempted result in only short-term, superficial application of the intended goals.
- People stop listening to leaders and could attempt to undermine the process.

Common symptoms associated with distressing change include confusion, anxiety, fear, defensiveness and withdrawal (Conner, 1998:29). People need to feel in control or at least need to have indirect control – for example knowing what is going to happen although they cannot influence what will happen.

Kotter (1995:61) provides eight steps to organisational transformation:

- Establishing a sense of urgency (examine market and competitive realities).
- Forming a powerful guiding coalition (assembling a group with enough power to lead the change effort).
- Creating a vision.
- Communicating the vision.
- Empowering others to act on the vision.
- Planning for and creating short term wins.
- Consolidating improvements and producing still more change.
- Institutionalising new approaches.

Kotter's steps to organisational change have similarities with knowledge enabling steps (Von Krogh *et al.*, 2000, Nonaka & Takeuchi, 1995). A synthesis can be made as indicated in Table 2.6.

Nonaka & Takeuchi	**Von Krogh**	**Kotter**
Fluctuation		Establishing a sense of urgency
Intention	Instill a vision	Creating a vision
	Manage conversations	Communicating the vision
Autonomy	Mobilise activists	Empowering others to act on the vision
	Create the right context	Forming a powerful guiding coalition; Planning and creating short term wins
	Globalise local knowledge	Institutionalising new approaches.
		Consolidating improvements and producing still more change
Redundancy		
Requisite variety		

Table 2.6 Synthesis of knowledge creation and change management enablers

According to Senge (*et al.*, 1999:5) the majority of change initiatives fail. They add that deep changes in how people perceive the world and how they think are difficult to bring about. Deep changes touch on values, and values cannot be enforced.

Crego and Schiffrin (1995:56-85) argue that most people are never encouraged to change and that individuals, like nature, have an innate mechanism that resists change in order to maintain what is referred to as *homeostasis* – a relatively stable state of equilibrium. Some individuals, on the other hand, naturally embrace change or continually strive to upset the equilibrium in order to grow. The authors (1995:59) mention that change in organisations threaten individuals on the following levels:

- Loss of status.
- Loss of job.
- Loss of security.
- Loss of structure.
- Social disruption.
- Group transformation.

Whereas the first three threats are self-explanatory, *loss of structure* refers to the chaos that ensues with change and innovation. It threatens the order and comfort zones of individuals. *Social disruption* refers to the fact that a social hierarchy exists in most organisations that is often linked to authority. A change can alter the social order and cause what the authors refer to as "disassociation" pain in those who are affected. The researcher is of the opinion that this factor is more prevalent in males, because they attach more value to power bases. *Group transformation* pertains to groups that are tightly knit and who have probably worked together for many years. These groups will resist change more than individuals or more loosely structured groups.

These threats could cause groups or individuals to consciously sabotage or undermine innovation and change.

The authors warn against a silo-based culture (1995:69) because it works actively against change "In the real world, in many organisations, each silo contains missiles pointed not at the enemy – the competitors – but at the other silos within the company". The first corporate maxim is "Be true to your silo". The second is "Protect your silo at all costs". Another great barrier to change is bureaucracy - entrenched policies, procedures and unofficial rules that often no longer serve the institution and are not necessarily focussed on the needs of customers, but have been shaped around he needs of individuals or departments.

In this light, Conner (1998:207) adds the following:

"Organisational renewal demands a re-examination and, if necessary, a significant modification to the basic assumptions, beliefs and behaviours serving as the cultural infrastructure for the enterprise. Without this type of cultural context to reinforce the innovations emerging from a learning environment, important changes tend to be initiated but not sustained".

Senge *et al.* (1999:43) list the following qualities of important change initiatives:

- They are connected with real work goals and processes.
- They are connected with improving performance.
- They involve people who have the power to take action regarding these goals.
- They seek to balance action and reflection, connecting inquiry and experimentation.
- They afford people an increased amount of 'white space': opportunities for
- people to think and reflect without pressure to make decisions.
- They are intended to increase people's capacity, individually and collectively.
- They focus on learning about learning, in settings that matter.

Conner (1998:207) recommends human due diligence, by which is meant that it is necessary to conduct a rigorous analysis to establish organisational readiness for change. Typical questions are as follows:

- How much resilience do people have available to help them absorb change, and how do we develop this trait if it is too low?
- How knowledgeable are people about the human dynamics that unfold during change (e.g., why people resist and how they become committed), and how can we encourage more learning about the people side of change?
- How likely is it that important initiatives will be poorly implemented because of insufficient diagnosis, planning, and execution skills, and how do we enhance these skills if they are insufficient?

On the execution side the following questions are critical:

- How close to future shock overload are people before the change is engaged?
- How much additional change-load demand will it generate for them, and how can the demands from other changes be reduced or people's adaptation capacity be increased?
- How strong is management's commitment to this change, and how can it be heightened if it is insufficient?
- How strong is the employee resistance to this change, and how can it be reduced or, at least, managed?

To once again consider systems theory: it is important to consider the impact a particular change initiative has on the various systems in and around which it occurs.
Crego and Schiffrin (1995:71) contend that a change management plan should be designed to ensure effective leadership, appropriate organisational alignment and adequate individual involvement.

One of the difficulties with commitment is that it is easy for people to fake commitment. This contention is emphasised by Conner (1998:117). The author states that the most reliable predictor of commitment is "the price people believe they will pay if they fail to achieve their change".

