

**ALIGNMENT OF THE SUPPLY AND DEMAND WITHIN A SUPPLY
CHAIN: A QUALITATIVE STUDY**

by

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DECLARATION

It is hereby declared by Theo van der Merwe that this dissertation has been linguistically groomed by Kjell Ruth, Managing Director of Kraft Foods South Africa.

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“Live as if you were to die tomorrow.
Learn as if you were to live forever.”

~ Metzsche

ABSTRACT

The dissertation "Alignment of supply and demand within a supply chain: a qualitative study" determines the causes of the misalignment between the supply and demand within a supply chain, with specific focus on Kraft Foods South Africa. The costs of a mismatch between supply and demand are growing in many industries. Companies have tried various approaches, however these approaches, while useful, have failed to address a number of the drivers of supply-demand mismatch.

The literature study starts with an overview of supply chain management. The study covers the various concepts of supply chain management, the importance of supply chain performance, the challenges of managing supply chains, demand management, supply management, as well as the relationship between supply and demand. The literature study continues to cover the various concepts related to the alignment of supply and demand within a supply chain. The study covers the effects of the misalignment between supply and demand within a supply chain, traditional approaches to align supply and demand and the transformation to a more responsive organisation. The various approaches to decrease the supply and demand lead time gap are also discussed. The literature study concludes with an overview of the supply chain of Kraft Foods South Africa, as well as the global Kraft Foods organisation. The review covers the challenges, the sustainable growth plan, the organisational set-up, sources and product range, geographical layout, people, functions and technology involved in Kraft's supply chain. The review concludes with an overview of the current alignment between supply and demand within Kraft Foods South Africa's supply chain.

Chapter five discusses the details of the research design and methodology that was followed in conducting the research. Chapter six indicates the findings of the structured interviews with the key players in Kraft Foods South Africa's supply chain. Chapter seven makes certain recommendations for the supply chain of Kraft Foods South Africa that will assist in improving the alignment between supply and demand.

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CHAPTER 1: OBJECTIVES AND SCOPE OF THE STUDY

1.1 Background to the study

1.1.1. Supply and demand alignment

Traditionally most companies have viewed themselves as entities that exist independently from others, and indeed need to compete with them, in order to survive. The challenge of supply chain management lies in the integration and co-ordination of the flow of materials from a multitude of suppliers, often offshore, and similarly managing the distribution of the finished product by way of multiple intermediaries (Christopher, 1998:15).

True supply chain integration not only requires internal realignment in terms of managing processes on a cross functional basis, it also requires that the company's processes align with those of its upstream and downstream partners (Gattorna, 2000: 281).

The costs of a mismatch between supply and demand, measured as the combination of inventory carrying costs, markdown costs and stockout costs, are growing in many industries. Companies have tried to reduce these costs through better demand forecasting, improved production and inventory planning, increased production capacity and reduced set-up and transportation lead times. Companies have also tried to manage the demand process through pricing policies intended to smooth the arrival pattern of customers. These approaches, while useful, have failed to address a number of the drivers of supply-demand mismatch (Gattorna, 1998:172).

Leaders in supply chain management know that the management of the supply chain represents only half of the business equation. While much attention has been paid to finding new and better ways to reduce inventory levels and increase stock turns, little attention is being paid to understanding, creating and managing demand more effectively. The reality is that superb supply and demand chain management is the challenge confronting supply chain practitioners, and will be the basis of competitive success or failure for many businesses (Gattorna, 1998:41).

A key part of understanding and retaining customers is to draw them into the company's orbit, through integrating the supply and demand chain. This means moving the supply chain from supplying customers indiscriminately according to their forecast demand, to supplying customers with precision according to their actual demand and their stated requirements. In this way businesses line up their supply chains to match and mirror the demand requirements of their customers (Gattorna, 1998:41).

The benefits of reducing the supply-demand mismatch are enormous. Fewer mismatches between supply and demand can lead to a significant increase in profits, better customer service and therefore additional sales (Gattorna, 1998:172).

1.1.2. Kraft Foods South Africa

Royal Baking Powder (Pty) Limited, a well- established company in South Africa, was owned by Standard Foods in the USA "(Templeton, 2004).

After several mergers during the 1980s and 1990s with various companies, including Beechnut Lifesavers and Nabisco, the company name Royal Beechnut was changed to Nabisco South Africa in 1996 (Templeton, 2004).

During the early part of 2002, Kraft Foods International announced the purchase of Nabisco International and later in 2002; Kraft Foods International purchased the remaining shares of Nabisco South Africa. Kraft Foods South Africa was then fully owned by Kraft Foods Inc. (Templeton, 2004).

On 1 November 2002, the company name changed from Nabisco South Africa to Kraft Foods South Africa (Templeton 2004).

The name- change to Kraft Foods South Africa marked a new beginning as the company was now part of Kraft Foods Inc., the largest food and beverage company in North America and the second largest in the world (Kraft Foods Inc.2004:1).

1.1.3. Kraft Foods South Africa's supply chain department

Kraft Foods South Africa only established a supply chain department at the end of May 2002. The demand and replenishment planning function, part of the supply chain department was only established in April 2003. The key focus of the Demand and Replenishment Planning function is to align the supply and demand of finished goods while improving the customer service levels, lowering supply chain costs and decreasing finished goods inventory levels (De Swardt, 2004).

The demand and replenishment planning department must therefore ensure that the right finished goods are in the right place at the right time in the right quantity and the right condition (De Swardt, 2004).

On 23 January 2004, Roger Deromedi, Chief Executive Officer, Kraft Foods Inc., also announced a new sustainable growth plan for Kraft Foods Inc. One of the four components of the new sustainable growth plan is the reduction of cost and an improvement in asset utilisation. (Kraft Foods Inc, 4 March. 2004:1).

1.1.4. Kraft Foods South Africa's supply chain alignment

Kraft Foods South Africa's supply and demand alignment has had a few successes, but more improvement is required.

The customer service level, measured in case fill rate, improved from 67 % in April 2003 to 88 % in December 2003. Case fill rate measures the customer order volume with the customer delivery volume (Templeton, 2004).

The results of Kraft Foods South Africa's December 2003 financial year-end also reflected the lack of alignment between the supply and demand of finished goods.

Kraft Foods South Africa's year-end result in 2003 was 76 % or ZAR 23 million more finished goods than the 2003 operating budget. The finished goods stock cover for Kraft Foods, measured in days' inventory forward cover, was 17 days or 35 % more than the 2003 operating budget (Templeton, 2004).

A portion of the increase in the finished goods inventory was as a result of the low sales forecasting accuracy. The sales forecasting accuracy measured per stock keeping unit was 43 % lower than the 2003 operating budget (Templeton, 2004).

In January 2004, the research proposal was presented to Kjell Ruth, the managing director of Kraft Foods South Africa, who approved the project.

1.2 Research problem

The supply chain of Kraft Foods South Africa is currently struggling with the classic symptoms of a mismatch between supply and demand, low sales forecast accuracy, high and aging inventory, as well as low customer service.

The aim of the research is to determine the following:

- To identify the causes of the misalignment between the supply and demand within Kraft Foods South Africa's supply chain.
- To identify potential solutions that could improve the alignment between the supply and demand within Kraft Foods South Africa's supply chain.

1.3 Research objectives

The primary objective of the research is to identify the main causes of the misalignment between the supply and demand within Kraft Foods South Africa's supply chain. The result of an improved match between the supply and the demand will be a reduction in inventory, higher sales forecast accuracy and an increase in the customer service level.

The secondary objectives of the research are as follows:

- To improve the supply and demand alignment for all partners within Kraft Foods South Africa's supply chain, including retail and wholesale customers, as well as suppliers.

- To identify the best practices that could add value to all Kraft units worldwide, in order to improve their alignment between demand and supply.

1.4 Research methodology

The research study consists of qualitative research through a literature review, in-depth interviews and a case study. Qualitative research determines the essential character and meaning of a research subject. (Cooper and Schindler, 2003: 152).

1.4.1 Literature review

There is extensive literature available concerning the importance of aligning the demand and supply side of the supply chain. Most of the literature identifies the major benefits of an improved alignment between the supply and demand within any supply chain. However, little research has been done on the alignment of the supply and demand within a supply chain (Cooper and Schindler, 2003: 152-153).

The research study will identify secondary literature inside and outside Kraft Foods South Africa. By reviewing prior research, methodologies can be identified that have proved successful or unsuccessful. By using secondary literature, the research will avoid duplication in instances when prior collected data can provide sufficient information for resolving the current decision-making dilemma. (Cooper and Schindler, 2003: 152-153).

1.4.2 Structured in-depth interviews

While published data is a valuable resource, it is seldom the case that more than a fraction of the existing knowledge in a field is put into writing. The structured in-depth interviews will essentially be experience surveys. A significant portion of what is

known on a topic may be proprietary to a given organisation and thus unavailable to an outside researcher. (Cooper and Schindler, 2003: 153).

The structured in-depth interviews will seek information from people experienced in the area of the research study, tapping into their collective memories and experience. (Cooper and Schindler, 2003: 154). The structured in-depth interviews will be conducted with people from within Kraft Foods South Africa, other Kraft Foods units and members of Kraft Foods South Africa's supply chain, including suppliers and customers. The structured in-depth interviews will not cover direct competitors of Kraft Foods South Africa, due to the sensitive and important nature of the research subject. The structured in-depth interviews and secondary literature review will also be aligned. In some cases the secondary literature review will provide leads for the structured in-depth interviews, while in others, the structured in-depth interviews will provide leads for the secondary literature review.

From the structured interviews a case study will emerge. An in-depth analysis of the supply and demand alignment of Kraft Foods South Africa's supply chain will be done. The analysis will focus on the current situation and potential areas of improvement, based on the findings of the case study, secondary literature review and structured in-depth interviews.

1.5 Benefits of the study

The research study could be beneficial to the following individuals:

- Academics may use the research study as a point of reference if they wish to expand their research on the topic. Only the key theoretical principles will be available to the public, due to the confidential nature of the study.
- The management team within the Centre of Excellence of Kraft Foods Inc. could decide to apply the findings and best practices to other Kraft Foods units.

- Decision- makers, in small, medium and large companies, struggling to align the supply and demand in their supply chains, could apply the findings and recommendations.

1.6 Outline of the dissertation

The dissertation documents the thinking around the research project, the decisions taken during the research process and the reconstruction of the logic of the research. The outline of the dissertation adheres to the rules of scientific evidence. (Moutton, 2001:112-113, 122-123)

The structure of the dissertation is as follows:

Chapter 1: Objectives and scope of the study

Chapter 1 provides the main reasons that led to the research topic. It also provides general information about Kraft Foods Inc. and Kraft Foods South Africa. It identifies the research problem and provides a general overview of the research design and methodology. Chapter 1 concludes with a general outline of the dissertation.

Chapter 2: Supply chain management

Chapter 2 contains the theoretical framework of supply chain management. It provides an introduction of the secondary literature covered and defines the key concepts. A detailed overview is given of all secondary literature read. The chapter concludes with a summary of the main conclusions and findings of the secondary literature review. The secondary literature study will provide the framework for the structured in-depth interviews.

Chapter 3: Supply and demand alignment

Chapter 3 contains the theoretical framework of supply and demand alignment. It provides an introduction to the secondary literature covered and defines the key concepts. A detailed overview is given of all secondary literature read. The chapter

concludes with a summary of the main conclusions and findings of the secondary literature review. The secondary literature study will provide the framework for the structured in-depth interviews.

Chapter 4: The supply chain of Kraft Foods

Chapter 4 contains the theoretical framework of Kraft Foods. It provides an introduction to the secondary literature covered and defines the key concepts.

Chapter 5: Research design and methodology

Chapter 5 documents the design and methodology followed during the research. It provides full details of the data- collection process, including gaining access to the subjects, data- collection techniques and procedures used.

Chapter 6: Research findings

Chapter 6 documents the results of the structured in-depth interviews done in Chapter 3. This chapter interprets the main findings of the structured in-depth interviews.

Chapter 7: Summary, conclusions and recommendations

Chapter 7 is the most important chapter, because it presents the end- product of the research. It draws together the results from the previous chapters and indicates how the results and conclusions relate to the secondary literature review and theory of the research topic. The larger relevance and value of the study is also described.

1.7 General

The Harvard method was used as a standard method of reference.

The contents of the dissertation will remain confidential and will therefore not be made available to the general public.

CHAPTER 2: SUPPLY CHAIN MANAGEMENT

2.1 Introduction

In today's highly competitive global marketplace, the pressure on organisations to find new ways to create and deliver value to customers grows ever stronger. Gradually, in emerging economies, as well as mature markets, the power of the buyer has overtaken that of the customer. The rules are different in a buyer's market, in particular, customer service becomes a key differentiator as the sophistication and demands of customers continually increase. At the same time, market inventory maturity combined with new sources of global competition, has led to an over-capacity in many industries, resulting in an inevitable pressure on price. Price has always been a critical competitive variable in many markets, and there is every indication that it will become even more of an issue as the commoditisation of markets continues. It is against this backdrop that the discipline and philosophy of logistics and supply chain management have moved to the centre stage over the last two decades. The concept of integration within the business and between businesses is not new, but the acceptance of its validity by managers, is. There has been a growing recognition that through logistics and supply chain management, the twin goals of cost reduction and service enhancement can be achieved. Better management of the pipeline means that customers are served more effectively and yet the costs of providing that service can be achieved (Christopher, 1998: ix).

2.2 Understanding, prediction and control

The three key processes in managing systems are understanding, prediction and control. Understanding provides the insights needed to predict how a system will behave in response to changes to its inputs. Prediction, on the other hand, allows one to control the system by making the best combination of adjustments. The sequence of the three key processes should therefore be understanding, then prediction, followed by control. Comparing predicted with actual results, deepens

one's understanding of the system, allowing one to make more accurate predictions and improve one's control. Together understanding, prediction and control form the heart of any successful management process. The problem is that the priorities between understanding, prediction and control are normally reversed in the short run, but are also self-defeating in the long run. Control is normally the primary concern, prediction is invoked only as needed to improve control, and understanding is viewed as an incidental by-product rather than the prime mover of the sequence. Although understanding is the most important management process, it is also the most neglected. The first goal of managing a supply chain is thus to understand the systems. To maximise the outputs of the supply chain, one needs some shared understanding of how the settings affect the operations of the supply chain, together with some co-ordination of the changes to get the best overall performance (Taylor, 2004:73-74).

The basic mechanics of supply chains are simple, but the behaviour of the supply chain as a whole can be very difficult to understand, much less predicted and controlled. Understanding is not a luxury when it comes to supply chain systems of this level of complexity; it is a necessity (Taylor, 2004:74-75). Steven Covey indicated that one should aim for understanding as a first priority, before attempting to convince others (Covey, 1990:237). Supply chain leaders, for example, Wal-Mart and Dell, did not succeed because they found a magic formula or were managed by business geniuses. These supply chain leaders succeeded, because they understood the core problems of the supply chains, committed themselves to long-term solutions rather than quick fixes, and had the stamina to stick with those solutions until they worked (Taylor, 2004:19). If anyone seeks to understand a situation or process, they need to know that process or situation very well. If the process or situation is not well understood, then the result of the efforts will be simplistic rather than simple. True simplicity comes from a thorough understanding (De Bono, 1998:283).

2.3 New nature of competition

Christopher (2004:1) mentioned that the environment in which the original frameworks and principles of marketing have been formulated has changed significantly. Instead of a situation where demand exceeds supply, a condition which persisted in some markets until quite late in the twentieth century, it is clear that the reverse condition is more often the norm.

This transition from a sellers' market to a buyers' market meant that the conventional focus in many companies on the classic '4 Ps' of Product, Price, Promotion and Place had to be radically reviewed. Now there is widespread recognition that companies compete, not so much through what they do, but through how they do it. In other words, the ways in which key business processes are managed and how those processes are aligned with the needs of the market, can be every bit as important as the quality of the product or its price.

Emerging from this changed competitive landscape, has come the idea that the processes that enable demand to be fulfilled in a more responsive and reliable way, can be critical to the achievement of market-place success. Of equal importance is the way in which relationships are managed, both upstream and downstream of the company. These three R's – Responsiveness, Reliability, and Relationships – underpin the idea of marketing logistics. Marketing logistics focuses upon the ways in which customer service can be leveraged to gain competitive advantage. It seeks to manage the interface between marketing and logistics activities of the organisation, in order to align their perspective strategies within the context of the wider supply chain.

Taylor (2004:3) mentioned that the way the supply chain is managed can make or break a company. Some of the most spectacular business successes or failures over the past 20 years have come from finding ways to deliver products to consumers. The nature of the competition has shifted from the classic struggle between companies, to the new competition of supply chain versus supply chain. As

companies have grown more comfortable working with partners from other industries, their focus has shifted to working with the best partners. Partners in supply chains are learning to play a new competitive game of supply chain versus supply chain (Berger & Gattorna, 2001:25). In future, companies and products will not compete, but supply chains will (Reeder & Rowell, 2001:6).

In recent years, one of the most significant developments in the way companies manage their operations and formulate their competitive strategies has been the focus on time. There are clearly many ways in which companies compete and through which they seek to gain advantage over their rivals. However, the ability to move quickly, whether in new product development or in replenishing customers' inventories, is increasingly recognised as a prerequisite for market-place success. The late twentieth century saw the emergence of the time-sensitive customer. These time-sensitive customers can be found in every type of market, whether high-tech markets where short life cycles demand short lead times, consumer durable manufacturing where just-in-time assembly requires just-in-time deliveries, or everyday living where the pressures of managing a more complex, hectic lifestyle have led us to seek convenience in, for example, banking, shopping and eating (Christopher, 2003:67).

The nature of the competition has thus shifted from a sellers' to a buyers' market; from managing marketing and logistics separately to the combination of supply and demand in marketing logistics; from competing against companies to competing against supply chains; and finally the progression towards time based competition.

2.4 Focus of supply chain management

Traditionally, companies used to maintain an arms-length, even adversarial relationship that so often typified buyer/seller relationships in the past. The focus of supply chain management changed the relationship to one based on co-operation and trust and the recognition that properly managed, 'the whole can be greater than the sum of parts' (Christopher, 1998:18).

Supply chain management can be defined as the management of upstream and downstream relationships with suppliers and customers to deliver superior customer value at less cost to the supply chain as a whole (Christopher, 1998, 18), (Gattorna, 1998:276). Supply chains exist to support the flow of demand, supply, and cash (Taylor, 2004:21). Although the phrase “supply chain management” is now widely recognised, it could be argued that it should really be termed “demand chain management” to reflect the fact that the chain should be driven by the market, not by the suppliers (Christopher, 1998:18). Equally the word “chain” should be replaced by “network”, since there will normally be multiple suppliers and, indeed, suppliers to suppliers, as well as multiple customers and customers’ customers to be included in the total system (Christopher, 1998:18).

We are entering the era of network competition where the prizes will go to those organisations who can better structure, co-ordinate and manage the relationship with their partners in a network committed to better, faster and closer relationships with their final customers (Gattorna, 1998:272). Extending this idea, it has also been suggested by J. Aitkin, that a “chain” should more accurately be defined as a “network” of connected and interdependent organisations mutually and co-operatively working together to control, manage, and improve the flow of materials and information from suppliers to end users (Christopher, 1998, 18).

2.5 Importance of supply chain performance

There has been a growing recognition that supply chain management can achieve the twin goals of cost reduction and service enhancement (Christopher, 1998, ix). The quality of a company’s supply chain performance can mean the difference between business prosperity and failure (Gattorna, 1998: xiii).

Cutting-edge supply chains are double-edged swords. Wielded with skill, they can slice open new markets. Improperly handled, they can lead to deep, self-inflicted wounds. For all the advantages from getting the supply chain right, getting it wrong can be catastrophic (Taylor, 2004:8). Improperly managed supply chains can be

disastrous for companies, for example, the following widely reported supply chain failures have occurred since 2001:

- Kmart, a major discount retailer in the US, went bankrupt (Taylor, 2004:8-9).
- Nike lost \$ 100 million in lost sales during the year 2000(Taylor, 2004:9-10).
- Cisco Systems wrote off \$ 2.5 billion in excess inventory, owing to poor management of its myriad outsourced contractors (Valdero, 2002). (Christopher, 2003:69).
- Micron Technology wrote down \$ 260 million of memory products inventory, representing 32 percent of revenue (Valdero, 2002).
- In his testimony before congress in February 2001, Federal Reserve Chairman Alan Greenspan said that the overbuilding of inventories by U.S. businesses and their failure to anticipate downturn in demand, despite significant investment in supply chain management technology, has greatly exacerbated the ill- effects of this country's economic slowdown (Valdero, 2002).

Broken or bad supply chains can also have an impact on the shareholder value of companies. The average loss of shareholder value due to ineffective supply chains was estimated at \$ 350 million (Taylor, 2004:11). 1131 supply chain problems were studied in the United States and a loss of shareholder value of more or less \$ 160 billion was discovered (Taylor, 2004:12) Research in the USA (Singhal and Hendriks, 2002:18) highlighted a direct connection between problems in the supply chain and the share price of the business. On average, bad news from the supply chain will reduce the share price by 7.5 percent, but this often triggers a longer-term decline averaging an 18.5 per cent reduction in shareholder return.

