CHAPTER 3 LITERATURE SURVEY

3.1 STRATEGIC APPROACHES

3.1.1 OVERVIEW

The earliest strategy formulation processes were closely linked to corporate planning. Corporate planning began as a simple extrapolation of budgets and was based on the assumption of a stable environment. More sophisticated methods considered the economic growth expectation of the firm concerned, the development of markets and the organisation's plans and intentions. The scope of corporate planning evolved to become corporate strategy when cases with many outcomes were considered. Various approaches to corporate strategy were developed and used during this period of evolution. Porter proposed the competitive approach to strategy (Kay 1993: 340).

According to Wolf *et al* (1998: 11) top executives are in for a rude awakening if they short-sightedly judge the organisation's performance only in terms of financial results and market share while ignoring internal and external clients and the culture needed to support their success. A sound, practical and achievable vision can resonate through an organisation to move people to come together in an extraordinary alignment of purpose and common goal.

The vision is the conceptual picture of how the organisation should operate at some point in the future.

3.1.2 ORGANISATIONAL SENSE OF PURPOSE

Lynch (2000: 7).describes corporate strategy as the organisation's sense of purpose and adds that plans or actions need to be developed and implemented to pursue the purpose

Irrespective of whether the organisation is a private or public body, Lynch (2000: 436) claims that all organisations need to develop their purpose and common understanding of the main elements of their activities. By identifying the organisation's essential elements, one can simplify them. This shaping of the organisation's purpose is a slow process that encompasses the following considerations as proposed by Lynch (2000: 436):

- Area of Activity: What is the organisation's area of activity and what should it be? The purpose of the organisation is related as much to its future direction as to that of the present. This is particularly important if the organisation's existence is

threatened or if unique, attractive opportunities suggestion a redefinition of purpose.

- Kind of Organisation preferred: Organisations have some choice in deciding whether or not to develop in any of the following areas:
- The nature of the internal environment to be created is generally determined by the existing culture and style within the organisation and is also dictated to some extent by the external environment. However, the organisation still has some choice as regards power, roles, tasks, and the personal types of culture described by Lynch (2000: 317).
- The challenges to be presented to the personnel. The type of challenge presented will influence the organisation's working style. Lynch (2000: 438) refers to Drucker (1961: Chapter 13) who described this as follows:

> *"No organisation can depend on genius; the supply is scarce and always unpredictable. But it is a test of an organisation that it can make ordinary human beings perform better than they are capable of, that it brings out whatever strength there is in its members and uses it to make all the other members perform better."*

- Relative Importance of Shareholders and Stakeholders: Typically, the purpose of a business is to increase the shareholders' wealth in the form of larger dividends and share price growth in the short term and profit growth in the longer-term. Stakeholders are those that have a stake in the purpose of the organisation. An example of stakeholders includes employees, clients and suppliers. There is potential for conflict between shareholders and stakeholders (Lynch 2000: 438).
- Growth Intentions: Some organisations wish to grow whereas others do not. This depends on the organisation and its environment (Lynch 2000: 438).
- Relationship to Environment: The immediate environment determines whether the organisation can compete or should concentrate on survival. Wider societal pressures, which could include pressure exerted by pressure groups, also dictate the nature of this relationship and influence the organisation's purpose. Government policy may dictate an adjustment in the organisation's purpose (Lynch 2000: 439).

3.1.3 MILITARY ASPECTS OF STRATEGY

As the SANDF is a military organisation, it is necessary to consider aspects of military strategy.

The professional soldier must pay attention to the future and the opportunities that it brings. However it is as important to consider the past with the lessons it has taught us and its and inherent inertia. Finding a balance between the perspectives offered by the past and those offered by the future is one of the greatest challenges the soldier must face (Irwin 1997: 229).

Modern information-age forces are equipped with the latest high technology combat and communications systems. Industrial-age forces tend to be larger and are often equipped with the kind of second-hand fighting systems that have been cast- off by the information-age forces. Somewhere between these two forces are those "minimalist" forces whose fighting methods include terrorism. Minimalist forces, which have many advantages over conventional forces, are difficult to counter especially for a democracy (Irwin 1997: 229).

Military policy is the art of the application of a nation's forces in war to enable its government to achieve its political goal, whereas tactics involve the deployment of individual military units to win a battle (Payne 1998: 153).

The inventory of a modern military force relies heavily on a variety of electronic devices for communicating with its own forces, predicting the movements of the enemy and then attacking the enemy (Payne 1998: 151).

According to Payne (1998: 153), there are widely recognised rules for the successful conduct of military operations. Of these rules, which are also known as principles of war, the United States Army recognises nine. These nine principles of war are described in Appendix A which also presents the 14 principles of war used by the SANDF.

The commander has a choice between the attrition and the manoeuvre styles of war-making (Payne 1998: 154):

- The Attrition Style: The attrition style of war-making is in most situations best able to achieve mass, economy of force, unity of command, security and simplicity. The attrition-oriented commander approaches the enemy as an inanimate object to be destroyed piece by piece and relies heavily on firepower rather than manoeuvre. This is a comparatively simple and predictable approach to

waging war and requires little initiative from lower-ranking officers. This approach is however very costly as was experienced in the trenches during World War 1.

- The manoeuvre style: The manoeuvre or indirect style of war-making attempts to approach the enemy as a living organism with a brain and nervous system. This approach wins by confusing the organism demoralising and paralysing it, ultimately killing the brain or high command and, preventing it from maintaining control over its combat units. This style of commander, when least expected, strikes the enemy in its weakest spot. Manoeuvre tactics create a fluid, volatile battlefield. Lower-ranking officers can exploit the advantage they have in terms of flexibility and unpredictability. The lower-ranking officers therefore have to be very competent at mission tactics (what the Germans call *Auftragstaktik*).

Wilson (1996: 5) classifies conflicts in the following broadly similar categories:

- Conventional Warfare: This is the primitive approach to the achievement of a victory by means of the brute conquest, attrition or overwhelming. This approach forces the collapse of the opposition's political economy.
- Manoeuvre Warfare: This consists of opportunistic attacks on the military, and, sometimes, the political infrastructure and dependencies of the opposition. The aim of this approach is to impair the operation of the opponent's forces thereby making them too costly to operate. The desired outcome of this approach is the cessation of hostilities by the opponent.
- Terrorism: In this mode of warfare, the aggressor attacks the social fabric and dependency infrastructure of the opponent with propaganda efforts that focus media attention on areas dictated by the terrorists. This form of warfare is considered to be particularly heinous, as the targeted elements are civilian.

Romm (1991: 1) compared the attrition style employed by the US forces previously with the approach they took in conjunction with the coalition forces in the Gulf war. He claimed that the Gulf war was won in the same way as the Japanese are winning the high-technology trade and manufacturing war against the US: by means of a fast cycle time-based, competitive strategy.

The coalition forces refused to meet Saddam Hussein on his terms, in the head-on conflict such as he had with the Iranians. Instead the coalition forces aimed all efforts at increasing the "fog" of war for Hussein by pre-empting his plans and adopting

coalition forces' tactics in a flexible, manoeuvre type of warfare with a faster cycle-time. In principle it was the investment in a highly trained force with advanced technology that won the Gulf war. This principle is equally valid for competition by nations in world markets (Romm 1991: 2).

3.1.4 STRATEGIC ANALYSIS

Some organisations cannot continue to survive with their current strategies and therefore should change. Three main aspects should be assessed before proceeding with a new strategy. A framework is presented in Figure 14 to aid the process of analysis of organisations' strategic change (Lynch 2000: 324).

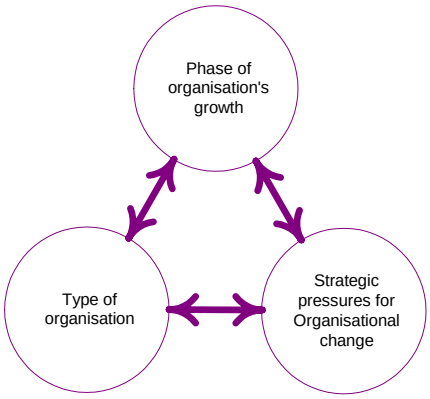

Figure 14: Framework for analysis of Strategic Change (Lynch 2000: 324).

According to Porter (1980: xvi) the development of competitive strategy is the development of a broad approach for the business' competitive stance, the nature of its goals and the policies needed to achieve those goals. Competitive strategy combines its ends (goals) and its means (policies) by which it intends to achieve. The wheel of competitive strategy presented in Figure 15 shows the "hub" as the set of the organisation's goals and the "spokes" as the key operating policies with which the firm wishes to achieve these goals. In Figure 17 the competitive strategy formulation context shows how the organisation's strengths and weaknesses in terms of its assets and skills relative to its competitors relate to the broader external environment (Porter 1980: xviii). Porter (1980: xix) presented a set of tests for consistency of the strategy in Table 6.

Figure 15: The Wheel of Competitive Strategy (Porter 1980: xvi).

Internal Consistency Are goals mutually achievable? Do the key operating policies address the goals? Do the key operating policies reinforce each other?	**Environmental Fit** Do the goals and policies exploit industry opportunities? Do the goals and policies deal with industry threats to the degree possible with available resources? Does the timing of the goals and policies reflect the ability of the environment to absorb the actions? Do the goals and policies responsive to broader societal concerns?
Resource Fit Do the goals and policies match the resources available to the organisation relative to competitors? Does the timing of the goals and policies reflect the ability of the organisation to change?	**Communication and Implementation** Are the goals well understood by the key implementers? Is there enough congruency between the goals and policies and the values of the key implementers to ensure commitment? Is there sufficient managerial capability to allow for effective implementation?

Table 6: Tests of Consistency (Porter 1980: xix)

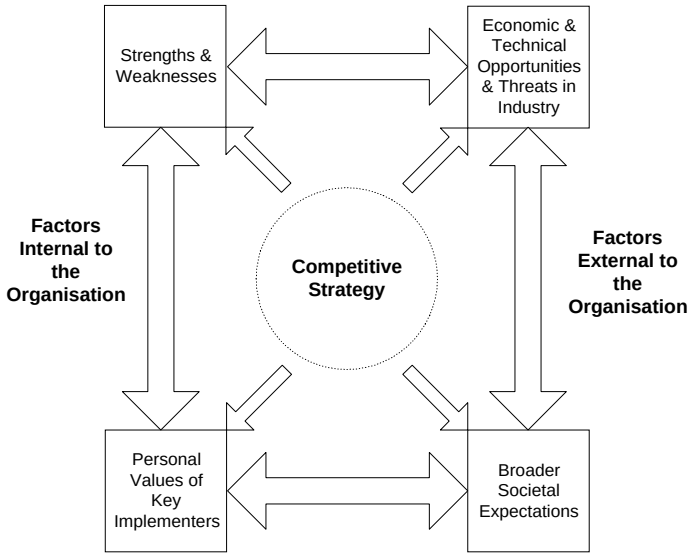

Figure 17: The Context of Competitive Strategy (Porter 1980: xiii)

A. ORGANISATION TYPE AND ABILITY FOR STRATEGIC GROWTH

Strategic change usually brings uncertainties. Analysis of organisations in advance allows them to be better prepared for the potential changes. No standard procedure exists for handling, analysing the relationship between the organisation and the proposed strategic change (Lynch 2000: 324).

Lynch (2000: 324) referred to the four main types of organisation that Miles and Snow proposed for analysis for their ability to cope with change:

Defender Organisations: These organisations aim for market leadership, possibly by concentrating on a niche and are more comfortable with steady strategic change although they are able to cope with sudden change.

Prospector Organisations: These organisations that are typically flexible, seek out new opportunities in growing markets. They respond quickly to change and are able to cope comfortably in this environment.

Analyser Organisations: These organisations follow the trends of innovation but wait while others prove the market potential. They tend to be cautious, protecting their interests while analysing the environment through marketing and responding accordingly.

Reactor Organisations: These organisations reluctantly take the initiative, being more reactive in approach. They often respond inappropriately to competitors and the environment and have difficulty in responding to change.

This classification may oversimplify the actual situation and should be treated with caution. It is essential to analyse the ability of the parts of the organisation to cope with change (Lynch 2000: 325).

B. PHASES OF ORGANISATIONAL GROWTH

As the organisation's willingness and ability to change changes with its phase of growth, it is appropriate to examine the type of change that may be expected (Lynch 2000: 325). Lynch (2000: 325) used Greiner's two major determinants to clarify the process:

- Organisation's age: Younger organisations are more receptive to change and often actively seek it. Older organisations that have achieved success can be more reluctant to change as they have more to defend and co-ordinate.
- Organisation's size: Smaller businesses may be have simpler administration and be closer to the market place. Older organisations may be larger with more personnel and have developed systems and infrastructure to cope with its environment.

According to Lynch (2000: 326), Greiner (1972: 265) postulated five phases of growth of organisations. This model is useful in identifying the main issues that could be encountered and the types of strategic changes that could be needed. In this model he describes the types of growth and crises that may occur in the organisations. He identified four types of organisations that would experience particular pressures for change. These are:

- Small Businesses.
- Large organisations previously owned by government.
- Not-for-Profit Organisations.
- Medium-sized Businesses.

C. STRATEGIC PRESSURES DRIVING ORGANISATION CHANGE

According to Lynch (2000: 327) there are two main sources of pressure that may drive organisational change:

- Internal pressure: This is due to the requirement for change in the internal organisational environment, for example greater profitability, growth, quality or innovation.
- External pressure: The influences of the external environment force the organisation to respond, or to pre-empt these changes. The organisation could be

forced to compete against new or existing competitors. The strategic environment may have changed and the organisation may have to compete differently due to political, economic, social or technological influences.

D. ANALYSIS OF THE STRATEGIC ENVIRONMENT

The SANDF operates in an environment that tends to be turbulent and not static. The prediction of the future state of the environment with any degree of accuracy is therefore difficult. This prediction can be improved by identifying those key elements that could influence the organisation's strategy (Lynch 2000: 105).

It is important to study and assess the environment for the following reasons (Lynch 2000: 105):

- It is necessary to determine the nature of competition in order to achieve sustainable competitive advantage.
- Identify the opportunities and threats.
- Identify the opportunities for networks and linkages.

The outcomes of an environmental study are either proactive or reactive. Proactive outcomes include those positive opportunities and negative threats for which strategies and actions can be developed to exploit or cope with the situation. Reactive outcomes are those important strategic occurrences over which the organisation has no control, but must be able to react to when they occur (Lynch 2000: 105).

3.1.5 STRATEGIC MODELS

The three core areas of corporate strategy defined by Lynch (1996: 18) are as follows:

- Strategic Analysis: In this core area of activity, the organisation, its mission and its objectives are assessed and analysed. Senior management develops a vision based on the organisation's objectives. They also assess the relationship between the organisation's objectives and the environment. Senior management analyses the organisation's resources.
- Strategy Development: In this area of activity strategic options are developed and the most suitable one selected for implementation. Factors considered during the selection of options include the organisation's skill resources and its relationships with clients, suppliers, government and other bodies that have an influence on the organisation or are influenced by the organisation.
- Strategy Implementation: In this area of activity the strategic option is implemented. If the strategy is non-viable and cannot be implemented, it must be reconsidered and a new strategy developed.

The influence of values and judgement and the high level of speculation involved in major predictions are significant factors in all three of the core areas of corporate strategy. Strategic decisions involve context, content and process, which must be considered both separately and together (Lynch 1996: 20).

Lynch (1996: 23) states, until recently, corporate strategy was presented as a single cohesive subject. Recent differing views have, however, merged to form two main approaches to the development of corporate strategy. The prescriptive and the emergent approaches to the development of corporate strategy differ, as shown in Figure 18, in the way they link the three core areas.

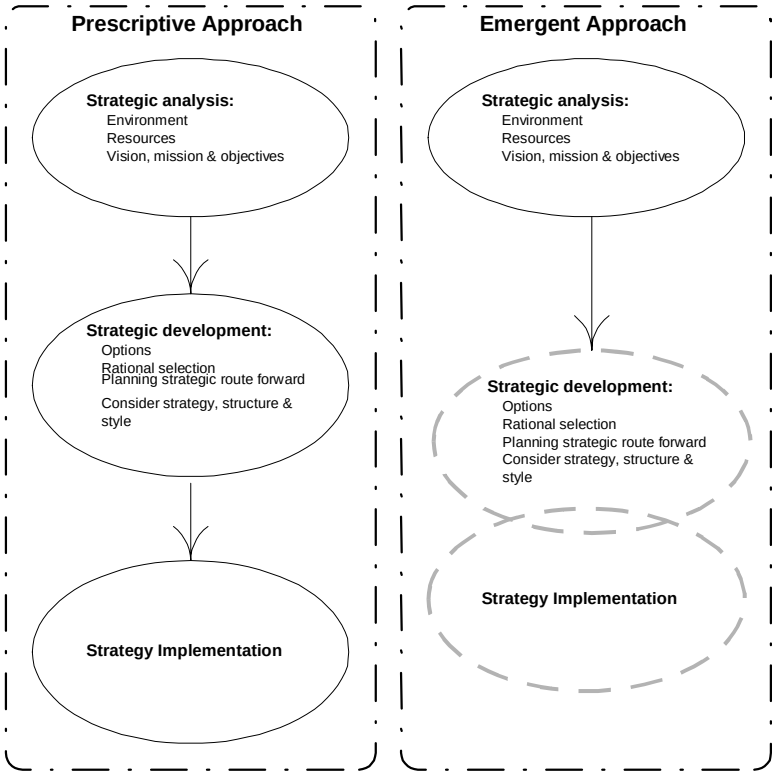

Figure 18: The Prescriptive and Emergent Approaches to the Three Core Elements of Strategy Development (Lynch 2000: 25)

The two models have been expanded further by Lynch (1996: 25) in Figure in which he illustrates the main activities in each of the three core areas of the prescriptive approach, and in Figure 20 in which he illustrates the emergent approach.

A. THE PRESCRIPTIVE APPROACH

According to Lynch (2000: 25), the prescriptive strategic processes take place in the following order as illustrated in Figure :

- Initially the organisation's environment and resources are analysed.
- This is followed by identification of the vision, mission and objectives.
- Next the strategic options available to the organisation are developed.
- Next the strategic options most suitable to the organisation in its efforts to achieve its goals are selected. This selection process is subject to the following two considerations:
    - Finding the strategic route forward.
    - Considering the structure and style suitable for the organisation.
- Finally, the strategic choice is implemented.

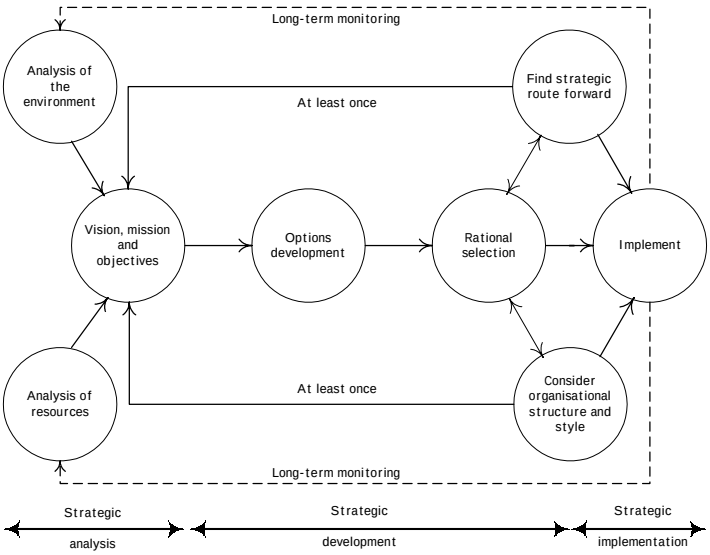

Figure 19: The Prescriptive Strategic Processes (Lynch 2000: 27).

Lynch (2000: 54) proposes that the prescriptive strategic process has the following advantages:

- The process presents a comprehensive overview of the organisation.

- It offers the possibility of comparing the defined objectives.
- It permits quantification of the resources required.
- The choices the organisation may have to make are more easily assessed when the resources are limited.
- The progress of the strategy is more easily measured.