Crego and Schiffrin (1995:78-85) point out that a shift has taken place from *business process reengineering* to *customer process reengineering*. The reason is that the latter focuses on organisational and cultural change as well as on business redesign. This is necessary for sustainable change because it addresses the human factor. They provide the *Seven C's* as critical success factors in change management:

- Closeness - to all customers, internal, external and stakeholders.
- Clarity – of vision and strategy.
- Courage – to make the difficult decisions and to act.
- Creativity – to think outside of the box.
- Competencies – which are distinctive, differentiating, and continually developing.
- Commitment – the will to persevere.
- Consistency – in words and deeds.

Senge *et al*. (1999:26-27) list the following challenges that occur when change develops:

- Time (we don't have time for this stuff) – people involved in change initiatives need enough flexibility to devote time to reflection and practice.
- Personal mastery: Learning to cultivate the tension between vision and reality.
- Mental models: Developing awareness of the attitudes and perceptions that influence thought and interaction.
- Shared vision: Establishing a focus on a mutual purpose.
- Team learning: Through dialogue and skilful discussion, teams transform their collective thinking.
- Systems thinking: Understand interdependency and change.

Duderstadt contends that transformations “are frequently launched by a few remarkable people with unusual ability” (2000:267). He continues to explain that those who innovate new paradigms and who destabilise, are often very young or new in their field and disregard current disciplinary rules. They are often mostly involved in the early, flatter, and less productive portion of the ‘S’-curve, where the broad outlines of the new business is hammered out. The ‘S’-curve is discussed in Section 2.7.1.

Sections 2.1 – 2.6 have explored theoretical fields that feed into innovation in a higher education context, as will be illustrated in Chapters three and four.

Section 2.7 deals with innovation.

2.7 Innovation

As mentioned before, innovation relates to market acceptance and adoption of a new concept. The way in which the market adopts a new product or service is called diffusion. *Diffusions of innovations theory* describe the factors that influence people’s thoughts and actions and the process of adopting a new technology or idea. Bryce Ryan and Neil Gross (Ryan & Gross, 1943) pioneered the model in 1943.

Diffusion consists of several aspects:

- Spatial
- Temporal (time)
    - Rate of adoption
    - Stages of adoption
    - Categories of adopters

Rogers (1995:281) describes the process that people experience when they embrace new ideas and innovations. It is described in Section 2.7.2.

2.7.1 Rate of adoption

The 'S'-curve empirical prediction cycle is a well- known indicator used in the technology and innovation environment. Technology diffusion into a market generally follows the 'S'-curve path (see Figure 2.6). According to Christensen (1997:41) 'S'-curves are only useful with sustaining technologies and that disruptive technologies cannot be plotted on the 'S' - curve because it is completely different in nature.

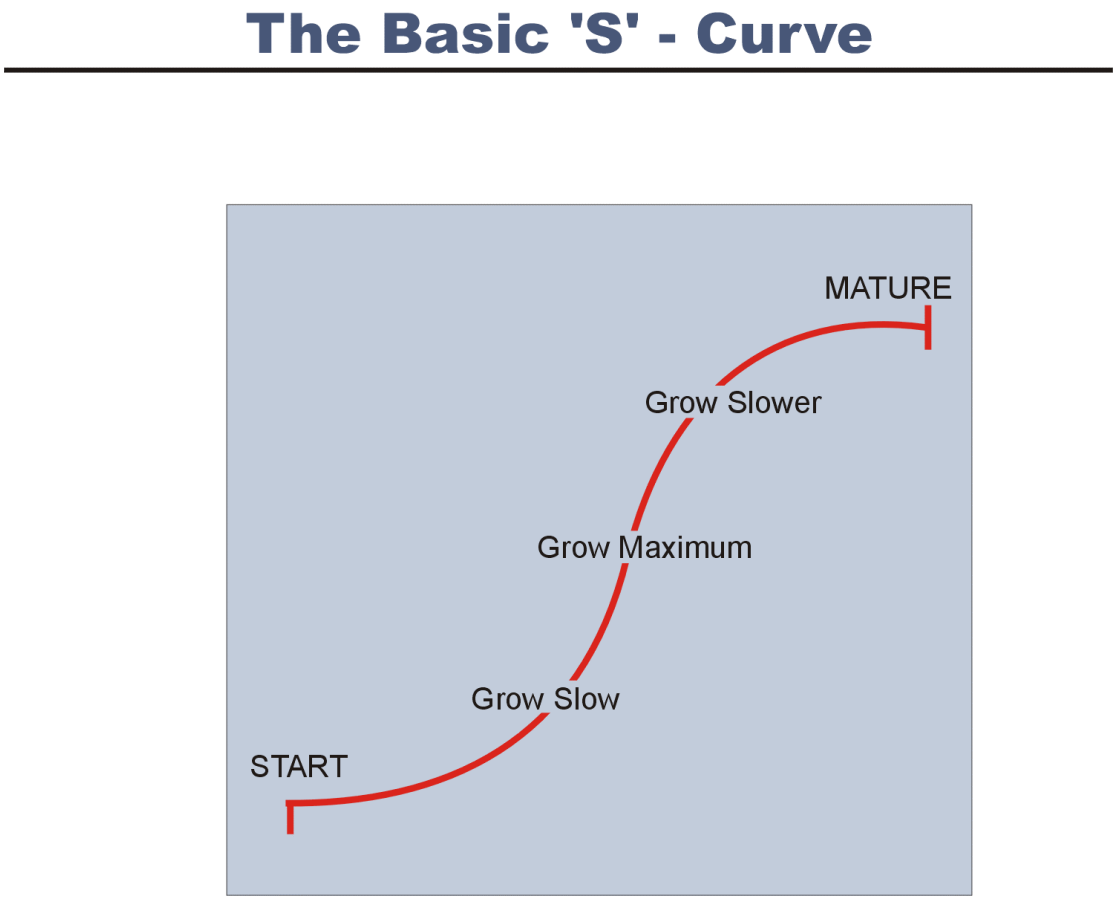

Figure 2.6 The basic 'S'-curve (Porter *et al.*, 1991)