Good supply chains, on the other hand, can have a positive impact on a company's top line, as well as the bottom line. (Taylor, 2004:6). Michael Hammer, for example, regards the supply chain as the last untapped vein of business gold (Taylor, 2004:8).

Well- managed supply chains can add value to a company's top and bottom line, while poorly managed supply chains, could even have an impact on a company's shareholder value.

2.6 Measuring performance

One of the keys to improving supply chain operations is having a solid set of measures in place to monitor performance. The challenge lies in making good choices among the dozens of measures available. Some companies try to measure too much, overwhelming themselves with data that never quite forms a coherent picture. Others measure too little, relying on one or two indicators that do not reflect the full spectrum of performance. The tendency to focus too narrowly on measures is exacerbated by management fads, such as cycle-time reduction in the 1990s and the current obsession with inventory velocity (Taylor, 2004:173). When dealing with any form of measurement, prevention is always the best solution. One should try to avoid performance metrics that are nothing more than post mortem certificates (Harmon, 1992:3-4).

Just as there is no easy answer to all supply chain problems, there is no magic measure for improving performance. Generally, the framework for understanding and selecting supply chain measures is based on four broad categories: measures of time, measures of cost, measures of efficiency, and measures of effectiveness (Taylor, 2004:173).

2.6.1 Measuring time

According to Taylor (2004:137, 142, 173-174, 176-179), time is the easiest measure to capture, because it involves nothing more than taking two readings and performing a subtraction. The four key measures of time are process time, interval, speed and throughput. Examples of process time are pallet transfer time, transportation time and order processing time. Order processing can be slow and complex. Even with a good order processing system, the sequence of events is often slow, labour-intensive, and prone to errors. One of the goals of product companies has been to fully automate order processing, reducing the time, cost, and mistakes associated with order processing. Intervals are as important as process times. Times that are not directly tied to a single process are usually referred to as intervals. Examples of cycle time are customer order interval, cash-to-cash time and machine cycle time.

Originally cycle time referred to the interval between repetitions of a periodic process, which is not necessarily the same as the duration of the process. Contemporary usage compounds two measures, applying the term cycle time to process duration, as well as repetition intervals.

Another approach to measuring times is to invert them and express them as speed, which is distance, divided by a unit of time. When speed takes on a particular direction, it is called velocity. People that talk about inventory velocity are not really describing the speed at which inventory is transported. Rather, they are referring to the amount of time it takes to transform raw materials into finished goods. If one looks for actual measurements of inventory velocity, one will come up empty-handed; what one will actually find are reports of traditional measures such as inventory turns or days on hand.

Variability in process time is also an important measure. Early deliveries force a company to hold the inventory longer than necessary, and late deliveries require an increase in inventory levels to avoid stockouts, so any deviation from the requested delivery data requires so much more inventory. To minimise variability in one's supply chain, one has to minimise variability in every single process along the way.

Whole industries have grown up against time compression, from overnight delivery to fast foods. Technology has facilitated this process – cellular telephones, fax and satellite communications have all contributed to the continued search for the achievements of quicker response to the demands that customers place upon companies. Quality is now measured, not just in terms of product performance, but also on delivery performance. Few industries have been immune to these pressures, and managers should constantly seek ever-more innovative ways to squeeze time out of every business process. Indeed, the main drive behind the Business Process Re-engineering philosophy has been the search for more time-effective ways of doing things (Christopher, 2003:67).

2.6.2 Measuring cost

Taylor (2004:180-184) mentioned that measuring costs is considerably more difficult compared to the simplicity of measuring time, and complex issues can arise when you try to mix or combine different types of cost. The three major types of costs that are usually measured are direct costs, indirect costs, and error costs. The other costs that can also be considered are periodic costs and incremental costs.

Direct costs are those costs that can be directly attributed to the production of finished goods, for example, the cost of materials and labour. The second type of costs are indirect costs which are those costs that are necessary to run a company, but cannot be attributed directly to the creation of a particular product, for example, facility cost and opportunity cost. The most systematic approach to allocating indirect costs is activity-based costing where indirect costs are allocated to products by the way of activities and the resources they require. In effect, activity-based costing seeks to translate indirect costs into direct costs. A third kind of cost is the expense that can be attributed to errors in supply chain processes. These errors include incorrect quantities, invalid product substitutions, inaccurate prices, inventory stock outs, late shipments, and deliveries to the wrong location, damaged goods and missing items. The most obvious error- cost is the expense of running corrective processes, such as handling returns, expediting replacements, reworking defects, and handling settlements. Because these corrective processes are usually ad hoc and time intensive, they are generally more expensive than the original process, causing the total cost of a transaction to more than double. Less obvious error- costs include costs such as long-term consequences, for example, the loss of future business from customers who change suppliers due to process failures, as well as damage to the company's reputation if these failures become frequent. These costs are, of course, much harder to measure.

It must be remembered that every day spent in the pipeline represents a cost to the business. Quite apart from the cost of funding the working capital employed, there is the opportunity cost – in other words, whilst cash is locked up in the pipeline, it cannot be put to use elsewhere in the business or, indeed, invested elsewhere. In

large organisations where a day's sales are measured in millions, the cost of even an extra day of pipeline- time will be considerable (Christopher, 2003:69).

2.6.3 Measuring efficiency

Taylor (2004:184) states that costs, although critical to supply chain performance, fail to capture an important aspect of supply chains: the efficiency with which a chain utilises its resources. Christopher (1998:81) adds that the high real interest environment has had a traumatic effect on business and has prompted a search for dramatic improvements in asset productivity.

Efficiency is concerned with the economical use of resources and thus measures how well you use what you have (Taylor, 2004:189-190). Taylor (2004:184-188) also indicates that of the many assets required for supply chains, inventory usually receives the most attention, because it inflicts such a heavy financial burden. The most widely used measure for inventory is the inventory turnover ratio, also called inventory turn. Another measure for the inventory is days on hand, which is the number of days the inventory would last given the normal consumption. One interesting approach to quantify inventory velocity is to measure the amount of time products spend being processed in some way, including transportation, and then divide that by the total time the products spend in the chain. Time- in- process indicates the relative amount of time the product is actually moving through the chain, rather than just sitting there taking up space. Several studies indicate that, despite attempts to accelerate inventory movement, products in the pipeline still spend the majority of their time waiting. The second type of efficiency measure deals with the use of fixed capacity such as capacity and machinery. The most common measure is the load, which represents the percentage of capacity that is in use at any specific time. The third kind of efficiency measure is concerned with the use of capital, which is particularly important, because it is the medium for acquiring other resources.

2.6.4 Measuring effectiveness

Taylor (2004:189-190) states, unlike efficiency, which is concerned with the economical use of resources, effectiveness reflects how well a process achieves its business objectives. Efficiency measures how well you use what you have, and effectiveness measures how well you get what you want.

The most important measure of effectiveness is concerned with customer service levels. It does not matter how good you are at purchasing and production if you cannot deliver products to your customers in a timely, reliable manner. Customer service levels can be applied in two ways: Sometimes it is a measure, and other times it is a constraint. Some companies simply measure their customer service level and use it to monitor their performance across products, regions and time. Other companies specify a target customer service level and use this target as a constraint on the supply chain, improving the chain until the target level is reached.

Although customer service levels can be calculated, mandated, or exist as a result of the way in which business is conducted, there are seven popular criteria for establishing service levels (Kobert, 1992:78-83). These criteria are:

1. Show the ratio of on-time, complete orders shipped versus total orders required.
2. Weighted service level is measured by giving weight to such factors as order quantities and customer size.
3. Compare line items shipped versus line items ordered.
4. Examine orders placed with tentative required order shipment dates.
5. Consider returns and the reasons for returns.
6. Estimate the value of lost business due to delivery problems.
7. Measure the customer service levels attained versus levels attainable due to capacity constraints. The capacity to ship orders can be constrained by factors such as production capacity limitations on production equipment; supply constraints forced by vendor capacities; order financing; space available to stock product in any stage; natural and unnatural disasters; monopoly restraints by overseas suppliers regarding strategic materials; available supply

of skilled staff; export or import restrictions; customised carrier capacities; rules, laws and regulations ranging from safety to environmental.

The other way to measure effectiveness is to measure customer satisfaction, which can be monitored either passively or actively. Passive measures consist mostly of counting complaints, returns, requests for adjustments and other indications of trouble. Active measures, on the other hand, solicit feedback from customers who might otherwise have remained silent (Taylor, 2004:191).

The ultimate measure of effectiveness, of course, is customer retention. If a company has a growing base of loyal customers that buy its products in ever-increasing quantities, that company is clearly doing something right (Taylor, 2004:191). There is also evidence to suggest that retained customers are more profitable than new customers (Christopher, 1998:45).

2.6.5 Difference between efficiency and effectiveness

Companies around the world use various concepts and tools to craft efficient and effective operations. To implement the various concepts and tools, companies must understand the difference between efficiency and effectiveness (Chase, Aquilano and Jacobs, 2001:6). Efficiency means doing something at the lowest possible cost. The goal of an efficient process is to produce a product or service by using the smallest input of resources. On the other hand, effectiveness means doing the right things to create the most value for the company (Chase, Aquilano and Jacobs, 2001:6).

Often maximising effectiveness and efficiency at the same time creates conflict between the two goals. We see this trade-off between effectiveness and efficiency every day of our lives. To use an example, at the customer service counter of a local store or bank, being efficient means using the fewest people possible at the counter. Being effective, though, means minimising the amount of time that customers need to wait in line (Chase, Aquilano and Jacobs, 2001:6).

2.7 Challenges of managing supply chains

The difficulty of managing supply chains comes primarily from the complexity that creeps into their structure and the variability that characterises their flows. It is the complexity and variability that make an easy game hard to master (Taylor, 2004:21). The real business challenge does not lie in complexity and variability themselves, but in the failure to recognise the havoc they cause on supply chains and making the necessary corrections (Taylor, 2004:41).

2.7.1 Managing complexity in supply chains

According to Taylor (2004:36-38), the first challenge of supply chains is coping with complexity. The complexity begins with the ways in which the three primary flows relate to one another.

Supply chain flows are linked in complex ways. A single production run generates orders to many different suppliers and these orders are usually combined with orders for other production runs to achieve economies of scale in purchasing. The shipments fulfilling these orders may further combine orders to reduce the cost of transportation, but large orders may also be split across two or more shipments, and backordered items are often sent in still later shipments. Invoices are usually multiple shipments; payments may cover invoices, and so on. The simple groupings between the three primary flows of orders, shipments and payments are quickly obscured by groupings and regroupings.

Another source of complexity is the way in which the supply chains are managed, with different groups handling each of the three basic flows. All of these groups operate at different levels, and all too often, with deeply incompatible agenda, and no one group is responsible for the outcome of the entire transaction.

Complexity is also created by the increase of documents associated with orders. Examples of supply chain documents are purchase orders, sales orders, packing lists, bills of lading and advance shipping notices.

The structure of the supply chains itself is another source of complexity. Most supply chains are never actually designed. Rather, they evolve over time through a series of independent decisions.

Managing a global network of materials and information flows, is not only more complex than managing a purely national logistics system, but it also involves some specific additional considerations Christopher (1998:137-141). There are four factors that are critically important for global supply chains (Christopher, 1998:137).

The first factor is extended lead time of supply. Although the normal assumption is long lead times, manufacturing lead times are an artificial constraint. In many cases, it is possible to make to order, instead of from the inventory. A buffer inventory, which is held between the manufacturer and customer, due to the extended transit times, should also be reviewed if it reflects inflexibility in manufacturing or poor materials management.

The second factor is extended and unreliable transit times. Shipping, consolidation and customs clearance all contribute to delays and variability in the lead time of global supply chains. The consequence is that local managers tend to compensate for the unreliability of supply, by over-ordering, double buffering, and applying competitive pressure on manufacturing and the central organisation.

The third factor is multiple consolidation and break bulk options. The options for the management of international freight are complex and the trade-offs will be complex and may vary for different market channels. The result is that the inventory holding, warehousing, customer service and freight costs balance will be different for each option and will be determined by the characteristics of the product and the profile of demand.

The fourth factor is multiple freight mode and cost options. Shipping companies offer mixed sea/air services, different container sizes, scheduled and unscheduled services. The problem with the conventionally organised international business is

that, if the transport decisions are taken purely on the basis of costs, as they frequently are, then this will lead to sub-optimal decisions in many cases.

2.7.2 Managing variability in supply chains

The second challenge of supply chains is coping with variability (Taylor, 2004:37-40). The real-world supply chains do not ever 'see' average values; what they deal with every day are the actual values that make up the averages. The more variability there is in these values, the more difficult and expensive it is to run the supply chain.

A great deal of supply chain management and cost is devoted to coping with variability. A few examples of how companies attempt to cope with variability are: a finished good inventory acts as a buffer against the variability in demand; raw material inventories offer protection against the variability of supply; redundant sources, such as alternate suppliers and transportation options, provide protection against variation in the availability of materials and services; quality programmes reduce the variability in product- quality and forecasting attempts to predict variation in demand.

Variability in the supply can amplify down the supply chain, while variability in the demand can amplify up the supply chain. The classic example of demand amplification is a study conducted by Procter & Gamble in the early 1990s. Small variations in the retail sales of the Pampers brand of diapers were amplified up the supply chains, producing large swings at the level of raw materials. The causes of this effect, which Procter & Gamble dubbed 'the bullwhip effect', are now understood. Demand amplification continues to be a serious problem in many chains. According to Christopher (2003:90), the well-known 'bull-whip effect' or 'Forrester-effect', named after the professor from Massachusetts Institute of Technology who first identified the effect, is the cause of considerable hidden cost to the supply chain as a whole.

Many industries have worked hard to minimise the variability in the supply chains. For example in the grocery industry, point-of-sale data is shared by all supply chain partners. The result is that better decision support tools can be developed that take

the actual historical sales trend from the point-of-sale data and separate normal replenishment volume from lift factors associated with promotional activities or other events, and they use this data to forecast the future demand more accurately (Gattorna, 1998:96-97). In most cases, a few variables cause most of the variability. According to the Pareto Principle or 80/20 rule, twenty per cent of the variables are responsible for eighty per cent of the result (Goldratt, 1990:123).

Taylor (2004:81-82) indicates that the main causes of variability in the supply chain are delays, phase shifts, distortions and economies of scale. Delays occur when any of the components are out of phase with each other. Delays in demand, supply and cash can vary from minutes to months. Phase shifts also cause havoc in supply chains. Based on the most current data, each company might reach totally different conclusions about how the chain ought to be responding to the current demand. If any company tries to make a correction on its own, it is almost certain to throw the other two out of balance. Even if the original signal is transmitted faithfully all the way up the chain, the amount of the delay introduced by each component varies, both within and across components. It takes very little variation of this sort to turn the neat curves into wild, unpredictable swings. As puzzling as the effects of delay might be, much more confusion is introduced if there is any distortion of the signal from one component to the next. Distortions of incoming signals can come from any number of sources, and they can be introduced accidentally or intentionally. Economies of scale represent a common cause of distortion in a supply chain, for example, customers order more than they need in order to get quantity discount and producers run larger batches than necessary to reduce unit costs. Such decisions may save money in immediate operations, but the distortions they cause in the signals for demand supply and cash, extract a much higher cost than most companies realise. The one result of demand distortion is demand amplification or the 'bullwhip effect'. (Taylor, 2004:82) (Chase, Aquilano and Jacobs, 2001:335).

Distributions are used to describe variability (Taylor, 2004:104,163,164). The distribution follows a common form, called the normal distribution, which has a mathematical formula with just two parameters: the mean, which is the formal name for the numerical average, and the standard deviation, which is a measure of the variability. Variability in most quantities conforms to the normal distribution, a

recurring pattern that describes how far values are likely to deviate from the average. Extreme values cannot be eliminated. The implication is that no amount of safety stock is enough to entirely eliminate the possibility of a stockout.

Inventory can, for example, be reduced by reducing variability in the supply chain and /or by a quicker responding supply chain states Kobert (1992:11-12.). Examples of inventory reductions include the following:

- Use faster external and internal transportation modes.
- Improve forecasting of customer requirements and time-phased demand, and take actions to make lead time assessments both realistic and current.
- Negotiate for price breaks for smaller ordering quantities than previously allowed by suppliers.

Products with steady, predictable demand are the easiest to handle, because their requirements are well known and the chain can be designed around their requirements. If the demand varies, but does so in a predictable way, this puts more stress on the supply chain but it is still manageable. The most difficult products to handle are those with highly variable demand that cannot be predicted with any consistency. This situation is most commonly encountered with innovative products, which have little or no sales history and whose sales are driven by trends and fashion (Taylor, 2004: 267).

To resolve the problem of variability, one should consider the total supply chain. Trying to reduce variability at any one link in the supply chain, may just push variability up or down the chain, often amplifying variability in the process. The only real solution to the variability problem is for trading partners to work together to remove variability across the chain, rather than trying to cope with variability through point solutions such as added safety stock (Taylor, 2004:166). It is this realisation, that the organisation no longer stands alone, that has prompted a new search for collaborative partnering. These partnerships may be with suppliers, distributors, retailers, specialist service providers, technology-sharing alliances, and increasingly, with competitors. The lines between suppliers, customers and competitors are sometimes becoming increasingly blurred (Christopher, 2003:29).

2.8 Interrelationship between people, processes and tools

The importance and interrelationship between people, resources and tools, must be considered when a supply chain is evaluated or managed.

People should come first, because they are the only ones capable of improving processes (Ptak and Schragenheim, 2000:39). Gattorna (1998:402), points out that experience shows that the people equation is the toughest part to get right. It requires a strong, continuing effort to secure the organisation's buy-in and commitment to change, empower employees to handle more responsibility and to do what it takes to ensure that they have a sense of ownership in the new process.

Processes, on the other hand, should be carefully monitored. According to W. Edward Deming, approximately 94 % of the problems within an organisation can be directly linked to the process and only 6 % to people (Ptak and Schragenheim, 2000:39). Understanding how processes work is therefore essential to ensuring the competitiveness of a company. A process that does not match the needs of the company will punish that company every minute that it operates. A process, by definition, is any part of an organisation that transforms an input into an output. The aim of a process should be to add value to the original inputs (Chase, Aquilano and Jacobs, 2001:92). The transition from volume-based growth to value-based growth will require a much greater focus on managing the core processes of a supply chain. Whereas the competitive model of the past relied heavily on product innovation, this will have to be increasingly supplemented by process innovation (Christopher, 1998:30).

Software or technology should also never be regarded as the cure to a company's problems. Companies frequently ask for the best inventory-management or forecasting packages rather than focussing on the more important issue, which is improving the processes that create the inventory. Only if the necessary corrections are made to the process, can the company consider choosing the best software that will allow the inventory reductions to occur (Gattorna, 2000:391).

An effective combination of people, processes and tools is necessary to consistently deliver world-class results. All three must be in place to produce sustainable results (Reeder & Rowell, 2001:6).

2.9 Managing inventory

2.9.1 Importance of inventory management

Inventory management has always been an important aspect of total supply chain management (Gattorna, 1998:381). Not only is an inventory an important cost, the carrying cost of the inventory has been estimated at between 25 to 40 percent of the value of the inventory itself. The carrying cost or maintenance cost of holding the inventory can thus be substantial (Gattorna, 1998:381). The costs related to the inventory can range from the obvious, semi-obvious and even hidden costs like data-processing and technical support (Schonberger, 1990:321).

The inventory is also an issue for shareholders. Capital tied up in the inventory is not available. If the inventory is freed up, it can be translated into applications that increase a company's share value or dividends to shareholders (Gattorna, 1998:381). Companies must critically analyse the reduction of the inventory to ensure the availability of a product, because the only time the inventory can add value to the customer, is when it is available for sale (Gattorna, 1998:242).

2.9.2 Classifications of inventory

Inventory can be classified in several ways. One way to classify the inventory is based on the stages of the production process. In this classification, there are three types of inventory: raw material, work-in-progress or semi-finished goods and finished goods (Gattorna, 1998:382). A second way of classifying the inventory is based on the types of inventory in the business process (Gattorna, 1998:382). The

seven types of inventory, according to the business process classification, are the following:

- Cycle stock –the inventory necessary to meet the normal daily demand and which is routinely replenished;
- Safety stock – the inventory that protects against uncertainty whether it be in demand, lead time, or both;
- In-process stock/in-transit stock – the inventory created in the steps to manufacture a finished product/inventory on route to a stocking or delivery point by some mode of transportation;
- Seasonal stock – the inventory held to meet increased sales volume during a particular time of year;
- Promotional stock – the inventory needed to meet the needs of marketing campaigns or advertising;
- Speculative stock – the inventory held to protect against price increases or limited availability; and
- Dead stock – the inventory that is no longer usable or saleable in the current market.

Each of the stock levels must be closely monitored and managed. No matter how safety stock is determined, the important thing to remember is that the operational planning system will treat stock like demand, rather than a supply. Therefore, safety stock needs to be managed and consumed like a forecast. If the safety stock is never used, then it is not really needed (Ptak and Schragenheim, 2000:35).

2.9.3 Inventory management of perishable items

Handling perishable products, also adds complexity to a supply chain. Perishable items refer to the physical deterioration of units of a product (Silver, Pyke and Peterson, 1998:403-404). Perishable items can be divided into two categories, fixed or random.