Concerns about the use of the prescriptive strategic process include (Lynch 2000: 56):

- The fact that the whole process may be invalidated if an unforeseen occurrence takes place
- The fact that it is not easy to see long term benefits and that it is difficult to motivate people to sacrifice jobs or invest in an intangible benefit
- The fact that it is often difficult for the strategy to survive the organisation's politics.
- The fact that, although the chief executive officer may have the knowledge and authority to proceed and does not need to persuade anyone else to do so, he often does not proceed himself
- The fact that it is not always true that strategy is fully defined and requires no further development after analysis
- The fact that most situations are complex and that implementation of strategy is not easily separated from the rest of the process.

B. THE EMERGENT APPROACH

Lynch (2000: 25) describes the emerging strategic processes illustrated in Figure 20 as an experimental approach to the choice of strategy.

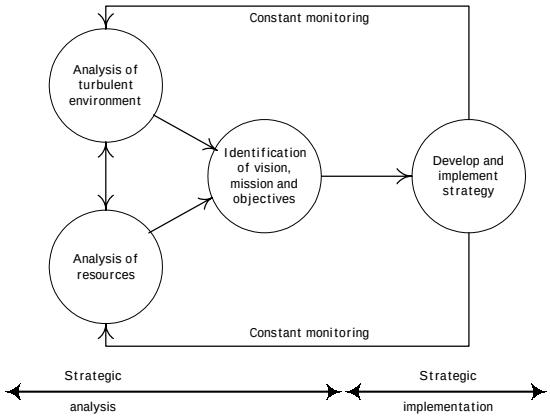

Figure 20: The Emergent Strategic Processes (Lynch 2000: 27)

This approach seems to be based on learning by trial and error as strategies are developed. There is no clear boundary between the strategy's development and its implementation. Furthermore, there is a strong feedback link from the implementation phase to the analytical phase.

Advantages of the emergent strategic process include (Lynch 2000: 63):

- the fact that many organisations use this approach, because it is practical
- the fact that the motivation of human resources is taken into account
- the fact that strategy is developed while the organisation learns about the strategic situation
- the fact that implementation becomes integral to the strategy development process and is redefined appropriately
- the fact that the organisation's culture and politics can become integral to the process
- the fact that the strategy process possesses the flexibility to respond in fast, chaotic markets.

Concerns about the use of the emergent strategic process include (Lynch 2000: 63):

- the fact that management may tend to muddle along instead of making visible progress towards realising the organisation's vision
- the fact that a strong strategic overview over the allocation of resources to the competing divisions within the organisation is required
- the fact that the thread of the strategic process may be lost if it is pursued over an extended period (Experimentation may be acceptable during the initial period, but strategy should be fixed for longer periods.)
- the fact that, during certain periods, evidence and logic may not drive the process
- the fact that managing this process is more complex, as the basis for actions is not planned in advance.

Wolf *et al* (1998: 13) proposed the following basic elements for a good strategy-developing programme:

Vision - a picture of the future: A vision must be crystallised based on what the organisation and market are expected to look like in several years time. Consideration must also be given to what the organisation may need to do to meet its people's needs.

- Leading by example: The tone for the new strategies must be set by leadership in thought, word and deed. Demonstrations of management's willingness to change old beliefs and ways of achieving goals must be constantly repeated.
- Communication: People are inclined to avoid discussion when faced with changes that could appear to be a threat. Effective and honest communication must be used to ensure that the necessary channels are kept open.
- Selflessness: The old paradigm of a company career is no longer valid. To keep their jobs secure, employees must spread selflessness by considering the organisation's well-being and relinquishing the 'every man for himself' tendency.
- Empowerment: People need more than to be delegated power - they need to be able to let others excel. An organisational culture encouraging teamwork with the common goal of superior service produces rewards for the organisation.

C. THE QUALITY OF THE STRATEGY

Lynch (2000: 28) describes the following tests for determining the quality of strategy:

- Value-adding: A good strategy will increase the value delivered or derived. This value may be in the form of profit or in the form of longer-term benefits such as innovative capabilities, employee satisfaction or market share.
- Consistency: A good strategy will be sufficiently robust to withstand the influences of both the internal organisational environment and the external environment. This relates to both the organisation's resources and external circumstances.
- Competitive Advantage: A good strategy will increase the organisation's sustainable competitive advantage.

3.1.6 LINKING CORPORATE AND OPERATIONAL STRATEGY

The success of industrial nations is generally ascribed to their management of production (Hill 1991: 16).

According to Hill (1991: 21) executives must recognise in the formulation of strategy that their business areas each have individual characteristics. It is necessary to perceive the organisation's markets in terms of segments, clients and generic Products. The production and /operations functions should be split accordingly. Errors of judgement in this area are very costly. Decisions based on sound judgement require that two issues be addressed, namely:

- Finding ways of extracting relevant information from production and operations to contribute to the strategy debate.
- The degree to which employees at operational level are aware of the various approaches as this will determine whether appropriate consideration is given to suitable alternatives.

Companies that developed marketing orientations earlier in their existences enjoy a higher survival and success rate than those that do not (Solomon 1992: 2).

Markets often change in a gradual, incremental manner, this resulting in an increasingly greater mismatch between the demands made on the operation and manufacturing functions and their ability to respond. Matching operation and manufacturing with marketing is therefore essential (Hill 1991: 22).

Hill (1991: 24) cites examples of businesses that to their own detriment failed to incorporate production and operations perspectives in their strategies and failed to differentiate their production and operations tasks. He proposes that these functions be distinguished as follows:

- The organisation must realise that it sells Products and services and not the markets or market segments.
- The organisation must find ways of wining orders in the various markets both now and in the future.

Hill (1991: 25) recommends the following analytical and objective steps for developing a link between marketing and production and operations:

- Definition of corporate objectives. The input made to the corporate strategy must be linked to the objectives of the business. This presents a clear strategic direction for the business and an intent to achieve corporate success. It also defines the boundaries and performance criteria for the organisation (Hill 1991: 27).
- Developing marketing strategies. The following marketing strategies must be developed to achieve these objectives (Hill 1991: 27):
    - Those Products that share closely related markets and marketing programmes must be “clustered” within common market planning and control units.
    - The situation in the Product and service markets must be assessed in terms of current and future volumes, end-user characteristics, industry

practices and trends, the major competitors and the relative position of the business.

- Winning orders. An assessment must be made of how the various Products and services can win orders over competitors. Typically, the ability of the organisation's Products and services to win orders is based on price, quality, delivery, technical support and reliability. This may change over time (Hill 1991: 28).
- Making available a process choice. The most suitable method of manufacturing these Product classes or of providing a process choice must be established. Each market has its own characteristics in terms of quantity and quality and forces the organisation to make trade-offs. This influences the choice of process.
- Creating an Infrastructure The necessary infrastructure for supporting the production or operating process must be created. The organisation's infrastructure is that part of production or operations that excludes processing.

The tendency is to treat the first three steps as interactive, with feedback loops, and the last two as linear and deterministic this leading to the above-mentioned mismatches between production and operations and marketing. The inherent complexity of production and operations and failure to take into consideration the mutual dependency between production and operations and marketing can be devastating. An approach that takes these factors into consideration is shown in Table (Hill 1991: 25).

It is clearly understood by all that there is a need for marketing to be differentiated. The production or operations function is perceived as a matter to be avoided for convenience while not to require differentiation is seen as a strategic asset. The reality of the matter is that not being able to accommodate all the demands of marketing effectively or efficiently and failure to take cognisance of production and operations in strategy could cost the organisation dearly (Hill 1991: 31).

An important distinction made by Hill (1991: 29) is the difference between being market led, and being marketing led. Substitution of the business or market perspective with the functional marketing perspective will invariably lead to the distortion of strategies and to corporate disadvantage.

Corporate Objectives	Marketing Strategy	How do Products Win Orders in the Marketplace?	Production/Operations Strategy	
			Process Choice	Infrastructure
• Growth • Survival • Profits • Return on investment • Other financial measures	• Product/service markets and segments • Range • Mix • Volumes • Standardisation • Customisation • Level of innovation • Leader or follower alternatives	• Price • Quality • Delivery • Speed • Reliability • Demand changes • Colour range • Product/service range • Design leadership • Technical support supplied	• Choice of various processes • Trade-offs embodied in the process choice • Process positioning • Capacity • Size • Timing • Location • Demand changes • Role of inventory in the process confirmation.	• Function supports operations' planning and control systems • Quality assurance and control • Systems Engineering • Clerical procedures • Payment systems • Work structuring • Organisational structure

Table 7: Framework for Reflecting Production/Operations Strategy issues in Corporate Decisions (Hill 1991: 26).

3.1.7 STRATEGY IN NOT-FOR-PROFIT ORGANISATIONS

The two main categories of organisations that operate without a profit goal are governmental organisations and non-governmental organisations (NGOs). Governmental organisations include national, provincial and local government organisations. NGOs include religious denominations, charities, pressure groups and professional societies. Government is the most dominant institution in society being able to legislate and administer a country into ruin or success (Steiner *et al* 1986: 285).

In government, decisions are essentially forged on the political anvil in contrast with businesses which are more concerned with economics when attempting to satisfy their customers and to survive and grow (Steiner *et al* 1986: 289).

Private organisations are not legally bound to respond to the demands of interest groups, although they may do so. They are primarily concerned with the opinion of their market segment. Public institutions listen to demands and the weight they have on the public scale determines public policy. They are concerned with the opinion of their constituency (Steiner *et al* 1986: 288).

In the governmental sector the formulation of policy is often tentative and incremental because the democratic process is a learning process and the state of knowledge is inadequate (Steiner *et al* 1986: 289).

Compared with the private sector, which tends to make decisions based on quantifiable issues, the government sector relies more on judgmental, non-quantifiable factors (Steiner *et al* 1986: 291). Even though the test of a "good" policy is conceptually the public interest, analysts often differ in opinion on the "goodness" of the policy in question (Steiner *et al* 1986: 294).

As decisions in government are often left to committees, there is a danger in the potential of "groupthink" in government. This has been linked to a number of major government policy fiascos in the United States (Steiner *et al* 1986: 290).

A highly experienced and successful businessman, commented on his experience when asked to join President Eisenhower's cabinet to restore order in certain government processes. He found the complexity of the many organisations in the government service to be overwhelming, since there was little co-ordination or integration even when work was being carried out on different facets of the same activity. Executive management operated under divided authority, members had to verify that their course of action did not conflict with the activities of others, laws, directives or policy. This would lead to numerous meetings with their associated delays (Steiner *et al* 1986: 291).

The implementation of policy in the government sector is very difficult as there are many, often conflicting and hard-to-measure goals to achieve. The interpretation of strategy can be problematic as this is done by various people who all have an influence on the process (Steiner *et al* 1986: 294).

As regards rewards for good employee performance, it is difficult for a centrally administered control system such as those encountered in governmental administrations, to function effectively if salary and promotions are tied rigidly to seniority (Steiner *et al* 1986: 294)

The three basic incentive mechanisms that can be applied to address the deeper problems to improve capability shown in Figure 21, are (International Bank for Reconstruction and Development 1997: 7):

- Effective rules and restraints to guide the state institutions.
- Increased competitive pressure to provide a benchmark for efficacy.
- Greater civil voice and partnership.

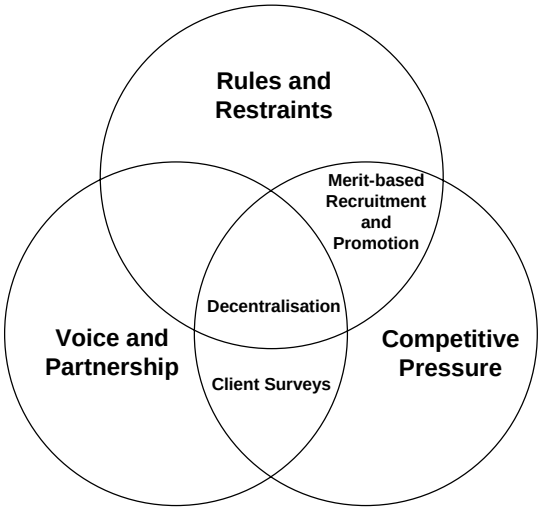

Figure 21: Mechanisms to Enhance State Capability (International Bank for Reconstruction and Development 1997: 7).

Further key mechanisms to ensure a capable state function include (International Bank for Reconstruction and Development 1997: 7):

- Merit-based recruitment and promotion to ensure the most suitable personnel are appointed.
- Decentralisation of functions.
- Client surveys to measure the degree of satisfaction and to take appropriate actions to strive towards the desired level of service.

Competent personnel are essential to achieve the desired level of service. Civil servants can be motivated to perform when they are adequately compensated, and enjoy merit-based recruitment and promotion. Evidence shows that bureaucracies employing competitive merit-based appointment and promotion are more capable (International Bank for Reconstruction and Development 1997: 9).

3.1.8 CORE COMPETENCE

The competitiveness problem facing companies today has more to do with "non-traditional" competition. The players in this arena are the laggards versus the challengers, incumbents versus innovators and the inertial and imitative versus the imaginative. The challengers typically develop more efficient solutions to satisfy clients' requirements. New solutions emerge because the challengers are substantially more imaginative, not because they are more efficient. The challengers discover innovative new solutions because they look far beyond the old (Hamel *et al* 1994: 17).

Some organisations seem to have over-the-horizon radar when it comes to predicting the future of their particular industry. According to Hamel *et al* (1994: 22) this ability requires:

- an understanding of how competition in the future will be different
- a process for finding and developing insight into future opportunities
- an ability to energise the organisation from top to bottom for what may be a hazardous journey toward the future
- the capacity to outrun competitors, and, while avoiding risks, to reach that desired future first

Many exciting new opportunities are not the result of innovation around a stand-alone Product, but rather the integration of complex systems across business unit lines (Hamel *et al* 1994: 33).

Prahalad *et al* (1989: 91) believe that the application of concepts such as strategic fit, generic strategies and strategy hierarchy have abetted the processes of competitive decline.

An organisation's capacity to improve existing skills and learn new ones is the most defensible competitive advantage of all (Prahalad *et al* 1989: 91).

In the long run, competitiveness is derived from the ability to build at lower cost and at a faster than one's competitors those core competencies that spawn unanticipated Products (Prahalad *et al* 1990: 81).

A. THE DEFINITION OF CORE COMPETENCE

Core competence is the communication and involvement required for, and deep commitment to, working across organisational boundaries (Prahalad *et al* 1990: 82).

The collective learning enabling the co-ordination of diverse production skills and the integration of multiple technology streams, is the core competency of the organisation (Prahalad *et al* 1990: 82).

Prahalad et al (1990: 83) postulated the following test for verifying the core competence of an organisation:

- It must provide potential access to a wide variety of markets.
- It must make a significant contribution to the perceived benefits derived by the customer from the Product.
- It must be difficult for competitors to imitate the Product.

According to Javidan (1998: 61), Prahalad and Hamel seem to consider the concepts of competence, core competence and capability as synonymous. He believes that their definition is too narrow, focusing only on a limited sector of the organisation's value chain and that it has generated some confusion between competencies and capabilities.

Javidan (1998: 62) divided the company's core competencies, competencies, capabilities and resources in terms of their difficulty and value into the hierarchy shown in Figure 22.

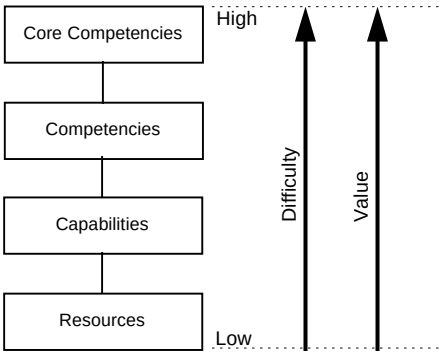

Figure 22: The Competencies Hierarchy (Javidan 1998: 62).

The hierarchy is described in more detail below (Javidan 1998: 62):

- Resources: These are the source of inputs to the organisation's value chain. Javidan postulates resources to include the following:
  - Physical assets such as plant, equipment and location.
  - Human resources such as manpower, management, experience and training.
  - Organisational resources such as culture and reputation.

- Capabilities refer to the organisation's functionally-based ability to exploit its resources by means of its business processes and routines and to guide the interaction that takes place between the resources (Javidan 1998: 62).
- Competency: A competency is the cross-functional integration and co-ordination of capabilities (Javidan 1998: 62).
- Core competencies: Core competencies cross boundaries when competencies interact and are shared by the strategic business units. Core competencies are in other words, the shared, harmonised competencies within the organisation (Javidan 1998: 62).

The higher the levels reached in the hierarchy, the broader the organisational scope becomes and the more difficult these levels become to accomplish, this increasing their value (Javidan 1998: 63).

B. THE PRINCIPLES AND BENEFITS OF CORE COMPETENCE IN STRATEGY

Intellectual capital depreciates steadily. Investment in creating new intellectual capital is essential to guard against this danger (Hamel *et al* 1994: 55). It is only by humbly considering the merits of other management frames that one can one enlarge and enrich one's own (Hamel *et al* 1994: 59). Industry foresight is forged on a deep understanding of lifestyles, technology, demographics and geopolitics. It also depends on imagination as much as it does on prediction (Hamel *et al* 1994: 82). To be able to compete for the future, an organisation must be able to expand its opportunity horizon by viewing itself as a portfolio of core competencies rather than a portfolio of business areas (Hamel *et al* 1994: 83).

Organisations run great risks if they don't have a vision of needs as yet unarticulated by the clients. Irrespective of how content the organisation's current clients are, it could find its growth stymied if it cannot appeal to new client groups (Hamel *et al* 1994: 101).

A graphic model of the relationship between client needs and types is presented in Figure 23.

Clients tend to seek the existing proposition because it is offered faster and at a lower price. They generally fail to conceive of creative solutions. Creative solutions that enhance value must be designed by the supplier and proposed to the user (Young 1997: 12).

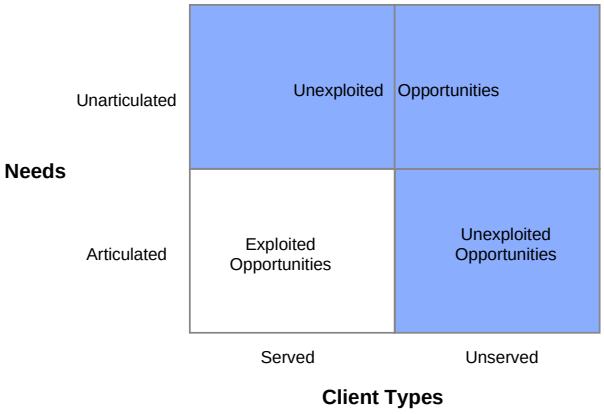

Figure 23: Relationship Between Client Types and Needs (Hamel *et al* 1994: 102).

To embed the perspective of core competence in an organisation, the entire management team must fully understand and participate in the five key competence management tasks (Hamel *et al* 1994: 224) namely:

- Identifying existing core competencies. A substantial effort is required to distinguish between competencies and the Products and services in which they are embedded. The shared core competencies must therefore be untangled from non-core activities. The task of developing this shared understanding is significant (Hamel *et al* 1994: 224).
- Establishing a core competence acquisition agenda. An organisation's competence-building agenda is generally determined by its strategic architecture. A competence-Product matrix is an excellent tool for developing competence acquisition and deployment goals. An example of such a matrix is presented in Figure 24 (Hamel *et al* 1994: 226).