Evolution normally takes place in predictable patterns of growth described as the 'S'- curve (Hambrick *et al.*, 1998:6). The pattern traces innovation in organisations from its beginning, with a variety of competing designs and technologies, to the emergence of dominant designs and a weeding out of competitors, and finally to the mature phase, when product innovation becomes secondary to process innovation. It forms the nucleus of technology strategy and posits that in the early stages of a technology, the rate of progress in performance will be

relatively slow. As people become familiar with the technology, it is diffused more rapidly throughout the organisation and the rate of technological improvement accelerates (see Figure 2.7). It is often used to predict whether an emerging technology is likely to supplant an established one. The stages of adoption and categories of adopters (Moore, 1999) are briefly discussed in Section 2.7.2.

2.7.2 Stages of adoption and categories of adopters

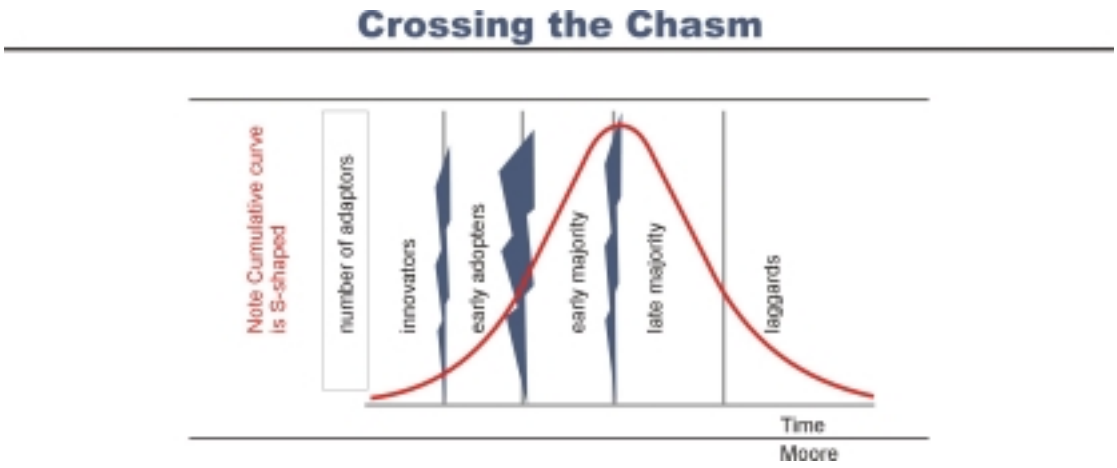

Figure 2.7 Crossing the Chasm (Moore, 1999)

The categories of adopters described are briefly discussed below (Rogers, 1995, Pistorius, 2000:4-16).

- *Innovators* take a keen interest in technology and like to experiment with new technology. They pursue innovation passionately because of their interest in new and advanced technology.

- *Early adopters* take a business interest in technology and are the greatest influence in opinion leadership. They adopt new technology because they can envisage its benefits without the need for well-established references. Opinion leaders are people who have the ability to informally influence other individuals' attitudes or overt behaviour with relative frequency (Rogers, 1995:281).

- The *early majority* usually adopt new technology once sufficient support and a track record of success are in place. They are driven by practicality.

- The *late majority* usually adopt because they have to. They are uncomfortable with technology.

- *Laggards* are the last to adopt, or they may never adopt.

Rogers (1995:369) emphasises the importance of change agents in the diffusion of innovation and argues that change agents have strong expertise regarding the innovative idea being diffused. Critical success factors in ensuring that an innovation is adopted is dependent on the extent to which change agents are:

- client oriented,
- accessible to clients
- empathetic
- perceived as credible
- able to foster a client's ability to evaluate innovations.

Rogers (1995) emphasises that adoption of technology is a communication process. He describes the process of diffusion in five stages:

- *Knowledge* is the stage where the potential adopter becomes aware of the innovation and gains understanding of it.
- *Persuasion* is the stage where a favourable or unfavourable attitude towards an innovation is formed.
- *Decision* is the stage where an innovation is put to use.
- *Confirmation* is the stage of reinforcement of a favourable adoption decision.

Rogers goes further to investigate the attributes of the innovation itself that could possibly influence its rate of adoption. These attributes are:

- *Relative advantage* - the degree to which an innovation is perceived to be better than the idea it supersedes.
- *Compatibility* – The degree to which an innovation is perceived to be consistent with existing values, beliefs, experience and needs.
- *Complexity* – the degree to which an innovation is perceived to be difficult to understand.

- *Triability* - the degree to which an innovation may be experimented with on a limited basis.
- *Observability* – the degree to which the results of an innovation are visible.

The chasms in Figure 2.7 show critical points in the adoption curve. Each gap poses a threat to successful diffusion of a particular innovation. The biggest risk is situated between the early adopters and early majority. Consequently, if there is too little momentum during the *early adopter* phase, market diffusion does not take place. Similarly, a gap between the early majority and late majority could mean that diffusion stops before it reaches the majority of the market. This does not imply market failure though. The researcher is of the opinion that complete diffusion is not always necessary and will depend on the business strategy of the organisation.

