CHAPTER 2
Literature Review

2.1 Introduction

True supply chain leaders are seen to be a rare breed, not only in South Africa but worldwide. Organisations have to learn to constantly improve existing supply chains in order to be competitive in the global marketplace. The playing field is wide open for any company that wants to step forward and assume a leadership position. In the never-ending quest to gain and sustain a lead over the competition, businesses in a wide range of industries are turning to the supply chain. They see the chain as a mechanism for transforming their companies into enterprises that are more efficient and more responsive to customer demand according to Poirier (1998:105).

Unfortunately, the success of these efforts has been far from uniform. The result is a littered battleground where a substantial gap exists between the leaders and the pretenders. The gap is so large, in fact, that some leaders now have a one to two year advantage over the competition. Certain Fortune 500 companies have established collaborative networks claims Poirier (1998:105). Examples of these are, Wal-Mart, Procter & Gamble and Toyota. These organisations have business models that exceed other organisation's programs. The express delivery service company, Federal Express, enjoy a year's lead over its competitors. High technology firms like Hewlett-Packard, Dell Computer, Sun Microsystems, and Intel are well ahead of the pack in the configure-to-order computer hardware industry.

2.2 The Literature Study

The above companies are only a handful of the leaders that have reached the highest peak of supply chain performance. The implication for other organisations is that any company can assume a supply chain leadership position in it's respective industry. If an organisation is committed to supply chain excellence, the model for the specific industry can be defined and the respective organisation should be able to improve market share.

The literature study will present a synopsis based on the research done in supply chain management. In theoretical foundation consideration will be given to the systems and contingency view as the basis for the research. The paradigm shift that is taking place worldwide will be considered. The importance of this chapter for retailers would be the exploration of new and innovative ways in which supply chains are seen and studied.

The re- engineering process in any organisation results in negative sentiments and a resistance to change. Organisations are therefore forced to consider the dynamics that take place when an organisation decides to implement new and innovative changes. Some of these issues are also addressed.

Existing supply chain models are also considered in this literature study. Models are firstly presented generally and then four current models are discussed in more detail to allow the reader insight into the current development of models. The literature study ends with an investigation of the factors that will ensure success in new supply chain management. The chapter then ends with a discussion of ways to evaluate supply chain success.

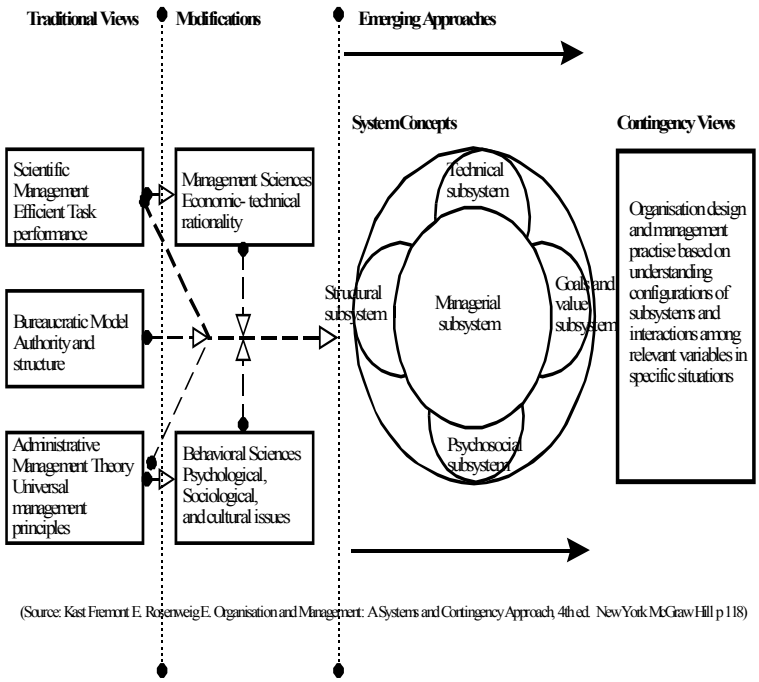
The importance of logistics was described as far back as 1962. Drucker (1962:103) the management guru stated in Fortune magazine that close to 50 cents of every dollar the average American spends on goods goes for activities that occur after the goods are made. Drucker further says that economically the distribution process is where the physical properties of matter are converted into economic value, ensuring that the customer is brought to the product.

Various researchers have made an in depth study of the organisation as a system. The system approach allows the researcher to have insight into the inner workings of an organisation and enables one to dissect the various subsystems for further analysis. Perrow (1973:11) delivers a short and powerful message stating that on one thing all the varied schools of organisational analysis now seem to agree, organisations are systems and that they are indeed open systems.

To fully understand the importance of the supply chain, one must study the organisation as an open system. Scott and Mitchell (1972:55) defines modern organisation theory as the distinctive conceptual and analytical base, with a reliance on empirical research data and a synthesizing, integrating nature. The authors also state that these qualities are framed in a philosophy which accepts the premise that the only way to study organisations is as a system.

Figure 2.1 describes the processes that organisational thinking evolved through to reach the stage where the contingency view is accepted as the norm. Figure 2.1 clearly illustrates an important concept, that the contingency theories did evolve from various other organisational theories and were not a lone standing theories with no theoretical foundation.

Figure 2.1 : Evolution of organisation theory

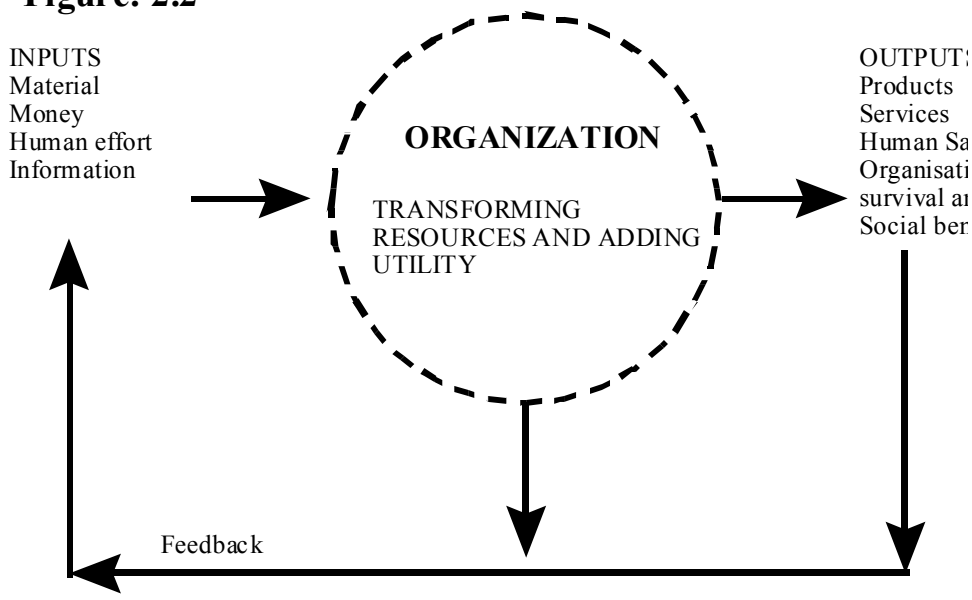


(Source: Kast Fremont E. Rosenweig E. Organisation and Management: A Systems and Contingency Approach, 4th ed. New York McGraw Hill p 118)

Nightingale and Toulouse (1977:264-280) define the concept further; stating that the contingency view of organisations and their management suggests that an organization is a system composed of subsystems and delineated from its environmental supra system by identifiable boundaries. The authors further say that the contingency view seeks to explain the interrelationships within and among subsystems as well as between the organization and its environment and to define patterns of relationships or configurations of variables. It emphasizes the multivariate nature of organisations and attempts to explain how organisations operate under varying conditions and in specific circumstances. Contingency views are ultimately directed toward suggesting organisational designs and managerial actions most appropriate for specific situations.

Figure 2.2 illustrates the organisation as a transformation system. Inputs in the form of materials, money, labour and information are processed by the organisation to produce outputs such as products, services and social benefits. The organisation is part of a continuous feedback cycle from inputs to outputs. The supply chain forms a critical Of the feedback and transformation system and is essential for the effective execution of the transformation system.

Figure: 2.2



(Source: Berrien Kenneth F. ' A General Approach to Organisations. Handbook of Ir
Organisational Psychology. Rand McNally College Publishing Company, Chicago, 1

The importance of this process is further supported by the Council of Logistics Management (1986), this organisation officially defines supply chain management as the process of planning, implementing and controlling the efficient, cost effective flow and storage of raw materials, in- process inventory, finished goods, and related

information requirements. The definition strongly supports the system elements of input, transformation and output.

Other authors seem to support the organisational theory in their respective definitions of logistics. Sussams (1994:36-40) describes logistics as the science which integrates all the activities required to move goods from the original sources of raw materials to the location of the ultimate consumer of the finished product. The author agrees that is a holistic science. It does not look at the individual parts of a system in isolation but looks at the ways in which the parts are connected and suggests better connections. Sussams also writes that sizeable cost reductions can be achieved through retailers and suppliers adopting collaborative logistical practices and that the extent of the cost reductions is typically between 0.5 % and 2% of retail sales.

Grange (1992:88) further supports the contingency views and defines the supply chain as taking control of all goods within the supply chain, all material, no matter how awkward to handle or manage. Each activity, no matter how small, has an effect on the rest of the chain and everything in the entire supply chain equation must be considered.

The United States of America's Defence Force was acutely aware of the strategic importance of effective supply chain management. Fully understanding that an Army fights on its stomach the Defence Force initialised groundbreaking research into logistics. Gecowets (1979:5) of the Defence Force defined logistics as the process whereby the right product, at the right place, at the right time, in the right condition, for the right cost is supplied to those customers consuming the product.

One can therefore deduce that all organisations are open systems and that there are appropriate patterns of relationships for different types of organisations. One can improve the understanding of how these relationships work by studying the interaction between the different subsystems. The overall impact of subsystems can then be calculated and the financial implications for the organisation accurately calculated.

