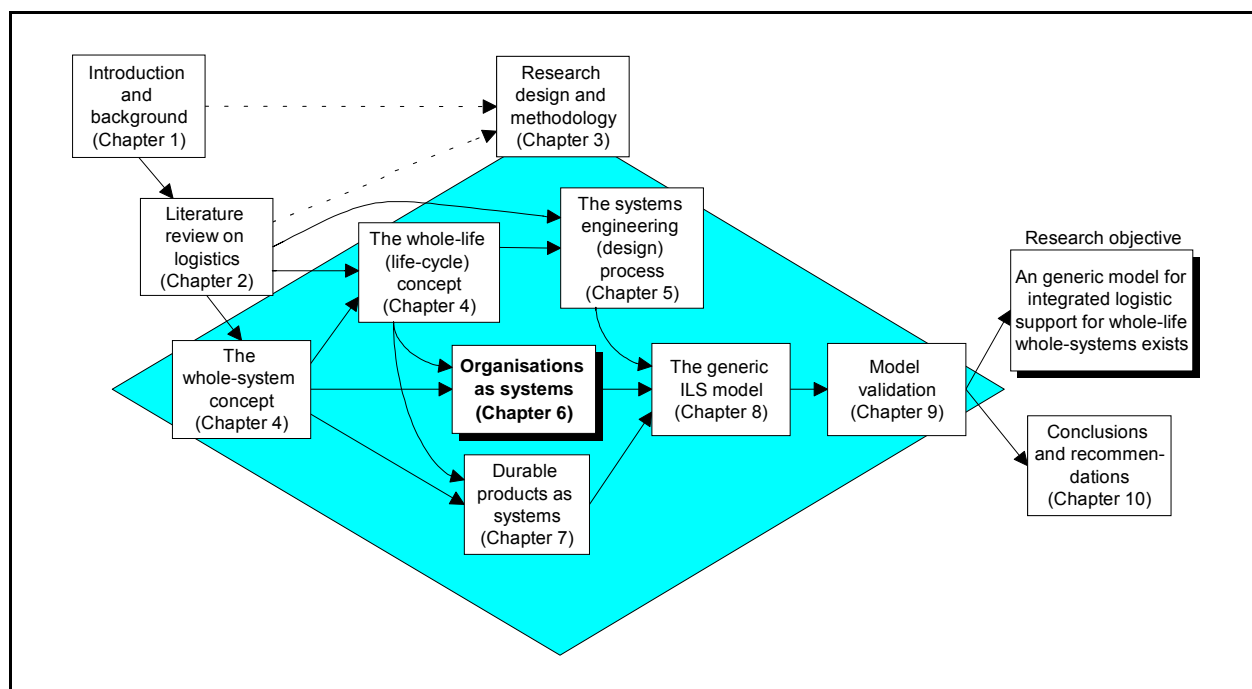# Chapter 6

The organisation as a system

"Living systems have integrity. Their character depends on the whole. The same is true for organizations; to understand the most challenging managerial issues requires seeing the whole-system that generates the issues."

Peter Senge [1990:66]

6.1 Purpose and outline of the chapter

The purpose of this chapter is to demonstrate that an organisation is a system because it exhibits all the system characteristics discussed in Chapter 4. However, this author will not attempt to demonstrate that organisations exhibit each and every system property discussed in Chapter 4. The most important system characteristics of an organisation will be highlighted in this chapter.

The outline of the chapter is as follows:

- The goal oriented nature of an organisation, irrespective of its nature or specific reason for existence, will be demonstrated.

- It will be shown how the generic system measurements, ability, availability and affordability, are applicable to an organisation, while also highlighting the generally accepted measurement of productivity and its relationship to these measurements.

- The hierarchy of systems within which the organisation exists pose necessary conditions that create the boundaries and constraints for the organisation. The necessary conditions will be discussed and it will be shown how they relate to the goals of profit and non-profit organisations.

- The role organisational strategy plays in creating a system perspective for the organisation is discussed and an approach to strategy formulation is introduced.

- Different ways of viewing the systemic nature of the organisation are discussed. The views are the functional interrelationship view (Porter's value chain [Porter, 1990:40-42]), and two life-cycle perspectives (Purdue enterprise reference architecture [Williams, 1994:142] and Rottier's enterprise life-cycle [Rottier, 1999:27-29]).

- Relationships between organisations (interactions across system boundaries), also known as the supply chain (Porter's value system [Porter, 1985:34]) are discussed.

Understanding the systemic nature of an organisation will allow the identification of requirements for a model of integrated logistic support that will improve understanding of the successful creation and operation of the organisation as a whole-life, whole-system.

6.2   The goal or teleology of an organisation

No organisation come into existence and continues to exist without a purpose, thus it is concluded that organisations exist for a reason. The goal of an organisation cannot be predicted beforehand or by outsiders, neither can it be imposed, unless we operate in a communist society. However, an organisation's purpose or goal is determined solely by its owners, otherwise the word ownership requires redefining. It is unimaginable that an organisation exists purely for the sake of its own existence [Goldratt, 1990a:10,12]. This

holds true for a public company and a private company, a for-profit and a non-profit organisation. Ackoff [1999:59-61] defines four essential characteristics of an organisation as a system, three of which relate directly to the goal or purpose of the organisation:

- *"An organisation is a purposeful system that contains at least two purposeful elements which have a common purpose.*

- *An organisation has a functional division of labor in pursuit of the common purpose(s) of its elements that define it.*

- *The functionality distinct subsets (parts of the system) can respond to each other's behavior through observation and communication.*

- *At least one subset of the system has a control function where achieved outcomes are compared with desired outcomes (purpose), and make adjustments toward reducing the observed deficiencies."*

King and Cleland in Pearce and Robinson [1988:75] provide seven reasons why a mission statements exist. Their first and seventh reasons are of interest to this study. The first reason for the existence of a mission statement according to King and Cleland is *"to ensure unanimity of purpose within the organisation"* [op cit]. Thus, when analysing the mission statement of an organisation one should be able to see the reason for the existence of the organisation. The seventh reason King and Cleland provide states that a mission statement is necessary in order *"to specify organizational purposes and the translations of these purposes into goals in such a way that cost, time and performance parameters can be assessed and controlled"* [op cit]. A clear link should thus be made between the purpose of the organisation and its measurements. This sentiment is shared by Goldratt [1990a:14]*: "Measurements are a direct result of the chosen goal. There is no way that we can select a set of measurements before the goal is defined."* Thus the defined purpose or goal in the mission statement will determine the measurements of the organisation. Measurements cause behaviour, illustrated by Goldratt's [1990a:26] observation of reality: *"Tell me how you measure me, and I will tell you how I will react. If you measure me in an illogical way... do not complain about illogical behaviour".* Invariably, an organisation stating in its mission statement that it wants to be the lowest cost provider of service X or product Y will have prime measurements relating to cost. Similarly, an organisation stating it wants to be the biggest in a particular market segment, will place

prime importance on measurements of market share. From this short discussion alone, it can be seen that it is critical to define the goal of an organisation correctly, so that the correct measurements can be derived and thus the correct behaviour be induced. Gharajedaghi [1999:143] supports this view on having the correct measures when he states "*we are much better of with an approximation of relevant variables than with precise measurements of wrong ones*".