The Technological Acceptance Model (TAM) is a widely used research model to predict IT adoption and was developed by Davis in 1983 (Davis, 1989). It identifies two perceptions by users of technology that have an impact on their adoption of technology:

- Perceived usefulness.
- Perceived ease of use.

Perceived usefulness relates to the degree that people believe that using particular technology would enhance their job performance. It also pertains the extrinsic characteristics of the technology, such as efficiency and effectiveness.

Perceived ease of use pertains to intrinsic characteristics of the technology. It relates to the degree to which a person believes using the technology will be free of effort, i.e. to ease of use, ease of learning and flexibility.

Section 2.7.3 provides a broader outline of innovation and discusses Intrapreneurship as an important aspect of Innovation.

2.7.3 Describing innovation

Innovation refers to any concept or invention; a product, service or process; which is adopted by a market (Utterback & Abernathy, 1975; Roberts, 1988, Girifalco, 1991; Betz, 1998).

Thus innovation contains an element of something new – either a completely new idea (invention) or a concept, which is improved - and an element of market acceptance. It is important to point out that *innovation* is not the same as *invention*, because a market does not necessarily adopt an invention. Furthermore, even if a concept is borrowed and not created; adapted, implemented and adopted by a new market; it is still an innovation.

Innovation is therefore not necessarily concerned with technology and could take on any form. Yet because of the dynamic nature of technology and its significant impact on organisations, innovation has moved to the forefront of management theory - primarily focused on technology innovation. Figure 2.8 illustrates the researcher's view of the dynamics of innovation within the context of this study.

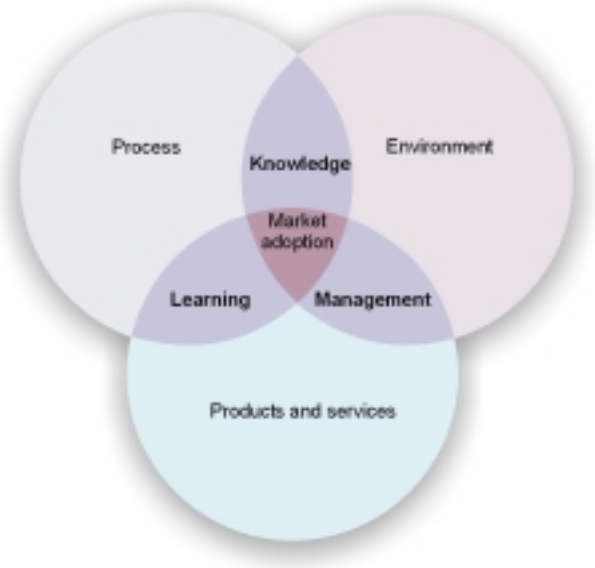

Figure 2.8 Dynamics of innovation

2.7.4 Intrapreneurship

Pinchot (1985:3) notes, "In this time of rapid economic and technological change, the entrepreneurial spirit can be a unique and important advantage, but only if we learn to use it". He continues to make noteworthy statements about innovation that should be heeded by large organisations:

- Innovation seldom succeeds without a champion.

- Continuous innovation is required just to stay where we are.
- Innovation requires flexibility and freedom to act (no red tape and hierarchy).

Importantly, he coins the term *intrapreneur* – a person who is an entrepreneur within a large organisation.

He describes the following characteristics of intrapreneurs:

- The intrapreneur is the general manager of a new business that does not yet exist.
- The intrapreneur has the ability to visualise the steps from creating the idea to actualisation.
- The intrapreneur can create order out of chaos.
- Intrapreneurs cross-organisational boundaries and must cross the barriers that divide the organisation into functions.
- They have vision, imagination, courage and resilience.
- They are naturally action oriented and pragmatic.
- They are unwilling to accept no for an answer.
- They could be too task-oriented (putting objectives before people).
- They have well developed intuition, take initiative and are creative.
- They are often natural strategists.

Conner (1998:190) picks up on resilience as a key success factor for change. The authors identify five personal characteristics that define resilient behaviour:

- Positive – identify opportunities and have the self-confidence to know they will succeed.
- Focused – have a clear vision of what they want to achieve.
- Flexible – draw on a wide range of internal and external resources to develop creative, pliable strategies for responding to change.
- Organised – use structured approaches to managing ambiguity, planning, and coordinating effectively in implementing their strategies.
- Proactive - engage action in the face of uncertainty, taking calibrated risks rather than seeking comfort.

Owing to the complex nature of large organisations, such as universities, Duderstadt (2000:273) points out that universities become encrusted with policies, procedures,

committees, and organisational layers that discourage risk taking and creativity. This could become a serious impediment to successful change. Ironically, it is the creative anarchy of academic culture that sometimes resists change. Because an intrapreneur works outside the normal governance of an organisation, high-level sponsorship is required, as indicated in table 2.7.

Inventor	Intrapreneur	Sponsor	Protector
Understands the new product or service, but not how to make a business of it.	Attention is on business realities; may occasionally forget realities of corporate politics.	Attention is primarily on removing organisational barriers and giving advice to the intrapreneur.	Very high-level sponsor who approves and protects, but only occasionally meets with the intrapreneur.

Table 2.7: Sponsorship spectrum (Pinchot, 1985:149)

Threats to intrapreneurs include the following (Pinchot, 1985:154):

- *Jealousy* – when one person or one group in an organisation is singled out to innovate, the others feel slighted and cheated.
- *Danger of success* – success becomes a threat to other groups and individuals because their resources could be drawn away; their reaction could cause isolation of the intrapreneur.
- *The spotlight* – the lack of mature profit centres with which to hide development costs make it hard to defend expenditures and demands for return on investment.