2.3 Supply Chain Management - The New Paradigm

Business process reformation has been at the forefront of organisational thinking and research over the past decade. The competitive advantages that are possible from these restructuring efforts have mostly been gained from these processes. Organisations now need to re- adjust their focus and move towards integrated supply chain management. Furniture retailers in South Africa have to a certain extent utilised the same concepts in supply chain management for the past 50 years. A new paradigm now has to be followed to enable supply chains to re- invent themselves.

KPMG conducted a research program in 1997 to establish the state of awareness for supply chain basics amongst 500 companies from all the major industry sectors, spanning 25 countries in all the major regions of the world. The key findings of the research which was conducted by Freeman (1998:2) were as follows:

a) Demand management and inventory management are seen as the most important supply chain processes for nearly all industries. Warehousing and transportation are seen as less strategically important for the overall company's performance.

b) Supplier and customer involvement is relatively low among all regions and industries. Generally suppliers are more involved in supply chain processes than are customers. Asian and European companies involve their customers and suppliers more in supply chain processes than North American companies do.

c) The overall level of outsourcing is low. Strategic reasons for outsourcing are becoming more important than lower costs. The majority of the companies have no clear performance metrics for vendor management.

d) The respondents view information technology as a major enabler for good supply chain management. A gap between the strategic requirements of information technology solutions and the ability to meet them exists among the respondents.

This study is not only seen as a landmark in the understanding of the current standing of organizations on supply chain management but also highlights four important categories for which organizations have to plan.

Poirier (1998:106) has made a study of more than 300 global firms engaged in supply chain practices. This study has revealed four levels of supply chain progression. The first two levels, where the vast majority of companies are situated, are internally focussed. The two higher levels, home of the true industry leaders, embrace a decidedly external focus. The internal orientation of levels one and two can yield significant savings in areas such as inventory, cycle times, purchasing, logistics, transportation, and warehousing. A few companies in the lower levels have even managed to improve customer satisfaction ratings.

Poirier also found that a huge gap exists between the lower level and top level companies. Businesses find it extremely difficult to get over the division. They continue to concentrate their efforts on internal excellence, ignoring the advantages that external networks and alliances bring. The higher levels, by contrast, are externally focussed, a perspective that results in greater and more lasting improvements. These are gained by leveraging shared resources to satisfy customers, reduce costs further, utilize total assets better, and build profitable revenue growth across a supply chain network.

The researcher Poirier (1998:107) further contents that the best of these organizations are building 'value-chain constellations.' These are organized networks of businesses that are working together by sharing resources and rewards in the pursuit of targeted markets and consumers. Working as a unified alliance and focussing intensely on the targeted opportunities, these constellations are outperforming the less tightly knit competing networks. The key ingredients of such advanced alliances are technology, digital commerce, cooperative use of resources, shared savings, and levels of trust not normally present in external relationships.

Only a few companies have steadily progressed to the higher levels. But their lead over those companies that are still in the trenches is becoming formidable. The opportunity to define new industry models, to forge those value-chain constellations, still beckons those organizations intent on using the supply chain to gain the lead position.

Metz (1998:34) approaches the mystique surrounding supply chains differently, this author asks the question whether supply chain management is just another business buzzword or faddish term

destined to be replaced by yet another buzzword. Metz further says that despite its current widespread popularity, supply chain management remains a somewhat mysterious concept.

Metz (1998:34) contends that supply chain management is rocket science at its core. Supply chain management (SCM) uses advanced technology, information management, and operations research maths to plan and control an expanding complexity of factors in order to produce and deliver products and services in a customer-pleasing way. Supply chain management uses sophisticated mixed-integer programming, relational databases, concurrent engineering, and similar mysteriously technical tools. Lastly, however, the author states that technology may be complex, but that the concept essential to supply chain management and its operational techniques are eminently understandable.

Poirier (1998:107) agrees to a certain extent and defines integrated supply chain management (ISCM) as a process oriented, integrated approach to procuring, producing, and delivering products and services to customers. ISCM has a broad scope that includes sub-suppliers, suppliers, internal operations, trade customers, retail customers, and end users. Poirier further sees ICSM as including management of material, information, and funds flow. A simple and mundane subject like logistics has come of age with the above definition.

Lambert and Stock (1993:99) have a very definite view on the advantages than can be obtained from effective supply chain management. The authors see logistics as the most promising area in which to achieve significant cost savings. And in some instances, such

cost savings can have a far greater impact on the firms' profitability than increasing sales volume.

Table 2.1 clearly illustrates that cost savings in logistics are equivalent to enormous sales increases. For example a saving of $200 in the supply chain will translate to an increase of $ 10 000 in sales. The organisation can therefore leverage huge savings by managing the supply chain effectively.

Table 2.1 : Profit Leverage Provided by Logistics Cost Reduction

If Net Profit on the Sales Dollar is 2 percent, then...	
A Saving of	Is Equivalent to a Sales increase of
$0.02	$1.00
$2.00	$100.00
$200.00	$10,000.00
$2,000.00	$100,000.00
$20,000.00	$1,000,000.00

(Source: Lalonde, Bernard J. Grabner, John R. & Robeson, James F. Integrated Distribution Systems: A Management Perspective. *International Journal of Physical Distribution Management.* October 1970. p 46.)

Sabath and Frentzel (1997:1) illustrate a perspective that is refreshing for a mundane subject like logistics. The growth message is significant in that opportunities exist in most industry segments, even those that have experienced little growth or that have actually declined in size. Research indicates that even large companies can grow, as growth rates do not significantly correlate with company size.

Pullin (1995:14) writes that economic ordering quantities and re-order stock levels in a horizontally organised industry can become impossible due to the fluctuations in trade and the interconnections between different customers and suppliers. The key issue is to set economic ordering quantities and the associated re-order stock levels of each item by calculation in relation to the variance of sales or consumption.

Bonney (1991:107-114) defines the issues even further, writing that inventory is normally taken to be synonymous with stock and that stock is something tangible, something to be mined, converted, created, transported and sold. Some researchers subdivide production inventory systems into push and pull systems. The original pull systems were the re-order level system (ROL) and the re-order cycle system (ROC). ROL and ROC systems were found to have many disadvantages, particularly the ordering of unwanted items and items in unbalanced sets. Materials requirement planning (MRP) is a push system attempting to produce items in balanced sets to meet the needs of consumers and it is clear that there is also a pull element. 'Just- in- time' (JIT) production is a philosophy which includes the concept that inventory is waste and aims to shorten lead times and use a demand pull approach.

Natarajan (1994:64-71) seeks to define the object further and the notion of 'just- in- time' is addressed positively. Natarajan says that one of the important elements of just- in- time implementation effort is the reduction of lot sizes in production and purchasing. Supplier deliveries as well as in-house production take place in smaller batch sizes but with greater frequency.

The research into the advantages of 'just-in-time' processes and other popular Japanese techniques ensured a steady growth of knowledge. The researcher Karlsson (1994:46-65) was less optimistic and cautioned organisations to be careful in the manner that the new techniques are applied and also that it is important to maintain a holistic perspective. External and internal steps must be coordinated if the results are to be advantageous from a total system point of view.

The implementation of 'just- in- time' in production and supply requires a number of well-coordinated decisions on several levels in the company as well as in its relations with suppliers and forwarding agents. Karlsson also warns that for the ' just- in- time' system to prosper, it is very important that the parties involved jointly solve problems that arise, otherwise the success of the whole system could be jeopardized. Long term cooperation on several levels between the buyer and seller company facilities a successful implementation of 'just- in- time'. The flow of information within the system is extremely important. Without a continuous and immediate access to accurate data it is not possible to co-ordinate the productive units in the way which is needed. Online systems are therefore of great importance. What is important to note is that Karlsson is advocating the importance of technology to assist organisations in the quest for improved supply chain management.

The increase in organisations' interest in the advantages of 'just- in-time' led to prominent authors cautioning that the 'just- in- time' process includes a wide range of other costs and factors. Bentley (1987:287-296) clearly demonstrates this by stating that purchasing decisions can no longer be based solely on invoice price but that consideration needs to be given to the total cost of ownership. Issues that must be covered include the cost of quality, cost of inventory, cost

of additional paperwork and the cost of transportation. Supplier relationships should be characterised by longer term agreements, exchange of information, forecasts, technical problems and other relevant data. Involvement in new product development, design reviews and performance data should also form part of this process. 'Just- in- time' cannot be introduced successfully without changing the purchasing function.

As early as 1987 the importance of technology was realised. Initially improved systems and more powerful computers allowed electronic data interchange (EDI) in its most basic form to be used. Harrison and Fiend (1987:263-268) define electronic data interchange as the capability to exchange information and to conduct transactions electronically between buyer and supplier. The benefits were faster response times, reductions in document retyping, saving in stocks and costs at all points in the supply chain.

The concept was of such importance in the 1980's that the United Nations went as far as to define the new process. The United Nations defined EDI as the electronic transfer from computer to computer of commercial or administrative transactions using an agreed standard to structure the transaction or message data.

Hay (1987:16-20) used a unique approach to the reasoning behind a 'just- in- time system'. The author firstly defines waste as anything other than the absolute minimum resources of material, machines, and manpower required to add value to the product. The author then says that a true 'just- in - time' relationship between buyer and seller is long term in nature, equally beneficial to both parties, and dedicated to the principle of continuous improvement in the future and most importantly, it prevents unnecessary waste.

The definition given by Baxter *et al* (1989:151) summarises the real reason for any system, in that the customer is king. Organisations exist only for and because of customers. Customer sovereignty is supreme and customers have the capability to create the conditions for relationships to grow, and in so doing reward the better supplier partner, not class him/her alongside the bad ones. This description by Baxter encapsulates the very existence of the supply chain. If an organisation's supply chain is not adding value to the customer and saving costs for the organisation, the strategic planning behind the chain must be revisited. As such the system that is used, either 'just-in- time' or any other system is for the benefit of all shareholders in the organisation.