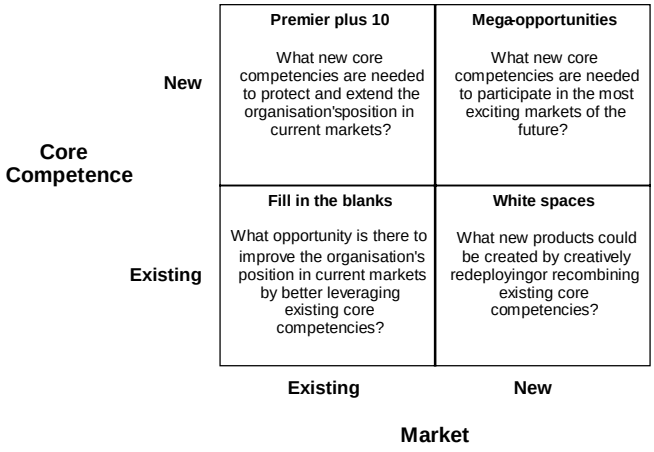

Figure 24: Matrix for the Development of a Core Competence Agenda (Hamel *et al* 1994: 227)

- Building core competencies. Core competencies take many years to develop. Consistency of effort throughout this period is essential but success, depends on a deep consensus about which competencies to build and support and the stability of management teams charged with the task of competence development (Hamel *et al* 1994: 231).
- Deploying core competencies. Capital is normally judiciously allocated within an organisation. In the same way, competencies should be allocated to leverage the organisation's total assets. The difference between asset value and book value is competence. Competence is embodied in people. Competence carriers should be shared between business units and not be jealously held by one when a demand exists throughout the organisation (Hamel *et al* 1994: 232). The benefits of competencies like those of money supply depend on the velocity of circulation as well as the size of the stockholding (Prahalad *et al* 1990: 87).
- Protecting and defending the organisation's core competencies. Leadership in core competence may be lost as a result of a lack of funding, fragmentation through decentralisation, loss of management's sponsorship, inadvertent surrender to alliance partners or divestment. Protecting the organisation's core competencies requires continuous vigilance by top management. Top management should develop the perspective of the organisation's personnel as follows (Hamel *et al* 1994: 235):
  - A deeply involving process for identifying core competencies should be established.
  - Strategic business units should be involved in a cross-corporate process for developing a strategic architecture and determining competence acquisition goals.
  - Clear corporate new business growth and business development priorities should be defined.
  - Establish explicit "stewardship" roles should be established for core competencies.
  - A structure for the allocation of critical core competence resources should be established .
  - Competence-building efforts against should be benchmarked against those of competitors.

- The status of existing and nascent core competencies should be regularly reviewed.
- A community of people who view themselves as “carriers” of the corporate core competencies within the organisation should be built.

Prahalad *et al* (1990: 88) illustrated the value of a strategic architecture in their case study of Vickers. The strategic architecture of that organisation represents a broad map of evolving linkages between client requirements, potential technologies and core competencies. This architecture assumes that the development of new Products cannot be predicted with certainty, but that to pre-empt competitors in the development of new markets requires an early start to core competencies.

Strategic architecture is a tool for communicating with clients and other role-players, this revealing the broad direction without exposing each step (Prahalad *et al* 1990: 89).

An organisation will only be fit to fight, if it is conceived of as a hierarchy of core competencies, core Products and market-focused business units (Prahalad *et al* 1990: 91).

Management’s ability to consolidate corporation-wide technologies and production skills into skills empowering individual businesses to rapidly adapt to changing opportunities, is the real source of competitive advantage (Prahalad *et al* 1990: 81).

Top management must add value by means of the strategic architecture that guides the competence-building process (Prahalad *et al* 1990: 91).

Incremental planning in a volatile world is unlikely to add value to an organisation. Because the very foundations of the organisation are being shaken, assumptions about the industry and the broader environment, are not dependable. Strategic planning works well when the foundations for planning are stable. Strategic planning does not build new foundations on which to extend leadership (Hamel *et al* 1994: 282). The models for strategic the planning and crafting of strategic architecture are compared in Table 8.

	Strategic Planning	Crafting Strategic Architecture
Planning goal	• Incremental improvement in market share and position	• Rewriting industry rules and creating new competitive space.
Planning process	• Formulaic and ritualistic. • Existing industry and market structure as baseline. • Industry structure analysis (Segmentation, value chain, cost structure, competitor, benchmarking, etc.). • Test for fit between resources and plans. • Capital budgeting and allocation of resources among competing projects. • Using individual businesses as the unit of analysis.	• Exploratory and open-ended. • An understanding of discontinuities and competencies as the baseline. • A search for new functionalities or new ways to deliver traditional functionalities. • Enlarging opportunity horizons. • Tests for significance and timeliness of new opportunities. • Development of plans for competence acquisition and migration. • Development of opportunity approach plans. • The corporation as the unit of analysis.
Planning resources	• Business unit executives. • Few experts. • Staff driven.	• Many managers • The collective wisdom of the company. • Line and staff driven.

Table 8: Comparison of the Strategic Planning and Crafting Strategic Architecture Models (Hamel *et al* 1994: 283).

Hamel *et al* (1994: 47) proposed a model consisting of three phases for competition for the future. The model is shown in Figure 25.

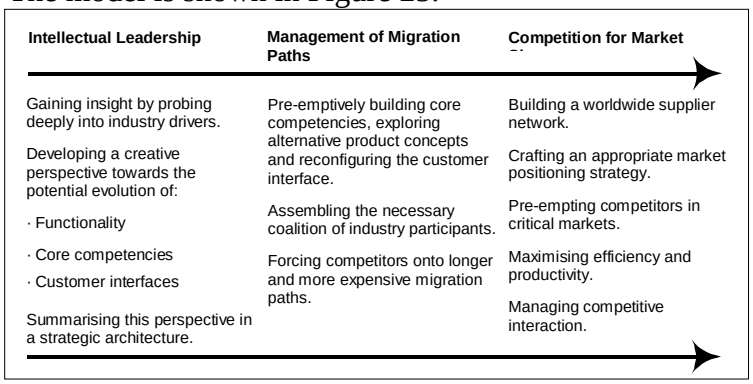

Figure 25: Three Phases of Competition for the Future (Hamel *et al* 1994: 47).

Successful firms that collaborated internally were found to have a culture in which managers and partners viewed partnering not as a threat or risk but as an opportunity. They perceived benefits in their participation in the outcomes of the decisions of other individuals or groups (Javidan 1998: 70). Basing their arguments on the principle of

ore competencies in organisations, Hamel *et al* (1994: 24) proposed the new strategy paradigm shown in table 9.

Not only	**But also**
The Competitive Challenge	
Re-engineering processes	Regenerating strategies
Organisational transformation	Industry transformation
Competing for market share	Competing for opportunity share
Finding the Future	
Strategy as learning	Strategy as forgetting
Strategy as positioning	Strategy as foresight
Strategic plans	Strategic architecture
Mobilising the Future	
Strategy as fit	Strategy as stretch
Strategy as resource allocation	Strategy as resource accumulation and leverage
Getting to the Future First	
Competing within an existing industry structure	Competing to shape future industry structure
Competing for Product leadership	Competing for core competence leadership
Competing as a single entity	Competing as a coalition
Maximising the ratio of new Product “hits”	Maximising the rate of new market learning
Minimising time-to-market	Minimising time toachieve global pre-emption

Table 9: The New Strategy Paradigm (Hamel *et al* (1994: 24).

According to Hamel *et al* (1994: 222), an organisation that is unable to conceive of itself in terms of core competencies, exposes itself to the following dangers:

- It risks reduction of its opportunities for growth.
- If someone within the organisation does identify an opportunity, it will encounter difficulties deploying the core competencies across business unit boundaries. This is because unit managers are possessive of their personnel and are reluctant to relinquish control of them.
- Competencies are further fragmented among the business units as the organisation breaks into more discrete business elements. Leveraging these competencies is then even more difficult.
- The lack of a core competence perspective can desensitise an organisation to its growing dependence on outsourcing of its core competencies.
- Organisations focused only on end Products could neglect to invest adequately in core competencies that would drive future growth.
- New entrants who rely on core competencies developed in other markets could surprise organisations that do not understand the competitive basis of their own core competency.
- Organisations insensitive to the issue of core competencies may unwittingly discard some of these valuable skills when divesting under-performing parts of their businesses.

C. IMPLEMENTING CORE COMPETENCE IN AN ORGANISATION'S STRATEGY

- Javidan (1998: 64) proposes the following eight steps for organisations attempting to incorporate the core competence principle in their strategies:
- At ...(name of organisation).. we know how to .....very well. Identify those areas in which the organisation performs well. These areas of know-how can be listed in the first column of Table 11.
- Is this know-how present in one function, one business unit or across the organisation? Each of the organisation's areas of know-how is classified as a capability, competency, or a core competency. The results of these decisions are listed in the three right-hand columns of Table 11. The number of groups sharing the know-how are listed in the appropriate column of Table 11.
- Is the organisation any better than its competitors? Management compares the organisation's performance in the know-how areas, with those of its competitors. They thus link the core competencies to competitive advantage and reduce any tendency towards introspection by consideration of the external environment.

		The know-how is a:		
We know how to:	**No of groups:**	**Capability**	**Competency**	**Core competency**
Know-how 1				
Know-how 2				
Know-how 3				

Table 11: Table for identifying the Core Competencies of an Organisation (Javidan 1998: 65).

- Is it significant? Successful competitive advantage is built on an organisation's core competencies. Management needs to link the organisation's capabilities and competencies to those Product/delivery attributes that are considered to be key buying criteria by the different markets. This ensures that management analyse the value of the organisation's abilities to the market. The finding of the significance of the know-how is entered in the appropriate column in Table 12 (Javidan 1998: 66).

	Relative to competitors?			Significant?		Durable?	
Know-how:	**Better**	**Equal**	**Worse**	**Yes**	**No**	**Yes**	**No**
Know-how 1							
Know-how 2							
Know-how 3							

Table 12: Relating Core Competencies to Competitive Advantage (Javidan 1998: 66).

- How durable is the advantage? The durability of the organisation's competitive advantage, which is determined by the following parameters is noted in the appropriate column in Table 12 (Javidan 1998: 67):
- The organisation's ability and willingness to continuously invest in related competencies and capabilities to remain a leader in the field.
- The competitor's ability to emulate the organisation's competitive advantage. The more difficult the organisation makes this, the more durable the advantage is. Potential deterrents of imitation include the uniqueness of resources, path dependency, causal ambiguity and economic deterrence.
- The competitor's ability to develop advantages as substitutes for those of the organisation. If imitation is not attainable for a competitor, it may attack the market with a substitute Product.

- The degree to which the Product and delivery attributes remains the key criteria for the market.
- What key changes are taking place in the industry? The market is volatile and the organisation could find that the industry changes the nature of the market.
- Given the key changes occurring in the industry:
  - Which competencies or capabilities will become obsolete?
  - Which competencies or capabilities should be retained or grown further?
  - How can the competencies or capabilities be used to further advantage?
  - Which new competencies or capabilities should be developed?
- Where are we to go from here?
  - Dismantle or adjust those competencies or capabilities expected to depreciate.
  - Sustain or upgrade the identified resources, competencies and capabilities.
  - Increase the leverage from the identified resources, competencies and capabilities.
  - Acquire or develop the identified resources, competencies and capabilities.

3.1.9 STRATEGY AND STRUCTURE

The prescriptive approach has been that structure follows strategy. Emergent strategists believe that the relationship is more complex as the organisation itself may hinder or enhance the proposed strategy (Lynch 2000: 717).

The following are the main criticisms of the strategy-first, structure-later process (Lynch 2000: 727):

- The structures may be too rigid, hierarchical and bureaucratic to cope with newer social values and rapidly changing environments.
- The type of structure the organisation has, is just as important as the business area in the development of the organisation's strategy. The structure will restrict, guide and form the strategy options that the organisation can generate. Strategy and structure are interrelated and need to be developed concurrently.
- The type of organisational structure may be dictated by the value chain configurations for cost reduction or new market opportunities.
- The complexity of strategic change needs to be managed, requiring more complex organisational considerations.
- Strategy is no longer solely the domain of top management. The organisation's culture and structure may be important to middle management in the development of new innovative strategies.

Lynch (2000: 734) presented the principle that there are six ways to link and co-ordinate the six parts of every organisation. The six parts of the organisation include:

- The Operating Core: This is the part of the organisation where it generates the Products or services.
- The Strategic Apex: This is the source of the strategic direction of the organisation.
- The Middle Line: This part of the organisation contains those managers between the apex and the operating core.
- The Technostructure: This part of the organisation contains personnel such as engineers, accountants, IT specialists, that design the processes that monitor and control the operating processes.
- The Support Staff: This part of the organisation provides support services such as transport and administration to the organisation.
- The Ideology: This intangible part of the organisation holds the culture and beliefs of the organisation.

The six co-ordinating methods to link the parts of the organisation together, include (Lynch 2000: 735):

- Mutual Adjustment: This type of informal communication, typical of smaller organisations, involves direct discussion and is useful in exploring difficult issues in complex situations.
- Direct Supervision: This supervision may be executed from the strategic apex to the operating core.
- Standardisation of Work Processes: This defines the way in which work is to be executed within the organisation.
- Standardisation of Output: This aims to ensure that the organisation's Product output is predictable.
- Standardisation of Skills: Skills, which in this case includes knowledge, can be more effectively managed if they are standardised and shared.
- Standardisation of Norms: This ensures the sharing of values and beliefs within the organisation.

3.1.10 THE DEVELOPMENT OF A STRATEGIC ROUTE

Lynch (2000: 671) presents the following four approaches to strategy:

- Survival-Based: This emergent approach emphasises survival and the seeking out of strategic opportunities in a highly competitive environment.
- Chaos-Based: Viewing the environment as uncertain, this emergent approach regards the strategic processes as opportunistic and transformational.
- Negotiation-Based: This route considers the following approaches:
  - The human resource aspect of strategic decision making.
  - The networks between the organisation and its external environment.
  - A competitive game involving negotiation between the organisation and the main role-players in the environment.
- Learning-Based: This approach emphasises context and the process derived from the organisation's knowledge and experience

A. SURVIVAL-BASED STRATEGY

This strategy is based on natural selection and the survival of the fittest. The mechanisms for survival are adaptation to the environment and selection for survival. Objectives are short-term and conservative. Analysis to assess whether survival is in fact achieved is very complex and predicting whether survival will b possible is very difficult. The choice is left to the market as long as the organisation leaves its choices open (Lynch 2000: 676).

B. UNCERTAINTY-BASED STRATEGY

According to this strategic approach, organisations survive by innovating and transforming themselves. According to chaos theory, a small change may later lead to a large consequential result. Actions should be based on the shorter term because of the difficulty of predicting the outcomes of actions and the future of the environment (Lynch 2000: 679).

C. NEGOTIATION-BASED STRATEGIC APPROACHES

Organisations developing their strategies when taking over outside organisations have to conduct considerable negotiation and persuasion within and outside the organisation to derive the full added value and to develop the sustainable competitive advantage of the enlarged entity. This approach has three conceptual areas: human resource, network-based and game theory strategies (Lynch 2000: 686).

I Human Resource-Based Strategy

Coalitions and groups in organisations are an important consideration in developing strategy. When the structure of the organisation changes, negotiation between the groups is essential to arrive at a compromise on important strategic issues. This is because it is difficult for senior management to define the combined strategy without any form of negotiation (Lynch 2000: 687).

II Network-Based Strategy

Network-based strategy is that set of relationships developed both inside and outside the organisation to add value. The two principles in the adding of value are the benefits of owning resources rather than outsourcing them and the value chain and its linkages (Lynch 2000: 688).
Table 13 presents a prescriptive approach to network-based strategy.

Internal Networks	External Networks
Economies of scale and scope	Cost-effective logistics
The development of superior, sometimes, unique knowledge and technologies	Superior purchasing from suppliers
Investment in client service, marketing and reputation	Skilled sourcing of new technical developments, licensing of new technologies and other technical advances
Skills, knowledge and expertise in financial matters.	Strong, stable relationships with government and other organisations with influence.

Table 13: Ways in which Networks can add Value to Organisations (Lynch 2000: 688).

III Game Theory-Based Strategy

Game theory uses mathematical models to deal with the structured approach of business decisions and is concerned with the strategy and not its implementation. It therefore clarifies the nature of the negotiation and can predict the optimal outcomes of some games. It is often difficult to model complex problems that are interdependent and interrelated (Lynch 2000: 690).

D. LEARNING-BASED STRATEGY

Including into strategy, mechanisms to transfer learning from the individual to the group, enhances survival in a turbulent business environment. Learning in this context means considerably more than memorising or coping with change but active creativity to generate new ideas and opportunities. Senge's (1990: 6-10) five learning disciplines are a useful model for use in a learning-based strategy (Lynch 2000: 696).
The learning process has the following advantages to the group and the organisation (Lynch 2000: 696):

- Through commitment to knowledge, learning presents new insights and ideas to the organisation.
- Organisations will tend to adapt through renewal and therefore not stifle.
- It will stimulate a greater openness to the external environment and the organisation will be more capable of appropriately responding to events.

3.2 STRATEGIC MANAGEMENT OF TECHNOLOGY AND INNOVATION

3.2.1 TECHNOLOGY

Technology influences many aspects of organisations. Changes due to technology influence the way organisations operate and therefore should also impact on strategy. Barker (2000: 49) demonstrated this principle by means of a comparison of the number of aircraft and bombs required to attack a target of 60 x 100 foot with 2000 pound bombs from a medium altitude of 1500 foot, in conflicts from the highly risky efforts of pilots in the Second World War to the recent operations using stand-off weapons in Yugoslavia during 1999 and is shown in Table 14. Stand-off or "smart" weapons allow the commander of the bomber to deliver the weapon at a distance without exposing the aircraft to air defence over the target.

Conflict	Bombs Required	Aircraft Required	Accuracy [ft]
WW2	9 070	3 024	3 300
Korean War	1 100	550	100
Vietnam War	176	44	400
Gulf War	30	8	200
Yugoslavia	1	1	6

Table 14: The Changes in Bombing Sorties due to Technological Advances (Barker 2000: 49).

A. DEFINITION OF TECHNOLOGY

Van Wyk (1988: 341) presented the following definition of technology:

> *Technology is created capability: it is manifested in the purpose of which is to augment human skill (Rapp 1981: 33-36).*

Van Wyk (1988: 342) described the following key concepts in the definition of technology:

- Created: It is the Product of deliberate action. Technology has to be cultivated and nurtured if it is to be harnessed as a resource.
- Capability: In this context it is the ability to manipulate aspects of the physical world.
- Artefacts: These are the repositories of capability and refer to devices, tools, instruments or machines.

- Augment: In this context augment is intended to refer to both the enhancement of human capability by means of adding artefacts to support human activities and the replacement of human ability by substitution with artefacts.

B. FRAMEWORK FOR ANALYSIS AND CLASSIFICATION OF ARTEFACTS

Van Wyk (1988: 343) proposed the following framework for the analysis and classification of artefacts:

- Function: This can be defined by the type or nature of the output as matter, energy, or information. The output is the result of the function, which can be categorised as processing from one form into another, transporting across a distance and storage of the input for later retrieval.
- Performance: This can refer to a variety of parameters including speed, power, and the number of instructions per second and so on. This allows a quantitative measurement and classification of the artefact.
- Principles employed: This refers to the principles employed in the use of the artefact. In the case of telephone switchboards, one may use electromechanical and another electronic principles.
- Material composition: The material used may be directly associated with the principle with which the artefact operates or it may be incidental only providing structure. The former is more difficult to substitute while the latter lend itself more easily to improvement by substitution.
- Size: This refers to the physical dimensions of the artefact.

C. TECHNOLOGICAL TRENDS

Van Wyk (1988: 345) proposed a set of standard technological trends listed in Table 15.

Feature	Trend
Function	Normally static
Performance	Increases in one or more of efficiency, capacity, compactness and accuracy.
Principles	Difficult to chart
Material	From natural to synthetic
Size	Extending range of size
Structure	Increasing complexity

Table 15: Technology Trends (van Wyk 1988: 346)

By the use of Table 15, managers can improve their ability to predict suitable configurations of their Products and develop suitable plans to exploit their technologies (van Wyk 1988: 346).

D. TECHNOLOGICAL LIMITS

Van Wyk (1988: 347) combined the functional categories with the technological trends in the format shown in Table 1 to relate each of the trends with the category of the artefact.

		Type of Limit					
Ouput Type	**Transformation Type**	**Efficiency**	**Capacity**	**Compactness**	**Accuracy**	**Size**	**Complexity**
Matter	Processing						
	Transport						
	Storage						
Energy	Processing						
	Transport						
	Storage						
Information	Processing						
	Transport						
	Storage						

Table 16: Technological Limits Chart (van Wyk 1985: 214).