These reactions, or ‘antibodies’ could result in many attempts to undermine innovation. Comparing it to a Darwinian process Duderstadt (2000:273) notes that when successful innovations, or “islands of entrepreneurship” are supported with the necessary resources and incentives; they draw away resources from existing activities resistant to change. The benefit is that these initiatives will attract staff and students into the new activities. It could also mean that the successful new initiatives destroy older, obsolete efforts. On the other hand, unsuccessful initiatives are unable to compete with ongoing activities capable of sustaining their relevance during a period of rapid change.

Conner draws on organisational learning as a solution for successful change. The author terms it nimbleness, i.e.: “the ability for an organisation to consistently succeed in unpredictable, contested environments by implementing important changes more efficiently and effectively than its competitors”(1998:39).
The characteristics of a nimble organisation are as follows:

- Repeatedly succeed in erratic, competitive environments through fast and effective modifications of their operations.
- Demonstrate a superior capacity to deal with unanticipated problems and opportunities.
- Rapidly redefine and redeploy their human, physical, and financial resources following a disruptive change.
- Orchestrate multiple, even simultaneous reconfigurations of their various corporate structures.
- Employ associates who accept frequent reassignment of their duties and perpetual reordering of their priorities as the norm.
- Help their people view a continuous flow of unplanned activities as simply the inevitable price to be paid for competing in volatile markets.

A very useful continuum is provided, which indicates that nimbleness is also about flexibility of decision, based on the context:

- Individual effort …Team work.
- Improvisation…Discipline.
- Defined structure…Fuzzy boundaries.
- Diversity of ideas…Shared perspective.
- Continuous improvement…Exploit what works as long as possible.
- Trust logic…Rely on intuition.
- Zero defects…Learn from mistakes.
- Near-term results…Long-term vision.
- Tactful feedback…Frank dialogue.
- Patience…Urgency.
- Pride in accomplishments…Humility for what is left undone.
- Forgiveness for being human…Insistence on accomplishing important tasks, no matter what.
- Leading the whole…Managing the segments.

- Attract unorthodox thinking…Eject destructive conflict.

2.7.5 Change management strategies for innovation

Duderstadt (2000:268) recommends the following actions that a university must take in times of great change:

- Commitment at the top.
- Seeking institution - wide involvement.
- Igniting the sparks of transformation (identify key individuals at different levels who will buy into the transformation process and become active agents to drive it).
- Controlling and focusing the transformation agenda (focus different members and groups of the university on the aspects of transformation that are relevant to them).
- Staying the course (don't let resistance to change and an attitude of 'we'll wait them out' or 'this, too, shall pass' wear you down.

Speaking from a Northern American perspective, Duderstadt (2000:37) mentions that some universities have attempted to restructure, reengineer, and reinvent their administrative services and core academic activities in response to global changes. Yet society is becoming impatient with reluctance of universities to truly face up to the challenge of change. He laments the fact that the major resistance concerns changes in curricula and pedagogy; and that technology has largely bypassed the classroom.

Revisiting the exposition on knowledge and learning; it is finally important to note that Conner (1998:24) stresses the importance of organisations to acquire new and explicit knowledge about change. He terms this 'generic knowledge', which unlike systemic and specific knowledge deals specifically with knowledge about change. Only if new learning is associated with change, does it result in generic knowledge, which he deems represents the strongest competitive advantage.

2.7.6 Types of innovation

Porter *et al*. (1991:5) state “International competitiveness in technology-based industries is the new metric of national economic achievement. A nation’s competitiveness depends on the capacity of its industry to innovate”.

Table 2.8 is an overview of the types of innovation.

Type of innovation	Author/s	Definition	Example
Radical/ Revolutionary/	Marquis, 1969 Henderson & Clark, 1990,	Establishes a new dominant design, which is embodied in components that are linked together in a new architecture of which no increase in scale, efficiency or design can make what it impacts upon competitive with the new. Impacts organisation-wide and often provide competitive advantage. Is accompanied by a high degree of change in human behaviour and paradigms.	Desk top computers
Incremental/ Evolutionary/	Marquis, 1969 Henderson & Clark, 1990	Refines and extends an established design, but underlying concepts, and the links between them, remain the same. Continuous improvement of products, processes and services	
Disruptive	Christensen, 1997	Results in worse product performance in the beginning – have attributes that (generally new) customers value	
Sustaining	Christensen, 1997	Improved performance of established products – could be radical or incremental.	
System	Marquis, 1969	Ideas that require several resources and many labour-years to accomplish.	Communications networks
Architectural	Henderson & Clark, 1990	Existing knowledge or hardware in a product is arranged differently, resulting in a different product and possibly a new market. Often small changes that lead to significant competitive advantage.	Ceiling mounted fans.
Modular	Henderson & Clark, 1990	Usually represents a radical innovation of a certain part of a total product and often takes place in complex products or processes with many sub units and functions.	Tone and pulse phones

Type of innovation	Author/s	Definition	Example
Process/ Procedure	Utterback & Abernathy, 1975	Improving current procedures and processes used in the production of products.	Any improvement to current manufacturing, delivery, packaging, marketing, project management.
Product/ Service	Utterback & Abernathy, 1975	Often associated with new product development. In a service organisation the product is supplying a service to the client.	Digital watch, self service
Market pull	Noori, 1990	Innovation starting with an identified customer or market need.	Velcro
Market push	Noori, 1990	Innovation based on new technology or bright idea.	Photocopier

Table 2.8 Types of innovation

2.7.7 Conditions for successful innovation

Drucker (1985) discriminates between the fundamental conditions under which new ideas become successful and enduring innovations in any field.