The latest research conducted by Seiersen (1999) shows ten trends in supply chain management. Compared with the earlier research conducted by Freeman (1997), certain issues have resurfaced. Company executives, however, showed greater awareness and better understanding of the issues relating to supply chain management. The findings can be summarised as follows:

a) Strategies for supply chains evolve toward supporting corporate strategies, although not fully at this time.
b) Organizing for supply chain management remains an elusive solution.
c) Technology can enable quantum improvements, but information technology (IT) achievements have been limited to date.
d) Organizations expect mostly incremental improvement roles for their future supply chains.
e) Corporate recognition of the importance of the supply chain is growing rapidly.

f) Supply chain management today is mostly cost- and asset-focused with large potential benefits not yet addressed.

g) Budgetary constraints are normally passed on to supply chains, inhibiting better IT systems and upgrading potential.

h) Effective supply chain management is far more complex and difficult than is generally recognized.

i) Outsourcing is constantly expanding and has significant potential.

j) Manufacturing drives supply chain performance in several situations, requiring competence at the manufacturing and operations levels of the supply chain.

The above research seems to confirm that there is still plenty to do to improve supply chain performance. The problem, however, is that it is extremely difficult to define and measure. Information technology is the greatest opportunity, although the limitations and potential are not fully understood. Seiersen says that the evidence shows that no killer supply chain strategy exists and that each organization has to define its own strategy. Refinements to this strategy will have to take place by trial and error.

Furniture retailers in South Africa will have to accept the new paradigm in integrated supply chain management. The furniture retailer that acts first in embracing the integrated concept will have a distinct competitive advantage over rivals in the sector for many years.

2.4 The importance of re-engineering the supply chain

The acceptance that a paradigm shift has taken place in supply chain management is the first step for any organisation in unleashing powerful forces. The second step would be to re- strategise and re-

structure supply chains and the traditional management concepts. The concepts of business process re-engineering will form a vital part of any strategic plan and a study of theories and research into supply chain re-engineering would be vital for any furniture retailer to ensure successful re-engineering of the organisation.

Sabath and Frentzel (1997:2) insist that re-engineering based on cost reduction will continue to help certain companies, although few organizations have downsized their way to long-term profitability. Instead, long-lived prosperity lies in revenue growth. Successful supply chain companies often follow one or more of three key growth strategies defined as, customer franchise management, new product development, and channel management. Each of these strategies depends on supply chain innovations. Importantly, to implement these strategic opportunities successfully, a company must have a solid foundation to support it. This includes the ability to consistently and reliably execute supply chain processes that provide superior value to the customer.

Hammer (1998:67) defines re-engineering as the fundamental rethinking and radical redesign of business processes to achieve dramatic improvements in critical contemporary measures of performance such as cost, quality, service, and speed. Hammer sees the supply chain as the cutting edge of contemporary re-engineering.

Gertz and Baptista (1997:6) analysed the growth of supply chain companies and pinpointed key drivers of profitable growth that are common across a wide range of industries from computers to basic manufacturing. The authors found that successful growth companies pursue the following strategies for growth and re- engineer their organisations in the process:

a) Organisations focus selectively on aggressively developing and managing the most profitable customers.

b) These organisations become exceptionally effective at rapidly developing large numbers of new products that offer superior value to customers.

c) They find and develop the most effective ways to connect customer segments with their products and services.

The impact on other parts of the organisation if the supply chain finally adjusts to a higher level, was described by Parker (1962:16), thirty years before substantial improvements will rewrite the supply chain management. Parker writes that improvements in marketing efficiency and reductions in marketing costs still lie in the future, representing a major frontier for cost economies. However this is where there is room for substantial improvement, particularly in the performance of the physical distribution functions of marketing which constitute a major part of total marketing costs.

The revolution within the supply chain would and could be vast for all the subsystems in the organisation. Walker (1994:23-27) reckons that supplier-retailer collaboration is a fundamental distinction between relationships and collaboration. Only when detailed and proprietary information, such as sales and forecasts, is exchanged between supply chain partners does collaboration take place. It is the quality, depth and openness of these relationships, not the quantity, which is important and which leads to true supply chain collaboration.

Sheffi (1990:27-39) shares the same fundamental principles - that the re-engineering of the supply chain will have a vast impact on organisations. Sheffi says that during the 1980's organisations began to examine the viability of developing strategic alliances and partnerships with logistics service providers. These organisations were exploring the ' make or buy' decision within logistics rather than manufacturing. As companies have been confronted with competitive pressures, shrinking budgets, transportation deregulation, and a need to improve customer service levels, they have been contracting some portion of their logistics activities out to third parties.

Hammer (1998:67) further defines the supply chain as inter-company processes and relationships or how pairs of companies, or even larger groups of companies, coordinate their individual activities to make things better for everybody. The author also believes that the next big wave of opportunity lies in knocking down the walls between organisations and their customers, and between organisations and their suppliers.

Superior supply chain strategy and execution are critical enablers for successful growth. Yet the cost-reduction message repeated by senior executives over many years has resulted in logistics managers who are experts at cutting costs and downsizing. The growth imperative requires a new way of thinking. Specifically, today's supply chain managers must understand how to align their operations to support and foster growth.

When re-engineering becomes a reality, organisations have to consider certain key elements to remain competitive. Ganeshan and Harrison (1999:10) describe these requirements as covering two broad categories namely, strategic and operational. As the term implies,

strategic decisions are made typically over a longer time horizon. These are closely linked to the corporate strategy, and guide supply chain policies from a design perspective. Operational decisions are short term, and focus on activities over a day-to-day basis.

Organizations will have to realize that changing the current supply chain process will be no easy task. The changes will have to be managed in conjunction with established procedures of change management. Short term gains might not be so easy to calculate but the long term prospects of a re - engineered supply chain are immense. The full extent of which is currently difficult to pinpoint with exact numbers.

Sabath and Frentzel (1997:3) write that many empirical studies exist that quantify the relation between supply chain excellence and above average growth and outstanding bottom line results. However, very few companies have succeeded without a well - managed supply chain strategy. The researchers have discovered that often the challenge is not so much convincing senior management of the value of supply chain management and explaining its influence on the issues they care about. Rather, the difficult part is helping the organization make the change and re-engineering the business process.

In a study conducted by Sabath *et al* (1997:3), logistics managers were asked to identify their top three barriers to implementing new supply chain approaches. Surprisingly, seven out of ten respondents cited resistance to change as the biggest impediment. To therefore assist organisations in managing change, a culture open to change must be brought about by focussing on three key areas namely communication, participation, and alignment.

The supply chain has a critical part to play in achieving strategic goals as set by management. The proper planning and integration of logistics into the overall strategic plan of an organisation are critical for the long term success of any strategic planning.

Cooper, Innis and Dickson (1995:44) defined strategic planning as a process of identifying the long term goals of the organisation and the broad steps necessary to achieve these goals over the long term, thereby incorporating the concerns and future expectations of the major stakeholders.

According to Pearce and Robinson (1997:3) strategic planning and implementation is a set of decisions and actions that result in the formulation and implementation of plans designed to achieve a company's objective. The importance of proper planning cannot be over emphasised, this even more so in the supply chain where share holder value is often diluted.

The planning and execution of a re-engineering process can be extremely complicated. Organisations have to realise the importance of proper planning and the involvement of strategic partners. Furniture retailers, however, will have to realise that, however painful, the supply chain is in drastic need of change and re-engineering is essential in achieving improved performance.

2.5 Supply Chain Models

Organisations can achieve supply chain excellence through the use of either existing supply chain models, or by developing their own model or by using a combination of the two. Current models in the furniture industry has developed over a number of years and incorporate the

vital issues needed to survive in the industry. Certain problems however persist in supply chain management, the most common ones being slow stock turns, damaged stock, phased out lines, high transport costs and ineffective warehousing and ordering techniques. These problems have persisted over the last few decades. Furniture retailers are still in a daily struggle to reduce stockholdings and order correct merchandise quantities. Different or new models could assist retailers in re-engineering and strategic planning of the supply chain.

Various supply chain models have been developed by researchers over the past decade. The renewed interest in integrated supply chain management is ensuring that research continues. The ideal or perfect model has not yet been developed but groundbreaking work has been done. Different models will be named but only four will be discussed in detail.

Researchers have realised that models must be developed to assist organisations in their search for supply chain optimisation. Stalk, Evans & Shulman(1992:23) write that at a time when cost pressures are pushing many companies to out-source more and more activities, capabilities - based competitors are integrating vertically to ensure that they, not a supplier or distributor, control the performance of key business processes.