According to Van Wyk (1988: 347), knowing and understanding the limits of technology, aids the manager in these ways:

- A large difference between the present technological characteristics and those ultimately achievable indicates the size of the opportunity that can be exploited.
- A forecaster of technology can gain insight into the steepness of the trend graph if the extent of the technological limit is evident.
- The direction and extent of the research and development effort can be determined with the knowledge when the areas of performance are more accurately defined.

E. SOCIO-TECHNICAL PREFERENCE PROFILE

Van Wyk (1988: 347) referred to the four categories of interaction between technology and society recognised by De Vulpain (1984: 32):

- Allergy: This is the rejection of a particular technology by society. An example is anti-personnel mines, which have been banned internationally.
- Deviation: Society partially rejects the particular technology. Some countries support nuclear weapons whereas others not.

- Enforced Penetration: A powerful force imposes a technology on society. France has endorsed the use of nuclear weapons in spite of the nation's rejection.
- Synergy: Society enthusiastically accepts the technology. The ubiquitous cellular telephone is an example of a synergistic acceptance.

3.2.2 INNOVATION

Two basic tasks required of general managers according to Burgelman *et al* (1996: 1) are:

- The acquisition, development and allocation of the organisation's resources. Technology is a key resource for many organisations.
- The development of the organisation's capacity for innovation. Assess the organisation's innovative capabilities and investigate methods for leveraging them.

A. DEFINITION OF INNOVATION

Burgelman *et al* (1996: 1) hold the following definitions in the innovation field:

- Basic research generates new knowledge about physical, biological and social phenomena.
- Applied research is concerned with solving technical problems. The success or failure in applied research is determined by technical rather than commercial criteria. Typically there is a significant period of time between the achievement of successes in applied research and the successful exploitation of the subject researched.
- Technology is the theoretical and practical skills, knowledge and artefacts suitable for development of Products, services and their production and delivery systems. Technology can be embodied in people, materials, processes, plant equipment and tools. Technologies are usually the Products of development activities to find practical application of the innovations. Certain key elements of technology may be implicit in trade secrets based on experience or know-how. The success of technologies is based on technical criteria.

- Technological innovations are either technology-based or technology-facilitated. The former have technology embodied while the latter are created by a technology. The success or failure technological innovations is determined by commercial rather than technical criteria, producing more in returns than the cost

of the investment to produce the innovation. Innovation processes lead to the new marketable Product, service or process.

The relationships between the technological innovation activities and their outcomes as described above are presented in Figure 26.

Porter (1990: 780) however describes innovation as the discovery of a new way of doing things, which can be commercialised.

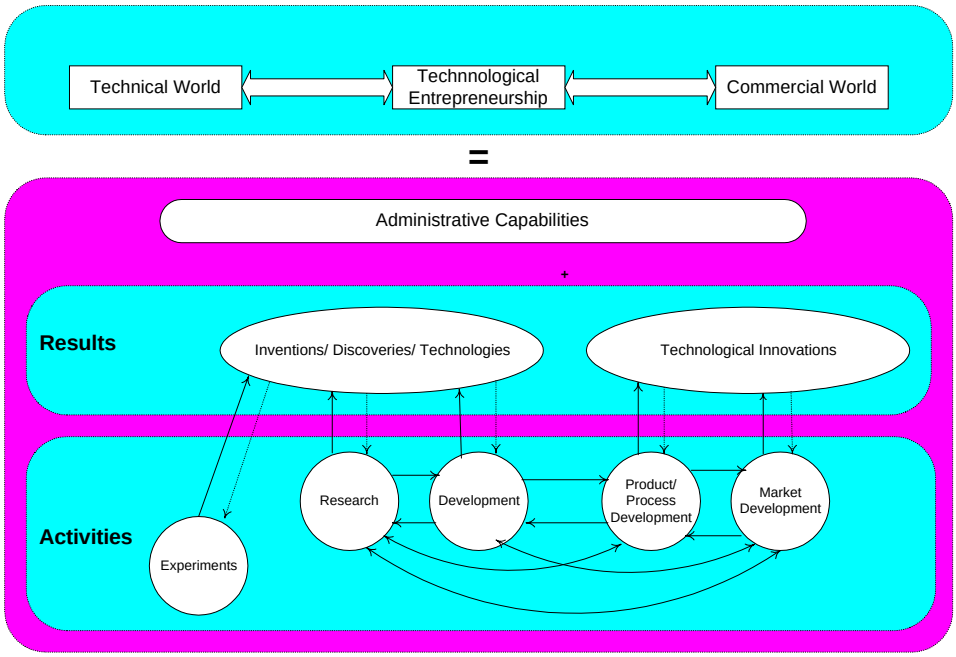

Figure 26: Relationships between Key Technological Concepts (Burgelman *et al* 1996: 5).

He also states that innovation is the result of unusual effort often in the face of obstacles or threats (Porter 1990: 49). Outsiders to the established social structure of an industry or organisation are often the catalysts for innovation (Porter 1990: 581).

Innovation pushes Products, markets and production beyond current capabilities and limits. It generates and exploits new data and ideas, allowing organisations the following advantages (Lynch 2000: 498):

- Substantial future growth.
- Competitive advantage.
- The capability to overtake even dominant competitors.

Innovation is an approach to limit the following three dangers associated with the analytical process in strategy development (Lynch 2000: 498):

- Strategy often is based on past experiences and historical data limiting the opportunities for breaking with the past.
- An overemphasis on analysis may stifle creativity.
- A reliance on past events for prediction of the future.

Successful innovation as a distinctive capability is often difficult to sustain as it often attracts imitation from imitators (Kay 1993: 14). To yield sustainable rewards from innovation, it must therefore sometimes be accompanied by other strategic tools such as architecture, etc…(Kay 1993: 106).

Project HINDSIGHT, an endeavour by the United States Department of Defence to assess the efficacy of their research and development efforts, produced findings that include the following:

- In the majority of cases it was found that the initial recognition for the need originated with the external group assigned to attend to the systems design. The technical initiative for the solution however came from the research-performing group. In another words the need-recognisers informed the researchers of the nature of the problems without prescribing the nature of the solution (Sherwin 1967: 93).
- The median for the time to application for science research results was nine years and that for technology research results five years. Project HINDSIGHT found that large changes in performance/cost were due to the synergistic effect of many innovations, of which many were modest (Sherwin 1967: 94).
- Investment in directed research effort produced returns many times over (Sherwin 1967: 95).
- The results of undirected research effort should be retained in an eternal archive to be available for future exploitation (Sherwin 1967: 96).

A Product requires two types of knowledge, firstly the core design concepts of the components and secondly, the architectural know-how of the ways in which the components are interrelated and integrated. The framework of the four basic types of innovation described below is shown in Figure 27 forms a useful guide to understand their nature and consequences (Henderson *et al* 1996: 402-403).

- Incremental Innovation: The individual components of the Product are improved or refined using current design concepts. The links in the new architecture remain therefore unchanged.
- Modular Innovation: This type of innovation retains the architecture with the relationships between the components while the core design concepts of one or more of the components are changed.

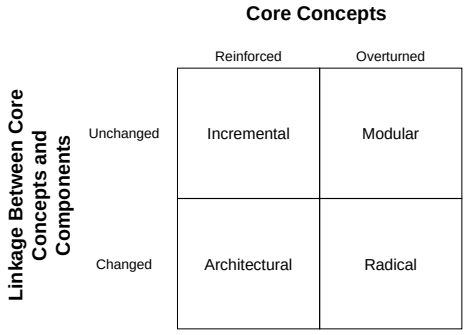

Figure 27: A Framework for Defining Innovation (Burgelman *et al* 1996: 403).

- Architectural Innovation: This is defined as those innovations that change the way in which the components of a Product are linked together but not altering the basic knowledge embedded in the design concepts. An example of this category would be the table fan, which could replace the ceiling fan. The difference is in the way in which the components are fitted together while some changes are made to the components to enable them to fit in the new configuration.
- Radical Innovation: This type of innovation establishes a new dominant design with a new set of core design concepts for the set of components that constitute the Product. This will of necessity require new sets of knowledge of the links in the new architecture.

B. DISCUSSION

The innovation process is integral to the organisation's strategic and competitive context. Innovation by perceiving or discovering new and better ways to compete in

an industry and presenting them to the market is the way organisations create competitive advantage. Innovation can be manifested in Product or process changes new approaches to marketing, distribution or a new concept of scope (Porter 1990: 44).

Merely by imitating competitors and basing advantage on cheap labour or raw materials is rarely sustainable as the basis for economic development beyond a certain level (Porter 1990: 780).

Due to large, established organisations' tendency to resist change, innovation is often suppressed in these organisations. Organisations that innovate are frequently not large established leaders in their respective fields as the larger organisations often tend to resist discontinuities (Porter 1990: 49).

Burgelman *et al* (1996: 3) describe the organisation's actual strategy and its creation as the positive view of strategy. This reflects the belief of top management through its experience of past and present success. These beliefs include core competencies, Product market areas, core values and people as well as their associations with the organisation's success gained as part of the organisational learning process. There is usually a difference between the organisation's statements of strategy and the actual execution thereof.

The way in which the organisation competes with its Products and services is referred to as the Product-market view of strategy. The resource-based view of strategy is mainly concerned with the acquisition of those factors needed to create the core competencies and capabilities for the establishment of sustainable competitive advantage. This is used to exploit opportunities, which may arise. This last approach to strategy falls into the category of Porter's "five forces of competition" and "generic strategies" whereby it is explained why some industries are more attractive than others (Burgelman *et al*, 1996: 3).

Technological change can create new opportunities for the design of a Product, its marketing, production, delivery and the provision of ancillary services (Porter 1990: 45).

According to Lynch (2000: 474) knowledge, creation, technology development and innovation need to be related back to the ability of the organisation to add value to its Products and sustainable competitive advantage as illustrated in Figure 28.

3.2.3 TECHNOLOGY AND INNOVATION STRATEGY

When strategy is developed, the focus is on the present and future Product or market mix. Once a decision is arriving at, the way in which the organisation's resources are to be exploited must be decided. As one of the resources to be considered during this process, the technological solutions proposed for the development of new Products must be evaluated in terms of their feasibility (de Wet 1992: 2).

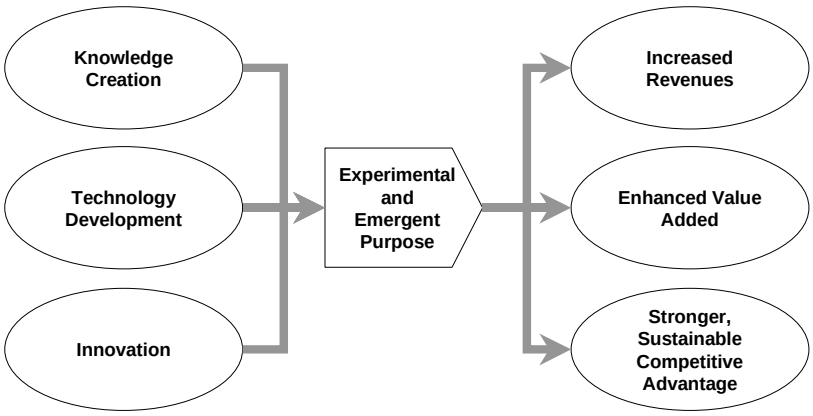

Figure 28: An Emergent Approach to Purpose (Lynch 2000: 474).

It is desirable that the managers of technology should be able to communicate with corporate management in a common language (de Wet 1992: 2).

De Wet (1992: 2) proposes the model shown in Table 17, which he terms the "Technology Balance Sheet", to depict the relationship between the various strategic factors in the management of technology. The relationship between the various Products and the market is shown in the upper right-hand corner of the table. The technologies for producing artefacts can be traced from the upper left-hand corner of the table through the processes that transform the artefacts into the end-Products.
Corporate management needs to know the financial implications of a technological strategy. For this purpose the lower right-hand corner of the table indicates the financial flows required for the research, development, production, logistic and sales activities (de Wet 1992: 5).

The lower left-hand corner of Table 17 shows the technological and Product life cycle phases applicable to the artefact technologies. They are shown separately as these life cycles do not necessarily coincide.
Technology has economic value only in its commercial manifestations (Solomon 1992: 2).

The most significant technological advances currently originate in the civil sector rather than the military sector of the economy. Reliability standards for civil sector Products are similar to those for military Products. In the civil sector there is enormous pressure on firms to advance technology Products in order to remain competitive in terms of capability, cost and reliability. With shrinking defence budgets, the trend in military organisations is, therefore, rather to rely on the acquisition of COTS Products than to be subjected to the risk of developing Products of their own. Development by military and defence organisations is now more focused on adding value by the integration of Products and lower-order items into more complex Products and Products Systems (Molas *et al* 1992: 15-16).

	Artefact Technologies							Products					
	Technology A	Technology B	Technology C	Technology D	Technology E	Technology F	Markets	Product M	Product N	Product O	Product P	Future product X	Future product Y
							Market A		x			x	x
							Market B	x	x	x	x	x	x
							Market C		x	x			x
							Market D			x			x
							Market E				x	x	x
							Process Technologies						
	x		x				Process 1	x	x		x		x
		x	x	x			Process 2	x		x	x	x	x
		x	x				Process 3				x	x	x
			x	x	x	x	Process 4						x
	x		x			x	Process 5					x	x
Technology Life-cycle													
Emerging				x		x							
Growth			x										
Mature		x			x								
Declining	x												
Product Life-cycle							**Product Phase**						
Emerging				x		x	Research		x			x	x
Pacing		x			x	x	Development		x	x		x	x
Key	x		x		x		Production	x	x	x	x		
Basic	x				x		Logistic	x	x	x	x		
							Sales	x	x	x	x	x	

: Future products.

Technology Income Statement [R1000s]						
	Period 1	Period 2	Period 3	Period 4	Period 5	Period 6
Research	(200)	(600)	(900)	(400)	(600)	(500)
Development	(10)	(100)	(700)	(100)	(500)	(700)
Production	(800)	(810)	(850)	(750)	(700)	(650)
Logistic	(100)	(150)	(200)	(140)	(120)	(110)
Sales	2,000	2,100	2,000	3,000	2,900	3,100

Table 17: Technology Balance Sheet (de Wet 1992: 10).

Accurate communication to corporate management, of the strategic aspects of an organisation's technology resources and position is essential to ensure that the correct decisions are taken. De Wet (1992: 3) developed a model, shown in Figure 29, to address this issue. This model correlates the life cycle phase and the systems hierarchy with the organisation's capabilities.

Figure 29 shows the two capabilities of a fictitious organisation. Capability A includes the ability to support, operate and dispose of assets at the User System, Products System, Product and subsystem levels. The abilities are however limited at the User System and subsystem levels. This capability cannot support the research, development and production of a new User System. Replacement will then have to take place by purchase or by expansion of the capabilities to produce a new User System by itself. The latter choice will demand high levels of investment, and protracted time scales.

Capability B in Figure 29 shows the research, design, development and production abilities at Product, subsystem and component levels. This capability is incomplete in the area of research and production abilities and generally low at the Product level. From this diagram it can be seen that this capability requires some resources to bring it to the point where it can be supported and operated.

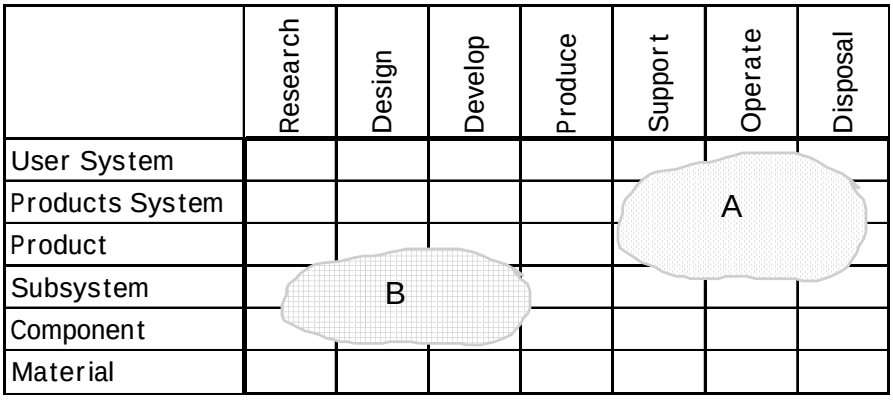

Figure 29: Technology Space Map (de Wet 1992: 6).

The block at the intersection of "Design" and "Subsystem" implies the capability to design a subsystem. This includes the following abilities, resources and infrastructure:

- Design theory, knowledge, codes and practice.
- Development and maintenance of specifications.
- Project, engineering and contract management.
- Systems and development engineering, including simulation, creating development models and testing.
- Testing and qualification of items.

The level of capability in the technology space map can vary between no knowledge of the subject to sufficient skill to function independently. By comparing the existing capability with the capability needed to pursue the strategy, one can determine what change is required (de Wet 1992: 9).

Technological forecasting is the process of estimating the importance and directions of present and emerging technologies. This type of forecast is used for strategy formulation. Twiss (1992: 260) offers the following reasons why technological forecasting would be beneficial to the business decisions of an organisation:

- A survey providing into developments in the greater environment to see what could potentially influence the industry's future and possibly the organisation's Products could form part of the forecasting process and provide very useful information.
- Estimating the time scales for the impending developments will make it possible to assess the urgency for action.
- Such a forecast may provide further information in an area where an incomplete initial analysis suggests a major threat or a major opportunity in the future or it may result in continued monitoring having to be done to ensure the availability of sufficient information for future use.
- Forecasting may expose a need for major reorientation of future organisational policy to cope with threats or opportunities.
- Forecasting could improve operational decision making.

Analysis of historical data on phenomena encountered when an organisation deals with a given technology has shown that such phenomena follow a regular pattern. When an attribute of value for example performance, is plotted with respect to time, the trend appears in the form of an S-Curve (Twiss 1992: 269).

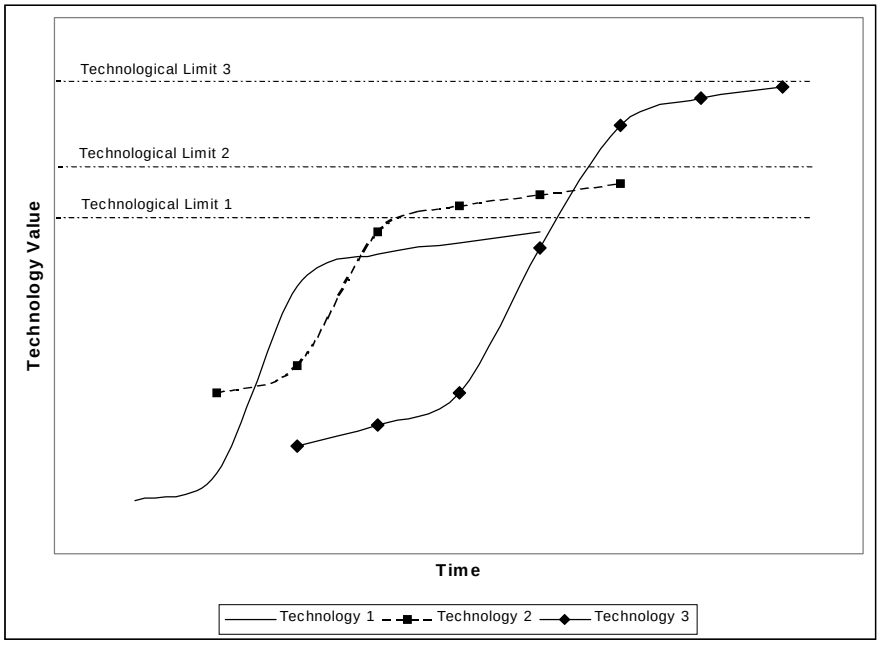

Figure 30: Examples of S-Curves for an Organisation's Technology Strategy Formulation.

The S-Curve is made up of the following main phases (Twiss 1992: 271-273):

- Initial Slow Growth: During this phase there is great uncertainty about the potential of the new technology. Examples of the slowness of this phase of growth include carbon fibre technology, which after being introduced in the 1960s only began gaining acceptance in aircraft construction in the 1990s.
- Rapid Growth: During this phase the uncertainty of the potential of the technology has diminished considerably and the technology may offer a value advantage to the client or user. The level of investment and infrastructure required will, however, affect the acceptance of the new technology.
- Reduced Growth: When the technology approaches its upper limit, it loses its attractiveness and is then ripe for replacement with a new technology with potential for further growth. In many cases there is reluctance to relinquish an understood technology, so there will still be further investment in small, incremental improvements.