However, many times organisations confuse the goal of the organisation with strategy, the necessary conditions, or even the means. McCormack [1984:199] states the most pressing problem established companies face is their bigness, which makes it so much easier to get off on tangents, forgetting why they are in business in the first place, which in the case of a for-profit organisation, is to make a profit. Forgetting about the goal often starts within the mission statement. Many times, the mission statement, intended to provide the definition of the goal, does not reflect the real goal. Ackoff [1999:125] starts his discussion on mission statements with: *"Most corporate mission statements are worthless."* A more elaborate discussion on this topic for profit oriented organisations can be found in Goldratt [1990a:10-13], a discussion that ends with the following: *"It is quite disturbing to see so many publicly held companies where top management confuses the necessary conditions, the means, and the goal. Such confusion often leads to misdirection and long-term destruction of the company. Customer service, product quality, good human relationships, are definitely necessary conditions, sometimes even means. But they are not the goal. The employees should serve the shareholders - that's what they are getting paid for. Serving clients is just the means to the real task, serving the company's shareholders."*

The example used previously of the organisation wanting to be the lowest cost provider, can be used to demonstrate how the wrong goal in the mission statement may lead to negative effects to the system as a whole. If this company has a profit motive, then its goal should be to make more money now as well as in the future. They may have selected to achieve their goal by reducing cost to become the lowest cost supplier, but this orientation reflects their strategy and not their goal. The most probable reaction to this mission statement would be to start reducing cost. Resulting from that a reduction in quality may follow which will invariable lead to an increase in quality costs. So much for becoming the

lowest cost provider. Cutting expenses generally boils down to slow suicide, because of the systemic relationship between income and expense. For more elaborate discussions on the nature and effects of cost cutting see Carlzon in Zbar [1994:77], Noreen *et al* [1995:143], Morgan [1994:23], Goldratt [1990b:92-93] and Corbett [1998:16].

Ackoff [1999:22] argues that systems should be viewed in an output-oriented way (teleologically), rather than in an input-oriented way (deterministically). He continues to state that organisations have a purpose of their own. He defines three levels of purpose when organisations are studied as a system, namely the purposes of the system, of its parts, and of the higher level system of which the system is part (the suprasystem) [op cit:23-24]. From this it can be concluded that any organisation exhibits the generic properties of a system, namely that it was built for a purpose or to be goal-seeking, and that it exist within a higher level system. This last property implies the existence of an organisation within a system hierarchy and interaction with its environment.

6.3 Generic organisational measurements

Looking at the organisation from a system point of view, the generic measurements defined for any system, namely ability, availability and affordability, can also be applied.

6.3.1 Organisational ability

The ability of an organisation is the ultimate function that allows the organisation to achieve its defined goal. Immediately one gets the feeling that it is impossible to generically define the goal of all organisations as the differences between types of organisations will not allow such a generic definition of a goal. According to Goldratt [1990a:12] it is possible to define a generic goal for at least one group of companies. Those companies trading their shares on the open market have stated their goal unambiguously, namely to make more money now as well as in the future. To answer the question what the goal of a company trading its shares on the open market is, is the same as asking the question: "Why did the shareholders invest their money in that organisation?" The goal of organisations who do

not trade their shares on the open market or who do not have shares at all, can only be determined by those who own that company (see § 6.2). Even these companies must have a goal, otherwise there is no reason for their existence. In order for any organisation to achieve their goal, the organisation must possess a certain ability. Without that capability, achievement of the goal is not possible.

The ability of an organisation can be defined as a set of interrelated activities using certain inputs to deliver an explicit output. Irrespective of the goal of the organisation, the interrelated activities or processes are the actions of people using information, material, equipment, facilities and capital to produce the desired output. The output or goal of the organisation can be regarded as an emergent property. As was highlighted in § 4.3.3, emergent properties do not exist within the individual parts of the system, but are the product of the interactions of the parts. Gharajedaghi [1999:46] argues that "*the mere notion of interaction signifies a dynamic process producing a time-dependent state.*" This means that the emergent properties are being continuously reproduced online and in real time, and they are dependent on the reproduction process. If these processes are to stop, the emergent properties will also cease to exist. It requires many simultaneous interactions among many parts of the organisation to produce the desired outcome, which can be expressed as the organisation's ability. To understand the outcome as an emergent property, one needs to understand the interactions of the processes or parts as well.

For a profit oriented organisation, profit and return on investment are characteristics of the organisation. However, none of these are characteristics of any of the parts of the organisation. Thus, profit and return on investment are emergent properties of the organisation as a system, and it comes about due to the interactions of the different parts (ability) to generate these emergent properties. Gharajedaghi [1999:46] confirms it in his statement: *"If success is an emergent property, then it has to be about managing interactions rather than actions."* Success is being defined as achieving the goal. It can thus be concluded that ability measures the capacity to achieve the goal (emergent property) of the organisation as a system. Therefore it is not necessary to know the goal of each and every organisation to know that ability is a generic measurement of any organisation, irrespective the actual goal of the organisation.

6.3.2   Productivity as a measurement of organisational ability

One generic organisational measurement that is often used is productivity or ability to translate input into output. In its most basic format productivity is the ratio of output to input. The question is whether it tells anything about the goal of the organisation? Many times productivity improvements are measured on a local level which may look impressive but does not add anything to the well-being of the organisation in achieving its goal. For example the installation of new equipment may cause the operation time on a certain part to decrease by 50%. When measured on a local level this may seem significant. But does it mean that the organisation increases its profits by 50%? If not, it is not a 50% productivity improvement. It will be less or can even be zero. In the worst case productivity can even be impacted on negatively. Therefore it is imperative that the measurement of productivity be viewed in its true context, namely that "*productivity is the act of moving an organisation closer to its goal.*" [Goldratt, 1992:32]

It is further important that the two components of productivity be considered. They are:

  • Effectiveness or doing the right things (to achieve the goal).
  • Efficiency or doing things right (the things to be done to achieve the goal).

The above two components will not be discussed in further detail at this point but will be expanded on later in this thesis.

6.3.3   Availability

The understanding of the interaction of processes leads to the next generic system measurement, namely availability. An organisation, being an open system and interacting with its environment [Gharajedaghi, 1999:29], is constrained in its output (or goal achievement) [Wang, Han & Spoere in Wang Ed., 1997:15] and is subject to entropy [Aslaksen and Belcher, 1992:70]. It now follows naturally that organisational systems cannot be available 100% of the time. The implication is that the ability of the organisation is not available (the system is down and not functioning) or may have deteriorated over a

period of time. As the organisational system is purposeful it will seek to restore the availability in order to achieve the required output. Non-availability of the organisational system may be caused by a single event or a combination of events. It can also be caused by an operational deficiency (e.g. lack of raw material) or deterioration or failure of one or more of the resources (e.g. equipment breaking down). In order to restore the availability a different set of processes need to be set in motion to that effect. These different sets of activities is what M'Pherson [1980:550] (as discussed in § 4.6) calls the support activities performed by the support subsystem.

6.3.4   Affordability

The third generic system measurement applied to an organisation is affordability. Very simply affordability translates to deriving more benefits from achieving the goal than the costs associated with deriving those benefits. The costs are calculated by looking at the sum of all costs associated with all processes (direct and indirect) to produce a desired outcome or goal, as well as the costs associated with maintaining and restoring availability (support processes). For a profit making company the benefits translate to the income generated. For a non-profit organisation the benefits must justify the costs, as in the case of a country's military force.