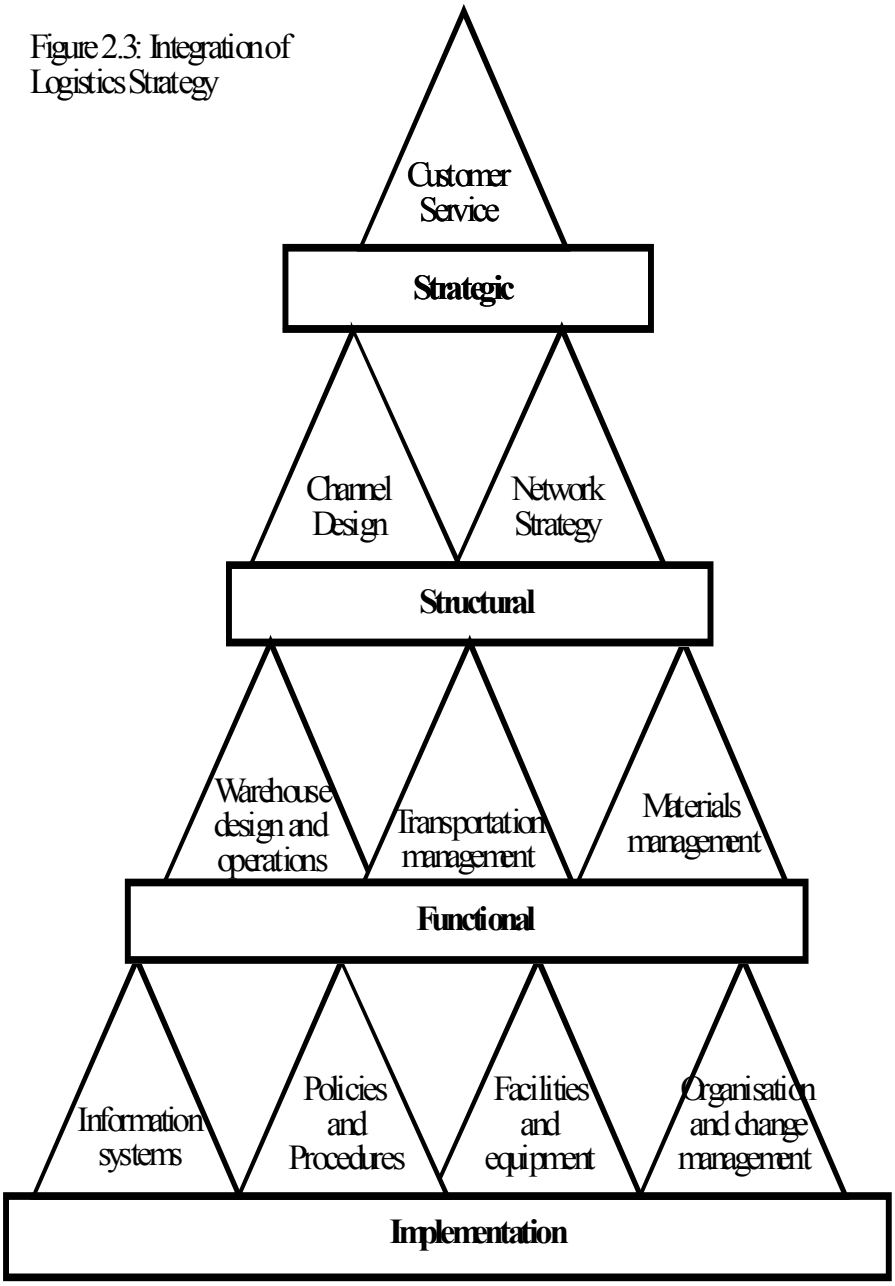
Garvin (1995:201) warns that before setting out to redesign a critical process, a manager first should ask whether the chief problem is quality, cost, or speed of the process or, rather, the fundamental inability of the process to support the strategy.

To assist organisations in ensuring that the components of the logistics system are correctly aligned, figure 2.3 indicates the relationships

between different strategic dimensions in an organisation. The functional and lastly the implementation phase follows. The supply chain models all follow this structure to a greater or a lesser degree. However certain authors have a tendency towards one of the main functions, either strategy or operations.

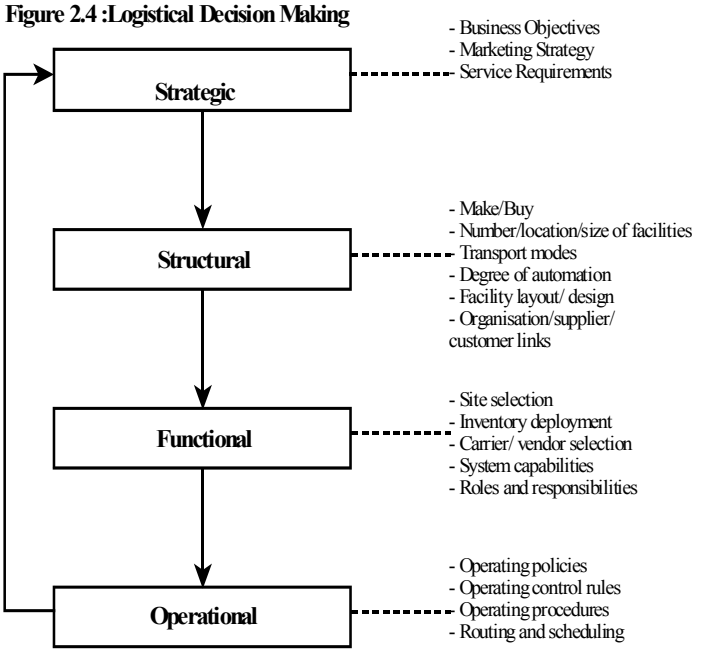
Figure 2.3 clearly indicates that logistical decisions are made hierarchically. As was previous stated structure follows strategy. Figures 2.3 and 2.4 must be seen as a unit complimenting one another. Figure 2.4 illustrates the logistical decision making process. No supply chain strategy can be complete unless each of the ten key areas are integrated.

Figure 2.3: Integration of Logistics Strategy



(Copacino, William C Andersen Consulting Presentation, International Logistics Manageeent and Strategy Seminar, Univ. of North Florida. March 9 - 11, 1992.)

Figure 2.4 :Logistical Decision Making



Source: Copacino William C. Andersen Consulting. Presentation, International Logistics Manageement and Strategy Seminar, Univ of North Florida. March 9 - 11, 1992

Ganeshan and Harrison (1995) write that there are distinctively different models. Firstly there are the models designed for strategic decisions and which are, for the most part, global or "all encompassing" in that they try to integrate various aspects of the supply chain. The models that describe these decisions are huge, and require a considerable amount of data. The authors furthermore state that these models often provide only approximate solutions as they require enormous amounts of data, and have a broad scope of decisions.

The operational models, on the other hand, address the day to day operations of the supply chain. Therefore the operational models are

often very specific in nature. Due to their narrow perspective, these models often consider great detail and provide very good, if not optimal, solutions to the operational decisions. Ganeshan & Harrison further divide operational models into three distinct, categories namely network design, “rough cut” methods and simulation based methods.

Most of the network design methods provide normative models for the more strategic decisions. These models typically cover the location, product, inventory and transportation decisions. The focus is more on the design aspect of the supply chain and the establishment of the network and the associated flows in them.

The network design models determine the location of production, stocking, and sourcing facilities, and plan the routes for product(s) to take through them. These methods tend to be large scale, and are generally used at the inception of the supply chain. Researchers have worked on these supply chain model for decades. The earliest work started in 1974. Geoffrion and Graves (1974:29) introduce a multi-commodity logistics network design model for optimizing annualized finished product flows from plants, to the delivery centers, to the final customers. Geoffrion and Powers (1993:131) later give a review of the evolution of distribution strategies over the past twenty years. They describe how the descendants of the above model can accommodate more echelons and cross commodity detail. Breitman and Lucas (1987:504) attempt to provide a framework for a comprehensive model of a production-distribution system. This design is used to decide what products to produce, where and how to produce it, which markets to pursue and what resources to use.

Cohen and Lee (1985:10) developed a conceptual framework for manufacturing strategy analysis, where they describe a series of stochastic sub- models, that considers annualized product flows from raw material vendors via intermediate plants and distribution echelons to the final customers. Cohen *et al* use heuristic methods to link and optimize these sub- models. In a later research project Cohen and Lee (1989:72) present a normative model for resource deployment in a global manufacturing and distribution network. Global after-tax profit is maximized through the design of a facility network and control of material flows within the network. The cost structure consists of variable and fixed costs for material procurement, production, distribution and transportation. Cohen and Lee validate the model by applying it to analyze the global manufacturing strategies of a personal computer manufacturer.

According to Arntzen, Brown, Harrison, and Trafton (1995:21) provision is made for the most comprehensive deterministic model for supply chain management. The object is to minimize the combination of cost and time elements. Examples of cost elements include purchasing, manufacturing, pipeline inventory, transportation costs between various sites, duties and taxes. Time elements include manufacturing lead times and transit times. Unique to this model was the explicit consideration of duty fees and their recovery as the product flowed through different countries.

The above network-design based methods add value to the firm in that they lay down the manufacturing and distribution strategies far into the future. It is imperative that firms at one time or another make such integrated decisions, encompassing production, location, inventory, and transportation, and such models are therefore indispensable.

The authors further contend that the review shows considerable potential for these models as strategic determinants in the future, but that they are not without their shortcomings. Their very nature forces these problems to be of a very large scale. The models are often difficult to solve to optimally. The models are also largely deterministic and static in nature. The models that consider stochastic elements are very restrictive in nature. Ganeshan *et al* agree that there does not yet seem to be a comprehensive model that is representative of the true nature of material flows in the supply chain.

"Rough cut" methods, on the other hand, give guiding policies for the operational decisions. These models typically assume a "single site" and add supply chain characteristics to it, such as explicitly considering the site's relation to the others in the network. These models form the bulk of the supply chain literature, and typically deal with the more operational or tactical decisions. Most of the integrative research on supply chain management in the literature seems to take on an inventory management perspective. The thrust of the rough cut models is the development of inventory control policies, considering several levels or echelons together. These models have come to be known as "multi-level" or "multi- echelon" inventory control models. The multi-echelon inventory theory has been very successfully used in industry.

Although current research in multi -echelon based supply chain inventory problems shows considerable promise in reducing inventories with increased customer service, the studies have several notable limitations. Firstly, these studies largely ignore the production side of the supply chain. Their starting point in most cases is a finished goods stockpile, and policies are given to manage these effectively.

Since production is a natural part of the supply chain, there seems to be a need with models that include the production component in them. Secondly, even on the distribution side, almost all published research assumes an arborescence structure, for example if a site receives re-supply from only one higher level site but can distribute to several lower levels. Thirdly, researchers have largely focused on the inventory system only. In logistics-system theory, transportation and inventory are primary components of the order fulfillment process in terms of cost and service levels. Therefore, companies must consider important interrelationships between transportation, inventory and customer service in determining their policies. Fourthly, most of the models under the inventory theoretic paradigm are very restrictive in nature. They mostly restrict themselves to certain well - known forms of demand or lead time or both, often quite contrary to what is observed writes Ganeshan (1995).

The simulation method is a method by which a comprehensive supply chain model can be analyzed, considering both strategic and operational elements. However, as with all simulation models, one can only evaluate the effectiveness of a pre-specified policy rather than develop new ones. The traditional questions of what if versus what's best, are asked.