By studying the S-Curve, can enable one to understand the technology phases, and enable forecasters to identify suitable new technologies to replace the old. In Figure 30 an example of three subsequent technologies is presented. Technology type 1 is initially exploited and adopted while Technology type 2, which has a higher potential, is investigated. When the former technology type reaches its limit, further investment

in the latter increases its acceptance and growth. The cycle is repeated with Technology type 3, which has potential that is considerably greater than that of the previous technologies. By studying the trends in technologies, the manager can constructively contribute to the formulation of an organisation's strategy.

3.3 MANAGEMENT OF KNOWLEDGE, EXPERTISE, SKILLS AND CULTURE

3.3.1 INTRODUCTION TO THE MANAGEMENT OF KNOWLEDGE, EXPERTISE, SKILLS AND CULTURE

According to Lynch (2000: 479) knowledge is a resource and as such it should be treated as any other. Normally an organisation's knowledge concerns markets, brands, customers etc. The creation of future knowledge and opportunities, is an aspect that one should be considered when analysing an organisation's knowledge resources. The latter consideration could impact on the organisation's purpose. According to Davenport *et al* (1998: 2):

> *Knowledge is a fluid mix of framed experience, values, contextual information and expert insight that provides a framework for evaluating and incorporating new experiences and information. It originates and is applied in the minds of knowers. In organisations, it often becomes embedded not only in documents or repositories but also in organisational routines, processes, practices and norms.*

Lynch (2000: 479) claims that knowledge is more than just data or information. He states:

> *The most useful knowledge in many organisations is often the most difficult to understand, codify and replicate.*

Knowledge as a resource can contribute to sustainable competitive advantage. Knowledge, which has a tacit component so that it is of no use outside the organisation, is therefore difficult for a competitor to replicate (Lynch 2000: 487).

Nonaka *et al* (2000: 7) have adopted the traditional definition of knowledge as 'justified true belief'. Nonaka believes that the focus should be on the 'justified' rather than the 'true' aspect of knowledge. He criticised the traditional Western view for failing to acknowledge the relative, dynamic, and humanistic dimensions of knowledge. Knowledge is context-specific and depends on its space and time of existence.

Lynch (2000: 485) lists the six mechanisms that, according to Davenport *et al* (1998: Ch3), aid the creation of knowledge. The are as follows:

- Acquisition: Ideas can be acquired by observing other organisations.
- Rental: By sponsoring an academic institution or consultants, an organisation can acquire specialist knowledge.

- Dedicated resources: A task force within the organisation can create specialist knowledge.
- Fusion: By grouping together people with different skills and backgrounds to adopt a novel way of looking at a problem, an organisation can create new knowledge.
- Adaptation: Existing knowledge can be adapted to suit a new situation.
- Networks: Formal and informal networks may share knowledge thus increasing everyone's store of knowledge.

Lim *et al* (1999: 615) propose that knowledge is the ability to act on information.

I one case, a more radical approach to redesigning the organisation's research and development processes appeared to succeed where the classical re-engineering effort failed. This subtle approach entailed that a small group of scientists collected the organisation's entire knowledge base of the entire research and development process, regulatory approvals and international variations. This knowledge was embedded in a series of documents and in a weblike hypertext computer system. After much consideration and changes, a greater sense of cross-functional understanding seemed to prevail. This illustrates how the classical top-down re-engineering approach is often insufficiently participative or flexible for improving work by autonomous workers (Davenport *et al* 1996: 53).

Engineering Productivity is largely determined by the effectiveness of the knowledge worker rather than the efficiency of the factory worker. Knowledge workers are referred to as those highly skilled types of labour who need education, sophisticated training and sharp talents to perform highly specialised tasks in organisations. Managers have the significant challenge of motivating engineers. Engineering resources are generally poorly managed and applied. As much as 30% of a professional's time is spent performing work that is within the reach of a high school graduate. There is also inadequate understanding between management and these technical resources (Badawy 1978: 27).

Badawy (1978: 35) proposes several strategies to improve the Productivity of engineers and other knowledge workers:

- Management should communicate their visions and strategies to knowledge workers.
- Engineers should not be tied to an organisation, but be motivated to remain in its service out of job interest for the rewards they are given.

- Senior engineers should be encouraged to venture into new fields to broaden their scope and interests, this will constitute a new source of motivation.
- Implement continuing education and training should be implemented.
- Their jobs should be redesigned.

More of organisations' core competencies will depend on how knowledge and knowledge workers are managed. Industrial growth and Productivity gains will depend heavily on the improvement in knowledge work (Davenport *et al* 1996: 53).
Davenport *et al* (1996: 54) referred to the work of Quinn *et al* (1996: 71-80) in which they equate knowledge with professional intellect. They propose that professional intellect in organisations centres on know-what, know-how, know-why and self-motivated creativity.

Davenport *et al* (1996: 54) define the primary activity of knowledge work as the acquisition, creation, and packaging or application of knowledge. Professional or technical workers perform knowledge work and this work is characterised by variety and exception rather than routine.

A process approach to knowledge work attempts to separate the work from the characteristics of the individual knowledge worker. The process approach allows the organisation an improved view of how to structure, sequence and measure activities to achieve the desired out comes. There are, however significant challenges to the application of the process approach. These are (Davenport *et al* 1996: 53) as follows:

- Variety and uncertainty of inputs and outputs.
- Unstructured and individualised work rules and routines.
- Little separation between process inputs and outputs.
- Insufficient measuring.
- Worker autonomy.
- High variability in performance between individuals and over time.
- Inadequate information technology support.

The task of managing of professionals differs from that of managing of administrative and operational workers in that it requires that the manager passes on day-to-day task control to the professional worker while retaining control and direction over strategic

issues. Knowledge workers are distinct from administrative workers in their greater level of discretion and autonomy (Davenport *et al* 1996: 55).

Based on their arguments on the results of a survey of thirty projects in a broad spectrum of industries, Davenport *et al* (1996: 57) distinguishes the following five primary orientations to knowledge:

- Finding. This entails the collection of existing knowledge.
- Creating. This is the creative process of generating new knowledge.
- Packaging. This is the packaging or integration of externally-created knowledge.
- Application. This focuses on the process of applying existing knowledge.
- Reuse. Previously used knowledge is leveraged in new processes.
-

Davenport *et al* (1996: 59) identified the following ways for improving knowledge work:

- Making an implicit knowledge process explicit and consistent.
- Adding knowledge to a process in order to add value to the process customer.
- Involving the customer in the process in order to increase their satisfaction with the results.
- Sharing knowledge more effectively throughout the process.
- Improving the execution of programmes and initiatives.

As knowledge work frequently involves expertise fragmented among several individuals, it is necessary to obtain the participation of all to gain a full understanding of the process (Davenport *et al* 1996: 60).

The appropriate knowledge process improvement method depends on the primary orientation of the work, the organisation's culture and the time and level of the risk that the project can endure. The *laissez-faire* approach is most suitable for those organisations attempting to improve their knowledge creation processes. Organisations intending to reduce or eliminate the amount of administrative activity should apply these changes by means of the more classical re-engineering approach. The organisational culture also has an influence on the suitability of the choice of knowledge work process improvement. The project's time frame and risk also dictates the choice of approach (Davenport *et al* 1996: 61).

Because decisions on the flow of work should be left to the individual knowledge workers, Davenport *et al* (1996: 61) believe that the primary knowledge work strategies lie in the following three areas:

- Organisations can change knowledge itself by reducing or creating a knowledge unit that can be reused or accessed by improving knowledge capturing processes.
- Organisations can improve knowledge work by changing the location where, and determining with whom people work.
- Organisations can bolster knowledge work by the use of technology to create knowledge bases and telecommunications infrastructure and applications.

The simple act of putting people together in the same room greatly improves knowledge work. When workers form divergent business functions, often from the same physical locations, were combined into teams, they shared a common purpose, common measure and often cross-training in tasks and skills. The knowledge process became more co-ordinated (Davenport *et al* 1996:63).

According to Malhotra (1998:1) knowledge management addresses the critical issues of organisational adaptation, survival and competence in an environment that is undergoing increasing amounts of discontinuous change. Knowledge management seeks synergistic organisational processes that combine information, its technology and the creative, innovative capacity of humans. It is a framework within which an organisation views its processes as knowledge processes. These knowledge processes involves the creation, renewal, dissemination and application of knowledge to the benefit of the organisation.

Malhotra (1998: 2) claims that information technology is regarded as a key component of the information value-chain principle. Knowledge management, by contrast, treats humans engaging in the continuous assessment of information as the key players. ‘Best practices’ are therefore not accepted unconditionally. ‘Double-loop learning’ needs to be incorporated into the design of the processes to learn, unlearn, relearn or discard processes and thus ensure that ‘best practices’ are appropriate in the context that the organisation finds itself. Knowledge management is therefore important for organisations because that which worked yesterday, may not work today.

Human sensors continuously interact with, and develop a rich understanding of the phenomena in the external environment (Malhotra 1998: 2).

Knowledge workers also need an overall understanding of the business of their organisation as well as the context of their contribution to optimally contribute to the organisational learning and unlearning processes. Creativity and inquiry-driven learning may be difficult to achieve in a control-and-command paradigm (Malhotra 1998: 3).

To a lesser or greater extent, all organisations possess organisational knowledge in their respective fields. Organisational knowledge according to Kay's definition, is distinctive to the organisation and is more than the sum of the expertise of the employees. It is, furthermore, not available to other organisations. Organisational knowledge is distinctive if the organisation is able to take ownership of, and apply, this knowledge. Competitive advantage in the market is achieved through distinctiveness in organisational knowledge. Kay presented the concept of employees each knowing only one part of the code to open a safe as the purest form of an example of organisational knowledge. In firms providing professional services or those in high-technology industries, knowledge is their stock in trade. Their challenge is the integration of their employees' individual skills into a greater knowledge-base from which Products or services can be produced (Kay 1993: 73).

Lim *et al* (1999: 617) propose the following four steps to enable knowledge management to become an integrated component of the organisation's quality strategy:

- Capturing or creating knowledge (Planning): Knowledge may be captured from external and internal sources or it may be created internally. Both structured and unstructured sources may be considered.
- Share knowledge (Do): Use as many media possible to share knowledge.
- Measuring effects (Checking): Determine the outcomes of possession of the new knowledge.
- Learning and improving (Acting): Any knowledge gained must be applied according to the Total Quality Management philosophy of continuous improvement.

Lim *et al* (1999: 617) present the following four perspectives in their COST model to analyse the elements to be measured:

- Customer: Identify the known customer problems, solutions and other information that can be used for learning.

- Organisation: Identify the key skills that can provide the organisation with success.
- Suppliers: Determine whether the links with suppliers are able to provide the organisation with an optimal quality, cost and delivery service.
- Technology: Establish whether technological links are optimally exploited both inside and outside the organisation.

According to Lim *et al* (1999: 620) knowledge management as a quality strategy offers the following benefits:

- It reduces the loss of intellectual capital resulting from the departure of employees.
- It reduces the cost of developing new Products.
- It results in increased worker Productivity because it streamlines access to knowledge.
- It results in increased employee satisfaction.

Competence carriers should know that their careers are tracked and guided by corporate human resource professionals (Prahalad *et al* 1990: 91).

3.3.2 COMPETENCE

According to Österlund (1997: 135), the working substance in new Product development is competence. This is the ability to perform certain work with the help and support of the organisation. Competence is made up of knowledge, skill, experience, and the ability to communicate with peers, the upholding of values and the ability to use externally-sourced knowledge, experiences and tools. The output of individuals proves their competence.

According to Verkasalo (1998: 415), knowledge is the capability to link pieces of information together intelligently. The utilisation of knowledge occurs in decision-making and the selection of alternatives. Pure information cannot be used in decision-making, it must be converted into knowledge.

Knowledge exists either in tacit or explicit form (Verkasalo 1998: 415) (Nonaka *et al* 2000: 7).

Tacit knowledge is difficult to formalise as it is personal and context-specific and may be considered to be akin to craftsmanship. Explicit knowledge is factual codified knowledge that can be formally documented and transmitted [(Verkasalo 1998: 415), (Lim *et al* 1999: 616) and (Nonaka *et al* 2000: 7)].

The knowledge creation school model describes how knowledge changes from tacit to tacit, explicit to explicit and explicit to tacit by means of analogies and metaphors to form a shared mindset and a pool of understanding during organisational learning (Verkasalo 1998: 415).

Through each of the four modes of knowledge conversion referred to in the previous paragraph, the knowledge created, interacts in the spiral of knowledge creation. This is called the socialisation, externalisation, combination and internalisation (SECI) process, and is graphically presented in Figure 31 (Nonaka *et al* 2000: 12).

Socialisation converts new tacit knowledge into explicit knowledge. Externalisation articulates tacit knowledge into explicit knowledge. Combination converts explicit knowledge into more complex and systematic forms of explicit knowledge (Nonaka *et al* 2000: 9). Internalisation involves the embodying of tacit knowledge into explicit knowledge (Nonaka *et al* 2000: 10).

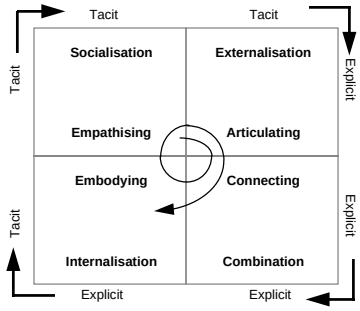

Figure 31: The SECI Process (Nonaka *et al* 2000: 12).

To facilitate the way in which knowledge assets are created, acquired and exploited, Nonaka *et al* (2000: 20) divided them into the four classes shown in Figure 32.

Experiential Knowledge Assets Tacit knowledge shared through common experiences: •Skills and know-how of individuals. •Care, love, trust and security. •Energy, passion and tension.	**Conceptual Knowledge Assets** Explicit knowledge articulated through images, symbols and language: •Product concepts. •Design. •Brand equity.
Routine Knowledge Assets Tacit knowledge embedded in routine actions and practices: •Know-how in daily operations. •Organisational routines. •Organisational culture.	**Systemic Knowledge Assets** Systemised and packaged tacit knowledge: •Documents, specifications and manuals. •Database. •Patents and licences.

Figure 32: Four Categories of Knowledge Assets (Nonaka *et al* 2000: 20).

A monodisciplinary group can form a living system for generating creative solutions by learning from sharing knowledge and experience with other members of the group in a common professional language. This group can create high technology by the driving force of just being problem-solvers. The requirement is that they support each other in common face-to-face dialogue (Osterland 1997:135).

Marquardt (1999: 34) refers to the development of knowledge as "action learning". He states that both significantly more learning and a higher level of learning occur when action is based on the reflective recommendations of the group. The action learning group should have the expectation and responsibility of carrying out their ideas and recommendations. He presents the formula for action learning shown in Figure 33 and proposes that learning will only have taken place after programmed knowledge has accumulated, the ability to ask insightful questions has developed and, reflection and implementation of the learnt activity have all occurred.

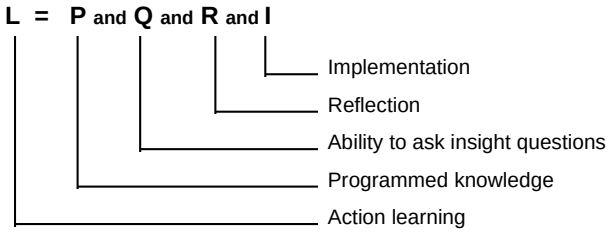

Figure 33: Action Learning Formula (Marquardt 1999: 34).

Programmed knowledge is knowledge that is in current use in books, for example in one's mind, in the organisation's memory, etc. The ability to ask insightful questions offers access to that which is not yet known. Reflection consists of recalling, considering, analysing and understanding. Implementation consists of taking action to apply the knowledge learning (Marquardt 1999: 29 – 34).

Hill (1991: 17) presents the levels of learning in Figure 34 below. The lower levels of learning involve things that are easier to perform, whereas the higher levels of learning, which include application, synthesis and evaluation, are more difficult but are essential for effectiveness (Hill 1991: 16).

Levels Of Learning	Description
Evaluation	Appraise, Compare, Conclude, Contrast, Interpret, Explain
Synthesis	Classify, Compile, Design, Modify, Reorganise, Formulate, Reconstruct, Substitute
Analysis	Select, Discriminate, Illustrate, Separate, Distinguish
Application	Demonstrate, Relate, Use Compete, Prepare
Understanding	Explain, Extend, Generalise, Infer, Summarise, Estimate
Knowledge	Know, Identify, List, Name, Outline, State

Figure 34: Levels of Learning (Hill 1991: 17).

Figure 35 shows Österlund's (1997: 137) representation of the transfer of competence in new Product development work over time.

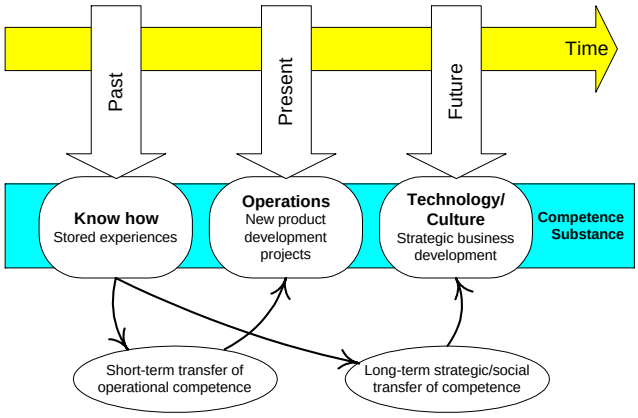

Figure 35: Competence Transfer over Time (Österlund 1997: 137)

Österlund (1997: 137) describes the resource box as a homogeneous group of individual specialists in a particular area of competence. The total competence of the resource box is greater than the sum of the individuals' competence. The size of the group is such that it will consist of sufficient members to form the critical mass for self-development of competence by internal dialogue on experience and theory. The group should be kept smaller than the size at which it becomes unwieldy so that all its members can engage each other in meaningful professional dialogue. The size of this group should consist of ten or fewer members. A diagram of a resource box with its three axes is shown in Figure 36.

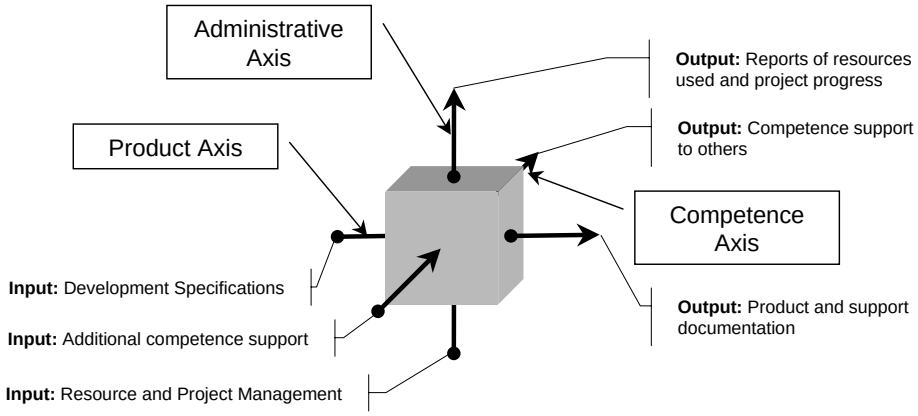

Figure 36: The Resource Box (Österlund 1997: 137)

The Product axis represents the task definition expressed in terms of requirements that have to be satisfied to meet the client's needs, including the method of verification of the appropriateness of the Product's quality. The competence axis represents the flow of competence from the external sources through the resource box where additional value is added and, back to the external sources. The administrative axis represents the requirements that have to be met in planning the assignment of resources to the resource box and in reporting project progress in terms of schedule, quality, reliability, resource consumption, economy and other resource criteria.

The advantage of these small teams is borne out by Federal Express experiencing a 13% reduction in service problems after it organised its 1000 clerical workers into teams of five to ten members each (Dess *et al* 1995: 15).