For items with a fixed lifetime, the utility of each item stays essentially constant for a fixed period of time, and then drops considerably. An example of fixed lifetime items

is blood stored in blood banks. In items with a variable lifetime, the utility can decrease throughout the lifetime in a fashion that may, or may not depend on the age of the unit. Examples of variable lifetime items include fresh produce, certain volatile chemicals and drugs. Most research suggests that a random lifetime inventory on hand deteriorates at a constant rate. It also suggests that the inventory is depleted according to a first-in-first-out policy. First-in-first-out is an optimal issuing policy over a wide range of assumptions. However, where the customer makes the selection, for example, in retail food distribution, where the expiry date is shown on every item, a last-in-first-out policy is likely to be observed.

The supply chain of perishable items must thus ensure that the items are delivered to consumers as soon as possible to minimise the loss of utility and value.

2.9.4 Managing excess inventories

Silver, Pyke and Peterson (1998:367), state that when studying the inventories of many companies, it is common to find a significant percentage of the stocked items that have recently had absolutely no sales. Any remaining stock of a dead item is by definition, excess stock.

The reasons for excess inventory items can be grouped into two categories. First are errors associated with replenishment, that is, having purchased or produced too much of an item. These replenishment errors include production overruns, unjustified quantity purchases and errors in transmission of an order request. The second reason for excess stock, relates to the overestimation of the demand rate. These demand forecast errors include inaccurate forecasts, deliberate changes in sales and marketing efforts, technological obsolescence such as engineering change, and customer cancellations.

To ensure that actions are taken against obsolescence, a company must identify the obsolete items that have a record of non-demand, and calculate the cost of the inactive inventory items. This will ensure that appropriate action is taken to phase these items out of one's supply chain (Kobert, 1992:118). Silver, Pyke and Peterson

(1998:371-372) indicates that companies can make use of various options to dispose of excess stock, which include some of the following:

- Use the product for other purposes.
- Ship the materials to another location.
- Use the stock for promotional purposes.
- Markdowns or special sales.
- Return to suppliers at a unit value lower than the initial acquisition cost.
- Auctions.
- Disposal for scrap value.

Whatever the causes of excess stock, it is important to be able to identify the items, and decide on what remedial action to take. It would be desirable to anticipate the decrease in usage of an item and take appropriate action to avoid being caught with a large surplus stock. The problem of excess stock is increasing as the rate of technological change increases, causing the life cycle of the typical product to shorten (Silver, Pyke and Peterson, 1998:367).

2.10 Managing supply chain strategies with Pareto

The ABC classification or Pareto Principle dates back to the Italian economist Wilfredo Pareto and his studies of the distribution of wealth in Italy. Pareto observed that about 20 percent of the population of Italy controlled 80 percent of wealth, and, over time, this observation led to the 80/20 rule used daily in an innumerable number of disciplines and methodologies (Miller, 2001:184).

The Pareto, or 80/20 rule, can provide us with the basis for developing a more cost-effective service strategy. The service issue is that neither all of our customers, nor all of our products are equally profitable (Christopher, 1998:56). The highest service should be given to key customers and key products (Christopher, 1998:57).

The objective of segmentation is to separate the important from the unimportant. The purpose of classifying items into groups is to establish the appropriate degree of control over each item. Class A items may be more clearly controlled with weekly

ordering, B items may be ordered biweekly, and C items may be ordered monthly or bimonthly (Chase, Aquilano and Jacobs, 2001:668).

Since all the items being forecasted are not equally important, it is not necessary to spend the same amount of time on each. One should spend the available time on items that are high volume, high revenue, long lead-time and/or marketing/business critical. The forecaster must periodically review these products to ensure these criteria are still being met (Johnson, 2002:8-9). Controlling the forecast is more important than spending extraordinary effort on refining the forecast. Therefore, modifying an existing forecast, based on actual data as it is received, is the most effective application of skills and time (Kobert, 1992:329-330).

The Pareto Principle can also be used to differentiate the forecast policies of A, B and C items as follows (Miller, 2001:186):

- The forecasts of “A” items should be monitored closely and adjusted as appropriate on a regular basis. A combination of sophisticated forecasting techniques, improved by current marketing and field sales input and top- down versus bottom- up forecast checks can be used. “A” items should be produced regularly and receive production priority in terms of inventory and production capacity shortages. “A” items will also receive priority in warehouse cycling counting.
- The forecasts of “B” items should be monitored less closely and adjusted on a less frequent interval than forecasts for “A” items. “B” items should be produced regularly, however, in terms of inventory and production capacity shortages. “B” items can be skipped in production cycles to ensure adequate capacity for “A” items. “B” items should receive a lower focus in cycle counting activities in the warehouse.
- Forecasts for “C” items should receive occasional review and simple forecast methods should be employed to establish forecasts for these items. Inexpensive “C” items should be produced in occasional, relatively large lot sizes while expensive “C” items should only be produced on a made-to-order basis, subject to capacity availability. “C” items should receive the least priority and frequency of checks in warehouse cycle counting procedures.

A company can also achieve savings, when different policies are applied to products based on stock value, for example order size, order frequency and size and frequency of internal production scheduling lot sizes (Kobert, 1992:210). Some of the advantages of applying different approaches include the following:

- Considering modes and costs of various transportation options.
- Reducing lead times.
- Determining the order approval levels.
- Conducting make versus buy analysis.

Normally A items are required to have a smaller stock-on-hand balance than smaller replenishment quantities, coupled with more frequent ordering, or scheduling in production (Kobert, 1992:210). C items, on the other hand, are ordered in much larger quantities than ordinarily required and ordering and production is performed much less frequently (Kobert, 1992:211). A company can also apply a process that allows for automatic and routine ordering of C items (Kobert, 1992:236).

The focus should always be on “A” items, as a mere ten percent reduction in stock levels of "A" items, would have to be offset by as much as a fifty percent increase for all C items' inventories. Pareto Analysis allows a company to focus its efforts, versus the normal approach of treating all items as equal, by applying average ordering procedures to all items (Kobert, 1992:211).

The ABC classification can also be used as the basis for classic inventory control, whereby the highest level of service, as represented by safety stock, is provided for the A products, a slightly lower level for the B products and lower still for C items. Alternatively, and probably to be preferred, we might differentiate the stock- holding by holding the A items as close as possible to the customer and the B and C items further back up the supply chain. The savings in stock-holding costs, achieved by consolidating the B and C items as a result of holding them at fewer locations, would normally cover the additional cost of despatching them to the customer by a faster means of transportation, for example overnight delivery (Christopher, 1998:58).

The suggested guidelines to control Class A items include the following (Silver, Pyke

and Peterson, 1998:317-318):

- Maintain inventory records for every transaction.
- Keep top management informed through frequent reports.
- Estimate and influence demand in three ways:
 - Provide manual input to forecasts, for example, ask customers to provide advance warning of their needs.
 - Determine the predictability of demand. Where the demand is known with some predictability, there is no need for safety stock.
 - Manipulate a given demand pattern. Seasonal or erratic fluctuations can sometimes be reduced by altering price structures, negotiating with customers, smoothing shipments, and so forth.
- Estimate and influence supply. Blanket orders and freeze periods, for example, can be negotiated with suppliers and result in a reduction of the average replenishment lead time, its variability, or both. The idea of a freeze period is that the timing or size of a particular order cannot be altered within a freeze period prior to its due date.
- Use conservative initial provisioning. Erroneous initial overstocking, due to overestimating the usage rate, can be quite expensive.
- Review decision parameters frequently. Order points and order quantities should be reviewed frequently, as often as monthly or bimonthly.
- Determine precise values of control quantities. The order quantities of “A” items should be based on the most exact analysis.
- Confront shortages as opposed to setting service levels. Expediting in and out of house, emergency airfreight shipments, and other actions are undertaken to avoid or eliminate stock shortages. On the other hand, some customers might be willing to wait a short time for delivery. Because “A” items are replenished frequently, it may be satisfactory to operate with very little on-hand stock. A backorder will ensure that the demand is satisfied with the next order.

Perhaps the best way to manage product service levels is to take into account both the profit contribution and the individual product demand (Christopher, 1998:58-59). The profit contribution and the individual product demand measures can be brought together in the form of a simple matrix demand:

- Quadrant 1 – Seek cost reductions for high volume and low profit contribution Stock Keeping Units: Some products might have a high volume because they are in frequent demand. However, they are also low in profit contribution and the priority should be to re-examine the product and logistics costs to see if there is any improvement in scope or enhancement in profits.
- Quadrant 2 – Provide high availability for high volume and high profit contribution Stock Keeping Units. The aim is the highest level of service with these items by holding them as close to the customer as possible and with high availability. Normally there would be relatively few items that could afford to follow such a strategy.
- Quadrant 3 – Review Stock Keeping Units with low volume and low profit contribution. Products in this category should be regularly appraised with a view to deletion from the range. They do not make any significant contribution to profit and they are slow movers from a sales point of view. Unless they play a strategic role in the product portfolio of the firm, there would probably be a strong case for eliminating them.
- Quadrant 4 – Just-in-time delivery for low volume, high profit Stock Keeping Units. These products should be kept in a central location, as far back up the supply chain as possible, in order to reduce the total inventory investment, and then shipped by express transport directly to customers.

Christopher (1998:59-60) adds that the concept of service prioritisation by product can also be extended to include customer priorities. Because the same 80/20 rule applies to customers as it does to products, it makes sense to focus resources on key accounts, as well as key products. “A” or key products and customers should be protected, “B” products or “B” customers should be developed, “B” customers that buy “B” products should be maintained, while the active status of “C” customers and “C” products should be reviewed.

If the 80/20 principle should be applied to both products and customers, then all businesses would have to rely on a very few customers buying a few high profit lines. The arithmetic is quite simple: If twenty percent of customers buy twenty percent of the products which provide eighty percent of the total profit, then only four percent of transactions, measured order-line by order-line, contribute to sixty percent of all

profits. The aim should be to offer the highest levels of service and availability to key customers ordering key products. A company should also constantly review the less profitable customers and the less profitable products. In between, there might be items of critical value to the customers. A weight could be assigned on the basis of criticality and the 80/20 ranking based on profit could be adjusted accordingly (Christopher, 1998:60-61).

Pareto or ABC Analysis could also help a company to reduce costs (Kobert, 1992:198-199). Some examples of how Pareto Analysis can assist in reducing costs include the following:

- Pinpoint areas where small savings in significant values of sitting stocks can greatly reduce total ongoing costs of carrying inventories.
- Isolate procurement opportunities for large potential savings, by allowing for time and skill- emphasis in contractual negotiations to move quickly, and, on a priority bases, to important issues.
- Establish priority rankings for all projects that relate to inventory reductions, such as lead-time analysis, vendor capacity planning, bottleneck analysis and safety stock calculations.

Pareto Analysis thus allows a company to focus its efforts versus the normal approach of treating all items as equal (Kobert, 1992:211).

2.11 Pull versus push supply chains

Taylor (2004:28-29) mentions that's orders trigger the flow of goods, but, depending on the production strategy, they may or may not trigger their immediate production by a supplier. In the made-to-stock strategy, a supplier makes products in advance of the demand and holds them in the finished goods inventory, satisfying the demand from that inventory as orders come in. In the made-to-order strategy, the supplier does not build a product until it has an order in hand. There is also an intermediate strategy, assemble-to-order, by which a product is partially built in advance of demand, but final assembly is postponed until an order is received. Some companies use a mix of these three techniques, but choose one as their primary strategy. For

example, Sony uses made-to-stock, Boeing uses make-to-order and Dell uses assemble-to-order.

The choice of production strategy has a major impact on the dynamics of a supply chain. With the classic made-to-stock strategy, the inventory is produced in advance and pushed down the chain toward consumers so that it will be on hand when they need it. The made-to-stock strategy relies on demand forecasts to determine how much inventory to build and where to hold it (Taylor, 2004:29). In most supply chains, the majority of manufacturing and distribution activities are driven by a forecast, rather than by a demand (Christopher, 2003:86).

With made-to-order production, the inventory is pulled down the chain by immediate orders. Forecasts are less important with this type of production, because there is no danger of making too much or too little inventory, though long-term forecasts are important to setting the correct levels of manufacturing capacity (Taylor, 2004:29). An example of a made-to-order operation is the National Bicycle Industrial Company that produces personalised bicycles to match a customer's size, weight and colour preference (Chase, Aquilano and Jacobs, 2001:18-19).

Almost every repetitive manufacturer tries to produce to stock, rather than to order, for two reasons: Firstly, production lead times are too long to provide the required levels of customer service. Secondly, there are major peaks and valleys in demand that do not equal the production capacity. To meet variations in the demand, manufacturers can either produce according to the inventory in anticipation of the demand, or produce at peak levels when it occurs (Harmon & Peterson, 1990:216).

For decades the automobile industry, for example, has operated under a push-distribution system. With this type of system, manufacturers produce according to long-lead time forecasts and rely on their dealers and periodic incentives to move the inventory. Push-distribution is characterised by high levels of inventory held in a distributed manner, thereby simultaneously driving high costs and low fill rates. Push-distribution focuses on selling what you have, rather than making what sells. In this type of environment, there is constant pressure to move volume through short-term incentives that undermine pricing and brand strategies. The alternative pull-based

model is built upon integrated information systems, which enable effective processes and encourage customer input (Gattorna, 2000:606).

Just-in-Time is an example of the pull concept, where demand at the end of the pipeline pulls products towards the market and behind those products; the flow of components is also determined by that same demand. The pull system differs from the traditional push system where products are manufactured or assembled in batches, in anticipation of the demand and are positioned in the supply chain as buffers between the various functions and entities (Christopher, 1998:179).

Some manufacturers are moving towards a make-to-order strategy, rather than make-to-forecast, by managing the pipeline better rather than reducing customer choice (Christopher, 1998:210). For example, some car manufacturers have centralised the control of the finished inventory of vehicles, rather than have the dealers carry stock. The car manufacturers also take advantage of the 80/20 rule, which tells them that 80 per cent of the total demand will be for just 20 per cent of the variant. The models that represent 80 per cent of the total demand are made to forecast, whereas the other 20 per cent of the demand is not only made against firm orders, but is given priority in the production schedule (Christopher, 1998:211).

The weak link in the build-to-stock model is inventory management, and this can be traced back to an even weaker link, namely, the reliance upon sales forecasts. A build-to-order model, on the other hand, begins with the order and not with the forecasts (Chase, Aquilano and Jacobs, 2001:549).

Although supply chains can normally be classified as either push or pull chains, in reality, every chain is a mixture of push and pull. As long as consumers have a choice about what products they buy and when they buy them, the last link in the chain is always a pull link. Somewhere between the push and pull chains is the push-pull boundary, the point at which the flow of goods switches from being pulled by consumers to being pushed by suppliers. In the case of assemble-to-order strategy, for example, the push-pull boundary is located at the final assembly plant (Taylor, 2004:29).

According to Gattorna (2000:606-610), companies implement a pull-based distribution strategy for various reasons. The four main benefits associated with pull-based distribution include the following:

- Reduced fulfilment costs of shipping, storing inventory and physically trading inventory.
- Higher revenue realisation through higher customer order fill rates.
- Lower sales costs: The high inventory levels and long lead times between ordering and production cause lower sales costs. Buffer stocks slow the feedback between sales and production, leading to excessive inventory. The push-based system fails to respond quickly with changes in product mix to meet market changes.
- Improvement retention throughout the ownership cycle.

The differences between the supply and demand chains should also be considered according to Langenwalter (2000:48). The supply chain starts with the initial supplier and consists of the following five steps: buying raw material, making the finished product, moving goods to the market, selling through retailers and receiving a return from retailers or collection points. The demand chain, on the other hand, reverses the steps of a supply chain by using a pull philosophy. This chain includes the following five steps: receiving a return from retailers or collection points, selling the customised product, moving to delivery based on consumption, making only those products for which there is a known demand, and buying raw materials as necessary to support production.

The goal of most manufacturers should be to supply customer requirements from production, and not from stock. This goal becomes feasible when total lead times are reduced, set-up costs become minimal, and the range of available, flexible capacity is sufficient to meet all, but the most unusual, peak demands. Ideally, every manufacturer should strive to achieve a make-to-order environment (Harmon & Peterson, 1990:200).

The aim of any company should be to convert its supply chain from push to pull by responding to customer demand. Technology is used to link the supply chain (Hughes, Ralf and Michels, 1999:163). In future, organisations should be more

demand-driven than forecast driven. The means of making the transition will be through the achievement of agility, not just within the company, but across the supply chain (Christopher, 1998:32).

2.12 Mastering demand

The first step in designing a supply chain is to understand the pattern of demand one's chain has to serve. The demand pattern is formed by the intersection of customer requirements and product constraints. Although demand is usually taken for granted, there are various techniques that a company can use to improve the shape of the demand to better suit its chain, including a few techniques that actually improve the demand by reducing it. Most of the causes of demand amplification are standard practices in supply chain management that can easily be modified to stabilise the flow of the demand (Taylor, 2004:259).

Leaders in supply chain management know that management of the supply chain represents only half of the business equation. While much attention has been paid to finding new and better ways to reduce inventory and increase stock turns, little attention is being paid to understanding, creating and managing demand more effectively (Gattorna, 1998:41). In the words of Terbeck, products and services should be brought closer to consumers, how, when, and where they value them most (Gattorna, 2000:635).

2.12.1 Knowing the customer

According to Taylor (2004:259-263), the starting point in the process of understanding the customer, is performing a geographical analysis of demand. The analysis can be as simple as plotting customer locations on a map, or as complex as combining consumer profile data with population density figures stratified by income and other characteristics.

In addition to analysing the volume and type of products that customers buy, it is also important to examine their actual buying patterns. The analysis should focus on five

major factors: the total volume of the product that customers purchase per period, the frequency of orders, the lot sizes within each order, the variety of products included in each order, and the customer service level required to keep customers happy. To cite two extremes, Just-in-time production facilities may require daily deliveries of small lots of very specific product mixes, and they may place very tight constraints on fill rates and delivery times. At the other end of the scale, wholesale distributors may place infrequent orders for large quantities of products, require a different mix on each order, and have much less restrictive requirements for times of delivery. These two kinds of customers would place a very difficult demand on a supply chain. The just-in-time customers would be best served by high-throughput distribution centres located close to their plants, whereas the distributors might be adequately served by a centralised, general-purpose storage facility.

Analysing the customer service level requirements of individual customers, can help to identify opportunities for major savings in a supply chain. Some companies take pride in setting a high standard for customer service level and applying that standard across the board, but providing a higher level of service than customers actually need, could be wasted, given the tremendous expense of maintaining the high cost of service levels. A more cost-effective approach would be to vary customer service level according to each individual customer's needs, eliminating the waste of over-serving customers with low requirements, while also avoiding unacceptable service for customers with high requirements. If a company would like to be recognised for excellent service, it would probably want to keep its customer service level at the upper end of the acceptable range, but if it wishes to compete primarily on price, then the adequate range would help keep costs down.

The next step is to look for correlations between how customers buy and where they are located. The distribution of sales across corporate customers often follows the Pareto pattern: The top 20% of customers account for 80 % of sales, and the bottom 50 % for just 5 %. If the majority of customers require high customer service levels, regional warehouses need to be considered in these regions.

If a single supply chain is designed that treats all customers the same, deliveries will be constantly expedited for type 'A' customers, in order to get those deliveries to

move faster than the bulk of the goods, and it may be found that the cost structure of the supply chain makes it too expensive for many type B and C customers. Type 'A' customers can be served by small warehouses adjacent to their plants, making precisely-timed deliveries in re-usable parts-kit containers. Type B customers, on the other hand, can have a package carrier, such as UPS or FedEx; deliver shipments from a central warehouse. Type C customers can be served by a conventional network of regional distribution centres.

According to Gattorna (1998:48-51), the science of segmenting customers from a logistics perspective does not differ significantly from traditional sales and marketing segmentation. Different customer-unique logistics need to drive the segmentation of customers, for example, buying relationship, ordering and billing, delivery and support services, ordering complexity and delivery complexity.

In defining customers' logistics requirements, organisations should also focus on understanding their own performance, versus that of their competitors'. This will provide greater insight into the priority of each service factor and how well these service requirements are being met. Where a high-priority service is not being met by the market, there will be an opportunity to differentiate. If, however, a service requirement is being met by most of the competition, then the time will have come to rectify this, in order to save the situation. In addition, a focus on non-priority service requirements could be avoided.

A supply chain should be designed according to the actual and also the different needs of its customers, which might mean different strategies for different customers.

2.12.2 Analyzing the product

2.12.2.1 Implications of product attributes on the supply chain

According to Taylor (2004:264-266), the qualities of products can impose constraints on how they are packaged, transported, and stored. The three product qualities that must be considered are form, density and risk.

With regard to form, the major concern is whether a product is shipped in bulk or packaged. Shipping and storing bulk material is much cheaper than handling packages. When materials are shipped in bulk form, the state of the material is a key consideration, because solids, liquids and gases differ greatly in the way they are transported. The condition of packaged goods is important, as well as those shipped in bulk, because liquids and gases generally require relatively expensive packaging, such as tanks.