Four models will be presented for more detailed analysis. They are the 'Growth Model', the 'Supply Chain Operations Reference Model (SCOR)', the 'Resource-Event-Agent Business Model (REA)' and the 'Supply Chain Management System Framework (SCMSF)'. The REA and SCOR are what Caneshan *et al* would describe as network design models. The SCMSF can be classified as a 'rough cut' model. The Growth Model however is not classified as a specific model but can be seen as a refreshing approach to supply chain management.

2.5.1 The Growth Model

This model developed by Poirier (1998) consist of four different levels through which an organisation must progress to obtain supply chain excellence. These levels are, sourcing and logistics, internal excellence, network construction and industry leadership.

The sourcing and logistics stage is the first level of supply chain progression, and the emphasis is on reducing sourcing and logistics costs. The organisation selects a driver to lead the effort. These drivers are conscripted by a more senior leader intent on driving down the cost of purchased goods. The driver generally displays a reluctance to be proactive.

Normally a special project or two is thrown in to redesign some part of the supply chain relationship. The tools used at this stage revolve around team building and development techniques, as team members use their functional experience and expertise to uncover savings that had eluded the organisation. Some companies conduct idea exchanges with a controlled number of key suppliers. Usually, these deliver good results. Novel suggestions on how relationships could be improved lead to real savings for both parties. An offshoot of this effort finds problem - solving teams being formed to discover root causes of poor performance or to look for new ways to perform old jobs.

There is no real model guiding the efforts on the first level. Typically, the teams are simply looking for quick hit savings as a means of justifying their programs and activities. Some preliminary alliances may be formed with a few trusted suppliers that are given larger positions

as a reward for major cost concessions. Any training that does take place relies on team techniques.

The biggest concern at this level is to make certain the improvements are real and not just a temporary exchange of costs from buyer to seller that are transferred back to the buyer at a later date.

The second level, the internal excellence stage, utilises the chief information officer as a driver and introduces a new dimension to information technology's role in the supply chain. The power of this vital function is brought to bear in designing leading edge systems and processes that lead to both internal excellence and more satisfied customers. The expected benefits come from a prioritized list of improvement opportunities that become the means to introduce elements of continuous improvement to the effort.

Companies at this level design tool kits with useful benchmarks showing the gap between their current performance and best practice. The demonstrated best practices are documented and studied to guide the teams in their quest for excellence. Plant and site visits to the acknowledged leaders become part of that effort. Business process re-engineering becomes a rallying cry, as business process re-engineering techniques are applied to root out the non-value adding features of supply chain activities. Activity-based costing is usually employed to show just how wide the gaps really are while pinpointing opportunities for real improvement.

Despite the tentative attempts to reach outside of the organization, the level two focus remains largely internal. Accordingly, the teams are exhorted to deliver savings to the company. As the constant hammering for improvement continues, some suppliers begin to lose

interest in the initiatives, particularly if they don't see anything in it for themselves. This fact is lost on some companies, as the drive for internal improvement takes precedence over the more beneficial approach of shared savings.

A model for success begins to emerge from the level two initiatives, but it is intra enterprise in nature. Thus, the emphasis remains on how to improve the performance of the company and not the total supply network. This is the basic shortcoming of the second level of progression. So much effort is expended on internal excellence that some companies become experts on processes not valued by the customer or end consumers.

Training remains largely underdeveloped at this level. But as organizations begin to recognize that the supply chain can be a defining market differentiation, leaders begin to step forward to deliver that message.

The third level which is the network construction stage, is seen as a division that separates the internal and external stages of the supply chain evolution. Those firms at level one and two work relentlessly on internal excellence, overlooking the opportunity to partner with external organizations to attain a better total network solution. Those organizations that remain mired in the internal supply chain stages will continue to focus attention on redesigning the corporation, typically using re- engineering techniques. In short, they maintain an intra enterprise view of progress.

The companies on level three and four, realize that to fully satisfy the ultimate consumer, they need to redesign the supply chain network, of which each company is only one link. They strive to combine their

strengths with others to develop a value chain constellation of working partners that creates a competitive advantage over other competing networks. As their mutual efforts progress, an important message emerges. The future does not belong to any single firm, no matter how large or well entrenched in a market. Instead, it belongs to the network of linked firms that concentrate joint resources on specific markets and consumers.

Core competencies are objectively reviewed, without the usual emotion that surrounds this exercise. Based on that review, decisions are made on where to manufacture a component or provide a service. If a company can find a supplier better able to make a part of the finished product or perform an essential service, that activity is out-sourced accordingly.

Once the supply chain's weak links have been addressed, the focus shifts to forecasting, collaborative planning, customers and services, targeted market opportunities, electronic commerce, and inter-enterprise objectives. This shift is critical as demand chain factors become linked to the supply chain. The need for forecasts evaporates as the linked organizations begin to work from information on actual consumption and not data created for financial purposes. These organizations connect their computers to communicate consumption activities across the network quickly. Replenishment comes directly from manufacturing and not from buffer stocks.

New tools appear at this stage to help produce realistic metrics with meaning for the consumer and not the manufacturer. Eliminating out of stock incidents, reducing returns, having available to promise inventory, and achieving other network oriented measures rise in importance over internally focussed indicators. Mutual databases are

mined deeply to find any information that will help in selling and servicing consumers. Sales force automation and data based marketing become realities in this stage, as real data help the network focus on the consumers of choice.

The action area at level three moves from localized sectors to the total organization. The linked companies look both inwardly and outwardly across their network to determine where resources are best applied to build the desired competitive advantage. Companies that formerly viewed one another as adversaries begin to sit down and talk about mutual investments in leading edge technology and equipment to capitalize on targeted market segments. The value chain constellation starts to come together as joint resources are applied to cross organizational teams pursuing the highest priority opportunities; opportunities that result in better asset utilization and profitable revenue growth.

Advanced cost models are applied, as the teams work from meaningful activity based costing data that clearly show the impact of their actions on the extended supply chain. With the help of data, the effort moves forward to concentrate on those processes that will differentiate the constellation from competing networks. The reach is across the full enterprise of interaction, from initial supply to final consumption and recycling.

Partial alliances are formed with key constituents at the third level. These tend to be characterized as partial primarily because of the difficulty organizations have in accepting assistance from the outside and generating the necessary level of trust. Usually, these alliances are made with the most important suppliers, a few key distributors, and one or two major customers. Pilot projects are often conducted to test

the validity of the new concepts and to find strategic advantages. The idea is to prove the concept's worth and show doubters the value of an external focus.

Training programs that address the requirements of this network construction stage do not really exist. They have to be created as organizations look for help in how to team up and partner across a value chain constellation.

The last stage, which is the industry leadership stage, needs three ingredients. They are imagination, determination, and technology. A company with a culture steeped in traditional thinking will have great difficulty moving to this level. The people will continue to insist that control is more important than innovation, that taking credit for any improvement outweighs finding new techniques that work, that the only good ideas are the ones developed internally.

In this final stage of evolution, the driver has to have management teams determined to make the value chain constellation work and committed to dismantling those boxes of traditional thinking. The team will push for the kinds of off - the - wall ideas that create tomorrow's solutions. These teams will seek the rich rewards that follow network superiority. Profitable revenues will flow to the industry leader because consumers will deal with no other network.

Critical needs are met by diverting the flow of important sub-assemblies or special parts, or by augmenting existing resources with additional ones. Safety stocks are reduced to absolute minimums. Forecasting disappears because the value chain members are working from actual consumptions. Working capital is reduced for the

organisation as the safety and buffer stocks are pared down to absolute minimums.

Global demand and supply linkages become the guiding principles as sourcing and delivery are accomplished around the world. The global market is the defining model as the value chain members leverage their network capabilities to focus on targeted consumers. The previous stage's tentative alliances are now solidified into joint ventures as mutual capital investments build on the network advantage. The training that began at level three is now developed more holistically to embrace all of the alliance partners, to identify even more improvement opportunities, and to keep innovations coming that will keep the value chain well ahead of the competition.

2.5.2 The Supply Chain Management System Framework (SCMSF)

The (SCMSF) is defined as a fundamental business system that integrates internal company resources to manage and work effectively with external suppliers. The objective is to enhance the company's performance through improved manufacturing capability, market responsiveness and customer-supplier relationships.

The SCMSF is a development tool and a best practical model based on a functional model of the Supply Chain Management (SCM) system. This functional model is a prototype for achieving excellence in SCM practice. It provides a coherent vision and language that can sustain the development of a well-integrated system. The framework comprises several components, which embody key functions and best practices. Supporting the overall performance of the SCMSF system are enabling organizational behaviors, the SCM enablers. Running through the framework are a number of operating and organizational

principles. Key to these are certain concepts. Concepts that are used are total costs vs. price, process or value chain analysis versus functional and a cross-functional, team approach with strategy and planning to align with overall business objectives and a culture of continuous improvement.

The seven SCM components represent business processes, not organizational structure in supply chain management. Each component is a bundle of business processes and practices organized conceptually around common themes. Collectively the components include all the activities required for successfully managing and working with suppliers in a manner well - integrated with and in support of the company's overall market and financial objectives. The components are SCM leadership, SCM strategy, operational planning, business relationship management, order-to- delivery processes, SCM quality and performance management and SCM human resource development.

The framework and its components are not prescriptive. It specifies the types of processes and practices a company should have in place to accomplish SCM but it does not specify how to deploy those practices or how relevant they are to a particular company. Companies may accomplish these tasks through a matrix of cross-functional teams that is superimposed on a traditional departmental structure. Companies may also create new organizational structures that incorporate the required skills and knowledge to support an entire bundle or component. The specifics of how the work is organized and deployed is dependent on strategic needs, market conditions, and organizational history and culture.

The six SCMSF enablers drive overall performance of the SCM system over time. The SCM enablers have been carefully conceived and defined to embody behaviors and approaches that allow, encourage, and reinforce a firm's achievement of high performance SCM practices. The enablers are, alignment, measurement, participation and involvement, customer-supplier focus, design and periodic review.