Österlund's model (1997: 139) of the processes on the three information axes of the competence resource boxes shown in Figure 37 are:

- Competence transfer axis: The competencies needed for the development of the new Product, are investigated, accessed, developed and disseminated on this axis.
- Product/task axis: The Product specification is taken to lower levels by means of a structured, functional breakdown of the Product and a work breakdown structure outlining the work expected of each resource box.
- Administrative axis: The project manager assembles a team of representatives from each resource box. A project plan is then devised on the basis of the work breakdown structure and the competencies required for completion of each work package. Thereafter the work packages are allocated to the resource boxes for execution.

The technology communicator, also known as the technology gatekeeper, tends to read far more literature relevant to the area of expertise, than his or her peers, and presents new knowledge to the group from the outside world (Allen 1971: 394). This role-player also presents competence goals that are aligned with the strategic competence goals (Österlund 1997: 137).

Technology gatekeepers also tend to maintain communication with each other and in this way sustain the flow of knowledge to the organisation (Allen 1971: 394).

The co-ordinator manages group co-operation, negotiates tasks with project managers, plans activities, distributes tasks, provides resources according to needs identified as a result of progress reporting and supervises the quality. In this way the co-ordinator acts as a buffer between the operators or specialists and management, allowing them to proceed with their work with minimum disturbance by bureaucracy. The group members rate the value of the co-ordinator on the influence he successfully exerts on the organisation (Österlund 1997: 137).

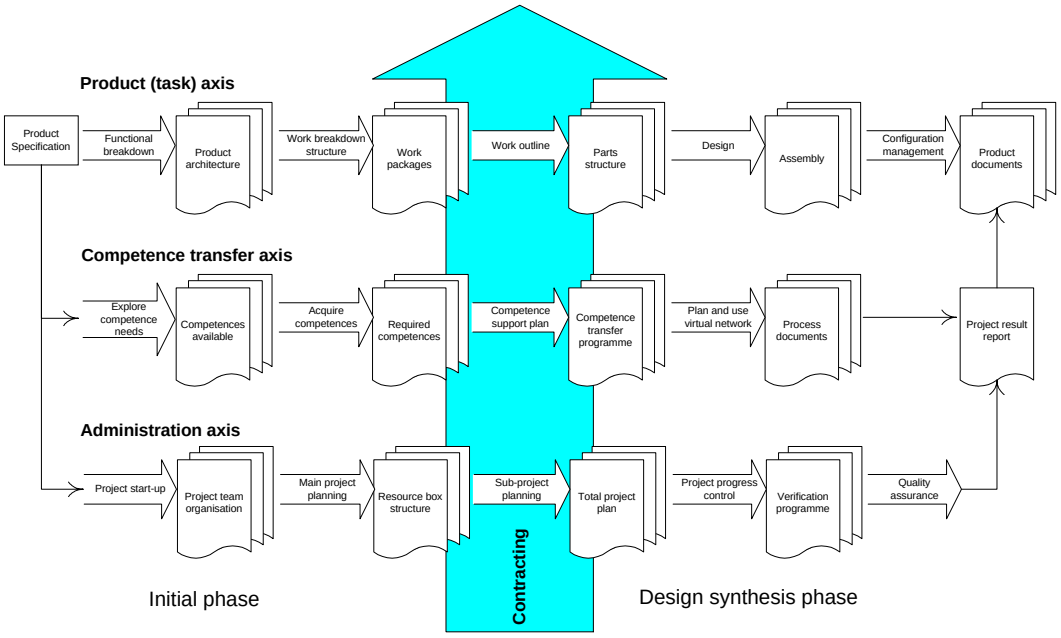

Figure 37: Österlund's Resource Box Information Process model (1997: 139)

The resource box operators play a cardinal role in creating solutions to development problems. These solutions are often based on innovations, which may originate from an unrelated discipline. Temporary virtual teams convened for problem solving can result in these beneficial learning contacts (Österlund 1997: 137).

Core competencies are not diminished but improved by the use of unlike physical assets, but can also be lost by a lack of use (Prahalad *et al* 1990: 85).

3.3.3 COMPETENCE PROCESS

Österlund (1997: 138) describes the new Product development process shown in Figure 37 as three phases namely:

- Definition Phase: This is a phase during which the client's requirements are translated into Product specifications.
- Initial Phase: This is a phase that includes the functional design of the Product's architecture by systems analysis. The Product sub-functions are then grouped into packages within a work breakdown structure in preparation for the design phase.
- Contracting Phase: Resources necessary for executing the work packages are identified. The work packages are then contracted to the various resources boxes.
- Synthesis Phase: The functional specifications are used to develop Products. Compliance by these Products with the specifications must be proven. The proof of compliance is known as verification. The resource box is responsible for the development and execution of the verification process.

Initial systems design is the most critical phase in the development of a new Product because of the need for an appropriate architecture based on functional requirements and the correct usage of competence (Österlund 1997: 138).

3.3.4 COMPETENCE INTEGRATION

Although teams allow more opportunity for creative contribution, they also open opportunities for conflict, which could result in the disintegration of the teams (Solomon 1992: 2).

The process of knowledge creation cannot be managed by simply controlling information, but requires managers to actively lead the process by creating conducive conditions (Nonaka *et al* 2000: 22).

On account of the boundless nature of knowledge, it is important for top management to articulate a knowledge vision that extends beyond the boundaries of existing Products, divisions and markets (Nonaka *et al* 2000: 23).

Organisations should stimulate their members' commitment by the formulation of an organisational intent. Commitment is the basis for human knowledge creation actions (Nonaka *et al* 2000: 24).

Competencies must be integrated to the advantage of the organisation. Österlund (1997: 140) proposes that the integrated competence structure should consist of operative resource boxes, supporting resource boxes and decider boxes. These form a three-layer communication network each with its own function and purpose as shown in Figure 42.

The operative resource boxes contain highly developed specialist competence and are responsible for all technical decisions. These resource boxes are self-organising while striving to become a core competence of significant value to the organisation (Österlund 1997: 140).

The supporting resource boxes, an example of which is shown in Figure 38, contain competence that are based on expertise gained from front-line technologies and users' field experience with similar Products and processes. The groups of supporting resource boxes are responsible for satisfying the competence requirements common to the other competence resource boxes (Österlund 1997: 140).

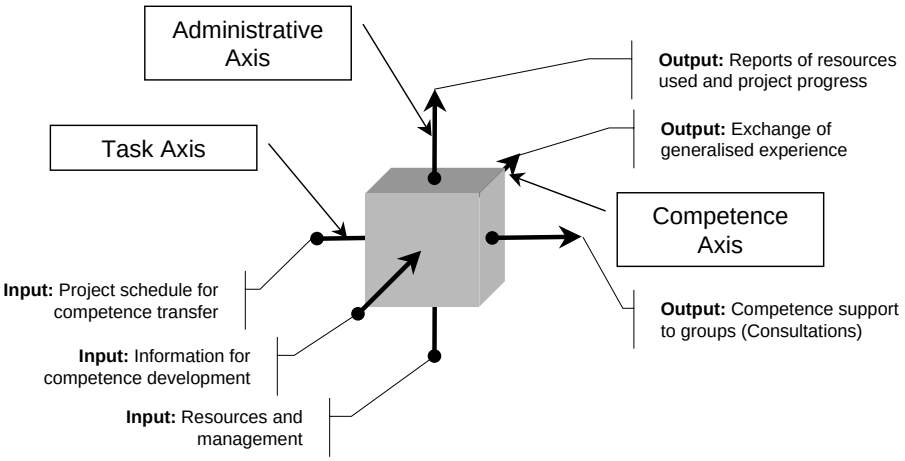

Figure 38: Supporting Resource Box (Österlund 1997: 140).

The decider box shown in Figure 39 is made up of interdisciplinary teams who analyse and monitor the progress of tasks that required co-operation between the disciplines to achieve optimal solutions. These teams also make decisions about the implementation of tasks. A temporary, virtual team is the more favourable option for the formation of this type of group. Management should establish a set of teams of this nature to address the profile of problems to be solved (Österlund 1997: 140).

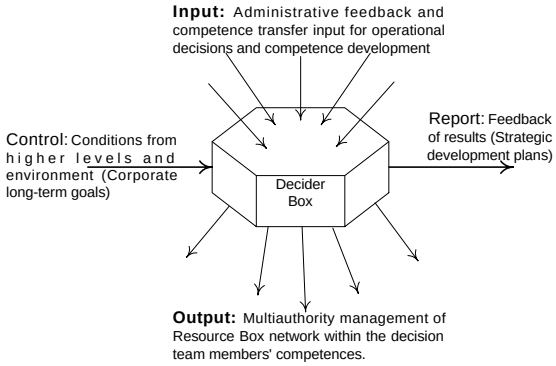

Figure 39: Decider Box (Österlund 1997: 143)

3.3.5 COMPETENCE COMMUNICATION

Allen (1988: 9) compared the communication orientations of scientists and engineers. He found an inherent incompatibility between the input and output of engineers' work as opposed to the inherent compatibility between the input and output of scientists' work. He attributed this inherent incompatibility in engineering work, to the difference between the natures of the input and output. The output in technology work by engineers has a physically encoded format.

For this reason the "backward engineering" of foreign weapons to establish the underlying principles, is difficult (Allen 1988: 9).

Figure 40 shows the extent to which scientific and technology projects differ in their use of communications channels in their work.

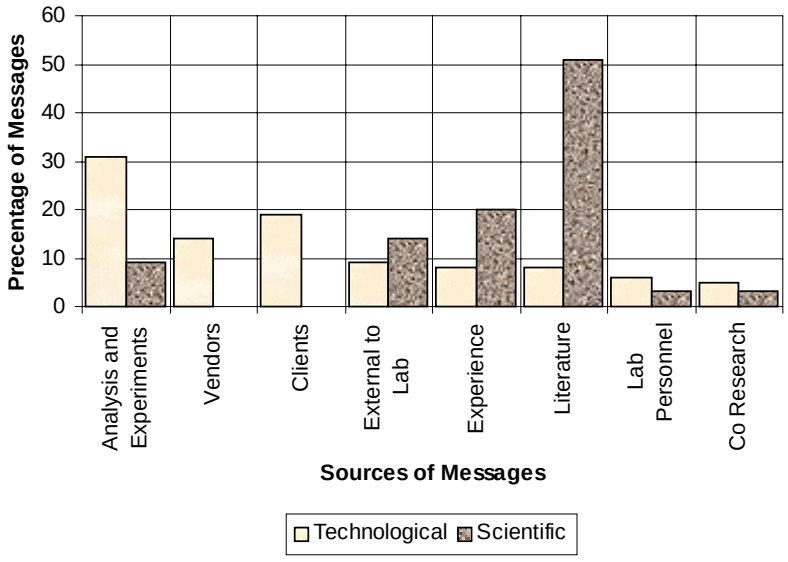

Figure 40: Sources of Messages in Technological and Scientific Projects (Allen 1988: 11)

The smaller the distance between the parties that are communicating, the greater the probability that they will be inclined to do so. Conversely, the benefits of higher performance are lost when distance or inconvenience is increased (Allen 1971: 399-400).

Wheelwright *et al* (1996: 862) discussed four modes of communication during interaction between upstream and downstream groups. The interaction described concerns the transfer of information between the designers of a Product and the group that is to design the production facilities. The modes of interaction shown in Figure 41 are as follows:

- The Serial Mode: In this relationship, the downstream group waits until the upstream group has completed its design before starting work. Design information is communicated in a single batch transaction. This transaction cannot include all the nuances nor can it include all the strengths and opportunities that the downstream group offer.
- The "Early Start in the Dark" Mode: The downstream group attempts to start earlier to ensure that it achieves its milestone. The upstream group, however, only transfers the design information after completion of its work in a single batch transaction. So, although the downstream has been preparing itself for the task, there will inevitably be some surprises on receipt of the design information. This effect could result in confusion and a slip in progress and possibly failure to achieve delivery of the completed project output on time.
- The Early Improvement Mode: This is also called the involvement mode. The two groups interact by bilateral communication of preliminary information during the initial design phase of the upstream group and before the downstream group starts its work. The downstream group then develops insight into the emerging design and is able to contribute through feedback to the design process. The downstream group only starts its work after the completion of the upstream group's work. The downstream group's work can then be completed more efficiently with fewer changes. In this case the downstream group relies on past practice and theoretical knowledge.

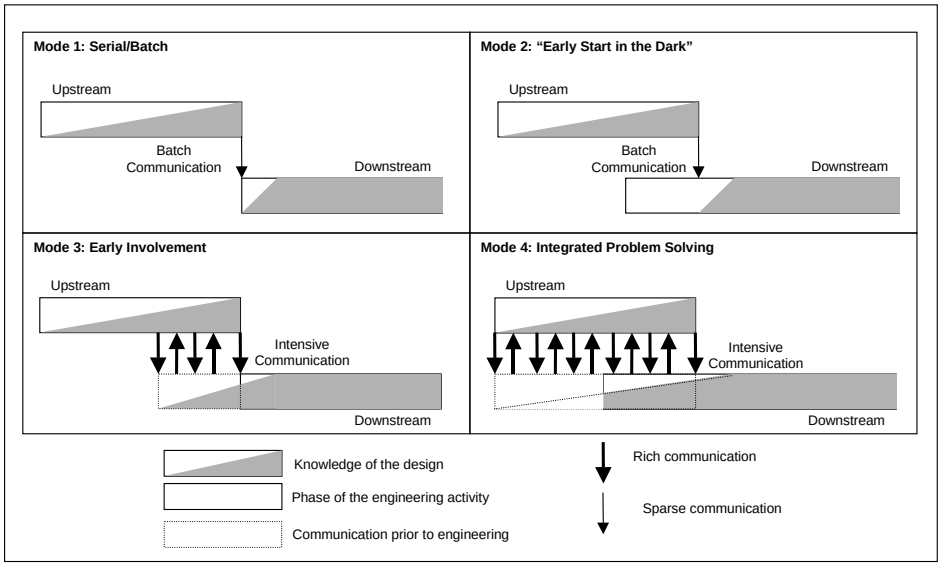

Figure 41: Modes of Upstream/Downstream Interaction (Wheelwright *et al* 1996: 863)

- The Integrated Problem Solving Mode: This mode links the two groups in time and by bilateral communication. The downstream group is able to start its work while the upstream group's design is still in progress. In this case the downstream group relies on practice and theoretical knowledge used to influence the upstream design. Communication in this mode is rich and intense.

According to Wheelwright *et al* (1996: 864), integrated problem solving during the design-build-test cycle relies on early inclusion of the downstream group, rich bilateral communication between the upstream and downstream groups and a broad, comprehensive style of problem-solving.

The task/product network in the diagram of the three layered competence network in Figure 42 carries information on product requirements breakdown and design parameters. This method of communication is intended for developing a product's architecture in relation to its use, suitable as tasks for distribution between the various operative resource boxes (Österlund 1997: 140).

The competence transfer network is capable of forming virtual decision teams with the appropriate competencies during the initial phase of new Product development. In this way the operative resource boxes are supported by a supply of competencies (Österlund 1997: 140).

The decision network reflects the structure of the problems requiring solving, the conditions laid down by the authorities and the business results, all of which are related to one another. A member of the organisation may then establish interfaces with several decision-making teams (Österlund 1997: 140).

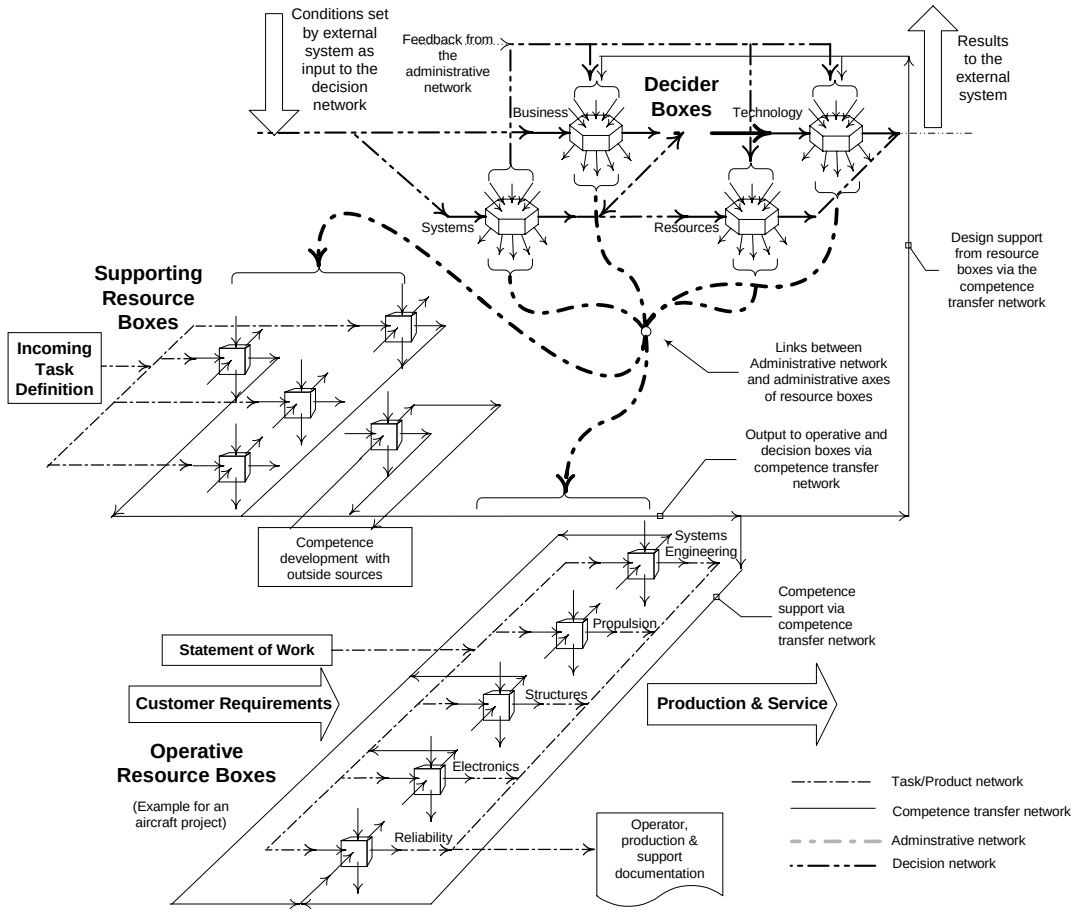

Figure 42: The Competence Network (Österlund 1997: 141)

The administrative network supplies co-ordination information as required, to all boxes and conveys feedback on project progress, resource consumption and needs. This network also carries verification information for project quality management (Österlund 1997: 140).

Allen (1971: 392) found that high performers have considerably more communication with colleagues including specialists in other fields and members of other project teams.

3.3.6 CULTURE

Marquardt (1999: 151) defines culture in terms of the following three elements:

- It is a way of life shared by the majority of the members of a group.
- Culture is characterised by the way that senior members of the group convey cultural information to the younger members.
- It is the way in which the individual member's perceptions and behaviour are shaped.

According to Österlund (1997: 142) it is important to initiate changes in the corporate culture while competencies are still being developed. The culture has to be in harmony with the strategic and market development. These cultural changes require time to become effective. The dynamics of development can be set in motion by exerting forces in a positive direction on the corporate members. Examples of these forces are:

- A reward policy.
- Human resource competence development.
- A career policy.
- Group resource competence development.
- Group development as a living system.
- Organisational development.
- Development of communication systems.

Although documentation of the organisation's knowledge, experience and skills is a way of retaining and preserving these resources, the competencies acquired must be embedded in the minds of those applying them. This form of learning is brought about by various forms of interactions within the monodisciplinary groups. Group competence is gained by sharing beliefs, values and understanding within the organisational culture. The communication by management of rules, symbols and statements to corporate members, contributes to the conversion of a cultural framework into a cognitive framework. This establishes a corporate "language" which facilitates the effective and efficient transfer and interpretation of information. This effect of achieving a common culture can be regarded as a competence of an administrative nature.

Lynch (2000: 317) uses Handy's (1993: 183) model to name the four main categories of culture:

- Power Culture: In this type of culture, an individual or a small group dominates the organisation.
- Role Culture: In this type of culture, the organisation relies on committees, structures, logic and analysis.
- Task Culture: In this case, the organisation is geared to tackle identified projects or tasks using flexible teams.