Density, expressed as the ratio of weight to volume, is also an important consideration in the supply chain design. Low-density products are more expensive to ship, because vehicles and containers “cube out” before they “weight out”, filling the available volume before they reach their full hauling capacity. When low density is the result of the way in which a product is constructed, effective density is often increased by shipping products in a partially assembled state. A property closely related to density is the product’s value-to-weight ratio. As this ratio increases, the relative cost of transportation drops and more options become economically feasible. When carbon travels in the form of coal, it usually moves by slow freight and goes no farther than it has to. When carbon travels as diamonds, it goes by plane and circles the globe.

Product risk could require special handling, packaging, transportation, and storage. Higher risk products include fragile items, perishable products and hazardous products. The risk of fragility, perishability and hazardousness increase the cost of transportation, and high-risk products are often shipped separately from other goods to isolate these added costs.

The design of the supply chain also has to take into account whether the products are standard or customised. In general, customisation shifts the push-pull boundary further up the supply chain. Standard products allow the push-pull boundary to be set right next to the customer, so these products can be ordered to stock and pushed all the way down the chain in anticipation of demand. Fully customised products, on the other hand, can move the push-pull boundary all the way up to suppliers, if the choice of material depends on the design. Shifting the push-pull boundary upstream reduces the need for the inventory, because products are pulled by immediate demand, rather than by being pushed down the chain based on forecast. The problem is, however, that the complexity of the fulfilment process is increased and it requires more flexibility in both upstream and downstream facilities.

According to Christopher (2003:42), Theodore Levitt introduced the idea of the 'augmented product', and this concept is still in operation today. Essentially, the notion of the augmented product is that it is not sufficient to focus on marketing effort of the tangible product features alone. These features are quickly imitated or cloned by competitors, and in many cases, as Levitt would argue, customers do not buy products, they buy benefits. Instead, the marketer needs to identify other ways in which value can be delivered to the customer, over and above the intrinsic elements embedded in the product itself.

Product attributes must be considered when designing and managing a supply chain. Different products require different supply chains. A well- managed supply chain should ensure that the product features, tangible and non-tangible, are delivered to the customer.

2.12.2.2 Implications of product demand variability on the supply chain

According to Taylor (2004:267-269), another important consideration for a supply chain design, is the variability in demand for products over time. Products with steady, predictable demand are the easiest to handle, because their requirements are well known and the chain can be designed around these requirements. If the

demand varies, but does so in a predictable way, more stress is put on the chain but this will also then be predictable.

A better approach to coping with seasonable variability is to use products with different seasons to counterbalance each other, distributing the load on a supply chain as evenly as possible over the course of a year. The classic example is the manufacturing plant that alternates between snow blowers and lawn mowers, taking advantage of common components and operations to minimise the cost of semi-annual changeovers.

The most difficult products to handle are those with highly variable demand that cannot be predicted with any consistency. This situation is most commonly encountered with innovative products, which have little or no sales history and whose sales are driven by trends or fashion. Products may start with low and slow growth, and later go through a period of rapid growth peaks and then slide into a gradual decline. The demand for newly introduced products is highly uncertain, and the uncertainty starts to decline only as the full market embraces the product and the growth rate begins to slow down. It is only after the product is well into its sales period that sales become reasonably predictable.

Until a product approaches its sales peak and begins to exhibit a stable pattern, the supply chain for that product needs to maintain high levels of safety stock to handle higher-than-expected sales. In addition, considerable excess capacity must be kept in reserve, in order to increase production quickly if the actual sales for the product escalate. A product's overnight success might be shattered by chronic shortages, cost overruns or quality problems. Erring in the other direction could lead to excess inventory, idle plants and massive returns. Dealing with innovative products is one of the toughest problems in supply chains.

According to Shapiro (2002:1), practical considerations cast doubt on the validity of order fulfilment strategies based on the classical models. Examples of supply chain complications include the following: individual items which may be shipped together and which, in turn, affect delivery times: limited storage space in the company's distribution centres which may constrain the quantities that can be ordered; vendors'

availability of products may be limited, which also constrains the quantities that can be ordered; inventories held in nearby distribution centres which may be used to serve customers when a stockout occurs in a given distribution centre and product demand which may fluctuate over time. Such complications reflect the realities of modern supply chain management. In practice, managers could and should use combinations of judgement and classical analysis in determining safety stocks for their products.

Companies must be wary of using marketing grouping for demand patterns. Product families are usually based on similarity of production or consumption, rather than similarity in their demand patterns, and families often mix products with very different supply chain requirements (Taylor, 2004:269).

Supply chains must be customised according to the demand variability of the product.

2.12.2.3 Pareto product groups

When deciding to aggregate products for design purposes, it is important to take the sales volumes of products into account. If a Pareto Analysis reveals that 20 % of the product line accounts for 80 % of the sales, companies should be able to take advantage of that fact in designing their supply chains. For example, one might be able to handle fast movers separately, gaining some economies of scale by shipping them only in full pallets or full truckloads. Alternatively, a company might be able to convert the other 80 % of the product to a centralised warehousing system, allowing them to bypass the regional distribution system. The numbers of Stock Keeping Units that have to be tracked and queued at the regional distribution centres will decrease to a fifth of what it would otherwise be, allowing for streamlining of operations at distribution centres, while decreasing inventories that do not sell over rapidly (Taylor, 2004:269-270). Knowing which products to forecast and when to keep safety stock, is a critical component of managing customer and supplier risk in the centre of the supply chain (Bonomo, 2003:4).

Pareto Analysis should be used as a powerful tool to aggregate products. The supply chain strategies should be customised according to the product groups.

2.12.2.4. Implications of product life cycle on the supply chain

According to Gattorna and Walter (1996:29), the implications of logistics management vary between the various stages of a product's life cycle. In the early stages of a product's introduction, it is important that it be made available to the innovator customer group that will account for its success-rate. Costs are not unimportant but they are viewed less rigorously than would normally be the case. In the growth stage, the channels of distribution are expanded as the demand grows. It is also important to ensure that the availability and delivery reliability are high if sustained growth is to be maintained. As the product reaches maturity while sales volumes are high and competition is intense, ways and means of maintaining margins must be investigated. Third-party distribution service companies may help maintain cost-effectiveness. Upon reaching the decline stage, both product and distribution service characteristics should be rationalised. The fact that typical customers may become highly price sensitive, means that margins could be seriously affected, unless the supply chain activity is reviewed (Gattorna and Walter, 1996:30).

Product life cycles are getting shorter. In many markets, the effect of changes in technology and consumer demand combine to produce more volatile markets, where a product can be obsolete almost as soon as it reaches the market. Shortening life cycles create substantial problems for logistics management. There are situations arising where the life cycle is shorter than the strategic lead-time. This means that the life of a product on the market is less than the time it takes to design, procure, manufacture and distribute the same product. Ultimately, the means of achieving success in such markets is to accelerate movement through the supply chain and to make the entire logistic system far more flexible and responsive to the fast-changing markets (Gattorna, 1998:31).

Long lead times to procure a specific product impede a company's ability to respond to market signals. Longer material procurement lead-time reduces the amount of time

available for reactive production. Because the demand for raw materials can be forecast more accurately than the demand for finished products, holding raw materials is often less risky than holding finished goods (Gattorna, 1998:178). In order to react more quickly to demand changes, a company might decide to hold raw materials, rather than finished goods.

Different demands are put upon the supply chain according to the life cycle stages and length of the product life cycles.

2.12.2.5 Implications of product life cycles on forecast error

Planners have used the product life cycle for decades. The product life cycle determines the profit potential of the individual product in its forecast life cycle. An active item is usually in one of the first four phases, namely development, introduction, growth or maturity. Seasonal and “one-of” products are treated as if they are in the termination portion of the life cycle (Kobert, 1992:328-329).

In the development phase, the forecast calls for an inventory build-up. Forecast errors result from a delay in start-up costs and lost opportunities when expensive introduction costs develop sales, but delivery is stalled (Kobert, 1992:328-329). A small amount of sales data should be used early in the life of a product to update forecasts. The effective use of early sales data could typically reduce the forecast error margin from between 50 and 100 percent to around ten percent. (Fisher, 1999:152).

In the introductory phase, the cost of a postponed delivery or lost order is critical. If the product must match a very costly introductory promotion, the promotion cost may greatly exceed the carrying cost of the inventory for an additional month or more, especially if one uses the true variable cost of the inventory versus the total cost of the cancelled or postponed orders (Kobert, 1992:328-329).

During the growth phase, optimistic forecasting can lead to excess inventories. Normally stock outs are perceived to be more costly than the variable carrying cost of

temporary stocks of raw materials and work-in-progress inventories. Excess stock is absorbed when calculating net requirements for the coming periods. Procurement and production are reduced by excess inventories during the growth phase (Kobert, 1992:329).

The maturity phase is the most difficult phase to define. Temporary upsurges in independent demand are viewed as a true sign that the product is still in the growth stage. Temporary steep declines are sometimes viewed as a sure sign that the product has entered the termination phase. A major inventory error occurs when the forecaster believes that the product is still in the growth stage, while it has actually moved into the termination stage, which is often the case with high fashion product lines. Often, large inventories of 'A' items must be written-off. 'A' items ought to be frequently and accurately tracked (Kobert, 1992:329).

When dealing with new products, companies must be conservative in situations of high uncertainty and instability. This normally applies when data contains high forecast measurement error, high variation concerning the trend line has occurred or is expected, instabilities have occurred or are expected, or the forecast goes outside the range of the historical data (Armstrong, 2001:14).

Traditional forecast methods cannot be used with short-lived products, that is, with a product life cycle of 9 to 18 months. Product life cycle forecasts allow for product life cycle phases, marketing events and other known information to arrive at initial forecasts. The product life cycle forecast method incorporates the impact of seasonality, price changes and promotional events, but also updates the forecasts as actual market data become available (Burruss & Kuettner, 2003:6).

The biggest challenge in demand forecasting is predicting the sales of a product that breaks new ground. Innovative products go through a life cycle that is characterised by slow sales as customers decide whether to adopt the product, and then a period of rapid growth as the product escalates. The difficulties in forecasting innovative products lie in predicting how soon a product will enter its growth phase, how quickly sales will escalate, and how high they will eventually go. If a company overestimates how well a product will be received, it could be burdened with excess production

capacity and unsold inventories. If the company underestimates demand, it will be faced with angry customers, expensive measures to accelerate production, and opportunities for competitors to gain market share (Taylor, 2004:207).

The accuracy of forecasts could be increased by identifying the location of a product in its life cycle and adapting different approaches to different product life cycles.

2.12.3 Shaping demand

A continuing problem for most organisations is the inaccuracy of forecasts. It seems that no matter how sophisticated the forecasting techniques employed are, the volatility of markets ensures that the forecast will be wrong. The evidence from most markets is that demand volatility is increasing; often due to competitive activity, sometimes due to unexpected responses to promotions or price changes and as a result of intermediaries' re-ordering policies. In situations such as these, there are very few forecasting techniques that will be able to predict short-term changes in demand with any accuracy (Christopher, 1998:153).

To understand the nature of the demand and to design the chain accordingly is important, however Taylor (2004:270-272) added that it takes a somewhat reactive point of view. It is possible to take a more proactive stance towards the demand, actively shaping it to suit one's purposes, rather than working within the constraints it imposes. In fact, some of the most effective techniques for improving the demand involve reducing it, at least in the short term.

One of the most important things a company could do to improve the shape of the demand, is to make sure that the right customers are being served. The relentless pursuit of revenue often blinds companies to the fact that some customers are being served at a loss. By removing these unprofitable customers, a huge contribution to the bottom line could be made, even if the performance of the supply chain is not improved at all.

A tiered pricing structure, based on service levels, can also assist in eliminating customers that decrease a company's profits. Often, it is those customers who place

the greatest demand on performance, who also demand the biggest concessions on price. A tiered pricing structure, based on service levels, will not allow discount on premier service. The result is that customers are allowed complete freedom of choice: They can allow a company to make a profit, or they can inflict their business on one of the company's competitors.

The value of reviewing the customer profitability could thus be substantial. The information could be used firstly, when the sales contract is negotiated and, secondly, as the basis for sales and marketing strategy in directing effort away from less profitable types of account, towards more profitable business. More significantly, it could point the way to alternative strategies for managing customers with high servicing costs. Ideally, all customers should be profitable in the medium to long term and where customers currently are profitable, a company should seek to build and extend further profitability (Christopher, 1998:91).

Taylor (2004:272) adds that eliminating customers that decrease a company's profits is only half of the solution; the other half is avoiding such customers in the future. Marketing and sales messages must strive to attract the right kinds of customers, and that means being clear about a company's distinctive competence. If customers are promised the fastest service and the best products at the lowest prices, then they will expect delivery according to those promises, no matter what it costs. If a company is honest about the ways in which it excels, it will be chosen for the right reasons and both the company and the customer will benefit.

The key to getting sustained co-operation across the supply chain is to align everyone's incentives. The idea of being selective about customers will strike some managers as a radical notion, but it is no more radical than being selective about suppliers. If customers, whose needs and expectations do not match the capabilities of the supply chain, are allowed, aligning those incentives becomes extremely difficult. Unfortunately, the practice of selling to anyone who will buy is deeply entrenched, so it takes careful alignment of incentives within a company to alter this behaviour. For example, sales commissions can be based on profit, rather than on revenue. Another idea is to reward marketing on the quality, rather than the quantity of leads, and making the alignment of customer requirements essential to the

definition of a qualified deal (Taylor, 2004:272). Gattorna (2000:460) also adds that changing performance measures is one of the few ways in which leaders directly affect and change people's behaviour. People will focus their own activities to maximise their performance and to achieve individual and workgroup goals that are measured. In the absence of new performance measures, there is no incentive for managers and employees to adopt the change, as it is not considered to be important enough.

Just as serving the right customers is vital to the shaping of the demand, being selective about the products a company sells is also critical. In the past, decisions regarding new products were usually made without regard to supply chain constraints. In the new supply chain-based competition, the selling of products that are unsuitable for the supply chain is a hard decision to justify. The problem is that these particular products cannot be moved through the supply chain cost-effectively. The deeper problem is, that the requirements of these products, can keep the entire chain from reaching peak performance. If a company's goal is to compete with other supply chains based on cost, it should re-assess some of the more innovative products which require excess safety stock and capacity (Taylor, 2004:273).

As with culling out unprofitable customers, eliminating products that are unsuitable is only half of the solution. The other half of the solution lies in making sure that all new products are well suited to the supply chain. If a company's goal includes making its supply chain as flexible as possible and responsive to changing needs, it should seek out innovative products that other supply chains are unable to handle cost-effectively. Supply chain considerations should help to shape the design of new products, allowing innovation not only in the product itself, but also in bringing the product to the market, for example the use of postponement (Taylor, 2004:270-273). The best way to manage product service levels, is to take into account both the profit contribution and the individual product demand (Christopher, 1998:58).

The biggest opportunities to improve the efficiency of supply chains still lie in innovation. Most of the money devoted to the improvement of the supply chain is spent on automating operations with a safe investment return that is easy to estimate. Less money is spent at the design level where there is the most opportunity

for innovation. The irony is that innovation offers a far bigger potential for return. To gain a few points of market share, companies should focus on cost reduction. To dominate a market, companies need to increase efficiency, which is something that cannot be matched by the competition (Taylor, 2004:273-274). Companies have to be highly efficient to remain in business. However, efficiency alone will not be a sustainable source of differentiation or competitive advantage. Innovation, based on a deep understanding of consumer needs, will become the leading source of differentiation and competitive advantage in the future (Gattorna, 200:121).

The supply chain should be actively and proactively shaped with customers and products that do not constrain it. In some cases, the demand could be improved by reducing the demand for products and customers that constrain the supply chain.

2.12.4 Stabilizing demand

As conventional supply chains comprise separate corporate entities with only minimal upstream and downstream transparency of market-related information, they protect themselves against the uncertainty of the demand by holding on to the inventory. As a result, these supply chains carry their inventories far in excess of current requirements, with duplication of stock for each buyer –this is known as supplier interface. Not only is this a significant burden in terms of working capital but, even more importantly, such chains are slow to respond to volatile demand. A further problem with supply chains with numerous buffers between the two ends of the chain is that small changes in the demand in the final market place are amplified and distorted as they move back through the chain. This variability is the well known ‘bull-whip’ or ‘Forrester effect’. (Christopher, 2003:90).

Variability is one of the most costly problems in supply chains, particularly when it amplifies as it flows up the chain. Anything that is done to stabilise the flow of demand across the chain, will improve the performance and result in substantial advantage versus chains that have to cope with higher levels of variability. In addition to focusing on customers and products that suit the supply chain, a company could shape the demand by stabilising it (Taylor, 2004:274).

The key for organisations to determine whether their current demand management practices are ineffective is to investigate whether volatile customer demand represents the customer's real underlying demand, or whether the organisation is, in fact, the primary driver of demand volatility. If the end consumer demand flows smoothly, then the organisation should start to analyse whether the demand is caused by its own policies and procedures (Gattorna, 2000:150).

Taylor (2004:274-276) added that the biggest source of variability in supply chains is caused by demand lumping. Demand lumping divides a steady flow of demand up into arbitrary chunks that appear as sudden surges in the demand. This occurs, for example, when a retailer sells products at a constant daily rate, but does not replenish the stock until the level hits the fixed reorder point. When the retailer reorders, the requirements are rounded up to the next level of packaging to avoid handling individual items, then it will be rounded up a little further if it is close to the next quantity break in the distributor's discount schedule. The distributor follows a similar policy, but waits longer and buys in larger quantities in order to get better prices. When the distributor does place an order, the quantity may be so large that it exhausts the producer's inventory of finished goods and triggers another production run.

Demand lumping distorts the demand signal in two ways. Firstly, it throws off the timing, delaying the demand signal as it moves upstream. If the producer only sees the incoming demand signal, he will not even know that the products are selling until a few weeks of sales have passed. Secondly, it amplifies the demand signal. When the producer finally receives information about the demand, it comes in such a large order that increased production will be necessary to handle the surge. But even the smallest variation in sales will continue to amplify up the chain, producing the infamous 'bullwhip effect' that has a devastating impact on upstream suppliers.

Demand lumping is usually a by-product of a company's routine practices such as quantity discounts, economic replenishment policies, volume packing and batch production runs. These business practices have all been designed to take advantage of economies of scale. The fact that these practices also create havoc in supply

chain management is a highly counterintuitive but deeply important insight. It seems that there is a fundamental tension between economies of scale and the smooth flow of demand up the supply chain (Taylor, 2004:276). An “everyday low pricing” strategy is one example of how a company can eliminate the forward buying of bulk orders (Silver, Pyke and Peterson, 1998:473). The result of forward buying is that it turns simple, predictable demand into a chaotic series of spikes that only add to the cost (Fisher, 1997:147).

Taylor (2004:276) also adds that there are other causes of demand lumping that are not related to economies of scale. One example is forward buying in which customers purchase supplies before they are needed, in order to take advantage of favourable prices. These prices may be the result of natural fluctuations in the market, but they are usually caused by promotions granted by suppliers.

Another cause of demand lumping is hoarding, in which customers buy more than they need, in order to protect themselves against current or expected shortages (Silver, Pyke and Peterson, 1998:473) (Taylor, 2004:276). Hoarding can have particularly unpleasant effects on demand, because it contains a positive feedback loop. Hoarding increases scarcity, which further increases hoarding, and in this way the loop will continue. In some situations in the electronics industry, this self-amplification can escalate a relatively minor shortfall into a worldwide crisis (Taylor, 2004:276).

According to Taylor (2004:276-278), companies do not have to give up all their established business practices in order to stabilise demand. They only need to modify those necessary to reduce the incentive to lump demand. For example, companies can try to base quantity discounts on total volume, rather than the size of individual orders. Quantity discounts will still encourage customers to buy in bulk, but the incentive to inflate each order will be eliminated. The result will most likely be a larger number of smaller orders, which will reduce the economies of scale in order processing. Companies can explore other ways of modifying common practices to reduce the problem of demand lumping, for example the sell-through and turn-and-earn systems. Instead of basing promotional prices on the quantity purchased by the customer, companies can base promotional prices on the quantity they sell to their

customers. The sell-through amount reduces the practice of forward buying and helps to ensure that promotions actually move the product down the chain, rather than just pushing promotions to the next link. Hoarding can also be reduced with a turn-and-earn system, in which customers can only purchase scarce products in proportion to their outgoing sales. This turn-and-earn system discourages customers from inflating their orders, with the hope of increasing their allocations.

One of the most effective techniques to stabilise a demand is to use promotions. Promotions should be run during the demand slump, raising it enough to consume the output of a stable production schedule. Even if most of the increased demand is due to forward buying, it is acceptable, because this stabilises the demand, rather than distorting it.

Mastering demand, rather than just managing it, is a powerful weapon in the supply chain-based competition. In addition to knowing the customers and understanding how a company's products suit their needs, one would have to be willing to make hard choices about which customers and products are right for a particular supply chain. The company would have to modify certain business practices that are deeply ingrained in its corporate culture. However, mastery is never achieved instantly, and these changes do not have to come all at once. If a company can simply shift its thinking about the demand from a conventional, reactive stance to a more proactive point of view, understanding that it can shape the demand to fit the competitive advantages of the supply chain, such a company will already be ahead of most other supply chain managers and companies.

Companies must use various strategies, policies, objectives and incentives to stabilise the demand. A better-stabilised demand pattern will result in major cost savings throughout the supply chain.