6.4   The necessary conditions and its relationship with the goal

A necessary condition is something that if it is violated, the achievement of the goal is not possible. The necessary conditions of a company are the boundaries within which it has to operate. Goldratt [1994:271] states that the goal does not justify the means, as it is futile to define a goal without defining the boundaries within which the organisation can attempt to reach it. Necessary conditions are normally imposed by power groups. Some examples of power groups and the necessary conditions they impose are the following [Goldratt, 1990a:11] and Ackoff [1999:333]:

- Government impose necessary conditions such as taxes, minimum wages, maximum allowable pollution levels.
- Customers impose necessary conditions such as minimum level of customer service and product quality, i.e. they define the order qualifiers and order winners.
- Employees impose necessary conditions such as minimum job security and fringe benefits.
- Society within which the organisation operates impose necessary conditions such as expected production and distribution of wealth.

If the necessary conditions are violated the organisation will face a real threat of being closed down in some way or another. Still, a clear distinction must be made between necessary conditions and the goal of the company. Even though these power groups do impose necessary conditions, they do not have the right to determine or interfere with the organisation's goal. Defining the goal lies solely in the hands of the owners of the organisation. Thus the organisation should strive to meet its goal within the boundaries set by the power groups. Linking it back to systems theory, the organisation needs to be designed with a specific purpose, inserted into its host system (the economic, social, political, environmental and technological environments), and operated to achieve its goal without violating conditions set by the host system.

In the final analysis, all organisations (irrespective of their nature) can be classified as for-profit or non-profit organisations. This covers all types of organisations from a one man concern, companies whose shares are privately held, companies who trade shares on the open market, to government departments and welfare organisations. Two diagrams are proposed to show the interactions between necessary conditions and the goal of the organisation.

Figure 6.1 shows the necessary conditions for profit-oriented companies. Each of the three components are equally important. The goal of making money now as well as in the future satisfy the needs of the shareholders or owners of the business. The first necessary condition of satisfying the market looks after all concerns of the host system. This includes the concerns of the direct customer, government, environmental groups and society at

A generic approach to integrated logistic support for whole-life whole-systems
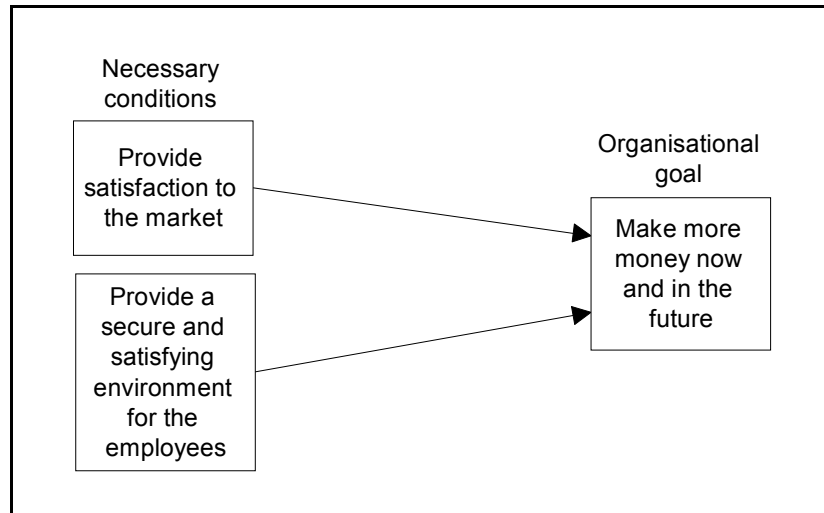
**Figure 6.1: The goal and necessary conditions for a
profit oriented organisation**

large. The second necessary condition of providing a secure and satisfying environment for the employees looks after the needs of those people employed by the organisation [Goldratt, 1994:273] in terms of job security, work satisfaction, career prospects and self-fulfilment. The requirements set by this last necessary condition is extensively covered by Wickens [1995: xvi, 88], and echoed by Ackoff [1999:126] and Richard Branson of Virgin [Wickens, 1995:100], and will not be discussed in more detail as part of this research.

Figure 6.2 shows the three necessary conditions applicable to non-profit organisations. Whatever the goal is, determined by the owners of the organisation, the three necessary conditions as stated hold true. The difference between the profit organisation and the non-profit organisation is that making money, is not a goal - as is the case with the profitorganisation - but a necessary condition for the non-profit organisation. Making money ensures the survival of the non-profit organisation. Without cash and at least being able to break even, any non-profit organisation will cease to exist, irrespective how noble its goal may be. This necessary condition does not specify the means of making money; the non-profit organisation may even be subsidised. However, the necessary condition remains.If the subsidy is to be removed and it does not make money in another way, the organisation will cease to exist.
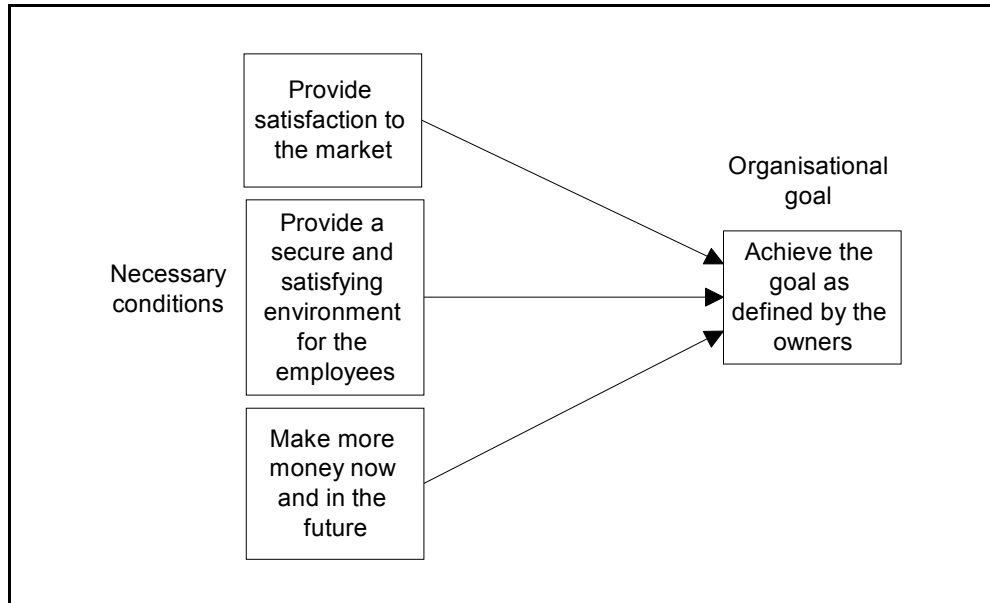
**Figure 6.2: The goal and necessary conditions for a
non-profit organisation**

In recent debates [Lagace, 2002] it has been stated clearly by Harvard Business School professor James E. Austin that *"'Profit' need not be a dirty word at a nonprofit organization".* A very strong argument is made out by Alfred Wise (director of the Community Wealth Ventures for-profit consulting unit within Share Our Strength, an anti-poverty nonprofit) in Lagace [2002] whether *"we can teach [the people we serve the importance of being self-sufficient while not being self-sufficient ourselves?"*

The necessary condition of making money for non-profit organisations may lead the non-profit organisation to make a profit in pursuit of its chosen goal and to ensure its continued existence. Making a profit does not suddenly change the goal of the organisation or turn it into a for-profit organisation. The difference between these two types of organisations lie with what happens to the profit when a profit is made. In most countries throughout the world, within the profit organisation, the owners have the right to decide what to do with the profits; they may even take it all. Similarly, in non-profit organisations worldwide, any profits made have to go towards the goal; the owners are not allowed to enrich themselves.