- Personal Culture: In this type of culture, the organisation is tolerant, but personnel may be difficult to manage.

Type of Culture	Prescriptive or Emergent Strategy	Delivery of Competitive Advantage	Ability to cope with Strategic Change
Power	Prescriptive	Enhanced but individuals may miss competitive moves	Depends on individual or group at centre
Role	Prescriptive	Solid, slow and substantive	Slow, will resist change
Task	Emergent	Good where flexibility is important	Accepted and welcomed
Personal	Possibly emergent	Depends on individual	Depends on individual

Table 18: Analysis of the Strategic Implications of Culture (Lynch 2000: 319)

The reactions of these cultures to strategies, the delivery of competitive advantage and their ability to cope with strategic change are shown in Table 18 above.
According to Marquardt (1999: 153), there are nine factors that create and influence culture. These factors are shown in Figure 43. The characteristics of the factors and their interaction determine the culture.

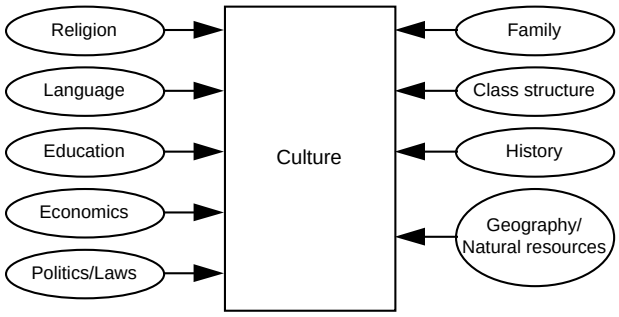

Figure 43: Factors Creating Culture (Marquardt 1999: 153).

Competence carriers should be loyal to the integrity of their competence areas more than the particular business (Prahalad *et al* 1990: 91).

3.3.7 ORGANISATIONAL LEARNING

Argyris *et al* (1978: 3) define organisational learning as a process of detection and correction of errors. The organisation therefore learns through the efforts of individuals acting as agents.

Senge (1990: 4) notes that adaptive learning is only the first stage of organisational learning. Double-loop learning, or generative learning, focuses on continuous experimentation and feedback while discovering the way problems are defined and solved by organisations (Argyris *et al* 1978: 3).

Lynch (2000: 696) refers to the five learning disciplines of Senge:

- Personal Mastery: This consists of both developing one's own goals and creating an organisational environment conducive to the development of new purposes by groups.
- Mental Models: The development of mental models consists of reflecting and speculating on the visions that others within the organisation have of the environment and assessing the influence of these on decisions and actions.
- Shared Vision: The group builds and shares a commitment to a vision and achievement while further exploring the aims.
- Team Learning: In team learning the members use their individual abilities to create a team ability that exceeds the sum of the abilities.
- Systems Thinking: Systems thinking is the type of thinking that enables one to visualise the sum of the elements of a system as a whole system.

When managers only raise the issue of effectiveness within an organisation, but cannot correct errors under existing norms using first-order learning, they can be driven to conflict. They must learn to accept that it may be the existing norm for predictable management that conflicts with their wish to achieve corporate growth through technological innovation (Argyris *et al* 1978: 22).

According to Malhotra (1996: 2) adaptive learning concentrates on solving present problems while failing to examine the appropriateness of the current learning behaviours. This approach also fails to question the underlying assumptions that lead to the present ways of doing work.

The type of collective learning approach that permits the co-ordination of diverse production skills and the integration of multiple technology streams, is what creates the core competency of the organisation (Prahalad *et al* 1990: 82).

3.4 VALUE CHAIN MANAGEMENT

According to Lynch (2000: 266) the value chain links the value of an organisation's activities with its main functional sections. He used the work of Porter (1985: Chapter 2) that presents the concept that the organisation can assess the contribution that each makes to the overall value of the business during strategic analysis. He links the following two areas:

- The value that each part contributes to the greater organisation (optimisation).
- The contribution that each of the parts make (co-ordination) to the organisation's competitive advantage.

Porter (1990: 40) proposes that competitive advantage originates in the way that firms organise and perform their various activities. The value chain of an organisation is the network of interdependent activities that are interconnected by linkages. In this context a linkage is the influence that one activity exercises on another activity. A linkage could exercise an influence on the cost or effectiveness of the other activities. To optimise the organisation's capabilities, it is necessary to make trade-offs in other activities. Thus, for example, when an organisation spends more on the Product design process, it could reduce after-sales service costs.

Linkages connect interdependencies both within an organisation and with the suppliers and channels (Porter 1990: 42).

Porter (1990: 40) divides the activities in which an organisation needs to engage, in order to compete, into primary and support activities. Primary activities are those concerned with the production of the organisation's Products or services and include marketing, logistics and operations. Support activities are those concerned with the provision of infrastructure, technology, human resources and procurement services to support the primary activities. Figure 44 presents a graphic model of Porter's value chain within an organisation. He uses the term "margin" in the diagram to represent the value added by the activities in the value chain. This value may be in the form of lower costs to the organisation or tasks performed in a unique way and that differentiates the organisation from others. According to Porter (1990: 42) strategy drives the way in which the organisation organises the individual parts of its value chain to achieve its competitive advantage. By reconfiguring its activities as a system, the organisation can discover its optimal value chain as a low-cost or a differentiated

producer. Competitive advantage is increasingly becoming a function of how the organisation manages its entire system.

The use of the value chain approach allows a more comprehensive look at the types of competitive advantage that can be achieved and the role that competitive scope can play in enhancing competitive advantage. The scope shapes the organisation's activities, the ways in which they are performed and the configuration of the value chain. When selecting a narrow segment, an organisation can tailor each activity's scope to suit the segment's requirements, thereby achieving the cost leadership or differentiation desired. When aiming at a broad scope across several market segments, the organisation gain competitive advantage by sharing the activities associated with the industry segments (Porter 1990: 44).

Wilson (1996: 2) describes two types of value chain, the material and the informational, each interlaced with the other, as follows:

- The material value chain consists of links each converting the Product from one state to another. Each step increases its value or utility in some meaningful way.
- The informational value chain converts data into information, information into knowledge and knowledge into wisdom.

This approach however neglects other aspects of value adding such as for example the physical location of the Product.

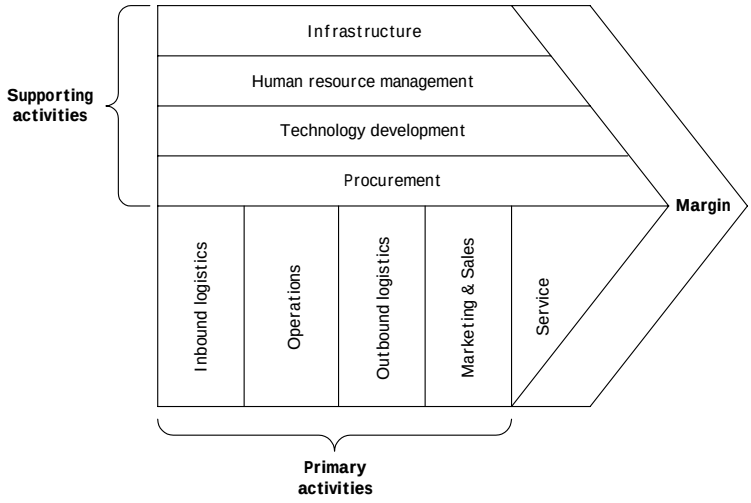

Figure 44: The Value Chain (Porter 1990: 41)

The value chain within the organisation is a subset of the larger stream of activities in which the organisation competes. This larger stream of activities is called the value system by Porter (1990: 42) and is illustrated in Figure 45. The suppliers of goods and services precede the organisation's value chain. The organisation's output Products or services are taken up by the channels and presented to the buyer.

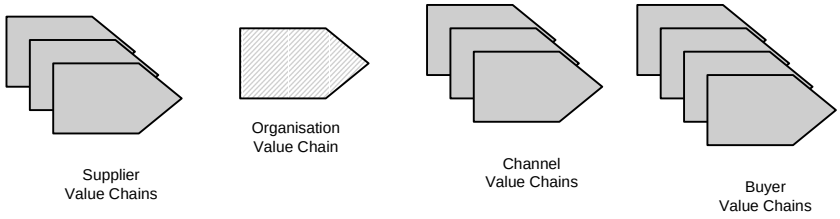

Figure 45: The Value System (Porter 1990: 43).

A. VALUE CHAIN MODELS

Value chain analysis affords a useful framework for assessing the set of activities that create value for the organisation (Dess *et al* 1995: 7).

Dess *et al* (1995: 8 – 14) presented three models of corporate architectures aimed at reducing boundaries and therefore increasing efficiency in value chains. These models are as follows:

- The Modular Type: In this case, the organisation retains full strategic control while outsourcing non-vital functions.
- Advantages: This approach can enable the organisation to improve the efficiency of new Product development by hiring superior external talent and thereby avoiding being locked into a potentially obsolete technology while allowing it to focus scarce resources in those areas where they hold a competitive advantage.
- Disadvantages: Ill-considered outsourcing can ultimately cause a firm to relinquish control over its core competencies and thereby lose its competitive advantage.
- Requirements: The organisation needs to gain access to loyal, reliable vendors that may be trusted with proprietary information and must know which competence to retain in-house.
- How-to: Develop a strategic plan that identifies core competencies to be retained internally and those non-critical functions that may be outsourced.

- The Virtual Type: In this case the organisation is part of a continually-evolving network of independent companies, linked together to share costs, skills and market access.
    - Advantages: This approach can improve the capacity of the organisation or its competitive advantage. Organisations of this type are able to pursue a collective strategy that enables them to better cope with the uncertainty in the environment through collaborative efforts. The alliances can be maintained for as long as mutual advantage is derived and then discontinued, whereas large monolithic organisations would then remain saddled with excess capacity.
    - Disadvantages: This type of value chain often fails to meet expectations. There is a potential for a loss of operational control among partners. A loss of strategic control over emerging technology can develop. This environment requires sophisticated managerial skills.
    - Requirements: This network of organisations requires tremendous analysis and consideration of the strategic issues, especially the identification of those core competencies should be retained internally, where the synergies between the partners should exist and what the common vision should be.
    - How-to: Develop a strategic plan that identifies core competencies to be retained internally, those non-critical functions that may be outsourced, how operational control will be exercised and the common vision.
- The Barrier-Free Type: The barrier-free organisation aims to bridge the differences in culture, function and goals to develop common ground in order to facilitate co-operative behaviour.
    - Advantages: This approach leverages the talents of all the organisation's personnel. Co-ordination and co-operation between the organisation's functions are enhanced. The organisation's response to market's demands is quicker.
    - Disadvantages: It is often difficult to overcome political and authority boundaries; sophisticated leadership and skills are required to promote co-ordination. Performance is very dependent on high levels of trust. This democratic process is time-consuming and difficult to manage.

- Requirements: This type of organisation must promote shared interests and trust, eliminate, or at least reduce the number of boundaries that stifle productivity. It must also raise the skill levels of personnel.
- How-to: Develop a strategic plan that addresses the requirements previously mentioned.

B. INTANGIBLE INTERRELATIONSHIPS

Porter (1985: 324) defined intangible interrelationships as those that involve the transfer of know-how or generic skills between separate value chains within the organisation. This sharing of know-how has the potential to reduce costs of value activities driven by learning or patterns of capacity utilisation (Porter 1985: 328). Intangible interrelationships lead to competitive advantage through the transfer of skills across separate value chains (Porter 1985: 350). Intangible interrelationships in business units within an organisation can be identified by (Porter 1985: 351):

- The business units sharing similarities in their strategies.
- The business units sharing similarities in their value chain configurations.
- The business units sharing similarities in their value activities.

3.5 THE MANAGEMENT OF PROJECTS

According to Nicholas (1990: 9) project management was brought to prominence by the changed environment of modern society. He identifies inter-dependence, complexity and rapid, radical change as the three characteristics that typify the modern environment. The centralised management style typical of bureaucracies encounters difficulties in dealing with situations requiring adaptability and rapid response. Project management requires high-level technical and managerial competence and a certain degree of latitude and decentralisation to deal with the risks and instability inherent in many modern situations.

Organisations must operate and survive in an environment of forces. These organisations each consist of interrelated elements that have their goals co-ordinated with those of the organisation. Project management integrates the system of interrelated tasks in progress in a dynamic environment and is therefore a systems-oriented approach (Nicholas 1990: 9).

Project management is based on the principle that projects are managed to satisfy the client's cost, schedule and performance requirements with a view to achieving a given outcome. Project management is therefore intended to provide the specified Product or service on schedule at the agreed cost (Nicholas 1990: 9).

The Project Management Institute (PMI) has published a Guide to the Project Management Body of Knowledge (PMBOK) to highlight those areas of knowledge that are important for the management of projects. The Guide to the PMBOK presents a well-structured reference work that deals with the key processes and information to be considered during the management of projects. British Association of Project Managers (APM) published a Body of Knowledge (BoK) in 1996. The purpose of both the PMI's Guide to the PMBOK and the APM's BoK is to define the areas in which a project management professional should be knowledgeable. (Morris 1999: 173)

Morris (1999: 176) believes that the task accomplishment or implementation of project management fails to accurately capture the real challenge of project management and that the primary concern should be with the delivery of project outputs to the customer or sponsor. He also states that ensuring that the technical, commercial and business, environment and other factors are aligned with organisational and control issues is fundamental to optimising the outcome. It was on

the basis of this premise that the APM's BoK was developed. In 1997 the University of Manchester (UMIST) Centre for Research in the Management of Projects started research to provide empirical data to support the upgrade of the APM's BoK.

3.5.1 PROJECT STAKEHOLDERS

Each project has stakeholders who contribute to and depend on its success. According to the Project Management Institute (PMI) (PMI 1996: 15), the key stakeholders include the following:

- The project manager who is responsible for managing the project.
- The client who will use the outcome of the project. The client may be a multi-layered group, for example the doctor who prescribes a drug, the patient who uses it and the medical insurance that pays for it.
- The performing organisation most directly involved in the execution of the project.
- The sponsor that may be an individual or a group that support the project financially or otherwise.

3.5.2 DESCRIPTION OF PROGRAMME AND PROJECT MANAGEMENT

Project Management is the planning, monitoring and controlling of all aspects of a project and in motivating all those involved in it to achieve the project objectives safely, within an agreed time frame and within the bounds of set cost and performance criteria. The Project Manager is the single point of responsibility for achieving this. (APM 1996: 15)

A project is a temporary endeavour or undertaking to create a unique Product or service. A project has a distinct beginning and end to its existence. The output of the project can continue to exist after its termination. The output required of a project differs from other available Products or services. (PMI 1996: 4)

Project management is also the application of knowledge, skills, tools and techniques in the execution of project activities with a view to meeting or exceeding stakeholders' needs and expectations. This requires that the project manager balance the way he meets competing demands between the following elements (PMI 1996: 6):

- Scope, time, cost and quality.
- Stakeholders with differing needs and expectations.
- Identified requirements (needs) versus unidentified requirements (expectations).

A project is a discrete undertaking with defined objectives often including time, cost and quality (performance) goals. Project objectives may be defined as financial, social or economic. Projects evolve through a set of life cycle sequences, each with its own beginning and end (APM 1996: 15).

A programme is a portfolio of projects.

Project Integration Management	**Project Scope Management**	**Project Time Management**
Project Plan Development Project Plan Execution Overall Change Control	Initiation Scope Planning Scope Definition Scope Verification Scope Change Control	Activity Definition Activity Sequencing Activity Duration Estimation Schedule Development Schedule Control
Project Cost Management	**Project Quality Management**	**Project Human Resources Management**
Resource Planning Cost Estimating Cost Budgeting Cost Control	Quality Planning Quality Assurance Quality Control	Organisational Planning Staff Acquisition Team Development
Project Communications Management	**Project Risk Management**	**Project Procurement Management**
Communications Planning Information Distribution Performance reporting Administrative Closure	Risk Identification Risk Quantification Risk Response Development Risk Response Control	Solicitation Planning Solicitation Source Selection Contract Administration Contract Close-out

Table 19: Competencies listed in PMI's Guide to the PMBOK (PMI 1996: 7).

The PMI Project Management Body of Knowledge (PMBOK) has key competencies that are classified into nine categories. Table 19 presents the PMBOK's list of competencies.

The APM Body of Knowledge has 40 key competencies that are classified into four categories namely Project Management, Organisation and People, Techniques and Procedures and General Management. The list of the APM BoK's list of competencies is presented in Table 20.

Morris (1998: 3) compared the 47 competencies of the process-based PMI Guide with those of the PMBOK and the APM's BoK. His finding was that 15 of the latter's competencies addressed all those of the former and that the latter was more widely

based. The competency associated with the project environment of the APM's BoK covered all the external influences. The PMI Guide to the PMBOK does however indirectly address the external influences in the project integration (PMI 1996: 49) and risk identification section (PMI 1996: 111).

Morris (1999: 174) questions the validity of limiting project management merely to schedule, cost and performance. He suggests that this is only half the battle and that it should extend beyond these limits to delivering projects successfully to the requirements of the customer or sponsor. He believes that the project should give consideration to technical, commercial, business, environment and other factors.

1	**Project Management**	**2**	**Organisation and People**
1.1	Systems Management	2.1	Organisation Design
1.2	Programme Management	2.2	Control and Co-ordination
1.3	Project Management	2.3	Communication
1.4	Project Life Cycle	2.4	Leadership
1.5	Project Environment	2.5	Delegation
1.6	Project Strategy	2.6	Team Building
1.7	Project Appraisal	2.7	Conflict Management
1.8	Project Success/Failure Criteria	2.8	Negotiation
1.9	Integration	2.9	Management Development
1.10	Systems & Procedures		
1.11	Close Out		
1.12	Post-project Appraisal		
3	**Techniques and Procedures**	**4**	**General Management**
3.1	Work Definition	4.1	Operations/Technical Management
3.2	Planning	4.2	Marketing and Sales
3.3	Scheduling	4.3	Finance
3.4	Estimating	4.4	Information Technology
3.5	Cost Control	4.5	Law
3.6	Performance Measurement	4.6	Procurement
3.7	Risk Analysis and Management	4.7	Quality
3.8	Value Management	4.8	Safety
3.9	Change Control	4.9	Industrial Relations
3.10	Mobilisation		

Table 20: Competencies listed in APM's BoK.

3.5.3 CONTRACTS AND AGREEMENTS

A contract or agreement is the basis of any project. The Project Manager has to know and understand the scope of the work undertaken, and the result to deliver to the client.

Contracts have a legal basis. Although business units within an organisation are inclined to resort to agreements, the principle is similar to that of contracts. Not every agreement is a contract, though. A contract has to comply with the following essential elements to be binding (Gibson *et al* 1988:11):

- The agreement must be lawful.
- The parties entering into the agreement must do so within the limits of their contractual capacities.
- The parties must have a serious intention to contract.
- The parties must communicate their intentions to each other.
- The agreement may not be vague.
- There must be a meeting of the minds between the parties regarding the matter of the agreement.
- Performance must be possible.

If satisfying the client's requirements is the principle of quality, then knowing and understanding the requirements is essential for the Project Manager. This also forms the basis of a contract.

Any agreement that lacks one or more of the elements listed above is void, or that is to say, it is not a contract and is therefore not enforceable by law.

3.5.4 PROJECT TEAMS

A project team consists of a cohesive group of people from differing disciplines and even differing organisations participating in the project wherever and whenever they are needed to contribute to its success. The team size and composition will change over time depending on the resources required during the life cycle phases of the project (Nicholas 1990: 11).

To manage projects effectively in a dynamic technological environment an understanding of the organisational and behavioural parameters and their interaction is required. While team-building is important in any environment requiring the co-ordination and integration of multi-disciplinary activities, it is especially crucial in a

technological environment where projects are often highly complex and require the integration of many functional specialists in an equally complex organisational setting (Thamhain *et al* 1987: 302). It is furthermore necessary that a climate conducive to multi-disciplinary team building, is sustained (Thamhain *et al* 1987: 303).