2.13 Demand management

2.13.1 Components of demand

A strategic supply chain begins with the customer. Customer service strategy deals with how the firm responds to the needs and expectations of its customers, in a manner that maximises profitability. How the firm 'senses and responds' to its customers is a primary determinant of its overall success. The focus on the sourcing strategy, demand flow strategy, customer service strategy and supply chain integration strategy will ensure that the company develops strategies that meet the needs of the market and integrates with supply chain partners to deliver improved shareholder value (Gattorna 2000:23).

In order to manage the demand, the various components must be considered and understood. Taylor (2004:189, 195, 197) stated that the best guide to future sales for a product with a known sales history is its past performance. Using the techniques of time-series analysis, standard formulas to analyse a sales history can be applied, information about recurring patterns can be extracted, and those patterns can be used to project future sales. If the product's history shows a more complex pattern, or if a company would like to forecast sales further into the future than just the following month, then the full model would have to be used.

Sales history should be analysed into four distinct components, i.e. the level, trend, seasonal and random component. The level component is a single value that represents average sales. All other components are variations around this level. The trend component is a straight line that reflects the overall tendency for sales to increase or decrease. The seasonal component is a curve that captures the rise and fall in sales over the course of each year. The random component represents all other variations in the demand, regardless of cause, and has no systematic pattern over time. The level, trend and seasonal components are called systematic components of demand, because they behave consistently over time and can be predicted.

In order to understand demand history, one needs to evaluate the level, trend, seasonal and random components of the demand. By understanding the various components of the demand, a company will be able to develop strategies that meet the needs of the market and shareholders.

2.13.2 Purpose and rules of forecasting

The business advantage of forecasting is that it eliminates predictable variability from the future demand stream, allowing for production to be planned much more precisely (Taylor, 2004: 199).

The purpose of forecasting is not to be one hundred percent correct, since that can never be achieved. The purpose is to improve the odds of being close to this figure. More important is the fact that, if there is no formal set of forecasts to drive operational planning activities, then everyone will develop their own set of forecasts. Employees will use their individual, independent views of the future for planning. The absence of formal forecasts to use as a guide will just mean that everyone will have to develop their own set of forecasts. A formal set of forecasts gets everyone on the same wavelength, helping to lead to co-ordinated and synchronised operations (Lapide, 2000:16).

Given that forecasts are, at best, educated guesses about the future, the rules of forecasts should be considered. Forecasts have three rules according to Ptak and Schragenheim (2000:47):

- Forecasts are always wrong. Given that the future is subject to many unseen factors, the only thing that can be counted on with certainty is that the forecasts will change.
- Forecasts are more wrong farther into the future. Forecasts that attempt to predict sales or other events from months to years in the future are much less accurate than those predicting sales for the following week. Taylor (2004: 198) added that the technical term for the most distant period for which a forecast is generated, is called a forecast horizon. Given the way the time-series model

works, the forecast horizon can be set as far in the future as one would like. However, the accuracy of the forecast falls off dramatically as one looks further out.

- Forecasts are more wrong when more detail is used. Whenever a small number of samples are used to generate predictions about a larger population, there is a risk of sampling error, that is, of picking a sample that does not happen to represent the population as a whole. Taylor (2004:200-201) added that one of the basic laws of statistics is that the likelihood of sampling error goes down as the sample size goes up. In addition to aggregating demand across products, forecasts can aggregate demand across customer type, geographical region, and other factors. When a forecast is based on large quantities of data, it is possible to get reliable forecasts down to the level of weeks or even days. Bonomo (2003:6) also adds that when the demand is aggregated for different customers and products, trends begin to emerge. Although the concept of aggregation is very basic, aggregation plays a very important role in a supply chain. Aggregation of product families can spot a move to or from a particular technology. Aggregation of customer orders can provide an early warning signal that customers are decreasing production. Customer level aggregation can spot a trend even before it is reflected in the customer forecasts. Aggregation has many advantages and is a powerful tool in supply chain management. By aggregation demand, a company can identify key trends in its demand history.

Although forecasts are always wrong, the various rules of forecasts should be considered to make meaningful conclusions from the information, and the forecast will at least ensure that everyone within the supply chain is on the same wavelength.

2.13.3 Understanding forecasting error

For many manufacturers, forecasting is still more of an art than a science, because it needs to blend intelligence from a field with actual past sales to create the most accurate forecast available (Langenwalter, 2000:67).

The forecast error is the difference between the forecast value and what actually occurred. In statistics, these forecast errors are called residuals. As long as the forecast value is within the confidence limit, it is not really an error. However, common usage refers to the difference between forecast and actual value as an error (Chase, Aquilano and Jacobs, 2001:447).

Forecast errors can be classified as bias or random. Bias errors occur when a consistent mistake is made. Sources of bias include failing to include the right variables, using the wrong relationships among variables, employing the wrong trend line, mistakenly shifting the seasonal demand from where it normally occurs, and the existence of some undetected secular trend. Random errors can be defined as those errors that cannot be explained by the forecast model being used (Chase, Aquilano and Jacobs, 2001:447).

If one is to improve the forecast accuracy, one must have knowledge of the factors that contribute to forecast errors. The forecast errors are usually caused by unanticipated purchasing or production delays, forecast overrides by human input, insensitivity of the forecast correlation factors, and unanticipated external events that change the anticipated customer demand beyond expectations and file maintenance errors (Kobert, 1992:321).

The first rule of forecasting is that forecasts are always wrong. No matter how well you predict the systematic components of demand; there is always a random component that cannot be predicted. Improving at forecasting does not mean eliminating error altogether. Rather, the goal is to make the residual error as small as possible, while eliminating any bias toward under-or over- predicting the demand. Two different measures are required to meet this goal, one to monitor the magnitude of forecasting errors and another to monitor the bias (Taylor, 2004: 250).

Forecasting experts have several good statistics for analysing the magnitude of forecast errors, but for management purposes the best one is probably the mean absolute percentage error. This error tells you how many percentage points your forecast tends to be off the mark, regardless of whether they are too high or too low. By monitoring the mean absolute percentage error over time, one can see if any

progress is being made in reducing the size of forecast errors. One of the advantages of using percentages is that the magnitude of forecast error is expressed in standard units, cancelling out any differences due to the actual sales volumes (Taylor, 2004: 250-251). Forecast error should be measured along several dimensions and at different levels. Ultimately, the primary measure of forecast error should reflect at the SKU and location, for example warehouse or factory level (Gattorna, 1998:135).

To understand the forecast error results, one must understand the characteristics of forecast errors. Forecast errors normally have the following characteristics (Jain, 2003: 18):

- The forecast error is lower at an aggregated level, for example, company total, than at a disaggregated level, for example, category or stock keeping unit level. When aggregated, the under-forecasts or positive errors are offset by the over-forecasts or negative errors.
- The forecast error normally increases as the forecast moves further into the future.
- The demand for all products is not equally predictable, some are easier to forecast than others. Normally forecasts of non-matured products have larger errors than non-promoted ones, and forecasts of new products have larger errors than existing ones.

For monitoring the bias of forecast errors, the tracking signal is a good choice for managers, because it expresses bias in standard units that do not depend on sales volume. When there is no bias, the tracking signal is zero. A positive signal means that most errors have occurred because the demand exceeded the forecast, whereas a negative signal means that the demand fell below the forecast (Taylor, 2004: 251). The tracking signal indicates whether the forecast average is keeping pace with any genuine upward or downward changes in the demand (Chase, Aquilano and Jacobs, 2001:448). It is crucial to look for forecast bias when measuring forecast error. When forecast bias is present, there is a problem with one or more data inputs, or the process itself is problematic. Often bias is injected when an organisation attempts to manipulate the forecast to match a functional goal, such as a sales objective or manufacturing volume commitment. A high bias will drive increased inventories in

proportion to lead times, while a low bias will hurt product availability and ultimately also revenues (Gattorna, 1998:135).

A product that is usually over-forecasted is considered to have a positive bias. Positive forecast bias can normally be observed with products that are in the phase of declining demand. In any company, products are budgeted and a budget implies certain optimism. Adjusting a forecast to a realistic level would mean that the forecaster has acknowledged the fact that the budget will not be reached. The best way to handle positive bias is to disconnect the financial budget from the operational forecast used in the supply chain (Petersen, 2004:12-13). In many organisations there is an incentive for a forecast not to represent the most likely outcome but, instead, to serve as a self-fulfilling goal. For example, sales personnel may deliberately provide low forecasts if they are rewarded for exceeding target levels based on the forecast values (Silver, Pyke and Peterson, 1998:133).

A product that is usually under-forecasted is believed to have a negative bias. A negative bias is often observed in new and growth-oriented products. The problem with a negative bias is not that the upward trend cannot be identified, but the incentive plan is put in place. This plan is based on overachievement, that is, for having sales over the budget. The incentive encourages sales management to under-estimate the sales. The solution to negative bias is to disconnect the operational forecast from the financial budget and to provide an incentive for forecast accuracy, instead of for overachieving (Petersen, 2004:13).

Forecasters usually set thresholds on forecast measures and they use their forecasting systems to call attention to forecasts that go out of bounds. Using these automated thresholds makes it easy to track the progress toward objectives for improving the forecasting process. It is good practice to keep the mean absolute percentage error down to single digits, but a tracking signal that is four to six points away from zero is a cause for concern (Taylor, 2004: 252).

The breakdown of a forecasting method is not always bad. If the forecast error for a well established product is getting larger and the forecast error is also high, it means that the demand for the product was static, but is now increasing. One needs to add

a trend component to one's forecasting model to accommodate the increase (Taylor, 2004: 253).

The magnitude of the forecasting error should be used for risk management in scheduling production. A product with a higher forecast error needs more safety stock than a product with a much smaller forecast error (Taylor, 2004: 254).

Jain (2004:2), states that, with the growing competition, it is becoming more important than ever to improve forecasts in order to cut costs and increase sales. Under-forecasting causes a loss of sales of regular and companion products. It also causes an increase in production, procurement and shipment costs. Production and procurement costs rise, because of unplanned changes in the production schedule. The shipment cost rises, because products that were under-forecasted have to be shipped in bits and pieces to meet the unmet demand. The over-forecasted products, on the other hand, are often transhipped from one distribution centre to another or from one warehouse to another, to make the sales, which add to the cost. A portion of the available inventory is sold at a discount. Whatever is not sold may have to be destroyed. The carrying of the unwanted inventory also adds to the cost, including the cost of investment in the inventory and warehouse charges. Under- and over-forecasting both add substantial costs to the supply chain.

In order to improve the forecast accuracy, one must have knowledge of the factors that contribute to forecast errors. The various measures of forecast error should be used to understand and decrease the magnitude, bias and costs of forecast error.

2.13.4 Forecast collaboration

Collaborative, cross-functional forecasting is an essential approach for managing inventory levels and supply and demand on a global scale. Collaborating with external organisations, for instance, such as retailers and wholesalers, is necessary for obtaining vital consumer-level demand data. Collaborating internally between sales and marketing, distribution and production departments – in domestic and

international locations – will enable one-number forecasts to be more accurately derived (Gattorna, 2000:330).

Taylor (2004:210-213) mentioned that a good way to improve the reliability of demand forecasts is to have multiple analysts generate forecasts independently and then combine their results. The problem is to figure out how to integrate the forecasts in a meaningful way. One solution is simply to average them all together, but it can be risky. Just as aggregating across seasonal products with different peaks can mask patterns that are evident in each forecast, but that do not align precisely across forecasters. A better approach is to try to understand the reasoning behind each forecast and somehow combine the reasoning, rather than just the numbers.

Combining forecasts to gain consensus is difficult within a single department, but the problem becomes even more difficult when forecasts are generated by different departments. Many departments have a stake in predicting demand, including marketing, sales, production, distribution, finance, and personnel. Unfortunately, these groups have different perspectives on demand, use different techniques for predicting it and have different incentives for how high they would like the forecast to be.

If forecasts across departments are too difficult for most companies, it should be no surprise that fewer companies integrate forecasts with those of other companies in the supply chain. Yet the failure to do so is one of the most destructive problems in supply chain management, because it impairs both the efficiency and effectiveness of the entire chain.

When one reflects on where demand ultimately comes from, a much better approach is suggested. When a supply chain is viewed as a whole, there is only one true source of demand: the consumers of final products. All other demands, for raw materials, subassemblies, intermediate products, and the like, ultimately derive from consumers' purchases. Consumer demand is known as independent demand. All the purchases made by companies upstream of consumers, depend in some way on consumer's choices, so these purchases are called dependent demand. The modern view of forecasting is that only the independent demand should be forecasted, and

that all other demands should be derived from these forecasts. Gattorna (1998:265) adds that consumer direct channels allow household purchases to be tracked, but original demand data that is missed on the day, can be captured as consumers perform their own substitutions for items not on the shelf.

Taylor (2004:212-213) also added that having each company focus its forecasting efforts on independent demand does not, in itself, eliminate redundant forecasting. It is common for manufacturers and retailers to each make their own forecasts of consumer demand and both types of companies justify the practice by claiming that they have a better understanding of consumer buying habits. The most powerful approach is for supply chain partners to collaborate in building a shared forecast, combining their different perspectives on consumer behaviour, in order to obtain the most reliable predictions of future sales.

Collaborative forecasting addresses the above- mentioned problems. Firstly, duplication of effort is eliminated, often reducing the overall forecasting effort by 80 per cent or more. Secondly, there is no cascade of errors up the chain to distort the demand. The most dramatic benefit, however, is the improvement of forecasting accuracy that results from sharing knowledge about consumer behaviour. There are sales patterns that manufacturers can see that distributors and retailers cannot, but there are other aspects of consumer behaviour that can only be observed close up. When supply chain partners combine their unique perspectives to improve their understanding of independent demand, they can do a much better job of anticipating the needs of the consumers who keep the chain in business.

Supply chain partners should collaborate to build a shared forecast, in order to obtain the most reliable predictions of future sales.

2.13.5 Forecast process performance management

Most companies have no idea as to how effectively they forecast. Commonly used metrics, such as mean absolute percentage error, show the ultimate result of the forecasting process, but give no indication of how efficient the organisation was in

achieving a specific level of forecast accuracy. Metrics, such as mean absolute percentage error, by itself does not tell the organisation whether other methods would have been equally or more accurate, with less management effort (Gilliland, 2003:9).

Due to personal biases, company politics, and the lack of training and tools, many management efforts fail to improve the forecast, but even make it worse. The traditional approach to forecast performance measurement misses a potential source of significant process improvement, by failing to consider the “forecast value added” by each of the participants in the forecasting process (Gilliland, 2003:9). Measurement of individual team members is critical to counteracting structural incentives to bias the forecast and to ensure an appropriate level of attention from them all (Gattorna, 1998:135).

The forecast value added analysis should be applied to each step and each participant in the process by comparing the forecast output of each step and each participant. For example, the naïve moving average forecast should be compared with the statistical forecast, perhaps a sophisticated triple exponential smoothing or regression model. The statistical forecast can be compared to the sales force rollup, the marketing override, the forecaster’s override, the consensus forecast, or the management approved forecast. Similarly, a forecast based on point-of-sale data could be compared to the forecast based on orders or shipments. By evaluating the ultimate forecast performance, for example, mean absolute percentage error, at each stage, we can identify what helps, and what is simply a waste of effort (Gilliland, 2003:9).

Eliminating the non-value adding steps and participants will help to make the forecasting process more efficient, achieving results with fewer organisational resources. Identifying and eliminating those steps and participants that actually make the forecast worse, will also improve the forecast accuracy, again with fewer organisational resources (Gilliland, 2003:9).

Looking purely at the traditional forecasting metrics as the end result of the forecasting process, can create the wrong impression. Typical responses that create

misconception are hiring more analysts, engaging more participants in the process and implementing more sophisticated forecasting software. In fact, it is more likely that forecast results can be improved by doing less (Gilliland, 2003:9).

Companies should realise that the aim is not to foretell the future, but rather to set up better procedures that will allow the company to react quickly to forecast errors as soon as their magnitude has been determined. It is at least equally as important, to develop techniques for responding to forecast errors as it is to try to measure and predict them (Silver, Pyke and Peterson, 1998:133-134).

In order to improve demand forecast accuracy, one should also measure the effectiveness of the forecast process and not just the ultimate result of the forecasting process.

2.13.6 Relationship between forecast error and response lead time

The reason why so much logistics activity is forecast-dependent is the long lead-time. The longer the lead-time, the further ahead must be forecasted. Lead times refer to the time taken to respond to an upward or a downward change in the demand. If there are long replenishment lead times for raw materials or packaging suppliers, for example, a company will be forced to try to forecast the demand over the lead time (Christopher, 2003:75-76). Sales and marketing are thus required to forecast requirements in line with the lead-time. Because of the rapidly changing marketplace, companies regularly suffer from the twin difficulties of excessive slow moving stock and an inability to serve customers with the items they really want. Companies normally hold higher levels of safety stock to meet customer service goals (Christopher, 1998:165-166).

Forecast error increases as the amount of time in the future increases. The longer the lead-time, the greater the opportunity for unanticipated events. One obvious way of reducing the forecast error is to reduce the amount of time in the future being forecast. For manufacturers, this means reducing the time required to make and ship

customer orders. The ideal manufacturing lead-time for finished goods is one that is shorter than the response time that customers require (Langenwalter, 2000:70-76).

The concept of velocity, which is the total lead-time divided by the total value added time, is critical. A company with a velocity greater than 2 is being forced by its own internal practices to forecast much farther into the future than it should have to. The costs of forecasting incorrectly include high inventory, low customer service and high administrative costs such as expediting, changing priorities in production with suppliers and making excuses to customers for poor performance (Langenwalter, 2000:73).

Increasing visibility into customer demand effectively increases customer lead times for the manufacturer. Many customers are willing to help their suppliers, realising that both parties will reduce cost and therefore increase profits (Langenwalter, 2000:73-74).

If the customer and the manufacturer can synchronise their material flow using Repetitive, Lean, Flow and Just-in-Time approaches, the synchronised schedule could radically reduce the actual lead time to the customer, which benefits the customer greatly, while also eliminating the need for the manufacturer to forecast, which in turn benefits the manufacturer (Langenwalter, 2000:76).

One way of reducing the forecast error is to reduce the lead-time and thus the required forecast horizon. The shorter the response lead times, the higher the forecast accuracy.

2.13.7 Types of forecasting

Forecasting can be classified into four basic types: qualitative, time series analysis, causal relationships and simulation. Qualitative techniques are subjective or judgemental and are based on estimates and opinions. Time-series analysis is based on the idea that data relating to a past demand can be used to predict a future demand. Past data might include several components of demand, such as trend, seasonal, or cyclical influences. Causal forecasting, for example linear regression

techniques, assumes that demand is related to some underlying factor or factors in the environment. Simulation models allow the forecaster to run through a range of assumptions about the condition of the forecast (Chase, Aquilano and Jacobs, 2001:436). Causal forecasting is a crucial part of the forecasting process, for example, regression analysis is regarded as the key to developing an accurate forecast (Catron, 2000:12).

Taylor (2004:199), states that in the past, when forecasting was done by hand, the more common practice was static forecasting, by which a forecast was generated and then used as is through the forecast horizon. A company could increase the accuracy of its forecasts substantially by updating them continuously based on current sales, a technique known as dynamic forecasting. Some companies, for example, use daily sales and operational forecasts according to Catron (2000:15). The daily operational forecast is used to balance the demand and the supply each day of the year. If the daily operational forecast is too low, supplies may not be adequate and an exposure to penalties exists. If the daily operational forecast is too high, unnecessary operational action may be taken. The forecasting process is important. A good process will ensure consistency between types of forecasts, and will, in time, identify and reduce the uncertainties of the forecast.

2.13.8 Constrained versus unconstrained forecast

Gilliland, (2003:8-9) stated that an operational definition of demand leads directly to the topic of what a company should be forecasting. The supply chain should be driven by a forecast of future demand, but one has to be careful. It is important to distinguish between unconstrained demand and the demand we actually expect to fulfil, subject to the supply- side constraints.

The supply- side of an organisation needs transparency as far as unconstrained customer demand is concerned. However, once constraints are identified, it is proper to issue a shipment forecast. When a shortage is anticipated, the customers should be contacted and, whenever possible, their demand redirected to a future date, i.e. to a date when the demand can be filled, or to alternative products. It is a failure for

sales management to accept orders, which they know in advance, cannot be filled. Forecasting performance should not include orders that cannot be filled. The proper organisational response to supply constraints is to redirect customer demand to alternative products or time frames. Orders that we know in advance cannot be filled, should not be processed. Orders are not a reliable component of performance metric calculations.

A company should be able to distinguish between the constrained and unconstrained demand. Where constraints for the demand exist, a company must constrain the unconstrained forecast.

2.13.9 Forecast models versus forecast judgment

Forecasts generated from mathematically complex models do not guarantee higher degrees of accuracy. The method used should, instead, focus on what makes sense for the business and provide an unbiased answer for the data being looked at. In other words, a method that relies on mathematical and business reasoning should be used. Forecasts generated in this manner provide useful statistical baselines. After statistical forecasts have been generated, conjecture and special information should be added to the baseline forecasts to further enhance the forecast accuracy (Johnson, 2002:8).