6.5   Strategy formulation

The realisation of the systemic interactions between these necessary conditions and the goal is the foundation on which strategy should be planned to provide an organisation with a sustainable competitive advantage. Because strategy is the direction an organisation takes to achieve its goal [Goldratt, 1994:275], and because necessary conditions may not be violated in pursuit of the goal, a chosen strategy should be discarded if it clashes with any of the necessary conditions.

Hill [1994:18, 25] is of the opinion that corporate strategy statements are flawed in that they are many times just a compilation of functional strategies and nothing more. Furthermore, a second mistake is that functional strategies are developed independently of one another and the corporate whole, ignoring the systemic nature of the organisation. In order to arrive at a sound strategy, the whole (systems) picture should be taken into account and the interactions amongst the functions should be considered.

The arguments that follow are formulated for a profit oriented organisation, based on the preceding theories and observations. Using the same reasoning logic, a similar model can be deducted for non-profit organisations, but is not explored further in this research.

From a strategic point of view, in order to provide satisfaction to the market (the first necessary condition) the organisation is to provide a product and/or service that:

• meets the order qualifier requirements Hill [1994:33], where order qualifiers are those characteristics of the product, service and /or organisations that will make the customer consider the organisation as a possible supplier; and

• exceeds the order winner requirements [op cit], where order winners are those characteristics of the product, service and /or organisations that will make the customer choose the organisation and product/service above the competitors.

For order qualifiers, an organisation has to be as good as its competitors; for order winners, an organisation has to be better than his competitors. Order qualifiers and order winners are not static, they are time and market specific [Hill, 1994:32]. This means that

in order to remain competitive, an organisation has to be flexible to adapt to changing market needs. This flexibility implies responding to changing market needs by changing order qualifiers into order winners, order winners in order qualifiers or creating new order qualifier and order winning criteria.

The second necessary condition, namely that of providing a secure and satisfying environment to the employees, is a subject that has been written about and debated for a long time. For the purpose of this thesis this author will stick to defining three prerequisites for meeting this necessary condition, namely:

- The organisation has to provide security to its employees, that means an absence of uncertainty as far as possible.
- The organisation has to provide satisfaction to its employees, resulting in employees feeling a sense of value contributing towards the overall organisational performance.
- The organisation has to provide scope for their employees, where endeavours can be undertaken by employees to further themselves within the company while at the same time contribute even more to the goal of the organisation.

Taking all the above into consideration, a systems view of developing a strategy can be developed. This view is shown in Figure 6.3 for a profit-oriented organisation. The goal and necessary conditions, once seen in a logical interaction, clearly defines the sequence of satisfying these necessary conditions and also how these strategies fit together. Thus strategy development cannot be a haphazard disconnected process of establishing functional strategies to end up in an organisational strategy, as has been observed by Hill [1994:18, 25]. Naturally, there are many outside factors influencing strategic decisions. For the sake of clarity, these are not included in the diagram as the focus is on the goal, necessary conditions and the prerequisites to that.

The organisation must clearly start with facing the market in determining the actual needs and opportunities that exist or potentially exist. Having identified the need or potential need in the market, the current (and future) abilities of the operations (or delivery) process must be considered to establish the market requirements (which include both the order qualifiers and order winners) for a product and/or service that will satisfy the market. This interaction
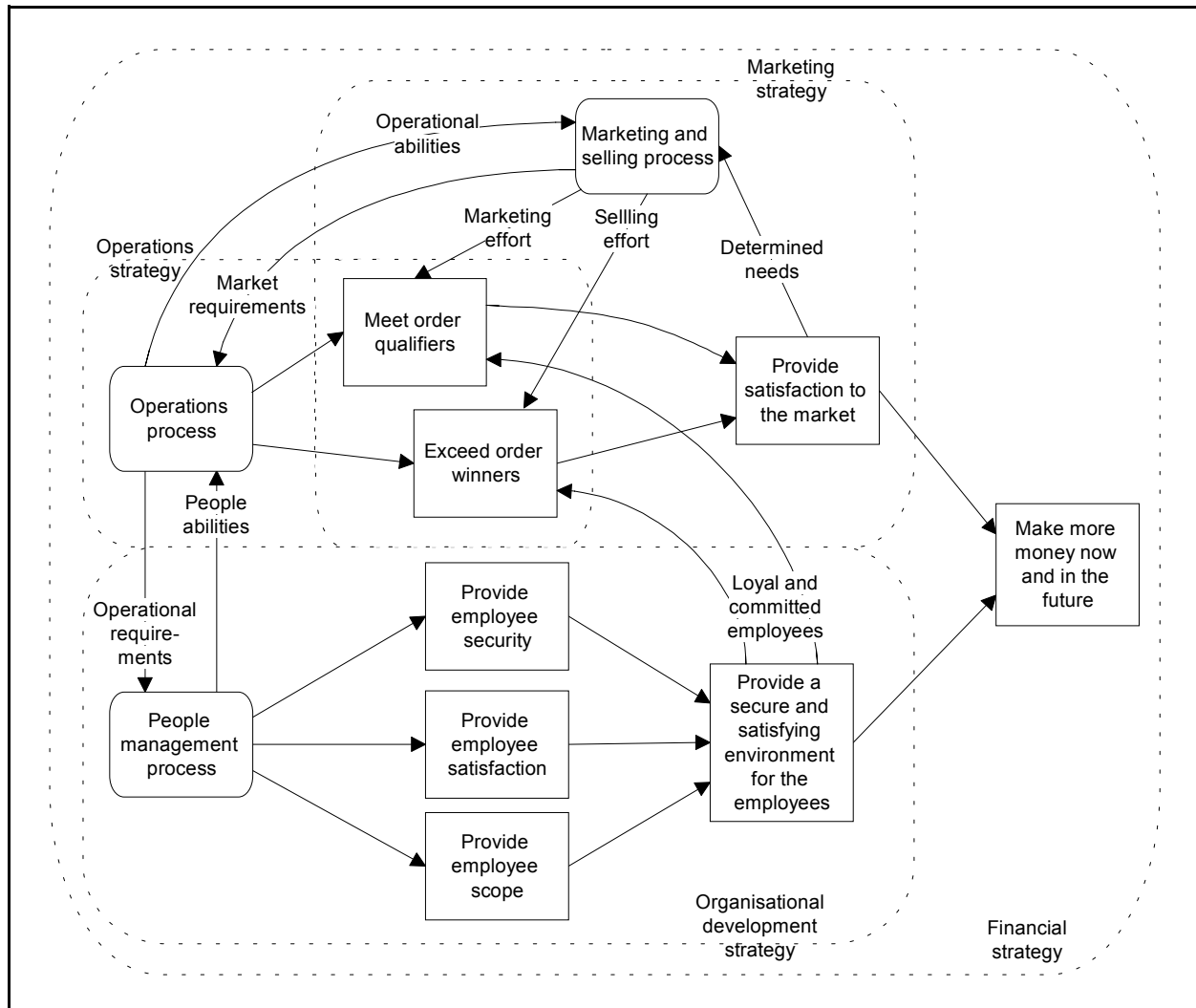
**Figure 6.3: The systemic nature of strategy development
for a profit oriented organisation**

between market analysis and operational capability is to ensure that what is promised by marketing can be delivered by operations. Only now can a marketing strategy be formulated. The marketing strategy is the first strategy that should be in place. Organisations should be very cautious not to confuse a strategy of being market-led or a strategy of being marketing-led. Having a marketing-led (functional) perspective as opposed to a market-led (business) perspective can be very dangerous [Hill,1994:41]. Going for a marketing-led strategy will again lead to a local optimum, which is not congruent with the systems view. One must beware of becoming so internally focussed and ignoring the customer, as is demonstrated by the next statement about General Electric (GE). *"Many of GE's best managers devoted far more energy to internal matters*

than to their customer's needs. As GEers sometimes expressed it, theirs was a company that operated 'with its face to the CEO and its ass to the customer' " [Tichy and Sherman,1993:6].