The enablers work throughout the SCM system and across all the components. Most, if not all, work throughout the entire company. The enablers are important underlying elements of the company's overall culture. The processes and practices of supply chain management are difficult, if not impossible, to implement without the underlying enabling behaviors. Supply chain management is, at its core, a cultural and behavioral system and mindset, which is a difficulty that companies could face in its implementation.

The framework embodies a number of characteristics of high performance business systems. This can be seen in the ways in which the framework incorporates the concepts of business results focus, a customer and market focus, market responsiveness and agility a system rather than a personality focus, management by fact, continuous improvement leadership, employee involvement and participation, strategy and planning, technological change, supplier involvement and participation, process vs. functional orientation and cross-functional, team-based work. Underlying the whole framework is its direct connection to the overall business objectives of the firm and to its customers. This is expressed through the connection between the SCM strategy and the overall market and manufacturing strategies of the company.

2.5.3 The Resource-Event-Agent Business Model (REA)

REA refers to the Resource-Event-Agent business model. The REA was originally designed for accounting. Haugen collaborated with McCarthy to extend REA for supply chain management. The key extension was the dependent demand relationship as defined by material requirement planning systems. As a semantic web, REA can link economic events together across different companies, industries, and nations. The links are activity-to-activity or agent-to-agent or person-to-person, not just company-to-company. This means each individual in a REA supply chain can be linked directly to each other individual.

The REA is a minimal model. McCarthy and his colleagues have spent years distilling business relationships down to the smallest set of objects required to do the job. Other data may well be required in particular industries or situations, which the REA model permits, but there is no extra baggage to get in the way.

Alternatively, other control mechanisms such as blanket releases or electronic kanbans may be substituted without changing the basic REA model. It is easier to adapt a minimal model which provides for extensions, than a complicated model with assumptions that do not fit particular situations. The difference has been experienced where costly projects have been required to work around traditional purchasing software in fast-moving supply chains.

As computer networks interconnect an increasing proportion of the businesses of the world, the Internet makes possible new ways of doing business. The new ways are much speedier than the old. The existence of the internet changes everything. None of the existing

enterprise software is a fit platform for dialogue with the other enterprises in the market space, even with the additional help from hubs and portals. The use of paper documents or their electronic equivalents, are too slow to keep up with the accelerated pace of the most wired businesses, yet most internet business applications are still based on the same old paper documents.

The REA business model contains an object called a stock flow that is the equivalent of a hyperchannel for business messages. REA stock flows can connect all of the activities in a multi-company supply chain in one simple and uniform way. The one end of a stock flow hyperlinks to the previous activity, the other end hyperlinks to the next activity.

An enterprise system, such as Enterprise Resource Planning (ERP) is a system for a single company, attempting to integrate most of the business activities within that company. A supply chain almost always spans across multiple companies, but involves only a relatively few people and resources within each company. One enterprise may be involved in many supply chains, for different product lines or different markets for the same product line. A supply chain semantic model is a model of the information flows that accompany the real world supply chain material flows, the demand flows, the material movements, the process activities, and the cash flow. The advantages for using REA are:

a) REA is a public-domain, non-proprietary model, anyone may use it without restriction;
b) REA models can cover whole supply chains across multiple companies;

c) The REA model handles all kinds of activities, manufacturing, transportation, purchasing, etc;
d) REA is also the links between activities, in a uniform way;
e) REA is a semantic web that can maintain persistent links across all activities in a multi-company supply chain until the chain's work is done;
f) The REA model handles all resources, products, cash, labor and machines in a consistent way;
g) The internet hosted REA supply chain model can communicate information across multiple companies in any direction in seconds;
h) A REA supply chain model readily accomodates an event driven business system;
i) The REA model has been validated for correctness by peer review in the leading accounting journals, and accounting is among the most meticulous of business professions;
j) The REA model accommodates continuous updates of accounting and performance reports of any kind;
k) A REA model can encapsulate other business models and use them as subsidiary components;
l) A REA semantic web would not need to be developed all at once (in an impossible engineering feat), it can be developed by piecemeal growth; as long as a core standard is preserved;
m) A REA supply chain model can work well with other systems; and
n) A REA model can perform planning functions like MRP and APS itself, or it can delegate these functions to other systems.

2.5.4 The Supply Chain Operations Reference Model(SCOR)

Effective management of supply chain operations is a critical factor in any company's ability to compete effectively; joining product quality and time-to-market as a key competitive differentiator. Success for many companies depends on their ability to meet increasing customer demands for delivery and flexibility. Demands that require rapid implementation of a constant stream of product and process changes. Companies that understand the importance of supply chain management are emerging as the success stories in the global marketplace. Process reference models integrate the well - known concepts of business process re-engineering, bench marking and process measurement into a cross functional framework. This allows companies to use common terminology and standard descriptions of the process elements that constitute the complex management process; to deploy benchmark and best practice information to determine performance goals, set priorities and quantify the benefits of targeted process changes; to understand the overall process and evaluate performance against the achievements of competing firms inside and outside their industry; to identify the software tools best suited for their process requirements and map available software products to standard process elements.

Once a complex management process has been captured in a process reference model, it can be clearly described, communicated consistently and redesigned to achieve competitive advantage. In addition, given the use of standard measurements for process elements and activities, the process itself can be measured, managed and controlled, and can be refined to meet a specific purpose. The SCOR model is a process reference model developed specifically for integrated supply chain management. The model focuses on the four

core operations processes namely, plan, source, make and deliver. This encompasses the supply chain from a supplier's supplier to a customer's customer.

In traditional process modeling, a high level process is broken down into a set of process elements, which are in turn broken down into sets of tasks and finally into specific activities. These hierarchical models are typically used to describe a specific combination of process elements which reflect a specific process configuration. Process reference models apply hierarchical modeling techniques to define a basic process type, such as the supply chain, in a way that facilitates development of specific configurations. SCOR is defined in increasing detail as the process elements are broken down through level one (process types), level two (process categories), level three (process elements) and level four (tasks and activities). It is not defined within the standard model, where the company-specific implementation takes place.

Companies that have used SCOR have found that as a result of applying the SCOR framework, the company is now able to selectively prioritize implementation of specific practices based on strategic importance. At the same time, it can set performance targets, identify associated information requirements and continue to align functional and organizational linkages. Project participants found that use of the model provided a common language and process descriptions that enabled immediate consensus regarding the appropriate supply chain configuration. Interdependencies and functional interactions were highlighted immediately through development of the supply chain map.

2.6 Key Factors for supply chain success

The complicated nature of supply chain design forces organisations to install certain precautions against possible failure. Certain aspects are currently an inherent part of the existing supply chain practise in the furniture industry. However the researchers Gertz and Baptista (1997:153) suggest that although strategies are important, they cannot deliver their full potential without certain organizational capabilities which the authors refer to as foundations for growth. Companies must master and link all three growth foundations. These growth foundations can be defined as follows:

a) Competitively superior value as determined by customers. As a primary interface point with the customer, supply chain management can offer value in the form of competitively superior delivery and value added services, as defined by customers. In this way, the value foundation translates to customer service excellence. Concurrent with the downsizing and engineering efforts of the past decade, customer service re-emerged as a key management priority for a wide range of manufacturers. But for many companies, meeting basic service requirements and achieving customer satisfaction are still the primary goals.

b) Comparatively superior economics across the value chain. After defining the supply chain, the next step is to thoroughly understand the economic levers, i.e. the cost elements that have the largest impact on supply chain economics. The final step to improving supply chain economics is to become more agile in order to adapt to the changing marketplace. To maintain

superior economics, companies must continuously reinvent themselves. In doing so, they need to strive for speed and flexibility in everything they do, information flows, reduced cycle times, flexible manufacturing, minimal inventories, and integrated inter-company supply chains.

c) Consistently superior strategy execution via organizational alignment. Traditional logistics departments typically strive to link the family of underlying functions as a way of overcoming the silo effect. But growth requires a supply chain organization and business processes that do more than just link functions. Through process redefinition and a horizontal management structure, supply chain management can integrate interdependent processes and their supporting internal specializations, with external customers and suppliers. Conversely, functional silos or traditional logistics organizations lack these processes and level of integration. This shortfall often results in conflicting objectives, priorities, and measures and can lead to uncoordinated actions that inhibit the effective execution of supply chain strategies

Managers increasingly find themselves assigned to the untenable position between customers mounting demands and the company's need for growth and profitability writes Anderson, Britt & Favre (1997:23). Managers have learned that they can keep the balance and, in fact, achieve profitable growth by treating supply chain management as a strategic variable. According to Anderson *et al* these managers recognize two important things. First, the supply chain as a whole and secondly the links involved in managing the flow of products, services, and information from their suppliers' suppliers to their customers' customers.

Secondly, they pursue tangible outcomes focused on revenue growth, asset utilization, and cost reduction. Rejecting the traditional view of a company and its component parts as distinct functional entities, these managers realize that the real measure of success is how well activities co - ordinate across the supply chain to create value for customers, while increasing the profitability of every link in the chain. They also reflect a holistic approach, viewing the supply chain from end to end and orchestrating efforts so that the whole improvement achieved in revenue, costs, and asset utilization is greater than the sum of its parts.