Statistical forecasting is superior to judgemental forecasts in two ways: Firstly, statistical techniques can consider far more data than a human forecaster. Secondly, statistical techniques do not suffer from human biases, inattention to detail and imprecision. Perhaps the greatest advantage of statistical forecasts is that they allow human forecasters to be much more effective by focussing their attention on only a subset of Stock Keeping Units (Gattorna, 1998:130).

It is important to adjust or clean the data used for forecasting models. Adjustments should be made for mistakes and changes should be made for definitions, missing values and inflation. An up- to- date log should be kept of any adjustments to records. The result of adjusted data is an improvement in forecast accuracy (Armstrong, 2001:9). Data is the lifeblood of any company. The individuals who

manage data should make sure they understand the need for the data to be clean and accurate (Berger & Gattorna, 2001:162).

The forecast methods used should also be kept simple. Complex methods may include errors that transmit through the system or mistakes that are difficult to detect. Simple forecast methods should be used, unless a company can clearly demonstrate that complexity should be added (Armstrong, 2001:14).

While knowledge of statistical forecasting techniques and quantitative methods is of the many characteristics necessary to be successful in demand forecasting, it is not at all the most important factor. More important for successful forecasting, are good communication skills, some sense of numbers, and an in-depth understanding of the business. For an efficient planning process, forecasters need to interact with others to get a good understanding of what is going on and they need to articulate the basic assumptions that underlie each set of forecasts. In essence, putting a bunch of quantitative forecasters in a room with computers to generate forecast numbers, can only lead to plans that are mechanically-driven by historical data, with no real basis of what drove the demand in the past; and therefore, no sense of what might impact on the demand in the future (Lapide, 2000:16-17).

There are a number of factors, normally not included in a statistical forecasting model, where judgement input is clearly needed. These factors can be internal or external to the organisation, for example competitor actions, consumer preferences, price changes, promotions, introduction of substitute products and the pipeline filling effect associated with the introduction of a new product (Silver, Pyke and Peterson, 1998:124).

Statistical models and judgement can add value to the forecasting process. A healthy balance between statistical models and judgement should result in higher forecast accuracy.

2.13.10 Forecasting software versus forecasting processes

Lapide (2000:17), states that while there is no question that forecasting software helps in producing a good set of forecasts, this is insufficient in itself. For example software, which is no different from any other software, needs to support a business process. Many companies are following the best practice of implementing a Sales and Operational Planning process to ensure that proper cross-functional inputs are brought into the process. A forecast system that is not part of a Sales and Operational Planning process will not ensure an accurate, collaborative, and consensus-driven forecast. Generally, software is never the only answer, as it always needs to be aligned to a good business process.

According to Ptak and Schragenheim (2000:134), the answer to good forecasts cannot merely be attributed to a more expensive forecasting system. Good useable forecasts result from hard work, timely review, and updates from the appropriate people using computer input, judgement, and software support. The combination of a good forecast process with a good forecast system can deliver better results.

2.13.11 One-plan mentality

The mission of supply chain management is to create a 'one-plan' mentality within the business, which seeks to replace the conventional stand-alone and separate plans of marketing, distribution, production and procurement. Supply chain management is therefore an integrative concept that seeks to develop a system-wide view of the firm (Christopher, 1998:14). The same plans must be used for all functions: sales forecasting, production planning and financial planning. Where an integrated planning process is not followed, the results will include inventories that will go out of balance, because the wrong products are produced and sales and profit forecasts can become unreliable (Byron, 1999:24).

In order to develop a consensus forecast or one- number forecast, it is important that the forecaster remains neutral and unbiased throughout the forecasting process

(Fosnaught, 1999:3). The forecaster should avoid data collected by persons or organisations that are obviously biased to particular viewpoints, perhaps because they are rewarded for certain outcomes. To analyse crime rates, for example, victim surveys would be preferable to police records. Biases should be identified before analysing the data, especially when people are emotional about the outcomes (Armstrong, 2001:6).

Although the aim is to create a 'one-plan' forecast, companies must recognise the difference between operational sales forecasts, sales budgets and goals. These planning numbers could differ throughout the fiscal year. However, when they do differ, it is important to use the information as a signal to take corrective action, and not to avoid conflict. Whenever warranted, operational forecasters will have to be brave enough to change forecast numbers to reflect reality, in lieu of unrealistic goal and budget-based numbers. While this will get them involved in a lot of organisational frays, they will be helping their companies stay on a profitable track by following realistic plans (Lapide, 2003:20).

Although the aim is a one-plan mentality, the forecast must be realistic and corrective action should be implemented where necessary.

2.13.12 Evangelical forecasting

Gilliland (2003:12-13,17), states that, while an organisation's forecast should represent an unbiased best guess at what really is going to happen, the forecast is more often an expression of the organisation's targets or wishes. The most significant forecasting mistake an organisation can make is to build plans around what it wants to see happen, rather than what it really believes will happen. Forecasting is thus simply an exercise to make the numbers match some predetermined financial objective.

The main purpose of a forecast is to drive the supply chain. The financial version of the forecast that is used for financial planning, analysis and reporting should be derived from the supply chain forecast. Evangelical forecasting is an approach where

the forecast comes from senior management. The advantages of evangelical forecasting are that it is quite simple and the company does not need a cumbersome consensus or sales and operational planning process to get everyone to agree upon a forecast number. The evangelical approach can be demoralising for the forecasting department, when all the thoughtful modelling and analyses are overwritten by executive decree. The management targets or wishes should not be confused with the unbiased best estimate of what the demand is really going to be. The worst impact of evangelical forecasting, or forecast derived from financial directives rather than by realities of the marketplace, is that the supply chain is given the wrong signal.

Another solution to evangelical forecasting, in the short term, could be to build multiple forecasts. The operational forecast could be used to predict production requirements based on the product demand. The evangelical forecast could be used for the financial forecast. Although the two forecasts are separate, a company should aspire to merge them into one as soon as possible (Wall, 2002:15). Although multiple forecasts will not create a one-plan mentality in the short term, it will improve the use of forecasts by reducing the forecast bias. Forecasts should be independent of politics (Armstrong, 2001:2).

Another alternative for less biased forecasts is to use quantitative forecast methods, rather than qualitative methods. Quantitative methods tend to be less biased, and they make more efficient use of data (Armstrong, 2001:12).

A company should aim to have one forecast plan based on realistic expectations and not just the financial expectations of top management. The one agreed upon and the realistic forecast should be used to drive the supply chain.

2.13.13 Legal aspects of forecasting

Armstrong (2001:41-42) mentioned that the primary purposes of following forecasting standards and practices, is to help forecasters to improve forecast accuracy, to better access uncertainty, and to help decision-makers to use the forecasts properly. They could also protect the forecast.

No- one has successfully sued a forecaster for making an incorrect forecast. However, some have successfully sued forecasters by showing that they did not adhere to the best practice. In a British case, *Esso Petroleum vs. Mardon* (London, 1996 E. no. 2571), Mardon contracted Esso to own and operate a gas station. A critical part of the negotiations was Esso's forecast that the station would sell 200 000 gallons of gas annually by the third year. Actual sales fell well short of the forecasted figure, and Mardon went out of business. Esso sued Mardon for unpaid bills. Mardon then counter- sued on the basis that the forecast misrepresented the situation. Esso had originally forecast the 200 000 gallon figure with the assumption that the gas pumps would face the road. After a zoning hearing, Esso had to change the station's design so that the pumps were not visible from the road. Despite this unfavourable change, Esso still used the original 200 000 gallon forecast in drawing up its contract with Mardon. Mardon won and the court concluded that Esso had misrepresented the facts in this situation.

This court case implied that if a company does not have a policy to provide forecasts, it is unlikely to be held liable. Furthermore, the courts recognise that forecasts involve uncertainty and making reasonable attempts to balance costs and benefits should provide forecasters with protection against lawsuits. Finally, forecasters could be held liable if it can be shown that they did not use reasonable practices to obtain forecasts, or if they intentionally used poor practices to bias the forecasts.

2.13.14 Demand planning versus demand management

Gattorna (1998:139) indicates that the term demand management is not new to supply chain practitioners. It is often used interchangeably with demand planning to account for activities such as forecasting, production planning, inventory management and deployment. But important differences exist between demand planning and demand management.

In a broad sense, demand planning includes the processes that an organisation takes to anticipate customer demand and ensure sufficient product is available - in

the right place, at the right time, to the required level of service and at the lowest possible supply chain cost. Demand planning, therefore, includes such activities as demand forecasting, inventory management, capacity management, production planning and scheduling and material requirements planning.

Demand-planning processes have developed rapidly over the last ten years. For example, just-in-time (JIT) was developed to reduce the lead times through smaller batch-size production to satisfy customer demand more effectively. Quick response (QR) takes just-in-time further and applies the principles to the retail industry. Efficient consumer response (ECR) was developed as an industry-wide demand-planning vision, linking all members by integrating four key strategies: efficient store assortments, efficient replenishment, efficient promotions and efficient new product introductions.

All these demand planning approaches are useful in that they take time and cost out of supply chains. However, they make one key assumption: the customer demand and the volatility of that demand is a given input into the demand-planning process.

Demand management, by contrast, actively seeks to ensure that the customer demand profile that is the input into the demand planning process is as smooth as possible as a means to simplify supply chain operations. It does so by reducing or eliminating the volatility of customer demand prior to input into the demand planning process.

Demand management may be defined as the identification, reduction and elimination, where possible, of the causes of customer demand volatility, with the objective of providing a smooth demand signal to increase supply chain visibility, planning accuracy and reducing total supply chain cost. Consequently, where demand planning is reactive to customer demand, demand management is proactive to customer demand.

Ineffective demand management practices manifest themselves as volatile customer demand and can have serious effects on the business and supply chain

performance. Servicing the excessive peaks and troughs of this volatile customer demand increases the cost and complexity of business operations.

2.14 Supply management

2.14.1 Streamlining replenishment

There has been a growing recognition of the critical role that procurement plays in creating and sustaining competitive advantage as part of an integrated logistics process. Leading- edge organisations now routinely include supply- side issues in the development of their strategic plans. Not only does the cost of purchased materials and supplies play a significant role as part of the total costs in most organisations, but there is a major opportunity for leveraging the capabilities and competencies of suppliers, through closer integration of the buyers' and suppliers' logistics processes.

Taylor (2004:167) adds that, like the customer order fulfilment process, the replenishment process has become increasingly complex over the years, producing corresponding increases in the time, cost and errors associated with the process. These problems, in turn, often lead people within a company to try to beat the system by speeding up their own orders, usually at the expense of other orders that may be equally urgent. In addition to slowing down the replenishment process as a whole, these expediting battles lead to extra work and may also incur surcharges for rush orders.

The solution to the replenishment process, as in the case of the customer order fulfilment process, is not to bypass the fulfilment system, but to improve it, and radical change in the replenishment system may produce better results than attempts at incremental refinement. In general, the further upstream a company can push the demand changes, the more likely it will be to remove the time and cost from the chain, as opposed to just pushing it around within the supply chain.

2.14.2 Replenishment process

Taylor (2004: 156-159) indicates that each time a facility fulfils an order, it reduces its inventory of finished goods. Sooner or later, the inventory has to be replenished. Replenishment policies answer three questions: When should the inventory be replenished, what quantity should be ordered with each replenishment cycle, and how much inventory should be maintained on site.

There are several ways in which a company can decide when to replenish the inventory. The monitoring of the inventory can be done using one of two forms, called periodic review and continuous review. With a periodic review policy, the inventory is counted at fixed intervals and an order is placed whenever the count falls below a preset re-order point. When a continuous review policy is used, the count is monitored at all times and an order is placed as soon as the count hits the re-order point. Periodic review requires more inventory than continuous review.

The ability to switch from periodic to continuous review is a good example of how information can replace the inventory, producing substantial savings. Given the escalating cost of the inventory, it is usually cheaper to hold a stock count than to hold the inventory (Taylor, 2004:159). Continuous inventory review can produce substantial savings for a supply chain.

2.14.3 Determining replenishment order quantity

According to Taylor (2004: 159-160), the preceding section answered the question of when to replenish the inventory, and the order quantity section covers the question of what quantity should be ordered with each replenishment. The quantity hinges on the relative cost of placing an order and receiving an order. This is referred to as the order cost and it is independent of the quantities involved. The holding or carrying cost is the cost of stockpiling inventory in advance of consuming it. The holding cost includes the costs of storage and handling, the opportunity cost of capital tied up in the inventory, the loss of value due to obsolescence or spoilage, and the cost of insuring against risks such as fire and theft.

The order cost and holding cost tend to push the order quantity in opposite directions. Increasing order quantities reduce the order costs, because fewer orders are required to buy a given amount of inventory, but it also pushes up holding costs by increasing average inventory levels. On the other hand, ordering in smaller quantities reduces holding costs at the expense of order costs. Finding some sort of balance between the two is important, because neither cost is trivial.

The economic order quantity model tries to find a balance between the order cost and the holding cost. This model was developed more than 80 years ago. However, its usefulness has been questioned. It does not take into account fluctuations in demand, incentives for buying inventory in advance of need, and the effects of requesting multiple products on a single order. An important disadvantage of this model is that it overlooks higher level opportunities for reducing costs, such as simplifying the order process or eliminating orders altogether (Taylor, 2004: 160-161).

The major reason why the economic order quantity model is used less frequently today, is that assumptions used to calculate the economic order quantity are too unrealistic to help plan the inventory in dynamic environments (Gattorna, 1998:385).

The assumptions for calculating the economic order quantity are the following:

- The demand rate is known, constant and continuous;
- The lead time or replenishment time is known and constant;
- The entire lot size is added to the inventory at the same time;
- No stock outs are permitted – since demand and lead times are known, stock outs can be avoided;
- The cost structure is fixed – order/set-up costs are the same regardless of lot size, holding cost is a linear function based on average inventory and unit purchase cost is constant, assuming no quantity discounts;
- There is sufficient space, capacity and capital to procure the desired quantity; and
- The item is a single product – it does not interact with any other inventory items, thus there are no joint orders.

In the absence of a more comprehensive plan, the economic order quantity model gives a quick and reasonably good answer for the recommended replenishment quantity (Taylor, 2004: 161).

2.14.4 Correlation between customer service level and inventory levels

According to Taylor (2004: 161-162, 164-165), the two preceding sections dealt with the question of when to replenish the inventory and how much to buy. The next section tackles the third question of how much inventory a facility should maintain on site.

The standard solution is to hold the excess inventory, called safety stock, to avoid stock outs when the demand is greater than expected or when supplies arrive late. A company needs to maintain enough inventories to support its normal operations called cycle stock, plus enough safety stock to protect against variations in supply and demand.

Given that stock outs cannot be eliminated altogether, the best method to follow as far as safety stock is concerned would be to reduce stock outs to an acceptable level. The standard procedure is to set a target level for product availability, called the customer service level, and then to adjust the safety stock to meet this level. Naturally, higher customer service levels are better, but setting them too high can be very expensive, because safety stock rises exponentially with the service level. For example, a simple increase of half a percentage point of customer service level from 97.5 % to 98% requires holding nearly three times the safety stock. A small improvement in customer service can be very costly given the high costs of holding the inventory.

Taylor (2004:165) also adds that the customer order complexity is closely correlated with the customer service level. Customer service level is the ability to fill orders for a single product from stock, often called the item fill rate. Customers normally order more than one product on one order. Although multi-line orders reduce the cost of

order processing on both sides of the transaction, it makes it harder for suppliers to fill orders, because the probability of filling an entire order, called the order fill rate, is the result of the item fill rates for all the items on the order. As the number of items on the order increases, the order fill rate decreases dramatically. The more complex the customer order, the more inventories are required.

Companies are now using innovative techniques to achieve, simultaneously, the conflicting goals of higher customer satisfaction and lower inventory investment. Traditionally this was a goal thought to be impossible; however, the goal can be attained by evaluating and improving internal processes (Gattorna, 1998:383).

2.14.5 Limitations of material requirements planning

Companies that face chaos, because of many items with a complex bill of materials, can benefit from the control and order provided by Material Requirements Planning. When the demand shows significant seasonality, or when the demand surges or declines, Material Requirements Planning could be put into operation so that by planning ahead clear benefits may be provided (Silver, Pyke and Peterson, 1998:617).

Nevertheless, Material Requirements Planning has some significant drawbacks that should be considered (Silver, Pyke and Peterson, 1998:616-618). These major drawbacks are the following:

- Long and fixed lead times. The lead-time given by users for each component and part is fixed. Due to expediting and priority changes, lead times could change, as a result of the time of year. The end of the month, in most manufacturing companies, results in shorter than expected manufacturing lead-times, as parts are expedited to completion to achieve monthly revenue targets (Ptak and Schragenheim, 2000:150). The most common solution to variable lead-time is to inflate the lead-time so that orders are rarely delivered late. This implies, of course, that orders are often delivered early, which increases work-in-process and finished goods inventory.

- High lot sizes. Multi-item and multilevel lot sizing can normally not be handled by Material Requirements Planning. Lot size rules normally support simple rules such as economic order quantity.
- High safety stock. Material Requirements Planning cannot handle complex safety stock calculations. Users may protect against costly stock outs by unnecessarily inflating safety stock levels.
- Little incentives for improvements. Because of the significant effort required to gather and capture input data, such as safety stock, lot sizes and lead times, users are reluctant to make regular changes to the values.
- Inconsistent data. If the data is not accurate, the Material Requirements Planning schedules will also not be accurate.
- A large amount of data maintenance is required for product changes. A product is often changed in small ways once it is in production. The added burden of accounting for design changes is often neglected.
- High data input. The data input personnel have the challenge that every change must be recorded in Material Requirements Planning, and every product must be added to the system.
- High data output. Handling the large amounts of data can be a significant task. Enterprise Resources Planning systems provide information only by exception, instead of struggling through an enormous pile of information (Ptak and Schragenheim, 2000:151).
- Completed work not immediately recognised. Material Requirements Planning does not recognise completed work, until an inventory transaction is made.
- Some implementations are complex, for example implementing a closed-loop Material Requirements Planning project is a complex task.
- Material Requirements Planning is not applicable to all situations. It applies well in situations of multiple items with complex bills of materials. However, it does not apply well in situations with relatively simple bills of materials and tightly linked stages of production.
- Material Requirements Planning assumes infinite capacity, which means that internal constraints do not exist. In the most cases, there are bottlenecks or constraints, which must be taken into account (Goldratt, 1990:70). Material Requirements Planning also assumes that the transfer batch is equal to the

process batch (Goldratt, 1990:72). A company should strive to maximise the process batches in the bottlenecks, while at the same time using small transfer batches everywhere, including through the bottlenecks, as small transfer batches do not have any impact on the set-up (Goldratt, 1990:52).

One also needs to understand the difference between the backward and forward scheduling systems. A scheduling system, like Materials Resource Planning, is called a “push” system, in which the demand to produce and procure parts, components and assemblies is pushed through by scheduled dates for “start in production” or “place order with supplier”. The “begin” dates are calculated backwards from the required receipt dates estimated for completion of the departmental production schedule or the on-site receipt of a purchased item. By contrast, Just-in-Time is a “pull” system, in which the authority to re-supply, by either scheduled production or authorised procurement, comes from the needs of the forthcoming operations. Forecasted lead times for replenishment determines the dates for initiating a production work order or a purchase request (Kobert, 1992:161).

Material Requirements Planning can assist a company in handling complex bills of materials. However, the limitations of this system should then also be considered.

2.14.6 Master production schedule- to freeze or not to freeze

The master production schedule normally has a long lead-time, determined by the cumulative lead-time to purchase raw materials and to process them into components. The longest of these cumulative lead times is the minimum planning horizon for the master production schedule (Silver, Pyke and Peterson, 1998:541).

To prevent extreme instability of production plans, organisations often use the concept of time fences. These fences freeze the master production schedule for the given time periods, helping to resolve conflict between sales and manufacturing (Silver, Pyke and Peterson, 1998:542).

Throughout the network of each manufacturer and his supplier factories, production schedule changes are perhaps the most disruptive factor (Harmon & Peterson, 1990:215).

For decades manufacturers have tried to freeze the production schedule, but not allowing for any changes to the final assembly schedule on which all components and material schedules are based. Most attempts to freeze the production schedule are relatively unsuccessful, and encounter the following problems (Harmon & Peterson, 1990:215):

- The lead times of the factory and its suppliers are too long to freeze production schedules for all, or even a major portion of the supply chain. Customers expect to be able to change their scheduled order receipt dates and to place new orders with a much shorter response time.
- All of the demand is ultimately driven by the marketplace. Successful manufacturers must be able to supply surprise surges in the demand, while avoiding build-ups of surplus inventory when the demand slumps. Success demands rapid response to the market, and not following an unrealistic production schedule.
- Production schedules, whether frozen or not, are unrealistic. Scheduled production is impossible to achieve without available capacity, materials, and components. When production schedules are frozen unrealistically, they become meaningless.

Exceptional swings of market demand will always occur, and the superior manufacturer must be prepared to take exceptional action in response. Thus, the master production should be neither liquid nor frozen, but slushy (Harmon & Peterson, 1990:216).

The master production plan should be dynamic and flexible since business itself changes constantly (Harmon & Peterson, 1990:216). Examples of changes include the following:

- New products are developed and added to the product lines. Existing products are changed or dropped.