- Ideas that become successful innovations represent a solution that is clearly definable, is simple, and includes a complete system for implementation and dissemination.
- Successful innovations start small and try to do one specific thing.
- Knowledge-based innovations are least likely to succeed and can succeed only if all the needed knowledge is available.

Collis *et al*. (2000) propose the 4-E model to implement technological innovation in an educational setting.

According to the model, an individual's likelihood of making use of a technological innovation for a learning-related purpose is a function of four groups of factors:

- Environment (institutional culture)
- Educational effectiveness (perceived or expected)
- Ease of use
- Engagement (the individual's personal response to technology and to change)

An important component of institutional culture is support, i.e. to what extent does the institution provide support in terms of online library services, technological infrastructure and training. Other elements include management style and vision of leaders and the institution's previous experiences with technology-related change.

2.7.8 Innovation management

Tidd *et al*. (1997:36) provide the following table to indicate how such a process of innovation can be managed:

Basic ability	Contributing routines
Recognising	Searching the environment for technical and economic clues to trigger the process of change.
Aligning	Ensuring a good fit between the overall business strategy and the proposed change – not innovating because it is fashionable or a knee-jerk response to a competitor.
Acquiring	Recognising the limitations of the company's own technology base and being able to connect to external sources of knowledge, information, equipment, etc. Transferring knowledge from various outside sources and connecting it to the relevant internal points in the organisation.
Generating	Having the ability to create some aspects of technology in-house, e.g. through R&D, engineering groups.
Choosing	Exploring and selecting the most suitable response to the environmental triggers, which fit the strategy and the internal resource base/external technology network.
Executing	Managing development projects for new products or processes from initial idea through to final launch. Monitoring and controlling such projects.
Implementing	Managing the introduction of change – technical and otherwise – in the organisation to ensure acceptance and effective use of innovation.
Learning	Having the ability to evaluate and reflect upon the innovation process and identify lessons for improvement in the management routines.
Developing the organisation	Embedding effective routines in place – in structures, processes, underlying behaviours, etc.

Table 2.9: Innovation management process (Tidd, *et al*., 1997:36)

Maddox, Anthony and Wheatly (1987, cited in Porter *et al*., 1991:40), on the other hand, provide the following framework.

- Forecast the technology.
- Analyse and forecast the environment.
- Analyse and forecast the market/user.
- Analyse the organisation.

- Develop the mission.
- Design organisational actions.
- Put the plan into action.

The value network (the context within which a firm identifies and responds to customers' needs, solves problems, procures input, reacts to competitors, and strives for profit) shape how an organisation perceives possible rewards from sustaining and disruptive innovations (Christensen, 1997:32).

Christensen (*ibid*.) claims that these expected rewards determine the allocation of resources towards sustaining innovations and away from disruptive ones. In other words, established organisations portray consistent leadership where sustaining innovation is concerned, but not where disruptive innovation is concerned. Because of this disruptive technologies are usually developed with very little resources and mostly within established organisations. Furthermore, they are seldom initiated by senior management and they often employ off-the-shelf components (Christensen, 1997:43).

Christensen (1997:99) adds that the following principles and management thereof, lead to successful innovation where disruptive technologies were concerned:

Principle	**How successful managers harnessed these principles**
1. Resource dependence: Customers effectively control the patterns of resource allocation in well-run companies.	1. Embed projects to develop and commercialise disruptive technologies within an organisation whose customers need them. When managers align a disruptive innovation with the right customers, customer demand increases the probability that the innovation will get the resources it needs.
2. Small markets don't solve the growth needs of large companies.	2. Place projects to develop disruptive technologies in organisations that are small enough to get excited about small wins.

3. The ultimate uses or applications for disruptive technologies are not known in advance. Failure is an intrinsic step towards success.	3. Plan to fail early and cheaply in search of a market for a disruptive technology – hence through an iterative trial and error process.
4. Technology supply may not equal market demand. The attributes that make disruptive technologies unattractive in established markets often are the ones that constitute their greatest value in emerging markets.	4. Develop new markets when commercialising disruptive technologies, rather than search for a technological breakthrough so that the disruptive product can compete as a sustaining technology in mainstream markets.

Table 2.10: Management of principles of disruptive technologies that lead to successful innovation (Christensen, 1997:99).

Pogrow (1996) makes a few thought-provoking statements concerning broad-scale reforms.

Myth	**Reality**
(i) You can change instruction via advocacy, in-service, and training.	Large-scale reform requires highly specific, systematic, and structural methodologies with supporting materials of tremendously high quality.
(ii) You can reform education by disseminating knowledge and leaving it up to practitioners to apply that knowledge.	Reform requires technology, methodology, structure, dosages, and materials. It is far more difficult to figure out how to implement theory than it is to generate it.
(iii) The most important change involves radical reformulation of existing practice, i.e., new paradigms.	The most important changes are incremental ones. While paradigm shifts are important in the evolution of knowledge, they are extremely rare.

(iv) The best way to achieve reform is through institution wide change/restructuring.	Institution wide change, while a nice idea, has never worked on a large scale and is probably not necessary.
(v) You can understand large-scale change by understanding what happens on a very small scale.	Large-scale change reflects properties that are often diametrically opposed to those in effect in small-scale research.