The second strategy is the operations strategy that should consider how to deliver the market requirements provided by the marketing function. Based on the market requirements and the ability of people that can be used within operations, a strategy for operations is developed to give direction to delivering products and/or services that will meet the order qualifiers and exceed the order winners as set by the market. In essence, the order qualifier and order winners (quality, flexibility, lead time, service, low variability, product/service profitability) [Schonberger & Knod, 1991:7], are created within the operational environment. Thus the operational strategy deals with a series of decisions concerning process selection (conversion, fabrication or assembly), flow structures (project, job shop, batch, assembly, continuous flow), quality, investment decisions (make or buy), degree of automation versus manual labour and other [Chase et al, 1998:96-98]. This strategy must provide, over time, the necessary support for the order-qualifiers and order-winners [Hill, 1994:41]. In short it is to establish the most appropriate mode to provide these sets of products or services AND to provide the infrastructure, policies and mechanisms required to support the operational processes. This operational support has three dimensions that has to be established along with the ability to deliver product and/or services:

- The flow of raw material from the organisation's suppliers to the organisation, as well as the distribution of end products to the markets of the organisation (business logistics).
- The support required to maintain the operational system in a functional state (maintenance).
- The support required by customers for the commissioning, utilisation and maintenance of the product/service they have bought from the organisation (after-sales-service).

Hill [1994:41] warns organisations of incorrectly seeing operation's role as being the provider of corporate requests. Corporate strategy debate should include discussing the

implications of decisions for operations and thus the organisational system as a whole. Erroneously viewing operations as the provider of corporate requests has been based on two incorrect assumptions:

- Within a given technology, operations is able to do everything.
- Operation's contribution concerns the achievement of efficiency rather than effective support of market needs.

The operations strategy should therefore be totally integrated with the overall strategy and cannot be viewed as unimportant or disconnected. The performance of the system as a whole will suffer if this strategy is neglected. In the final instance, the operations function should become the source of competitive advantage for the organisation, as this is primarily the function where the order qualifiers and order-winners are created.

The third strategy is the organisational development strategy. This strategy takes into consideration the people requirements for the organisational system as a whole considering quantity and quality of people needed for operations and marketing. It supports the human side in terms of assessing the people's needs from a personal and organisational point of view. The organisational development strategy is further aimed at providing employee security, satisfaction and scope (meeting the second necessary condition). In this context, the phrase people management is preferred to human resource management. This view is shared by Wickens [1995:xvi] where he argues that the statement "*Our people are our biggest asset*", is a hypocritical one, as executives rarely act that way. Making such a statement implies subconsciously that 'our people' are something separate from 'us', that they belong to the company, as if the company owns them. Assets are shown on the balance sheet; no company has ever shown their people as asset on their balance sheet. He continues to say that *"the real company is just as much the people who work in it and give their time as those who are outside and invest their money"* [op cit].

Wickens [1994:88] further argues that another hypocritical statement made by organisations is *"we are all one family here"*. He argues that no children choose their family but will in most cases stick together and support each other within the family in the good

times and the bad. Individuals have a choice whether to accept a position or not, or if they are in a job they have the choice to stay there or not. Organisations have a choice to appoint a person or not and to keep him in the organisation's employ or not. It is not characteristic of a family to have these choices. Breaking the relationship between an employee and an organisation is not hard to do. Thus, loyalty has to be earned, it does not come from a written piece of paper (the mission statement). This demonstrates the importance of the organisational development strategy.

Quite obvious in Figure 6.3 are the interrelationships between the marketing, operations and organisational development strategies. These interrelationships probably illustrate the systemic nature of organisations best. This interaction between marketing, operations and people is what Carlzon [1989:3] calls the "moment of truth", where the customer meets with the organisation, directly or indirectly, through its employees, processes and product and/or services. This is also where customer perceptions about the organisation are formed . These customer perceptions may be right or wrong, but nevertheless, the customer will act upon his perceptions in future dealings with the organisation and this is what ultimately translate to customer satisfaction. To a customer his perception is reality. Therefore carefully aligned strategies between marketing, operations and organisational development through the employees are of the utmost importance. This approach is echoed by Richard Branson, Chairman of Virgin Atlantic Airways, when he states [Wickens, 1995,100]: *"We give top priority to the interest of our staff; we give second priority to the interests of our customers; and third priority to the interests of our shareholders. Working backwards, the interests of our shareholders depend on high levels of customer satisfaction, which enable us to attract and retain passengers in the face of intense competition. We know that the customer's satisfaction which generates the all-important word-of-mouth recommendations and fosters repeat purchase, depends in particular upon high standards of service (and this) depends on happy staff, who are proud of the company they work for."*

The last strategy is the financial strategy that will allow the organisation to finance the other strategies, make investment decisions in line with the goal of the organisation and develop a dividend policy, which is beyond the scope of this research.

6.6 The organisation as a system of dependent variables

In order to get the correct perspective on the way an organisation functions, considering the goal, necessary conditions, prerequisites to the necessary conditions and how it all translate into a coherent organisational strategy, it is necessary to switch the *"view of organisations as systems of independent variables to viewing them as systems of dependent variables. Many functions have to carry out, in sync many tasks, until a sale is realized, until throughput is gained"*[Goldratt, 1990a:52-53]. This means that organisations should be viewed as a chain or a grid of chains. Even though the strength of a chain is determined by its weakest link, all other links are required to make up the chain. If any one link is missing, the chain loses its overall strength. The focusing efforts should always be at improving the weakest link, without forgetting the importance and dependencies of all the other links. Thus, a better way of looking at an organisation is to view it as a set of dependent functions, of which all must perform at least as well as the weakest link, to achieve the desired output. Three different views of the organisation are now presented to illustrate different perspectives of the organisation as a system.