- Product lines are added as a result of acquisitions or dropped because of divestitures.
- Processes are altered to reflect product changes and to process improvements.
- Processes are added and eliminated as a result of changes in make or buy decisions.
- Sales volumes change over time.

The forecast drives the production. If the forecast is frozen to changes, production will be wrong (Riehm and Stephen, 1999:16). By not freezing the forecast and allowing all available information to be included, the production planner has better data to use when scheduling production. Altering the forecast, even without being able to change the production, provides better information for future planning (Riehm and Stephen, 1999:17). It is better if the forecast is not frozen. If all the available information could be utilised, or if updates could be provided as soon as circumstances have changed, then inventories could be better managed, and ultimately, the customer could be better served (Riehm and Stephen, 1999:18).

In order to adapt to the best up-date demand forecast, the master production schedule should be flexible to accommodate changes.

2.15 Supply chain exceptions

Exceptions in the supply chain represent very large opportunity costs for companies. The most common causes of exceptions germinating from suppliers include changes to lead times, allocation of products that are facing high demand, form-fit-function changes to parts and product obsolescence (Woermer, 2001).

Perhaps the greatest cause of supply chain exceptions is inaccurate forecasting. A survey done by Industry Directions Inc. indicates that less than 20% of companies forecast with an accuracy greater than 90%. Most companies surveyed had less than 90% accuracy and a significant number were not tracking forecast accuracy (Woermer, 2001).

Of the most recent and exciting developments is the emergence of supply chain visibility applications, which track the movement of the inventory as it flows throughout the chain, providing graphical displays of expected and actual inventory levels at each location. Supply chain event management software allows the business to define rules that trigger when specific events occur or fail to occur. The event management software allows the supply chain managers to focus their attention to managing exceptions, rather than having to personally monitor every movement and compare it to a plan (Taylor, 2004:119-120).

The forecasting frequencies, whether daily, weekly, monthly or yearly, are not as important as the ability to adapt and change the process, based on significant, unplanned events that occur. There are countless alerts that may trigger the need to adjust the forecasts for a particular product. The ability to react to these demand change triggers in a timely manner has a dramatic impact on the quality of the forecasts and the performance of the inventory. Early detection and quick responses to many types of risk are therefore essential to supply chain management (Bonomo, 2003:8).

Many companies focus resources on optimizing processes when things go as planned, but often do not have a well-defined process in place or the tools to manage situations when things go wrong. The first step in managing these costly exceptions is to provide a standard and repeatable process when looking outside your normal supply chain partners to correct over-buys or under-buys (Woerner, 2001).

The increasing complexity and the pace of change have a dramatic impact on how successfully companies operate. Achieving a competitive edge demands a fresh approach to both strategy formulation and execution (Gattorna, 1998: 8).

The true test of an inventory management system is not merely in the planning and forecast stage, but also in the ability to re-plan and react. The ability to re-plan and react is the essence of management control. The “fire prevention” system will make “fire fighting” an exception-based activity (Kobert, 1992:165-166). A company should try to minimise supply chain exceptions, in order to reduce costs dramatically.

2.16 Relationship between supply and demand

The importance of integrating demand and supply planning should not be underestimated. This integration is regarded as one of the seven principles of supply chain management (Berger & Gattorna, 2001: xiii).

There is an interdependent relationship between supply and demand. The demand defines the supply chain target, while the supply-side capabilities support, shape and sustain demand (Gattorna, 1998:92).

To achieve state-of-the market supply chain management, companies need to focus on more than just supply-side efficiencies. They also need to integrate their demand and supply regimes to build a platform for achieving competitive advantage (Gattorna, 1998:92).

2.17 Conclusion

This chapter describes the importance and dynamics of supply chain management, which are no longer a matter for the operational and functional areas of the firm. Today supply chain management is a strategic issue, demanding top-level management attention. Indeed, the quality of a firm's supply chain performance can mean the difference between business prosperity and failure (Gattorna, 1998: xiii). The nature of the competition has also shifted from the classic struggle between companies, to the new competition of supply chain versus supply chain (Taylor, 2004:3). Supply chain management is able to deliver superior customer value at less cost to the supply chain as a whole, by managing the upstream and downstream relationships between suppliers and customers (Christopher, 1998, 18), (Gattorna, 1998:276). Cutting-edge supply chains are double-edged swords. Wielded with skill, they can slice open new markets. Improperly handled, they can lead to deep, self-inflicted wounds. For all the advantages from getting the supply chain right, getting it wrong could be catastrophic (Taylor, 2004:8). Supply chain leaders succeed,

because they understand the core problems of the supply chains, have committed themselves to long-term solutions rather than quick fixes, and have the stamina to stick with those solutions until they work (Taylor, 2004:19).

Just as there is no easy answer to all supply chain problems, there is no magic measure for improving performance. Generally, the framework for understanding and selecting supply chain measures is based on four broad categories: measures of time, measures of cost, measures of efficiency, and measures of effectiveness (Taylor, 2004:173). The ultimate measure of effectiveness, of course, is customer retention. If you have a growing base of loyal customers that buy your products in ever-increasing quantities, you are clearly doing something right (Taylor, 2004:191). There is also evidence to suggest that retained customers are more profitable than new customers (Christopher, 1998:45).

The difficulty of managing supply chains comes primarily from the complexity that creeps into their structure and the variability that characterises their flows. It is this complexity and variability that make an easy game hard to master (Taylor, 2004:21). Variability is one of the most costly problems in supply chains, particularly when it amplifies as it flows up the chain. Anything that is done to stabilise the flow of demand across the chain will improve the performance and result in substantial advantage over chains that have to cope with higher levels of variability (Taylor, 2004:274). Variability in supply can amplify down the supply chain while variability in demand can amplify up the supply chain (Taylor, 2004:39). The only real solution to the variability problem is for trading partners to work together to remove variability across the chain, rather than trying to cope with variability through point solutions such as added safety stock (Taylor, 2004:166).

Mastering demand, rather than just managing it, is a powerful weapon in supply chain-based competition. In addition to knowing one's customers and understanding how the company's products suit their needs, one has to be willing to make hard choices about which customers and products are right for the supply chain; practices that are deeply ingrained in the company's corporate culture have to be modified. A company should shift its thinking about demand from a conventional, reactive stance

to a more proactive point of view, understanding that the demand can be shaped to fit the competitive advantages of the supply chain (Taylor, 2004:278).

One of the most important things that can be done to improve the shape of demand is to make sure that the right customers are being served. The relentless pursuit of revenue often blinds companies to the fact that some customers are being served at a loss. By removing these unprofitable customers a huge contribution can be made to the bottom line, even if the performance of the supply chain is not improved at all (Taylor, 2004:270-271). The Pareto, or 80/20 rule, can provide the basis for developing a more cost-effective service strategy (Christopher, 1998:56). The highest service should be given to key customers and key products (Christopher, 1998:57). A company should also constantly review the less profitable customers (Christopher, 1998:60-61).

The weak link in the build-to-stock model is inventory management, and this can be traced back to an even weaker link, namely the reliance upon sales forecasts. A build-to-order model, on the other hand, begins with the order and not the forecasts (Chase, Aquilano and Jacobs, 2001:549). For decades manufacturers have tried to freeze the production schedule, not allowing for any changes to the final assembly schedule on which all components and material schedules are based. Most attempts to freeze the production schedule are relatively unsuccessful, and encounter the following problems (Harmon & Peterson, 1990:215): Exceptional swings of market demand will always occur, and the superior manufacturer must be prepared to take exceptional action in response. Thus, the master production should be neither liquid nor frozen, but slushy (Harmon & Peterson, 1990:216). It is thus better if the forecast is not frozen. If all the available information is utilised, if updates could be provided as soon as circumstances change, then inventories could be better managed, and ultimately, the customer could be better served (Riehm and Stephen, 1999:18). The true test of an inventory management system is not merely in the planning and forecast stage, but also in the ability to re-plan and react. The ability to re-plan and react is the essence of management control. (Kobert, 1992:165-166).

Although supply chains can normally be classified as either push or pull chains, in reality every chain is a mixture of push and pull. As long as consumers have a choice

about what products they buy and when they buy them, the last link in the chain is always a pull link. (Taylor, 2004:29). Although the phrase “supply chain management” is now widely recognised, it could be argued that it should really be termed “demand chain management” to reflect the fact that the chain should be driven by the market, not by the suppliers (Christopher, 1998:18). The aim of any company should be to convert its supply chain from push to pull by responding to customer demand. Technology is used to link the supply chain (Hughes, Ralf and Michels, 1999:163).

The key to getting sustained co-operation across the supply chain is to align everyone’s incentives (Taylor, 2004:272). The mission of supply chain management is to create a ‘one-plan’ mentality within the business which seeks to replace the conventional stand-alone and separate plans of marketing, distribution, production and procurement. Supply chain management is therefore an integrative concept that seeks to develop a system-wide view of the firm (Christopher, 1998:14). The importance of integrating demand and supply planning should not be underestimated. The integration of demand and supply planning is regarded as one of the seven principles of supply chain management (Berger & Gattorna, 2001: xiii).

CHAPTER 3: SUPPLY AND DEMAND ALIGNMENT

3.1 Introduction

In many Western economies the dynamics of the market place has changed in recent years. Markets are increasingly characterised by sophisticated and demanding customers and consumers, within a competitive environment that is far more volatile and less predictable than before. Under these conditions marketing's reliance on the classic '4 Ps' of product, price, promotion and place is no longer sufficient to achieve market leadership. Instead, winning companies are those that can speed up the rate of innovation, bring new products and services to the market place faster, and replenish demand in shorter lead times and with greater reliability, in other words, these companies are more responsive. Creating a responsive organisation has to be the main priority of management in any business, and achieving it requires a much greater focus on the process through which the demand is met. This is the arena of marketing logistics - the critical interface between the market place and the organisation seeking to satisfy customer requirements (Christopher and Peck, 2003: vix).

Matching supply and demand is the fundamental cornerstone of the logistics process. Conventional business practice seeks to mediate demand and supply through forecasts, in other words, the forecast is used as an attempt to predict demand and then the finished goods inventory is created ahead of that anticipated demand. However, because today's market place is considerably more volatile and, as a result, less predictable, it has become necessary to seek alternative approaches to demand management. The way forward is to substitute information for inventory and, in the process, to become more responsive to real demand. Becoming demand-driven requires a supply chain that is agile in its ability to meet changed customer requirements. New ways of working with supply chain partners are required if customer responsiveness is to be enhanced (Christopher and Peck, 2003:85).

3.2 Misalignment between supply and demand

3.2.1 The effects of the misalignment between supply and demand in a supply chain

Ineffective demand management practices manifest themselves as volatile customer demand and can have serious effects on business and supply chain performance. Servicing the excessive peaks and troughs of volatile customer demand increases the cost and complexity of business operations (Gattorna, 1998:140-141).

3.2.1.1 Supply chain volatility increases cost

Retailers and manufacturers in many product categories have struggled to put together a match between the supply and the demand (Gattorna, 1998:171).

The costs of a mismatch between the supply and the demand, measured as the combination of inventory carrying costs, markdown costs and stockout costs, are growing in many industries. Companies have tried to reduce these costs through better demand forecasting, improved production and inventory planning, increased production capacity and reduced set-up and transportation lead times. Companies have also tried to manage the demand process through pricing policies intended to smooth the arrival pattern of customers. These approaches, while useful, have failed to address a number of drivers of supply-demand mismatch (Gattorna, 1998:172).

A firm's ability to match supply and demand is an indication of its capacity to react to market signals- its reactive capacity. A company reactive capacity is affected by the company's inventory and capacity levels. Supply-demand mismatch costs are affected by the company's labour costs, working capital costs and incentives for stocking the inventory (Gattorna, 1998:172).

Firstly, the working capital cost will increase as organisations seek to minimise the risks of running out of stock and maintain high customer service levels through increased inventory levels. And secondly, variable costs will also rise as a result of increased labour costs and the greater use of contract storage needed to hold the

excess production during the demand peaks. Labour becomes more expensive, because of the casual or temporary staffing needed for order processing, production and warehouse operations. The overtime and adjusted shift patterns needed to cover demand peaks also increase labour expenses (Gattorna, 1998:141-142).

When the customer demand is low or in a trough, the same organisation risks the significant inefficiencies through idle labour and idle production and storage capacity. The greater the volatility of demand, the greater the resulting costs (Gattorna, 1998:142).

3.2.1.2 Supply chain volatility creates complexity

Demand volatility also causes significant complexity which must be managed (Gattorna, 1998:142-143). The complexity created by demand volatility may take many forms, for example:

- Increased supply chain uncertainty about future pressures on the supply chain.
- Increased reliance on accurate, timely information as a means of gaining increased visibility of future customer demand.
- Increased risk of stock outs, especially if the organisation operates in a made-to-stock environment. Furthermore, if it is operating on a long production cycle, the time taken to replenish the inventory may be significantly greater than customer order periodicity. Back orders may result and become a chronic customer service problem.
- Increased customer lead times to increase demand visibility and mitigate against an organisation's ineffective internal operations is, in effect, a reduction in customer service.
- Increased reliance on effective production planning capability. Organisations must ensure that a significant volume of the monthly production is available in stock to fulfil customer orders prior to the beginning of the month. The misalignment between the weekly production and weekly demand implies that organisations must effectively plan a mini stock build every month.

- Decreased ability to provide accurate information to manufacturing. Generally sales and marketing divisions produce sales forecasts monthly and at a reasonably high level in the product hierarchy, that is the product-group level, not the stock-keeping unit. Volatile demand profiles make accurate sales forecasting extremely difficult.

Increased obsolescence, if the demand fails to materialise, particularly for products with a short shelf- life.

Demand volatility thus adds complexity and costs to the supply chain.

3.2.2 Traditional approaches to resolve mismatches between supply and demand

Past attempts to address the supply-demand mismatch problem have focussed on improving forecasting, optimising production and inventory plans and reducing lead times (Gattorna, 1998:173).

Some of the traditional approaches to resolve supply-demand mismatches include the following:

- Improving forecasting: Despite considerable progress in developing new demand-forecasting techniques, there is a limited potential for these demand forecasting techniques to be implemented effectively. The short lifecycles of some products, for example fashion, toys and music, limit the extent to which historical demand can be collected. Inaccurate recording of sales data also impedes the implementation of data-based forecasting. Even scanned items in a supermarket have only 95 per cent data accuracy and this is much lower for items that are not scanned, such as fresh produce (Gattorna, 1998:174).
- Improving production and inventory planning: Many companies use various methods and models to optimise production and inventory plans, for example, the economic order quantity. Even large material requirement planning systems, for example, often have modules with economic order quantity embedded in them. A pitfall of most of these planning approaches, however, is that they are static, ignoring the possibility of a future operational environment. In deriving the optimal order quantity, the model assumes that the ordering set-up costs are fixed and cannot be alerted by management practices.

Companies, such as Toyota, have shown that set-up times can be reduced. The failure of these models to feature in the links between inventory levels and operational improvement reduces their relevance in many applications (Gattorna, 1998:174-175).

- Reducing lead times: Whilst many forecasting errors are the result of inappropriate forecasting methodologies, the root cause of these problems is that the forecast error increases as the lead-time increases (Christopher, 1998:153). The pressure from the customer will continue to be for deliveries to be made in ever-shorter time frames (Christopher, 1998:158). Companies can reduce lead times through various measures, including reducing set-up times, increasing conformance quality levels and reducing the frequency of machine breakdowns, thus reducing the inventory level required to achieve a target fill rate. Many companies that face unpredictable demands have found that they can decrease lead times by reducing their dependence on forecasts that tend to be unpredictable and thereby improve their responsiveness to demand. The quick response programme, for example, has resulted in a reduction of manufacturing and transportation lead times and batch sizes and by using information technology, for example, point-of-sale and electronic data interchange to accelerate information transfer (Gattorna, 1998:175) (Christopher, 1998:153, 192, 194). The essence of the quick response approach is to change from selling what you buy to buying what you sell (Hughes, Ralf and Michels, 1999:102). The forecast lead-time should also correlate with your supply chain lead-time. This will ensure that the supply will be able to react to forecast changes (Johnson, 2002:9).

In order to achieve success, a company must accelerate movement through the supply chain to make the entire logistics system far more flexible and thus responsive to fast-changing markets (Christopher, 1998:31).

Responsive supply chains are, by definition, highly integrated. They are internally integrated across functions and externally integrated with upstream suppliers and downstream customers. Many companies are impeded in their attempts to become more agile and responsive because of entrenched functional measures. They measure functions rather than processes and hence have a fragmented approach to

the marketplace. It is difficult for such firms to contemplate external integration when they lack internal integration (Christopher, 1998:248). All companies and departments within the company must adopt the same strategy: to serve the customer with ever-better quality, lower cost, quicker response, and greater flexibility (Schonberger, 1990: viii). The aim should be the establishment of an integrated company, rather than a bunch of functional silos (Gattorna and Walters, 1996:12), which are blind spots (Kaplan and Norton, 1996:12).

The companies that have succeeded in breaking down the functional silos are now looking to forge ever closer linkages with their supply chain partners. A key to supply chain integration is the open flow of information from one end of the pipeline to another. By sharing information, supply chain partners are able to respond more rapidly to known demand and to do with less inventory in the system as a whole and hence at lower costs (Christopher, 1998:248).

The classic response to the dilemma of supply chain response, has mainly been to add computer inputs and communications to each step, which only adds still more steps and complexities to the problem. The real problem is the neat compartmentalisation of specialised functions. The solution is to simplify communications and to re-establish direct, person-to-person relationships as the foundation of new, co-operative teamwork between both internal and external people and organisations (Harmon, 1992:116).

Forecasts, for example, are by definition inaccurate. No matter when the forecast changes, a company should communicate the full effect of the changes throughout the organisation and to its suppliers (Langenwalter, 2000:77).

Past attempts to address the supply-demand mismatch problem included various approaches, for example, improving forecasting, optimising production and inventory plans and reducing lead times. These traditional approaches, although useful, have not resolved the major mismatches between supply and demand within a supply chain.

3.3 Transforming to a responsive organization

A company's capacity to match supply and demand is a function of its reactive capacity, i.e. its ability to respond to market signals. Firms have struggled to match supply with demand by focussing on improving forecasting, optimising production and inventory plans and cutting lead times. But while these measures are useful, they do not offer a holistic solution. Firms also need to consider measures to address the costs of labour and working capital, and they need to find ways to align the incentives both internally and externally (Gattorna, 1998:171).

In order to remain flexible, organisations need to believe that change does not have to wait for a crisis to occur. Change should be viewed as an opportunity and not a threat; a chance to do something better, not a personal risk (Gattorna, 1998:16).

According to Jack Welch, previous chief executive officer of General Electric, businesses tend to go wrong, because they focus on the predictability of operations. Instead, businesses should be flexible in order to meet the needs of the marketplace. Additionally, long-term relationships between companies should be based on flexibility, rather than today's market or specific volumes (Langenwalter, 2000:44). The basic problem that arises from a system that is based on predictability and standards is that more and more markets are moving faster than traditional measurement time frames. The other problem with such systems is that they actually discourage continuous improvement (Langenwalter, 2000:45).

Demand flexibility requires supply flexibility. Demand is flexible and will always be. Therefore, factories must develop flexible people, equipment, and practices capable of varying the rate of production to meet the current rate of demand. Flexible supply will eliminate costly inventory build-up in slow periods and late shipments in others (Harmon, 1992:30).

The key to effective supply chain management is in closing the gap between day-to-day changes in the supply chain and companies' ability to recognize and respond to them. Specifically, companies should be able to identify these changes as they

occur, to quickly understand their potential impact and to act immediately (Valdero, 2002).

Gattorna (1998:23) states that, how a company “senses and responds” to its customers is a primary determinant of its overall success. Of the many changes that have taken place in the marketing environment, perhaps the biggest is the focus on speed. The main reasons for the changes are shortening product lifecycles, shorter time to market products and the growth in just-in-time practices.

The challenge to every business is to become a responsive organisation. The organisation should respond to changes in the market with products and services which provide innovative solutions to customers’ problems. In addition to this; it should be able to respond to volatile demand and it should also provide high levels of flexibility in delivery. The five major distinguishing changes required of a responsive organisation are the following:

- From functions to processes.
- From profit to performance.
- From products to customers
- From inventory to information.
- From transactions to relationships

3.3.1 Changing from functions to processes

3.3.1.1 Organizational structure

The concept of integrated logistics management, whereby flows of information and materials between source and user are co-ordinated and managed as a system is now widely understood, if not widely implemented. The logic of linking each step of the process, as materials and products move closer to the customer, is based upon the principles of optimisation. This means that the goal is to maximise customer service whilst simultaneously minimising costs and reducing assets locked up in the logistics pipeline. However, in the conventional organisation, this poses an immediate problem. Most companies are organised on a functional basis. In other words, they

have sought a division of responsibility concerning a certain function for example purchasing, production or sales (Christopher, 1998:217).

Most companies adopt an approach whereby each functional area optimises each of its individual pieces. Experience has shown that that this functional approach will result in sub-optimal results for the company (Ptak and Schragenheim, 2000:39).