The failures in supply chain management have a consistent profile. Anderson *et al* (1997) state that they tend to be functionally defined and narrowly focused, and they lack a sustaining infrastructure. The authors visited various organizations to determine the reason as to why they were successful. Seven fundamental principles were established from this research:

a) Principle 1: Customers are segmented on the service needs of distinct groups and adapt the supply chain to serve these segments profitably. Segmentation has traditionally grouped customers by industry, product, or trade channel and then taken a one - size - fits - all approach to serving them averaging costs and profitability within and across segments.

b) Principle 2: Customize the logistics network according to the service requirements and profitability of customer segments. Companies sometimes take a monolithic approach to logistics network design organizing their inventory, warehouse, and transportation activities to meet a single standard. For some,

the logistics network has been designed to meet the average service requirements of all customers, for others, to satisfy the toughest requirements of a single customer segment. Neither approach can achieve superior asset utilization nor accommodate the segment specific logistics necessary for excellent supply chain management. The networks will require more robust logistics planning enabled by real time decision support tools that can handle supply flow through distribution and more time sensitive approaches to managing transportation.

c) Principle 3: Listen to market signals and align demand planning accordingly across the supply chain; ensuring consistent forecasts and optimal resource allocation. Forecasting has historically proceeded silo by silo, with multiple departments independently creating forecasts for the same products, all using their own assumptions, measures, and level of detail. Many consult the marketplace only informally and few involve their major suppliers in the process. The functional orientation of many companies has just made things worse, allowing sales forecasts to budget for growing demand while manufacturing second guesses how much product the market actually wants. Like all the best sales and operations planning this process recognizes the needs and objectives of each functional group but bases final operational decisions on overall profit potential.

d) Principle 4: Differentiate products closer to the customer and speed-up conversion across the supply chain. Organizations have traditionally based production goals on projections of the demand for finished goods and have stockpiled inventory to offset forecasting errors. These firms tend to view lead times in

the system as fixed, with only a finite window of time in which to convert materials into products that meet customer requirements.

While even such traditionalists can make progress in cutting costs through set - up reduction, cellular manufacturing, and 'just-in-time' techniques, great potential remains in less traditional strategies such as mass customization. For example, organizations striving to meet individual customer needs efficiently through strategies such as mass customization are discovering the value of postponement. Realizing that time really is money, many manufacturers are questioning the conventional wisdom that lead times in the supply chain are fixed. They are strengthening their ability to react to market signals by compressing lead times along the supply chain, speeding up the conversion from raw materials to finished products tailored to customer requirements. This approach enhances their flexibility to make product configuration decisions much closer to the moment demand occurs.

e) Principle 5: Manage sources of supply strategically to reduce the total cost of owning inventory. Determined to pay as low a price as possible for finished goods, retailers have not traditionally cultivated warm relationships with suppliers. Excellent supply chain management requires a more enlightened mind set.

While retailers should place high demands on suppliers, they should also realize that partners must share the goal of reducing costs across the supply chain in order to lower prices in the marketplace and enhance margins. The logical extension of this thinking is gain - sharing arrangements to reward

everyone who contributes to the greater profitability. Some companies are not yet ready for such progressive thinking because they lack the fundamental prerequisite. This is a sound knowledge of all their commodity costs, not only for direct materials but also for maintenance, repair, and operating supplies, plus the money spent on utilities, travel, temps, and virtually everything else.

f) Principle 6: Develop a supply chain wide technology strategy that supports multiple levels of decision making and gives a clear view of the flow of products, services, and information. To sustain re-engineered business processes, many progressive companies have been replacing inflexible, poorly integrated systems with enterprise wide systems. One study puts 1995 revenues for enterprise wide software and service, provided by such companies as SAP and Oracle, at more than $3.5 billion and projects an annual revenue growth of 15% to 20% from 1994 through to 1999. Many of these companies will find themselves victims of the powerful new transnational systems they put in place.

g) Principle 7: Adopt channel spanning performance measures to gauge collective success in reaching the end user effectively and efficiently. Evaluation of internal performance forces companies to look inward and apply any number of functionally oriented measures. Supply chain managers have to take a broader view, adopting measures that apply to every link in the supply chain and include both service and financial metrics. Firstly they measure service in terms of the perfect order i.e. the order that arrives when promised, complete, priced and billed correctly, and undamaged. The perfect order not only spans the

supply chain, as a progressive performance measure should, but also views performance from the proper perspective, that of the customer. Secondly supply chain managers determine their true profitability of service by identifying the actual costs and revenues of the activities required to serve an account, especially a key account.

While the seven principles of supply chain management can achieve their full potential only if implemented together, these principles may warrant early attention because the savings that can be realized from the start can fund additional initiatives. Creating a data warehouse to store vast amounts of transnational and decision support data for easy retrieval and application in annual negotiations consolidated across six divisions cut one manufacturer's operating costs enough in the first year to pay for a redesigned distribution network and a new order management system according to Anderson *et al* (1997).

2.7 Information Technology

The importance of and phenomenal growth in information technology has stunned everybody. Robson (1994:35-40) defines Electronic Data Interchange (EDI) as allowing the exchange of business information between the computers of different organisations, regardless of size, make or location. EDI is best described as a process involving computer application to computer application communication based on agreed message standards without human intervention.

Ghobadian, Lui, and Stainer (1994:24-27) see the benefits of information technology to retailers as a reduction in order cycle times, reduction in stock holding requirements, reduction in telephone and stationary costs, accurate and efficient order transmission, sharing of

management information, and the integration of the order invoicing matching system. Perceived benefits for suppliers are accurate data, reduction in queries, improved invoice processing and removal of key problems.

In the late eighties, Thornton (1989:44) realised the benefits of information and technology in order to realise the full business benefit of just- in- time. Information technology is not sufficient to merely integrate conversion and supply activities. Information technology is necessary to align all functions so as to synchronise the business to customer requirements. The objective, therefore, should be to understand how sales and marketing activities can accentuate variability and equality and how these activities can positively smooth demand, enabling information technology to achieve an easier match between manufacturing flexibility and market viability.

Oddy (1993:02) and Bamfield (1994:01) both write about the importance of technology. Oddy states that in view of the logistical problems of adopting close quick response relationships with a large number of manufacturers, retailers may concentrate on those who are most responsive in adapting themselves to the new operational logic (EDI). Understanding and applying the full implications of EDI may therefore prevent competitive disadvantage even if information technology does not provide competitive advantage.

In his research Freeman (1998:3) found that companies realize that improving relationships with information technology suppliers and customers requires a commitment to information technology, integrated systems and improved communication. More than 87 percent of companies said they viewed information technology as a critical strategic tool, but when asked about their satisfaction with

information technology and current supply chain technologies, most noted slight dissatisfaction. A gap exists between the strategic requirements of information technology solutions and their current ability. However, the satisfaction with information technology has improved compared to previous survey results.

Respondents are of the opinion that information technology systems are much better integrated in non supply chain functions, than within supply chain operations. Twenty-five per cent of the companies have to some extent integrated their information technology systems concerning supply chain processes with those of suppliers or customers. The automotive industry has integrated information technology systems more than any other industry. Distributors (retail/wholesale) have integrated more than manufacturing companies. Companies spend between one per cent to two per cent of their gross sales on information technology. All industries expect an increase in information technology spending within the next three years. Nearly all companies expect a dramatic increase in the requirement of EDI and bar coding by their suppliers and customers in the next three years.

Major challenges arise as organizations try to make the move to an extended supply chain management strategy with its requirement of the right mix of technology, process and organizational change. Sewell (1999:1) is further of the opinion that extended supply chain models also requires a higher level of integrated information flows along the supply and demand continuum. Collaborative planning and operations require shared commitment, people, processes and technologies. To date, supply chain management implementations have been typically ERP based and Y2K driven. Until recently, ERP solutions have offered limited supply chain functions. Information technology

implementations focused on a single function within a single enterprise. Therefore, specialist software vendors have provided critical supply chain management capabilities, that are often absent in traditional ERP systems.

The first wave of technology installations driven by supply chain integration strategies are currently being implemented. These new solutions feature supply chain decision support and are usually installed by multiple vendors, complicating the software integration and interfacing task. These strategies require the co - ordination of multiple planning and execution processes to meet the challenge of rolling out cross functional integration across global supply chains. Several new integration applications are now entering the marketplace to help ease the integration effort.

Sewell (1999:3) further says that it is important to note that while the supply chain management market will grow substantially, the split between ERP and the independents is likely to be 60/40 in the next three years. Therefore, creating a complete solution means integrating multi - platform products. Supply chain strategies for collaboration and synchronization will drive new processes and technical capabilities. No one solution will fit every organization. Systems will be delivered in several different ways, including the single vendor model, multiple vendor models, collaboration models which integrate vendor software across the supply chain and synchronization models which co - ordinates decision making to create high performance supply chains.

Advanced synchronized planning across the extended value chain increases responsiveness at reduced costs through timeous, collaborative sharing of demand and planning information across

multiple enterprises. Ensuring that all resources are efficiently aligned to support end demand. The business benefits of technology enabled supply chain wide planning far outweighs the challenges of implementing such a multi functional, inter organizational change. Measurable improvements to shareholder value result from effective synchronized supply chain planning which focuses on the customer and manifests itself as substantially less inventory, better turns and asset utilization, lower returns and much improved customer service levels.

A second, equally important area to examine is supply chain execution. Once the correct business tactics have been determined in the planning step, supply chain execution becomes the next critical stage. Often, mission critical elements of fulfillment have been outsourced and are out of a company's direct control. A continuous communication framework is required among the members of the supply chain. Order tracking is the first step in establishing control and predictability in the supply chain according to Porter (1998:13).

Kilpatrick (1999:33) is of the opinion that there are a number of obstacles to achieving breakthrough performance for the supply chain. Firstly, few companies have established a management environment that supports the integration required for effective supply chain management. Instead, they remain functionally oriented with limited cross-functional teamwork and a lack of trust and credibility between the supply chain and sales organizations.

Secondly, new skills are required to effectively manage the flow of materials, information and funds across the supply chain. Strategic planning and financial planning are the skills most lacking in supply chain management today. As a result, most supply chain information

technology initiatives are strictly cost focused. Very few organizations take a value based management perspective of supply chain performance that assesses the impact of information technology initiatives on revenues, costs, investments, and cash flows in ultimately improving shareholder value.

As is the case with the supply chain overall, technology must be enhanced, however many companies have no strategic plan for their supply chain information systems. Companies have installed a variety of systems to accomplish a range of objectives, but in many instances, there has been little coordination of these efforts. The result is a failure to lever the capabilities of an integrated supply chain system. The lack of an over - arching strategy for the information systems facilities for the supply chain can cause the benefit of such systems investments to be isolated and not have a profound effect on the supply chain overall.