6.6.1 Porter's value chain concept of the organisation

One popular approach to view organisations as a system is the value-chain concept as defined by Porter [1990:40-42] and illustrated in Figure 6.4. The basic philosophy of the value chain is that *"firms create value for their buyers through performing these (discrete)activities."*[Porter, 1990:40]. Value is defined as the amount customers are willing to pay for whatever the organisation is selling to them [Porter, 1985:38]. The value chain shows all activities that an organisation uses to create value for its customers. The margin is the difference between total value (sales or income) and the collective cost (expenses) to perform these activities. He classifies five primary activities of the value chain and shows four more support activities that support the primary activities. The dotted lines illustrate that some of the secondary activities may be associated individually with primary activities or the total chain, whereas the firm's infrastructure supports the whole value chain [op cit].
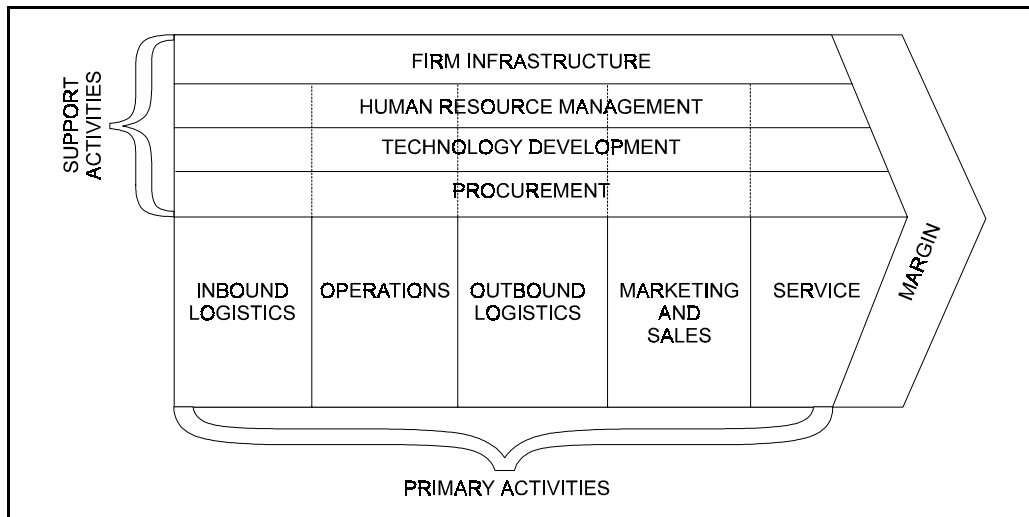
Figure 6.4: Porter's value chain
[Porter, 1985:37]

Porter's [1985:39] idea with the value chain is to be able to examine competitive advantage. He prefers the value chain concept to the value added concept (which he defines as selling price less the cost of purchased materials) for the following reasons:

• Value added incorrectly distinguishes raw material from the many other purchased inputs used in an organisation's activities.

• Cost behaviour of activities cannot be understood without simultaneously examining the costs of the inputs used to perform them.

• Value added fails to highlight the linkages between an organization and its suppliers that can reduce cost or enhance differentiation.

Porter's value-chain concept of "*the ultimate value a firm creates is measured by the amount buyers are willing to pay for its product or service*" [1990:40], clearly demonstrates the point that the way he defines value is not equal to product cost. Product cost is based on the amount of activity and resources spent (value added) on delivering the product or service. Value is based on the perception of the buyer of the benefit(s) which can be gained from having the product or service. Thus if Porter's value chain is to be understood correctly, one must rather look at adding value to the organisation than adding value to a product or service, which will make the reasons for preferring the value-chain concept to the value-added-concept, much more defendable However, a detailed discussion on this topic is beyond the scope of this thesis.

By looking at value as value to the company (achieving the goal) as opposed to value of the product/service,   it eliminates the confusion over whether money spent is an investment or an expense [Goldratt, 1992:59-60]. *"The whole concept of adding value to a product is a distorted local optimum. So we should not be surprised if it will cause distortions in the company's behaviour. The local viewpoint of adding value to a product causes companies to slow down considerably their efforts to reduce material inventory. Local optima do not add up to the optimum of the total"* [Goldratt, 1990:24-51,51].

Porter [1990:41] thus supports the principle that an organisation must be viewed as a system when he states that "*a firm is more than the sum of its activities. A firm's value chain is an interdependent system or network of activities, connected by linkages. Linkages occur when the way in which one activity is performed affects the cost or effectiveness of other activities. Linkages often create trade-offs in performing different activities that must be optimized. For example, a more costly product design, more expensive components, and more thorough inspection, can reduce after-sale service costs. Linkages also require that activities be coordinated. On-time delivery requires that operations, outbound logistics, and service activities such as installation should function smoothly together.*"

6.6.2   The Purdue enterprise reference architecture

As opposed to Porter's value chain which simply looks at an organisation from a running concern or operational phase point of view, the Purdue enterprise reference architecture [Williams, 1994:142] takes a life-cycle approach and view the organisation through all its phases from concept to the operational phase. An adaptation of the model is shown in Figure 6.5. In this model the phases used to describe the life-cycle are the concept phase, followed by the definition and design phases, leading into construction/installation and finally operations. The model does not cater for recycling and phase-out, even though it may be implied in some phases. Even though the architecture was primarily developed to model organisations that uses computer integrated manufacturing (CIM), the model can
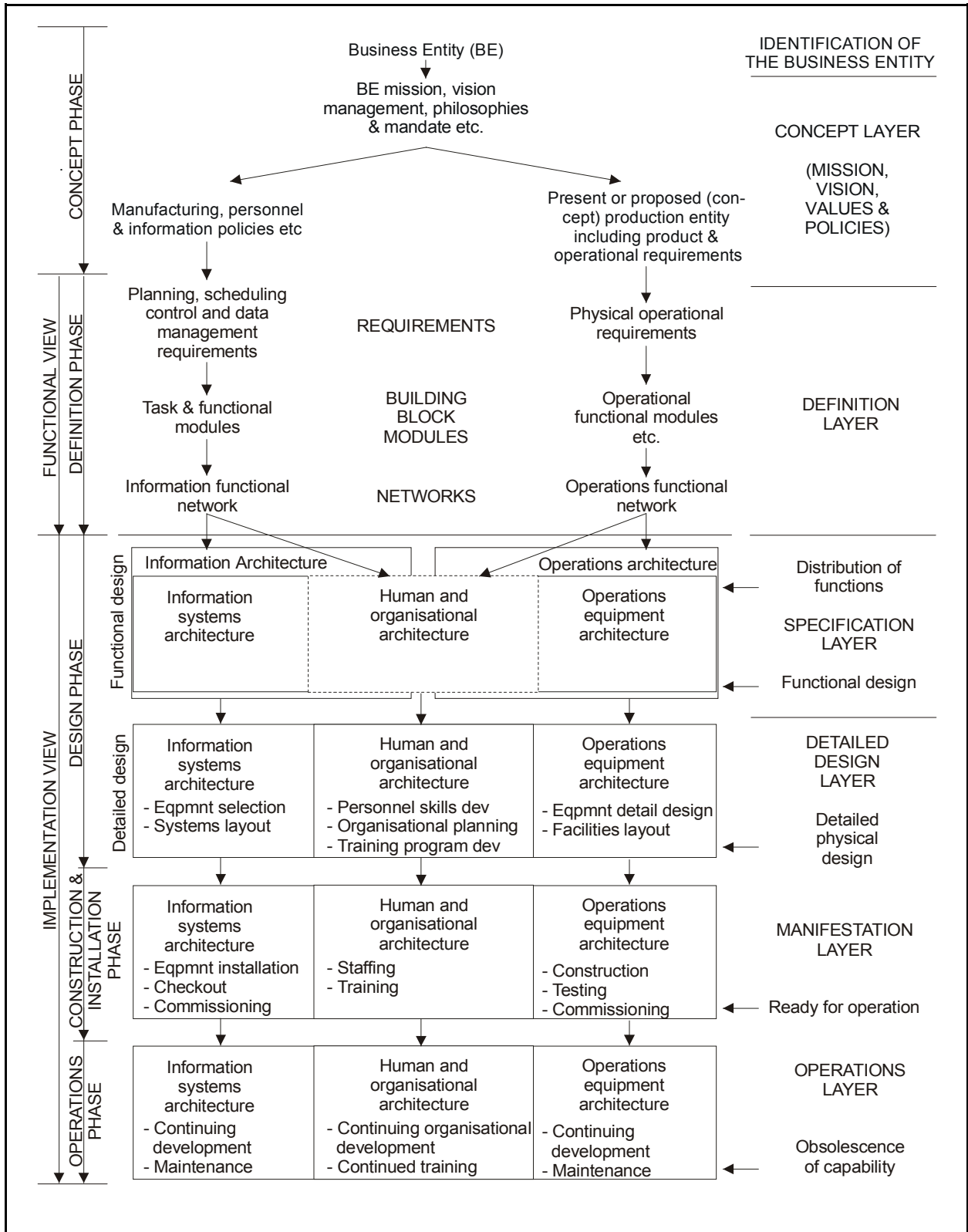
	Business Entity (BE) ↓ BE mission, vision management, philosophies & mandate etc.	IDENTIFICATION OF THE BUSINESS ENTITY