Thamhain *et al* (1987: 304) found that there was a general agreement among a sample of 500 engineering managers the three most important criteria for measuring team performance were, in order of priority, technical success, performance to schedule and consumption of financial and other resources within the planned budget. Furthermore, these engineering managers consistently stressed that high-performing teams are also characterised by specific task- and people-related qualities. Those qualities most closely related to positive team performance are shown in Figure 46.

Thamhain *et al* (1987: 304) found that those drivers and barriers shown in Figure 46 had the strongest influence on project team performance.
It appears from these findings that project success is primarily determined by six driving forces and barriers that are related to leadership, job content, personal needs and the general work environment, shown in Figure 46 (Thamhain *et al* 1987: 308).

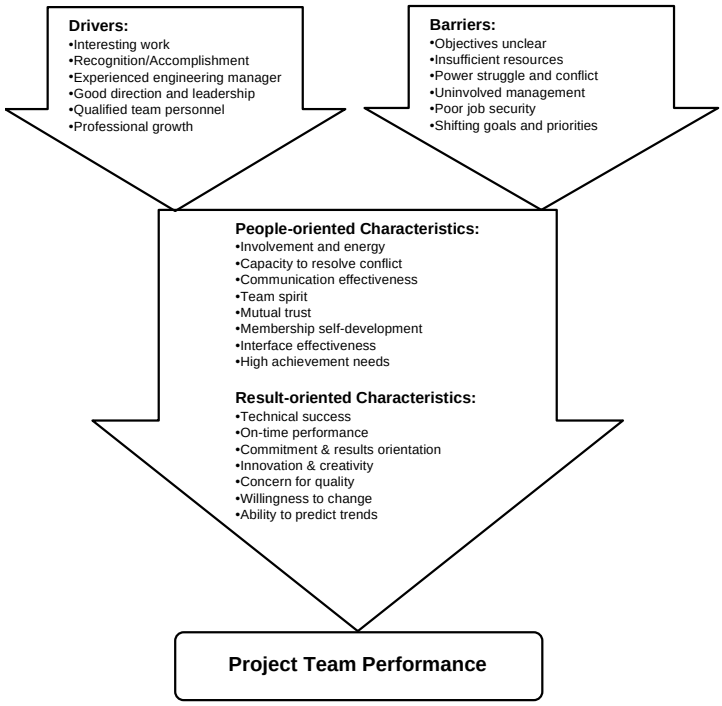

Figure 46: Major Drivers and Barriers to Project Team Performance (Thamhain *et al* 1987: 303).

Project success is also strongly correlated to a professionally stimulating team environment that is characterised by interesting and challenging work, visibility, growth potential and good project leadership. A professionally stimulating team environment also contributes to low levels of perceived conflict, high levels of commitment, high levels of personnel involvement, good communication, change orientation, innovation and on-time performance within the limits of the budget (Thamhain *et al* 1987: 308).

A. PSYCHOLOGICAL CLIMATE

Literature now discusses two types of climate, the organisational, which is studied at the group or organisational level and the psychological, which is studied at the individual level. Climate perceptions are the individual's description of organisational experiences and remain relatively stable over time. An organisation may have more than one climate at any given time (Koys *et al* 1991: 265- 266).

Perceptions of psychological climate may affect organisational commitment and job satisfaction and determine the extent of absenteeism and turnover (Koys *et al* 1991: 281).

Koys *et al* (1991: 273) proposes that psychological climate has eight dimensions . These dimensions are defined and described in Table 21.

B. RECOMMENDATIONS FOR TEAM MANAGERS

Thamhain *et al* (1987: 308) proposes the following recommendations to enhance the project manager's effectiveness in creating high performance teams:

- Remove or diminish barriers. Project managers must diminish those barriers to improved project team performance.
- Ensure objectives are clear. Project managers should develop clear project objectives and communicate them to the team.
- Management commitment. Project managers should regularly lobby to ensure that management is apprised of the project's status and that they support the project.
- Image building. Project managers should build a favourable image for the project. This favourable image would relate to those drivers listed in Figure 46 and other positive aspects such as the project's importance to the organisation. This engenders a climate of active participation and unifies the team.

Dimension	Definition	Examples
Autonomy	Perceived self-determination regarding work procedures, goals and priorities.	I make most of the decisions regarding the way my job is performed. I determine my own work procedure. I schedule my own work. I set the performance standards for my job. I organise my work as I see best.
Cohesion	Perceived togetherness or sharing within the organisational setting. This includes the willingness of members to provide material support.	The firm's people assist each other. The firm's people get along with each other. The firm's people take an interest in each other. There is a team spirit in the firm. I believe I have a lot in common with my colleagues.
Trust	Perceived freedom to openly communicate with management about sensitive or personal issues with the expectation that the integrity of these communications will not be betrayed.	I can trust my superior with confidential information. My superior has personal integrity. I can be candid with my superior. My superior keeps promises. My superior is unlikely to give bad advice.
Pressure	Perceived task completion standards in terms of time and performance.	I have inadequate time in which I can do my work. It is stressful to work for this firm. I dread being called at home to resolve a work-related problem. I feel like I never have a day off. Too many of my colleagues are burnt out by the demands of their work.
Support	Perceived tolerance of member behaviour by superiors, including the willingness to allow members to learn from their mistakes without fear of reprisal.	I can rely on support from my superior. My superior supports my career within the firm. It is easy to talk about work-related problems to my superior. My superior supports me in learning from my mistakes.
Recognition	Perception that the member's contributions to the organisation are acknowledged.	I can count on some form of recognition when I excel. I don't only hear about my work when I make a mistake. My superior lets me know that he is aware of my strengths. My superior doesn't hesitate to recognise good performance. My superior cites me as an example.
Fairness	Perception that organisational practices are equitable and non-arbitrary or capricious.	I can count on fairness from my superior. My superior sets reasonable job goals. My superior is impartial. If my superior disciplines someone, they normally deserve it.
Innovation	Perception that change and creativity are encouraged. This includes the risk-taking in new areas of business or experience.	My superior encourages me to develop my ideas. My superior appreciates me trying new ways of performing my duties. My superior appreciates me attempting to improve on his methods.

Table 21: A Definition and Description of Psychological Climate (Koys *et al* 1991: 273- 283).

- Leadership positions. The definition of team leadership and the staffing of team leadership positions at the beginning of a project, should be performed carefully. The credibility of project leaders among team members, senior managers and project sponsors is crucial for the project managers of they are to manage the multi-disciplinary team effectively across functional lines.
- Effective planning. Thorough and effective planning early in the life of the project, impacts favourably on the work environment and team effectiveness.
- Involvement. Project managers should strive through thorough project planning to involve project team members at all organisational levels. This may be achieved by initially using key project team members during the project definition phases. By an improved understanding of the project, the team will be encouraged to become more involved and more committed to the project and its goals.
- Project staffing. Prospective project team members should be thoroughly interviewed, the performance expected of them and the reporting relationships involved thoroughly explained to them. Only suitable, willing candidates should be considered for appointment.
- Team structure. The project team structure and the operating concepts to be used must be established during the formulation phase. The project plan, task structure, project charter and policy may be used for this purpose. The project manager should regularly apprise management of the status of the project and the team.
- Team building. The goal should be an effective team. The project manager should convene team-building sessions to enhance cohesion and co-operation among its team members.
- Team commitment. Project managers should seek out and eliminate instances where members show a lack of commitment. Conflict and insecurity often cause lack of commitment. Such instances should be identified and eliminated by bringing personal and project goals into congruence.
- Senior management support. A project's support by senior management is crucial to its success. Using his influence with senior management, the project manager should ensure that the correct environment is created and that the required resources are made available. The project manager should therefore develop credibility to ensure their support from management.

- Organisational development. The project manager should monitor performance continuously. The sooner problems are addressed, the better. An organisational development specialist can assist with the diagnosis of team problems and in eliminating the causes. He may also be able to propose new perspectives to emotionally complex situations.
- Problem avoidance. The project manager should attempt to identify all potential problems and deal with them before they become a serious issue for the project team.

3.5.5 ROLES IN PROJECTS

Although each project has its own characteristics and compositions, there are certain roles that must be fulfilled in the process. As the scope of this study is confined to the role of the Engineering-Technical Family, only the role of the Project Manager and those of members of this group will be discussed. Other roles would include those of the Project Administrator, the Project Controller, the Project Accountant, members of the Customer Liaison service, the Field Manager and the Quality Assurance Supervisor (Nicholas 1990: 184).

A. PROJECT SPONSOR

A senior manager may assume this role. At the firm, Ericsson, the telephony company, the Project Sponsor is responsible for the outcome of the project and approves the various project phases. This role-player is responsible for the business case and updates it during each phase (Mulder 1997: 3)

B. PROJECT MANAGER

The Project Manager is responsible for the execution of the project, defining the project's goals and objectives and preparing the project plan and budget. Regarding the execution of the project, the Project Manager enters into contracts with the relevant line managers. This role-player is responsible for what is delivered and when it is delivered. The line manager in turn is responsible for how and by whom the deliverable is produced. This is referred to as the balanced matrix approach at Ericsson. The Project Manager reports to the project sponsor (Mulder 1997: 3).

The Project Manager's role is central to project management and it is the overriding force behind a project's success. His primary role is to integrate everything and co-ordinate everybody's activities to ensure that the goals of the project are achieved.

Many of the project's elements may be scattered and the activities involved diverse. The Project Manager is the hub of internal project communication and the single point of entry and exit for project communication with the external environment. In this role, the Project Manager is well poised to make project-related decisions. The Project Manager's responsibilities include (Nicholas 1990: 173)-

- Planning project activities, tasks, end results, work breakdown, schedule and budget.
- Project team organising, selection and placing and co-ordinating tasks and resources allocated to the project.
- Interfacing with functional management, contractors, clients and top management.
- Effective application of project team and client personnel.
- Monitoring the project progress.
- Identifying and solving technical and functional problems.
- Recommendation of termination or redirection where the desired project results are not achievable.

Project Managers should have at least managerial ability, technical competence, a broad background of experience and the ability to lead and motivate project teams (Nicholas 1990: 177).

Except in large projects, Project Managers are not delegated with legal authority, but rely on influence from expert and referent powers. Project Managers therefore depend on the goodwill of others to execute the work needed to achieve project goals (Nicholas 1990: 177).

The research of Grant *et al* (1997: 12) indicates that-

- The technical competence of Project Managers is absolutely essential or at least extremely important.
- The technical competence of Project Managers is most important during the demonstration and validation phase of the Product's life cycle.
- The importance of competence does not diminish as the Project Managers gain experience.
- Technical competence is perceived to be more important for Project Managers with teams that are technically competent than those with less competent teams.

C. PROJECT ENGINEER

The Project Engineer is responsible for co-ordinating activities in technological areas and assuring the integration of the various subsystem designs for the delivery of the final Product. This includes systems analysis, systems engineering, design, interface control, configuration management and systems integration and testing.

Where the project involves many disciplines, the Project Engineer-

- Derives design requirements from performance requirements.
- Oversees design and development.
- Supervises the communication, co-ordination and direction of functional areas.
- Plans, assesses and records the progress in design, development and testing of Product subsystems.
- Plans, monitors and assesses system integration tests.

The Project Engineer supervises configuration management which tracks and controls changes to the project's Product. The changes and their influences on other parts of the Product are analysed and documented. (Nicholas 1990: 184).

D. SYSTEMS ENGINEER

Systems Engineering is the discipline that is responsible for creating and managing the effective implementation of solutions to problems. Scientific and engineering effort is applied in an attempt to achieve the following goals (Blanchard *et al* 1986: 9):

- Deriving a set of system performance parameters and a preferred configuration from an operational requirement stated by the user.
- Integrating the system's technical parameters while ensuring that all of the interfaces are compatible, and optimising the total system.
- Incorporating producibility, reliability, supportability and safety in the engineering effort.

The relative position of Systems Engineering within the Project and Enterprise is presented in Figure 47 (Stevens *et al* 1998: 12). Systems Engineering is the engine that drives the technical direction of the project by defining the system requirements and creating the system architecture (Stevens *et al* 1998: 7).

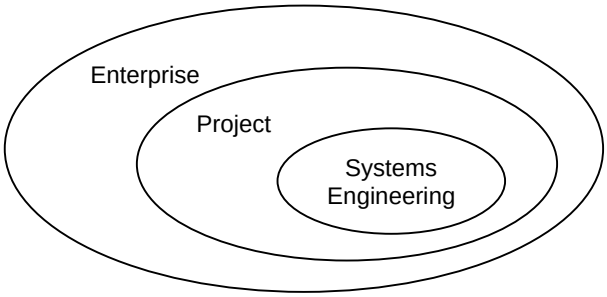

Figure 47:Context of Systems Engineering within the Project and Enterprise(Stevens *et al* 1998:2)

E. CONFIGURATION MANAGER

Configuration management provides visibility and permits control of the performance and functional and physical attributes of the Product over its life cycle. It thus facilitates the orderly management of information on and changes to the Product (EIA-649, 1998: v).

Configuration management links systems engineering to project management, as shown in Figure 48 (Stevens *et al* 1998: 158).

The purpose benefits of configuration management include (EIA-649, 1998: v):

- The Product attributes are defined, providing measurable parameters that give both buyer and seller a common basis for negotiation.
- The documented Product configuration presents a defined basis for making changes on correct, current information. It is possible to repeat production with identical results.
- Products can be identified and linked to their requirements, design and production information. Guesswork and errors are eliminated, as the relevant data is accessible.
- Proposed changes can be evaluated for their impact prior to implementation, thus reducing downstream costs.
- The cost of *ad-hoc* adjustments is eliminated by managing change using a defined process.
- The configuration information is captured and recorded during the definition, change, distribution, operation and disposal processes. This information is then available and accessible and consequently permits timeous and accurate decisions.
- The actual configuration can be verified by comparison with the required attributes during the various life cycles. This breeds a high level of confidence in the information available.

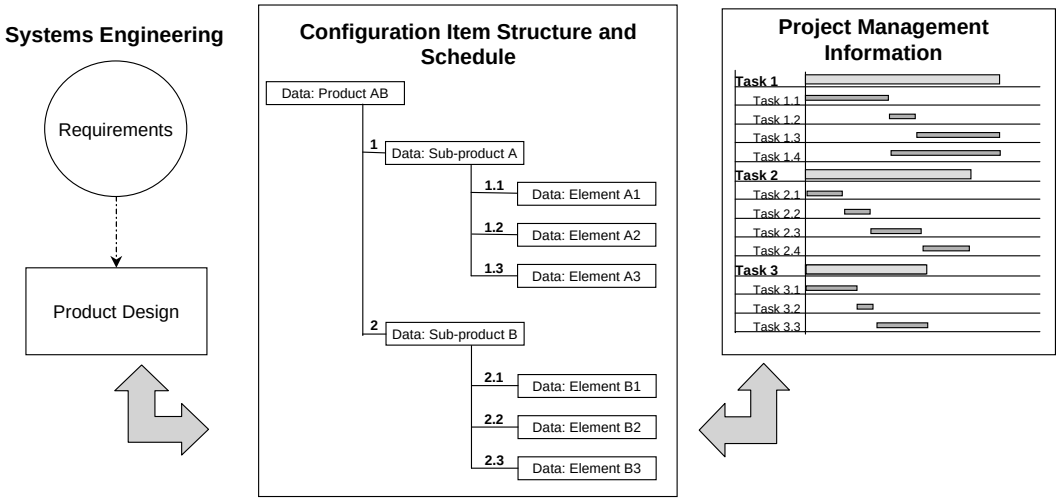

Figure 48: Linking Systems Engineering and Project Management (Stevens *et al* 1998: 158).

Configuration management, as described previously, regulates change, is typically performed by the organisation's facility and plays a very significant role in assuring the project's success.

Typical Configuration Management (CM) processes executed by the Configuration Manager include (EIA-649 1998: 10)-

- CM planning and management.
- Configuration identification.
- Configuration change management.
- Configuration status accounting.
- Configuration verification and audit.
- Configuration management of digital data.

Changes have an adverse influence on project cost and schedule goals. To reduce the number of changes and the negative impact on project performance it is necessary to employ a formal change review and control system. Drafting and implementing changes is similar to other project work that must be defined and scheduled. The change control system reviews and authorises design and work changes whilst rejecting unnecessary ones. (Nicholas 1990: 398).

F. OTHER FUNCTIONAL ROLES

Personnel falling under the organisational line functions also make up part of the project team and contribute towards its success. Typical roles of these team members include systems engineering, software engineering and other associated disciplines.

3.5.6 PROJECT LIFE CYCLE PHASES

Any Product passes through various phases in its life. The **EIA-649** (1998: vi) proposes the set of Product life cycle phases presented in Table 22. This table presents the names or aliases that are often used to describe these phases. Irrespective of whether the Product is a facility, aircraft or computer software, it will go through all or most of these phases.

Nicholas (1990: 91) divided the project's systems development cycle into the following four phases: Conception, Definition, Acquisition and Operation.

The depiction of the product life cycle phases proposed by the EIA and Nicholas (1990: 91) are similar in principle.

Ericsson attempts to use a common methodology in its projects. As it has many companies across the globe participating in its projects, it found it necessary to use a common methodology to make the processes manageable. A shared view on project management is a prerequisite for handling and resolving conflicts. Ericsson divides its projects into the following four phases: the pre-study phase, the feasibility phase, the execution phase and the conclusion phase. At the beginning of each phase, the project must pass what Ericsson terms a tollgate. This is a decision-making point where senior management or the project sponsor makes a formal decision regarding the aims and execution of the project and is based on the assessment of three concerns (Mulder 1997: 2):

- Project status in terms of requirements, the supply of deliverables, and progress.
- The benefit to Ericsson and the client.
- The use of resources in both the short and long terms.

Milestones in contrast with tollgates are concerned with the project's work model and are controlled by the Project Manager and the project team (Mulder 1997: 2).

Phases:	Aliases	Characteristics	
Conception	Marketing Concept Study Research Exploration Pre-development	Need Mission Trade-offs Survey Pre-concept & Concept	Opportunity Analysis Investigation Functions Definitions
Definition	Development Design Programme definition & Risk Reduction Engineering & Manufacturing Development Coding/Software build	System Definition Architecture Design Software Code & Test Planning Testing	Specification Preliminary Detailed Design Manufacturing Prototyping Evaluation
Build	Fabrication Production Construction Manufacturing	Facility Construction Assembly Inspection	Production Installation
Distribution	Sales Delivery Installation Fielding Deployment	Order Stock Acceptance Installation	Supply Transport Deployment Set-up
Operation	Operational Maintenance Warranties Service Life Performance Operation & Support Repair	Use Operate Service	Utilisation Maintain Depreciate
Disposal	Removal from Service Disposition Unsupported	Mothball Deactivate Disassemble Recycle	Discard Destroy Scrap Disposition

Table 22: Product life cycle phases EIA-649 1998: vi).

3.5.7 UNDERTAKINGS WHERE PROJECT MANAGEMENT IS APPROPRIATE

Project Management originated in the aerospace and construction industries where creative management is needed to cope with the demanding environments and types

of activities. In some situations project management would be inappropriate as its implementation would be greater than the effort of the undertaking itself. Cleland and King (1983: 259) list five indicators for the appropriateness of project management when considering an undertaking:

- The magnitude of effort: When an undertaking demands more resources than usually applied in an organisation, the use of project management techniques would be advantageous.
- Unfamiliarity of undertaking: Where an undertaking differs from the normal routine processes used by an organisation, project management is a suitable for integrating the effort to achieve the desired goal. Nicholas (1990: 30) describes a project as always requiring that different things be done or that the same things be done differently. Project management is a more suitable way of handling unique or non-routine situations.
- Volatile environment: Project management provides the flexibility needed to pursue new opportunities and changing goals encountered in the volatile environments encountered in modern industry.
- Inter-relatedness: When joint effort from several functional areas is needed, conflict often arises between them, defeating the effort required to achieve the goals. Project management induces and co-ordinates lateral relationships across functional boundaries thereby reconciling the conflicting groups and inculcating a sense of common purpose.

Organisational reputation: If there is potential for project failure which could lead to the damage of the organisation's reputation, loss of future contracts, or other undesirable consequences, it is advisable to put the management responsibility in the hands of a single individual charged with ensuring the success of the project. This individual project manager assisted by his team would reduce the chances of failure.