Metz (1998:56) identifies further factors that enable the development of the supply chain. The author writes that no other factor has had as much to do with the development of supply chain management as the advance in key technologies. The improvements have brought about agile manufacturing, cheaper and more reliable transportation, a wide bandwidth global communication, and powerful information processing. This, in turn, is enabling organizations to co - ordinate multiple supply chain functions; responding ever more frequently and rapidly to changes in the market, business environment, and product design.

The competitive urge has inspired organisations to implement these technology advances swiftly. Thus, rapid technology advances have made SCM a fast moving, sometimes breathtaking, field. The doubling of semiconductor performance every 18 months or so has been going

on for decades. Over and over, a new development has overcome what seemed to be looming barriers to such rapid advancement. This pace will continue. Massive multi - stage supply chain analytical problems currently take a long time to solve on very large and expensive computers. As a result, they are solved only occasionally and then only for planning purposes. In the future, these problems will be solvable in minutes or seconds on affordable operational computers, making such analyses an everyday part of real time supply chain operations management.

2.8 Measurement of supply chain success

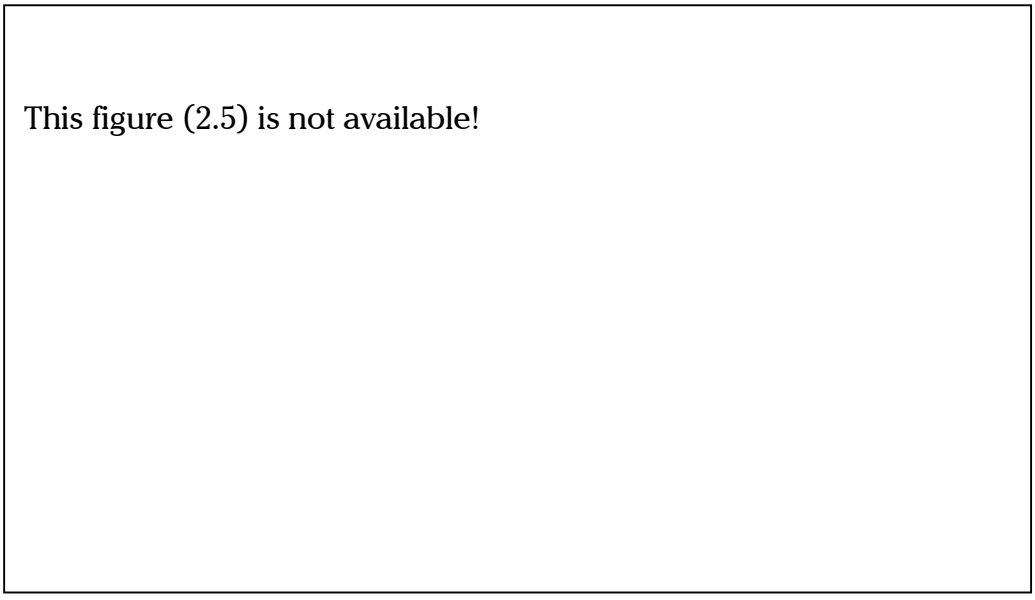
In the complex and often highly unpredictable modern economy it is of outmost importance that management maintain profit growth and return on investment. Mature markets, international competition, high cost of labour, low productivity and a highly regulated labour market, currency devaluation, high interest rates and shrinking disposable incomes are making this task even more difficult. The management of an organisation must be on a constant look out for improvement opportunities in cost and increase sales.

According to Lambert and Stock (1993:6), logistics has the potential for profit improvement that few other areas have, because the cost of logistics can exceed twenty five percent of each rand at the manufacturing level. The supply or logistics function has therefore to be managed as an integral part of the organisation. Lambert & Stock(1993:39) further define integrated logistics management as the process of minimizing the total costs of transportation, warehousing, inventory, order processing and information systems, and lot quantity cost, while achieving a desired customer service level.

To obtain acceptable returns on gross assets and maximise cash flows the top management in a retail environment has two options. The first is to reduce the accounts receivable, therefore increasing the cash flow, and secondly, reducing the investment in inventory. The reduction in either of these will substantially improve cash flow as well as improving the proportional ratio's return on investment and return on gross assets.

However, if the reduction of the assets were so simple, this dissertation would not be necessary. A simple reduction in the level of inventory can significantly increase the cost of logistics, if an organisation has current levels of inventory that allows the organisation to achieve the least total logistics cost, for a desired level of customer service.

The one method that management can utilise to evaluate whether the proposed system change will influence profits is the strategic profit model (Figure 2.5) suggested by Stock and Lambert (1993). This model shows that return on net worth (return on investment plus retained earnings), is a function of three controllable factors: net profit, asset turnover and financial leverage. The definitions for these are as follows:



a) Net Profit: Net profit as a percentage of sales measures how effectively and efficiently products are purchased and sold. Net profit alone however is, not sufficient. One would need to know sales volumes as well as required investments for various sales levels. The utilization of assets should also be evaluated.

b) Asset Turnover: Sales divided by total assets indicates how efficiently assets are employed to generate sales.

c) Return on Assets: Determined by multiplying the net profit margin by asset turnover. This relates profitability to the value of the asset employed and remains the best single yardstick of corporate performance. It allows different companies to be measured against each other irrespective of the industry segment.

c) Financial Leverage: This is calculated by dividing the total assets with the organisation's net worth. This measurement is designed to calculate management's outside use of financing to increase a firm's return on net worth.

d) Return on Net Worth: Equal to net profit divided by shareholder's equity.

The authors argue therefore that an organisation only has to follow the model to establish the financial success of supply chain management decisions.

Although financial statement analysis is a highly useful tool, it has two limitations according to Garrison & Noreen(1997:788). The limitations are firstly that differences in accounting methods sometimes make it difficult to compare results and secondly that ratios are a good starting point but that they should only be regarded as tentative in nature. Other sources of data should also be used.

Garrison & Noreen (1997:788) further identify two methods of financial statement analysis. The horizontal shows changes between years in currency and percentage form. The second is trend analysis. Trend analysis state several years financial data in terms of a base year. The base equals 100%, with all other years stated as some percentage of this base. The most basic of statements to use is the balance sheet and income statement. The authors also identify other methods to establish how well the organisation is doing. The most commonly used of these are:

I. Earnings per share = (Net income - Preferred dividends) / number of common shares outstanding.
II. Price earnings ratio = Market price per share/ earnings per share
III. Dividend payout ratio = Dividends per share / earnings per share
IV. Return on total assets = {Net income + [Interest expense x (1 - Tax rate)]}/ Average total assets.
V. Current ratio = Current assets / current liabilities.

Organisations, shareholders and investors all use different models and formulae, depending on the available information, the reasoning behind the investment decision or the strategic intent. The main purpose of any organisation remains to add economic value. If this economic value added (EVA) is not positive or maximised by the management. The basic rule of existence of the organisation is being violated.

2.9 Conclusion

Effective Supply Chain Management is a subject that eludes many an organisation. Most organisations utilise a supply chain in some or other format. For organisations to fully understand and study the supply chain or any other part of the organisation, it is important to understand that organisations are viewed as open systems. The contingency theory forms the basis of study and improvement of any or part thereof the organisation. The organisation acts as a transformation system were inputs, for example materials and labour, are processed to deliver outputs such as products and services. The organisation forms part of a continuous feedback cycle.

Organisations are starting to realise the huge advantages that can be had from effective supply chain management. Demand and inventory management are seen as the most important factors. Supplier and customer involvement as well as levels of outsourcing are very low. But organisations are realising the importance of technology in the new paradigm. Although these organisations are not yet investing sufficient funds in supply chain technology the awareness is there and it is only a matter of time before the momentum reaches critical mass.

Companies can be classed into four categories of supply chain management skill. The first two levels are where organisations are internally focussed, with a decisive movement towards external focus during the latter stages of growth. The cost savings that can be obtained through the supply chain translates into a ratio of approximately 2:100, savings to growth, in sales growth. Thus showing the true potential of effective cost savings in the supply chain.
Organisations have to realise that in many instances the supply chain will have to be completely reinvented. Especially in terms of

management structures and liaisons between suppliers, customers and manufacturers. In essence the concept of re - engineering and refocusing strategies at all levels of the organisation will be critical to the future survival of organisations. The word re- structure or re-engineering conjures many negative images in employees minds. When the need arises for re- alignment the keywords for any organisation are communication, participation and alignment.

The re-engineering label can also be viewed from another perspective. If organisations approach the supply chain as the nucleus for growth a very positive and inspiring message can be sent to participants in the chain.

Various supply chain models have been developed to assist organisations in streamlining the supply chain. The most important question would be whether the model can integrate with the existing strategy or will the organisation have to rethink the very reason for its existence. The strategic decision making process will have to follow certain steps. The planning process will have to re-visit strategy, structure, functional and operational processes. Models can be divided into three categories, namely, network design based, 'rough cut' and simulation models. Four models are presented in the literature study - the Growth model, the Supply Chain Operations Reference model, the Resources Event Agent Business model and the Supply Chain Management System Framework.

The choice and implementation of a model will not guarantee an organisation success. Companies have to ensure that certain other key criteria are met before effectiveness will be achieved. Seven basic functions can be identified that will assist firms to achieve excellence. These are customer segmentation, network customization, planning

alignment, product differentiation, strategical supply chain management, supply chain wide technology and channel spanning performance measures.

The final criteria for an organisation's success is the way in which the expectations of all the stake holders in the company are met. The overwhelming criteria remains the financial well - being of the entity. Management has to plan and execute with the main objective in mind, the increase of the economic value. Certain technological and internet companies have survived without these basic criteria being met. However, the markets worldwide are moving back to the basics of corporate governance and stock exchanges world wide are experiencing massive adjustments in the value of non - profit making organisations. To enable management of organisations to effectively manage their corporations, models have been devised to measure performance and the utilisation of assets.