CONCEPT PHASE

Manufacturing, personnel & information policies etc

Present or proposed (concept) production entity including product & operational requirements

CONCEPT LAYER

(MISSION, VISION, VALUES & POLICIES)

FUNCTIONAL VIEW — DEFINITION PHASE

Planning, scheduling control and data management requirements

REQUIREMENTS

Physical operational requirements

Task & functional modules

BUILDING BLOCK MODULES

Operational functional modules etc.

DEFINITION LAYER

Information functional network

NETWORKS

Operations functional network

IMPLEMENTATION VIEW — DESIGN PHASE

Functional design

Information Architecture		Operations architecture
Information systems architecture	Human and organisational architecture	Operations equipment architecture

Distribution of functions

SPECIFICATION LAYER

Functional design

Detailed design

Information systems architecture - Eqpmnt selection - Systems layout	Human and organisational architecture - Personnel skills dev - Organisational planning - Training program dev	Operations equipment architecture - Eqpmnt detail design - Facilities layout

DETAILED DESIGN LAYER

Detailed physical design

CONSTRUCTION & INSTALLATION PHASE

Information systems architecture - Eqpmnt installation - Checkout - Commissioning	Human and organisational architecture - Staffing - Training	Operations equipment architecture - Construction - Testing - Commissioning

MANIFESTATION LAYER

Ready for operation

OPERATIONS PHASE

Information systems architecture - Continuing development - Maintenance	Human and organisational architecture - Continuing organisational development - Continued training	Operations equipment architecture - Continuing development - Maintenance

OPERATIONS LAYER

Obsolescence of capability

Figure 6.5: Block diagram of the Purdue Enterprise Reference Architecture

Adapted from Williams [1994:142-143]

be applied to the development and operation of an organisation regardless of the industry or field of endeavour [Williams, 1994:142]. The changes that were made to the model by this author were primarily removing the references to manufacturing and replacing it with operations. In making these replacements the model was made generically applicable to manufacturing and service organisations, and thus also for any profit and non-profit organisation.

When comparing this architecture to systems engineering, the technique discussed in Chapter 5 that concerns itself with bringing systems into being, the similarities are obvious. It boils down to the same approach but translated specifically to use the terminology when an enterprise is taken from concept, through functional and detail design, into construction/installation and operation. It can thus be concluded that this architecture also supports the system's view of organisations.

The whole idea of an organisation having a "life", which implies a life-cycle, is confirmed by Senge [1990:17]. He refers to a study conducted by Royal Dutch/Shell in 1983 that found one third of the firms in the Fortune 500 in 1970 had vanished. It was estimated at that time that the average lifetime of the largest industrial enterprises was less than forty years, which is roughly half the lifetime of a human being.

6.6.3   Rottier's enterprise life-cycle

Similar to the Purdue enterprise reference architecture, Rottier [1999:27-29] also takes a life-cycle approach to view the organisation through all its phases from concept to the operational phase. As opposed to the Purdue model which emphasises the design phase, Rottier places a major emphasis on the operating phase (Figure 6.6). The different phases of the enterprise life-cycle adapted from Rottier [op cit] are:

- *Identification of the opportunity/need for an enterprise.* This phase marks the start of an enterprise. It is the entrepreneurial phase where new opportunities or gaps in the market are identified, or possibilities exploited because of new technologies.

- *Establish an enterprise capability, including the enterprise support capability.* This phase is similar to the detailed design phase of a new product after a viable concept has been established in the previous phase. This phase is probably the one phase in the organisational life-cycle that gets neglected the most. Similar to a product design the support design is left until later which results in it not being done at all or done in a haphazard fashion. The reasoning most of the time is to get the organisation up and running (or the product to the market) as quickly as possible inorder to start generating income. The peripherals (support system) will be added later. This approach normally results in having sub-optimal design of the sub-systems that are to support the smooth flow of work through the enterprise, both from a supply/distribution and preventing disruptions to flow (corrective and preventive maintenance) point of view. Once the design of the organisation is completed, it can be 'constructed'. However, in reality, the 'construction' of an enterprise many times 'happens' as design goes along. Similarly, the 'construction' often determines the design, not by conscious effort, but by default. The part of the enterprise that gets designed by default most often, is the support system.

- *Operate, support and improve the enterprise capability.* This phase is what the enterprise is all about. All normal business functions (marketing and selling operations, finances and people management) are required to effectively achieve the goal of the organisation. It is important from the viewpoint of this thesis to take note of the following support related functions within this phase:

  - Support the capability, which consists of the business logistics (those activities which ensure the effective flow of work through the enterprise), as well as the corrective and preventive maintenance which are required to eliminate as far as possible disruptions to the flow.

  - Develop products/services, which is a three layered process, namely the design of the product or service itself, the design of the product or service delivery process and the design of the support capabilities associated with the new product or service.