Table 2.11: Myths and realities about educational reform (Pogrow, 1996)

Consequences of the myths, according to Pogrow (1996), are “massive waste of resources on staff development and dissemination. In the absence of a valid technology and a body of experience for carrying out a proposed reform on a large scale, in-service training and dissemination strategies are largely ritualistic shams that waste time. Staff development gets everyone excited, but little happens. Still, despite its woeful track record, we keep on pushing staff development with religious fervour as the key to improving education”.

Section 2.7.9 provides technology innovation strategies.

2.7.9 Technology innovation strategies

Tidd *et al*. (1997:58-63) mention the long-standing debate between ‘rationalist’ and ‘incrementalist’ strategies for innovation.

A rationalist strategy entails the following linear steps.

- Describe, understand and analyse the environment.
- Determine a course of action in the light of the analysis.
- Carry out the decided course of action.

An incrementalist strategy entails the following iterative steps.

- Make deliberate steps (or changes) towards the stated objective.
- Measure and evaluate the effects of the steps (changes).
- Adjust (if necessary) the objective and decide on the next step (change).

The authors contend that real-life management is too complex to be prescriptive about using certain strategies and that managers often shift between both strategies, depending on the particular environment at the time. Laurillard (1996:1) provides the following useful critical success factors that should be borne in mind with technology innovation within an educational context:

- A pro-active process that ensures synergy among all units and that can maintain a proportion of new methods.
- A course production-presentation process that can be responsive to curriculum development and flexibility in its team building, project management and creative collaboration processes.
- A staff development programme that supports academic and production staff in their exploration of ways of utilising technology for teaching and learning.
- Resource planning and activity costing procedures that enable all units to use new technology resources effectively.
- A technical infrastructure that will support all learners and staff.
- Quality assurance mechanisms.
- Collaborative partnerships.

Section 2.7.10 explores the relationship between innovation and competitiveness.

2.7.10 Competitiveness

As indicated, there exists a link between economic competitiveness, and technology innovation. This is emphasized in the World Competitiveness Rating (World Economic Forum, 2000): “In 2000 the world ‘on-line’ meets the world ‘off-line’. The winning nations for competitiveness are those, which create the best environment for the interaction between the enterprises of the ‘new economy’ and those of the ‘brick and mortar’ world. Massive investment in technological infrastructure is now paying off …” Duderstadt (2000:15) notes that there has been a shift in emphasis within the university away from simply distributing and analyzing knowledge, e.g. ‘teaching’ and ‘scholarship’, to creating knowledge, to activities such as ‘innovation’ and ‘creativity’.

An increase in returns is linked to four factors related to technology innovation. These factors are briefly described by Teece (1998:58).

- The first pertains to *standards*. If, for example a company like Microsoft develops an operating system protocol, which is proprietary, and the protocol gains acceptance, the better the chance the standard has of becoming the dominant operating system and thus yielding significant rents.

- The second to *customer lock-in*. Investment in high technology products amplify switching costs, hence many suppliers focus their energy on initial sale because follow-up sales will be easier. An example would be selling a network infrastructure to a University. Once the University has bought into that network infrastructure, the costs of switching to another network will be high.

- The third relates to *up-front costs* required to develop a product. A typical example is the enormous initial investment to develop new software. Hence the first copy literally costs millions, but the second zero.

- The fourth deals with the *cost of producer learning*. Producers often become more efficient as they gain experience, but if the knowledge is tacit and difficult to transfer to other producers, competitors with less experience are at a competitive disadvantage. In this sense process technology is easier to protect than product technology: a laser printer can be bought and imitated through reverse engineering, but a manufacturing process in a biological factory is hard to imitate by looking at the end product. The point made, though, is that high technology does not give a competitive advantage if it is not supported by cognitive and managerial skills to discern the correct strategies in time. Moreover, imitation is often hindered because few routines are stand-alone and imitating only a part of what a competitor does may not achieve the required result.

The fact that innovation depends on market adoption renders interaction with the market very important. Customer relationships have become important for any business or organisation. It is the contention of the researcher that Customer Relationship Management (CRM) should be a strategy in an organisation's change management plan. Its relevance to the field of innovation is discussed in Section 2.8.

2.8 Customer Relationship Management

It is essential to explore Customer Relationship Management (CRM) to understand how important organisational change in higher education institutions have become. In light of lifelong learning trends and wider choice, institutions need to become increasingly customer/consumer centric. As was pointed out in Section 2.5, *knowledge management* is a useful strategy to attain consumer satisfaction by giving consumers access to topical and relevant information according to their needs.

CRM goes a step further, i.e. beyond information and knowledge provision. It posits that a relationship with the customer is necessary for sustainable growth.

Gartner (2001:7) define CRM as "a business strategy whose outcomes optimise profitability, revenue and customer satisfaction by organising around customer segments, fostering customer-satisfying behaviours and implementing customer-centric processes".

Characteristics of a customer driven organisation are as follows (Prinsloo, 2001):

- They spend time meeting customers and listening to their problems.
- They benchmark competitor's products and seek 'best of class' solutions.
- They continuously improve and refine service offerings according to market feedback.
- They meet customer requirements for customisation where it can be done profitably.
- They study customer needs and wants in well-defined market segments.
- They measure company image and customer satisfaction continuously.
- They influence all employees in the organisation to be customer-centred.

A look at Figure 2.9 shows the similarities of a CRM model and aspects of change management, knowledge management and creation, and the innovation process.