  - Providing support (after sales service) for products/services, an activity which can generate a substantial income to the organisation.
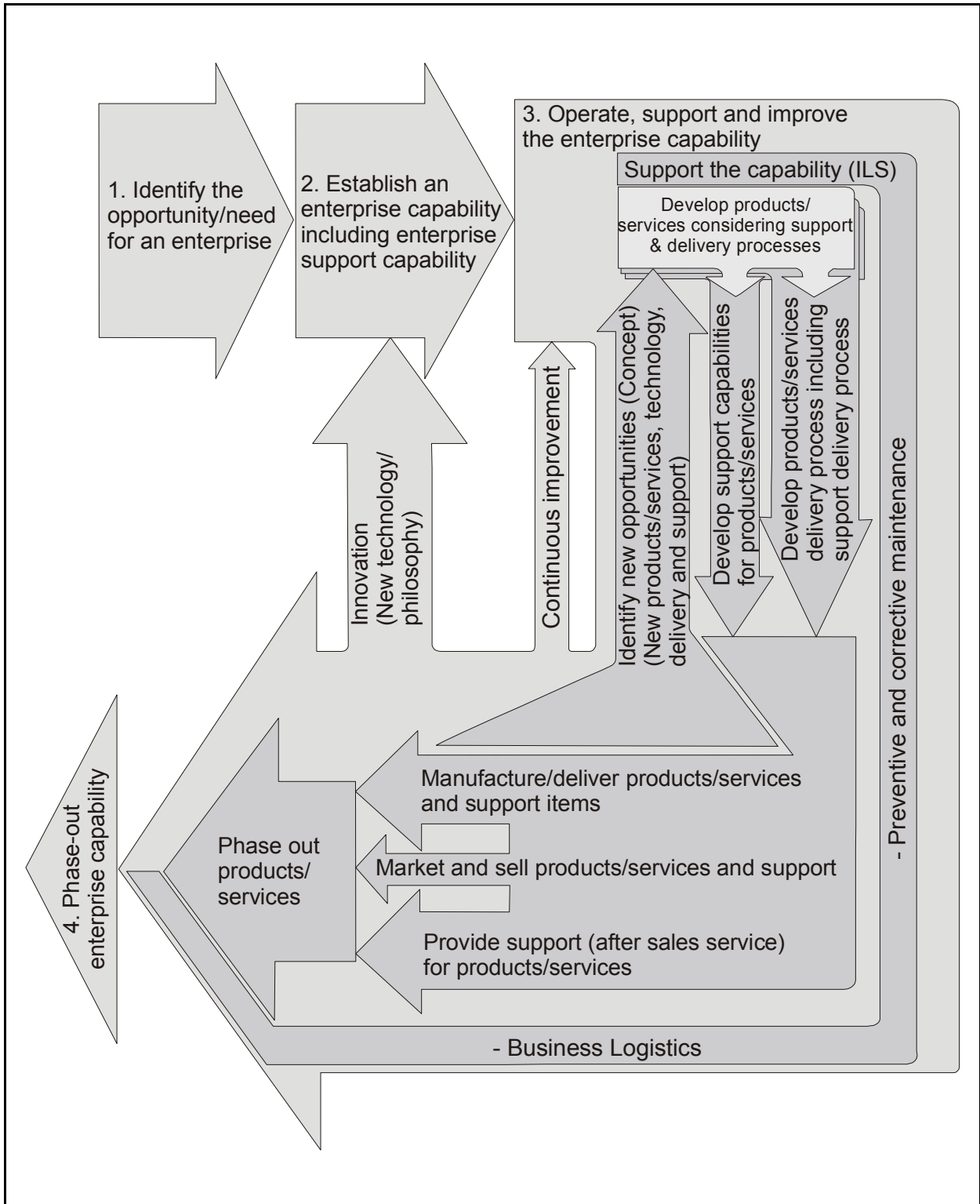
Figure 6.6: The enterprise life-cycle
Adapted from Rottier [1999:28]

The first function mentioned, namely support the capability, can only be successful if it was considered in an integrated way when the design of the organisation was done in the previous phase. In a similar way, the support provided for a product or service can only be done successfully if the support design is considered simultaneously with the product or service design.

It is also clear from this model that the third phase of the enterprise life-cycle, is taking products and/or services through their (similar) life-cycles of concept, design, build, operate and support, with phasing out the final life-cycle phase.

Continuous improvement efforts are required to improve the overall capability of the enterprise, while innovation (which may consist of new technologies or new philosophies) normally requires a major redesign of the enterprise capability that results in a step improvement of overall capability. This redesign may also require a relook at the support design, or support improvement may be the focus of a new innovation (e.g. lean thinking and JIT).

- *Phase out of enterprise capability.* This phase represents the end of an enterprise. As opposed to discontinuing a product or service, discontinuation of an enterprise is much more traumatic as it has an impact not only on the market and customers, but also on suppliers, employees and the socio-economic environment in which they operate. Enterprises come to the end of their life-cycles when continuous improvement efforts and/or innovation cannot improve their capability to a level where it can sustain the goal of the enterprise.

6.7 The larger system context - the supply chain

Even though the terms supply chain and supply chain management have become popular only recently, the concept was already defined by Porter [1985:34] at the end of the 1980's, calling it the value system (Figure 6.7). He states that " *a company's value chain for competing in a particular industry is embedded in a larger stream of activities that I term the value system. The value system includes suppliers, who provide inputs (such as raw*

materials, components, machinery, and purchased services) to the firm's value chain. On its way to the ultimate buyer, a firm's product often passes through the value chains ofdistribution channels. Ultimately, products become purchased inputs to the value chains of their buyers, who use the products in performing activities of their own" [Porter, 1990:43].
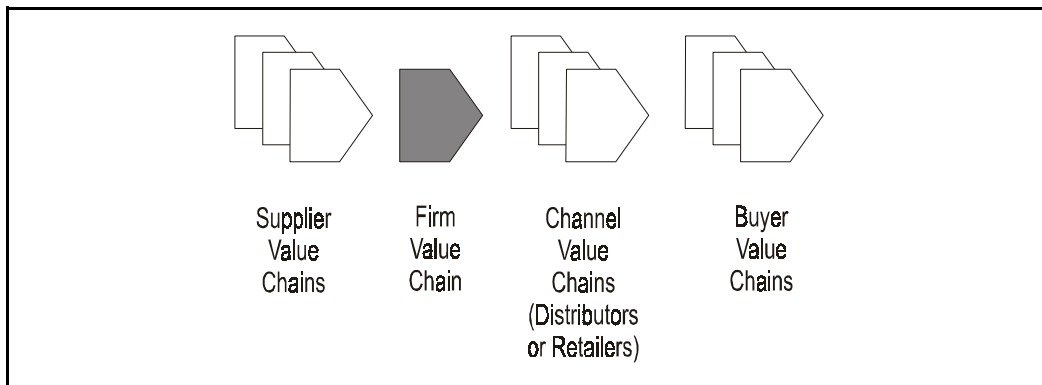
Figure 6.7: Porter's value system
[Porter, 1985:35]

What Porter calls the value system, is thus nothing else than the popular concept of the supply chain as it is known today. The importance of the supply chain cannot be overemphasised. Linking the value chain to the value system he states that *"gaining and sustaining competitive advantage depends on understanding not only the value chain but how the firm fits in with the overall value system"* [Porter, 1985:34]. To recognise the existence of, and the dependencies within the supply chain is important from two perspectives:

- The larger context must be considered when designing a system to ensure proper integration with the host system.
- Stuffing the supply chain will not lead to long term profitability of the organisation. Unless the final customer has bought, a sale has not been made. [Goldratt, 2000:223].

6.8 Chapter summary

Organisations exhibit many system characteristics. The major system characteristics proving that organisations indeed exist as systems are the following:

- Organisations are goal seeking which should be stated explicitly in their mission statements. The mission statements should be worded in such a way that the correct measurements can be derived in order to induce correct behaviour within the system.

- Organisations can use the generic system measurements of ability, availability and affordability to measure system performance i.e. achievement of the goal. Productivity is an ability measure that should be used on system level. If used on a local level, results may lead to an optimised sub-system but a sub-optimised system.

- Generic necessary conditions exist that defines the boundaries within which organisations exist and operate. These necessary conditions cannot be violated if the goal of the organisation is to be achieved.

- The necessary conditions dictate an approach to strategy formulation to ensure the best possible chance for the system to operate at it's full potential. The functional strategies and their sequence are:

  - The marketing strategy.

  - The operations and support strategy.

  - The organisational development strategy.

  - The financial strategy.

- Organisations act as systems of dependent variables both in interrelationships (the value chain), external relationships (supply chain) and time (life-cycle).