It focuses more on measurement (metrics) and on the customer, whereas *knowledge management*, *knowledge creation, organisational learning, change management* and *innovation management* focus predominantly on internal organisational dynamics and processes.

Hence CRM is complementary to the above theoretical fields by providing strategies to establish sustainable relationships with the external market.

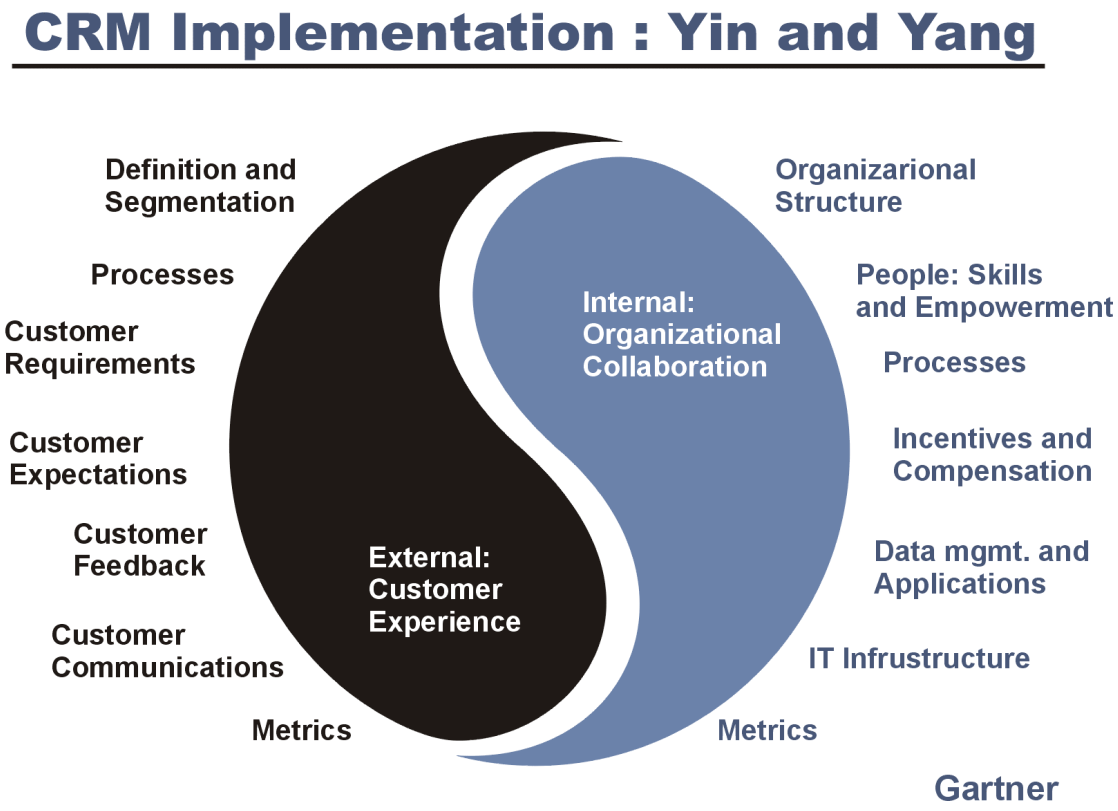

Figure 2.9 CRM Implementation: Yin and Yang (Gartner, 2001:11)

According to Radcliffe (2001:1-4) there are eight building blocks of CRM:

- Vision
- Strategy
- Valued customer experience (understand requirements, monitor expectations, collaboration and feedback)
- Organisational collaboration
- Processes (customer lifecycle, knowledge management)
- Information (data, one view across channels, analysis)
- Technology (applications, architecture, infrastructure)
- Metrics (value, retention, satisfaction, loyalty, cost to serve)

Figure 2.10 illustrates the levels of Customer Satisfaction.

Figure 2.10 Customer Satisfaction model (Adapted from Barnes, 2001:32-64)

If one has service failure on the top level, i.e. the emotional level, the customer usually goes to another service provider. In the case of the university, students who experience lack of caring, rudeness and neglect are likely to cancel their studies. The virtual campus that is described in Chapter Four addresses the first three levels of customer satisfaction.

Very few universities actually monitor why students cancel their studies. If the student has established a good relationship with staff at the University, the chances of this happening decrease.

2.9 Conclusion

Chapter Two explored the concept of *knowledge* and continued to weave a tapestry of various theoretical fields that build on *knowledge* and *learning*. These theories provide a scientific base for the analysis of the virtual campus case study in Chapter Four that deals with *process, product* and *service* innovation at the University of Pretoria. It demonstrates the synthesis reached in epistemology of learning as informed action and how *constructivism* has created praxis in learning theory in stressing the importance of social interaction in real life environments. It is constructivism which has transferred to the field of *knowledge creation*. Theorists discovered that knowledge management is not limited to systems but inherently deals with knowledge creation through interaction with people. In organisations, knowledge creation goes hand in hand with change.

The reason is that new knowledge signifies change, especially if it occurs on a wide scale. *Change Management* is a field that focuses on how to bring about transformation and organizational change *Innovation* is when new concepts are implemented and accepted in the market. It implies change on a relatively large scale. The importance of the market has led to a new business strategy of C*ustomer Relationship Management* (CRM), that emphasises the need to create relationships with clients in order to sustain profit and return on investment. However, CRM is not based on business alone, but on values. Customers should be treated in terms of the value system of an organisation. Ultimately, customers make decisions driven by emotional drivers.

Chapter Three provides an overview of theory in practice, describing how technology impacts upon the higher education landscape.