Christopher (1998:218-221) added that the traditional vertical or functional organisation creates some of the following problems that hamper the successful implementation of integrated logistics management:

- Inventory builds up at functional boundaries. Individual functions are encouraged to 'optimise' their own costs, because of the budgeting system. The cost optimisation will often be at the expense of substantially increased inventory across the system as a whole.
- Pipeline costs are not transparent. The costs relating to the flow of material across functional areas are not easy to measure, nor are the real costs to serve customers with different needs. 'Throughput accounting' and 'activity based costing' are two attempts to pin down costs as they occur and hence to make the total pipeline costs easier to identify. It is only a problem because the costing systems are designed to monitor functional or input costs, rather than flow or output costs.
- Functional boundaries impede process management. Many of the causes of variation in the order-to-delivery cycle, for example, stem from the variability that inevitably arises in the efficient processes that have to be created to manage the interfaces between functions. The phenomenon is further compounded by the inability of managers to detach themselves from their familiar surroundings and to see the 'big picture'. To achieve a smooth-flowing logistics pipeline requires an orientation that facilitates end-to-end process management.
- Conventional organisations present many faces to the customer. The most damning criticism of the traditional organisation is that it does not present a 'single face' to any particular customer. The activities of a traditional organisation are sequential, performed in series, rather than parallel. Each function performs its task and then passes the order on to the next function.

The real problem is that no one person or department is empowered to manage a customer from enquiry through to order delivery, in other words to take full responsibility for the provision of service to the customer.

Christopher (1998:222) also adds that the horizontal logistics organisation has unique characteristics which must be considered. These characteristics are the following:

- Organised around processes, not tasks.
- Flat and de-layered.
- Built upon multi-functional teams.
- Guided by performance metrics that are market-based.

Christopher (1998: 223) also mentions that the process teams should comprise specialists, drawn from the functional areas and led by 'integrators', whose job would be to focus on the process team concerning the achievement of market-based goals. The process team should therefore focus on the limited number of core processes that are central to most businesses:

- Brand development (including new product development)
- Consumer development (focussed on building loyalty with end consumers)
- Customer management (creating relationships with intermediaries)
- Supplier development (strengthening upstream and alliance relationship)
- Supply chain management (the cash-to-cash cycle)

The problem with functions in most companies is that they perform the wrong tasks. In the lean enterprise the functions have two roles. The first is to serve as a school where they systematically summarise the current knowledge, search for new knowledge, and teach all of this to their members. The second role of the functions is to develop guidelines or best practices (Womack, & Jones, 1994:234).

The problem with the vertical organisational approach is that it is inwardly focussed and concentrates primarily upon the use of resources, rather than upon the creation of outputs. The justification for the process view of the business is that these processes are in effect capabilities and it is through capabilities that the organisation

competes (Christopher, 1998:260). The result is an integral management of materials and goods flow. The skills that are required are cross-functional management and planning skills (Christopher, 1998:265).

3.3.1.2 Conflicting objectives

In practice, objectives often conflict with each other, so that progress toward one objective takes you further away from another. The problem of conflicting objectives can be particularly hard to detect in supply chains, because different groups within the company may set their own objectives without realising that they are creating conflicts. If you fail to detect and eliminate these conflicts, the company will work against itself, exerting greater effort, but reducing its ability to make any real progress (Taylor, 2004:239-240).

Inventory levels are a common battleground of conflicting objectives (Taylor, 2004:240-241), (Gattorna, 1998:383), (Gattorna and Walters, 1996:87). Manufacturers are trying to increase inventory turns by reducing the raw materials, work-in-progress and finished goods. Manufacturers prefer longer production runs of like units to help spread the fixed costs of set-up and changeover, thereby reducing increased levels of inventory. Inventory-managed personnel strive to keep the levels of inventory as low as possible. The purchasing group is trying to reduce order costs by placing large orders, which increase the raw materials inventory. The purchasing department is often evaluated on the lowest purchase price per unit and therefore has an incentive to buy in larger quantities at a lower purchase price per unit. The sales force needs more finished goods so that it can offer customers better selection and faster delivery. Sales and marketing would rather have too much inventory so that fewer stock outs occur and customer satisfaction is as high as possible. The transportation department is often evaluated on the lowest cost per ton, resulting in large shipment volumes to realise truckload discounts and increasing the amount of inventory on each shipment.

The conflicting objective creates a chronic tension that pulls the company in different directions. The company that should run smoothly exerts most of its energy into

fighting its own movements, and the best it can do is stagger around (Taylor, 2004:240-241).

Many of the actions of various functional personnel are based on their current performance incentives within the company. People are only acting to meet their set performance goals; however, the end result is increased inventory for the entire company. Performance incentives should therefore be changed so that the efficiency of the whole company is achieved, rather than the performance of a particular department (Taylor, 2004:240-241), (Gattorna, 1998:383).

Behaviour is likely to be very consistent with the current performance measures. If the behaviour of the company is not consistent with the desired company direction, the measurement system must be checked. The review of the measurement system must be addressed at the most senior levels of the organisation (Ptak and Schragenheim, 2000:150).

The only way to make any real progress is to align objectives across all the groups involved in managing the chain. Effective supply chain management involves almost every department in the company, and the long-standing motivations and practices of these groups makes alignment a difficult process (Taylor, 2004:241).

One approach to solving the problem of aligning objectives is to find a single, common objective and map all other objectives back to it. The obvious candidate for the common objective is profit. Any objective that reduces profit, rather than increasing it, is not such a good objective (Taylor, 2004:241).

Objectives should be measured on three levels corresponding to the three levels of management: operations, planning and design. To justify operational objectives, a company only has to show an increase in sales or a decrease in costs. For planning purposes, it might compare the net present value of future profits against the more immediate costs to demonstrate the expected real profit from meeting the objective. Similarly, one would justify capital expenditure to improve the design of the chain by calculating the return on the investment of those assets.

TABLE 3.1: MAPPING OBJECTIVES TO PROFIT

Level of objective	Management Processes	Mapping to Profit
Design Objectives	Asset Acquisition and Chain Design	Return on Investment
Planning Objectives	Forecasting and Scheduling	Net Present Value
Operational Objectives	Fulfilment and Replenishment	Sales and Costs

Source: Taylor, 2004:241-242.

There are no simple formulas for improving a supply chain. Reducing lead times, improving fill rates, and increasing turns may produce dramatic improvements in performance, but they can also do more harm than good. Each of these measures has an optimal setting, and those settings interact in complex ways. The only reliable way to improve one's supply chain is to use a model and let it seek out the settings that will produce the most profit. The optimal settings should be used as targets for each measure, rather than picking arbitrary targets or just pushing as hard as one can in what seems to be the right direction. If the model says that inventory turns should be increased from 10 to 15, then stop at 15. Increasing the inventory turns up to 20 may be as bad for the company as staying at 10 (Taylor, 2004:245). A survey reported in *Supply Chain Management Review* (Cook & Tyndall, 2001) concluded that they could not find a single incidence of extensive analysis of the total supply chain to understand the inter-relationships to set the goals. The survey also found that no company has a model of the supply chain on which to test different models of operation or the impact of different strategies (Taylor, 2004:67).

Throughout the history of business, managers have made subjective judgements about what would improve the performance of their groups, and then worked to do as well as possible on their chosen measures. Mathematical and simulation models now reveal the true complexity of business systems, making visible the intricate interdependencies among objectives and measures that once seemed to stand on their own merits. Today, the path to excellence lies not in improving individual measures of performance such as fill rates, but using formal models to find the best balance among these measures (Taylor, 2004:245).

If the root cause of supply-demand mismatch is the mismatch between objectives, commissions can be altered and brands and vendor-managed programmes can be used (Gattorna, 1998:182), (Jain, 1994:44). If high inventory holding costs are the root cause of supply-demand mismatch, ways might be found to make it cheaper to carry inventory. Large companies, for example, own the inventory at their suppliers (Gattorna, 1998:182).

3.3.1.3 Aligning objectives

Research has shown that most companies set too many objectives and take too few measures, producing conflict concerning the company's direction and confusion about its progress. Industry leaders in supply chain performance usually focus their efforts on either three or five areas, defining and tracking several measures of each. Another interesting characteristic of these leading companies is that they favour measures of effectiveness over measures of efficiency (Taylor, 2004:237). The aim should be to align the individual, departmental and organisational goals (Kaplan and Norton 1996:139).

3.3.1.4 Misaligned incentives

Companies that fail to acknowledge the relationship between incentives and channel inventory levels can incur significant spoilage costs. Some supply chains have reduced supply-demand mismatch costs by identifying ways in which to reduce labour and working capital and align incentives. Intermediaries play a useful role in high factor costs and mismatch incentives (Gattorna, 1998:181-182).

3.3.1.5 Aligning incentives

Improving the performance of your supply chain involves using formal models to find the performance levels that maximise profit, setting objectives for moving toward these levels, and taking systematic measures to track the progress. However, these

models do not allow for motivating people to achieve the objectives. It is not enough to set objectives and to encourage people to strive toward them. One has to provide incentives that reward people for making the right kinds of choices, and the incentives have to be powerful enough to produce significant changes in behaviour (Taylor, 2004:245-246).

An alternative strategy is to develop a “golf” game for the key participants in the forecasting process, namely sales and marketing. A forecasting golf game is particularly popular with sales people, who normally play golf and are characteristically competitive in nature. Playing a monthly golf game coupled with prizes, increases the interest and participation of sales and other key participants (Kahn, 2002:23).

Employees often receive incentives that are aligned with corporate objectives, and their incentives are rarely tied to supply chain performance. A recent study in the United States (Anderson & Delattre, 2002) shows that most companies which use incentives based on supply chain performance; use incentives that are only based on internal performance measures and are not tied to the performance of the chain as a whole. The majority of these companies choose the wrong measures and their incentives are rarely aligned in a way that encourage consistent behaviour. Profound changes will be necessary if incentives are to be used. (Taylor, 2004:246).

Some incentives might change dramatically. Instead of basing sales commission on total sales, it could be based on profit contribution. The sales team will then be encouraged to sell the products that actually make money (Taylor, 2004:246).

Once profit contribution is accepted as the common denominator across all objectives, all company policies should be examined for their contribution to profit. For example, a small change in the policy that governs the sequence of processing incoming orders, could improve a company's profit potential. A company usually has an un-stated, implicit policy of processing orders in the order in which they arrive. A recent study (Anderson & Delattre, 2002) found that the average profits could be increased by 19 % per year, if orders were to be serviced according to their profit potential, rather than their arrival date. Most managers would be thrilled to achieve

an 18 % increase in profit from such a simple change, but this would never occur to them, unless they were already examining every policy for its contribution to profit (Taylor, 2004:247).

Taylor (2004:247-249) mentions that incentive alignment is a powerful tool that ensures that everyone's personal win is consistent with the objectives of the company. People normally behave in ways that maximise their personal rewards, no matter how those rewards are defined. If a company's incentives were to be aligned in such a way that they all pointed in the same direction, it would create a powerful force that could drive the company to unprecedented levels of performance. If, however, these incentives point in different directions, all that energy will work against itself and the opportunity for stellar performance will be lost.

To achieve the maximum company performance, four distinct steps should be followed: Firstly, use business models to identify the combination of performance targets that maximise profits. Secondly, set achievable objectives that will bring the company closer to its ideal configuration. Thirdly, motivate employees to strive for these objectives by making their incentives dependent on hitting the targets. Fourthly, set up a systematic program of measurements to track the progress of each objective. The results of the measurements will provide the feedback necessary to guide the entire program. The measurements will determine the size of the incentive awards, they indicate how much progress has been made toward achieving the targets, and they will also provide vital feedback on the business model that can be improved as time goes on.

Profits should also align the objectives across the whole supply chain. If the individual profits can be aligned with the total profits of the chain, then it is in the interests of the company to work for the good of the chain. If their profits are not aligned, they will inevitably pull in different directions and reduce the performance of the chain. Sharing profits always requires some trade-off. A shared supply chain model should be built in order to maximise the total profit across the chain and then the allocation of the profit could be negotiated.

3.3.2 Change from profit to performance

According to Christopher (1998:261-262, 265), there is a growing realisation that if profit is the end result, then we should spend more time examining the means whereby it is achieved. There is a saying: what gets measured gets managed, implying that it is through the choice of performance measurement that behaviour is determined. The underlying viewpoint is that performance drives profitability.

The management review of the future may not begin with the financial review, but with a review of non-financial performance indicators such as customer satisfaction, flexibility and people commitment. Examples of these measures include the following:

Customer satisfaction

- Customer retention
- Brand preference
- Dealer satisfaction
- Service performance

Flexibility

- Set-up times
- Commonality of components and materials
- Reduction of complexity

People commitment

- Employee turnover
- Suggestions submitted and implemented
- Internal service climate and culture
- Training and development index

The focus of companies should be on the key performance drivers of profit. If the performance improves, the profits will also improve.

3.3.3 Changing from products to customers

There is still an underlying tendency in companies to manage products rather than customers, as reflected in job titles such as brand manager and product manager. The customer-focussed company needs to be supported by accounting systems that can better identify the costs of giving quality service to customers and hence improved profitability. The problem in the past has been that traditional accounting systems have not been able to provide accurate measures of the cost-to-serve. By using activity-based costing and throughput costing, it is possible to identify the aspects of service that create costs and hence, where necessary, to modify the service package, customer by customer. In marketing terms, the transformation will also require more emphasis on customer value and not just brand value. The result will be more focus on markets and the creation of customer value (Christopher (1998:262, 265).

3.3.3.1 Making the customer part of the supply chain

A key part of understanding and retaining customers is to draw them into the company's orbit, through integrating the supply and demand chain. This means moving the supply chain from supplying customers indiscriminately according to forecast demand, to supplying customers with precision according to their actual demand and their stated requirements. In this way the company lines up its supply chain to match and mirror the demand requirements of its customers, and it is capable of moving with customers as their needs change (Gattorna, 1998:41).

3.3.3.2 Flexible manufacturing and logistics

The need for manufacturing agility has been fuelled by shrinking product life- cycles and increasing competitive intensity. Manufacturers should now, more than ever, streamline their internal and external processes to maximise the speed of new product introduction and eliminate the delays and quality problems that typically occur when it comes to escalating production volume (Berger & Gattorna, 2001:103-104).

In Japan, Toyota has used the principles of flexible manufacturing and logistics to provide higher levels of responsiveness to customer needs, with a reduced level of options. A feature of the Toyota production system is the concept of a 'full daily mix schedule'. This means that the aim is to make at least some of every variant every day. Ideally every factory ought to aim to make every product every day, assuming that there is a demand. The aim is to achieve a 'level schedule' with an optimum mix of variants so that the demand can be met from the minimum stock (Christopher, 1998:210).

The progress towards the idea of supply chain management as a source of competitive advantage, will gain momentum as the growth of 'time-based competition' accelerates. In markets that are increasingly volatile, responsiveness becomes a critical competitive requirement (Christopher, 2003:20).

3.3.4 Changing from inventory to information

An information flow challenge is ensuring that the right people receive the right information. A common misconception is that companies use information. However, people use information, and people use it in different ways depending on their job functions and how their companies are organized. The flood of available information overwhelms users. In finding solutions to this problem, companies should strive to customize information for each individual user. Today's software technologies

support creation of solutions that filter information based on individual preferences and job functions (Woerner, 2001).

The key issue that any company should recognise is the fact that order, and its associated information flows, should be at the heart of the business. The only rationale for any commercial company is to generate and fulfil orders (Christopher, 1998:226). The order fulfilment process should thus be designed as an integrated activity of the company with the conventional functions of the business supporting that process (Christopher, 1998:226).

The right information should be used to make the right decisions (Ptak and Schragenheim, 2000:35). Christopher (1998:263,265), states that when companies are unsure of future demand, they carry inventory to buffer against the uncertainty. The conventional solution to the problem of uncertainty has been to make a forecast. It is, however, self-defeating to rely on a forecast since, by definition; the degree of forecast error will directly influence the need for stock. Instead, if information concerning actual customer usage of a product could be linked directly with the logistics system, then the need for the forecast could be reduced. This is the concept of substituting information for inventory. By capturing information at the point of sale and swiftly transferring details of what is being sold back to the point of production, the total response time can be shortened by whole weeks. The results of applying this concept are a demand based replenishment and quick response systems. The skills required are information systems and information technology.

3.3.5 Changing from transactions to relationships

One of the primary goals of many companies is market share. However, it can sometimes be the case that a blind pursuit of market share will put more emphasis on the winning of customers than keeping them. More and more research is suggesting that the longer customers stay with a company, the more profitable they become. There is even a trend with suppliers towards single sourcing. The benefits of single sourcing include improved quality, innovation sharing, reduced costs, and

integrated scheduling of production and deliveries. Logistics thus becomes the thread that connects the inbound and outbound flows of channel partners. The result is a supply-chain-partnership which requires relationship management skills and a win-win orientation (Christopher, 1998:264-265).

3.3.6 Changing from Economies of Scale to Economies of Scope

Christopher (1998:207-209), states that as the demand by all of the partners in the supply chain for a quick response increases, more pressure will be placed upon manufacturing to meet the customer's need for variety in shorter and shorter time frames.

The answer to a quick response has to lie in flexibility. The key to flexibility in manufacturing is not just a new technology e.g. robotics. The main barrier to flexibility is the time taken to change from one level of volume to another and to change from making one variant to another. This is referred to as 'set-up time'. The goal in many Japanese plants is 'Single Minute Exchange of Die' (SMED). In other words, constant attention by the management and the workforce is focussed upon the ways in which set-up times can be reduced. Sometimes it will involve new technology, but more often than not, it is achieved by taking a totally different look at the process itself. In many cases set-up times have been reduced from hours to seconds, simply by questioning conventional wisdom.

What is being seen is a fundamental shift away from the economies of scale, which are volume-based and hence imply long production runs with few change-overs, to the economies of scope which are based upon producing small quantities of a wider range, and hence, requiring more change-overs.

Using the economies of scope model, a single plant can produce a variety of output at the same cost as, if not lower than, a separate plant dedicated to producing one type of product at a given level. In other words, an economic order quantity (EOQ) of one unit, and specific production designs, engender no additional costs. Economies

of scope change the materials-driven, batch-system technology into a multi-functional, flow system configuration.

3.3.6.1 Supplier integration

Conventional purchasing tends towards multiple sources of supply for a single item. Co-makership, on the other hand, is the development of a long-term relationship with a limited number of suppliers on the basis of mutual confidence. Supplier development streamlines and integrates the vendor's own systems and procedures more closely with the customer's (Christopher, 1998:242-243,246).

3.4 Lead time gap

Most organisations face the fundamental problem that the time it takes to procure, make and deliver the finished product to a customer is longer than the time the customer is prepared to wait for it. This is the basis of the lead-time gap (Christopher, 1998:167).

In the conventional organisation, the only way the gap between the logistics lead time, i.e. the time taken to complete the process from goods inward to the delivered product, and the customer's order cycle, i.e. the period they are prepared to wait for delivery, is by carrying inventory. This normally implies a forecast. Most companies seek to forecast the market requirements and then build inventory ahead of demand. All mistakes in forecasting end up as an inventory problem, whether too much or too little (Christopher, 1998:168).

Whilst improving forecast accuracy will always be a desirable goal, it may be that the answer to the problem lies not in investing more money and energy in improving forecasting techniques, but rather in reducing the lead-time gap (Christopher, 1998:168).

The company that achieves a perfect match between logistics lead-time and the customers required order- cycle has no need of forecasts and no need for inventory (Christopher, 1998:169).

Reducing the lead time gap can be achieved by shortening the logistics lead time, whilst simultaneously trying to move the customer's order- cycle closer by gaining earlier warning of their requirements through improved visibility of demand (Christopher, 1998:167-169).

A significant contribution to the way in which logistics processes are viewed, has been made by Goldratt who has developed the theory of constraints, which is better known as optimised production technology. The output of non-bottlenecks that feed bottlenecks must be governed by the requirements of the bottlenecks they serve (Christopher, 1998:171), (Halevi, 2001:277), (Goldratt, 1990:4), (Silver, Pyke and Peterson, 650-652, 658-659).

The aim is to manage the bottlenecks for throughput efficiency, which implies larger batch quantities and fewer set-ups at those crucial points, whereas non-bottlenecks should minimise batch quantities even though more set-ups will be involved. The result is that the flow of work-in-progress increases and the transfer batches merge into larger process batches at the bottlenecks, enabling a faster flow. (Christopher, 1998:172).

Further opportunities for pipeline reduction can be found at the interfaces with suppliers' logistics systems. Lengthy, paper-based re-ordering systems add to the total lead-time. Even more of an issue is the fact that customers rarely share their usage data with their suppliers and the supplier is forced to forecast requirements and carry inventory, thus exacerbating the problem. Many companies are facing replenishment lead times as long as months, which could be reduced to weeks or even days (Christopher, 1998:172).

3.5 Rationale for supply chain time compression

Until recently, supply chain changes have been driven largely by cost, with a narrow focus on tangible supply chain efficiencies. Organisations looking for business success need to rethink their strategies for their supply chains (Gattorna, 1998:158).

Innovative organisations are examining their supply chains, not for cost-reduction opportunities, but for opportunities to improve their service to customers. Companies that have compressed their supply chain response times have found that the financial benefits have far outweighed the cost. (Gattorna, 1998:158). The strategic rationale for time- compression includes some of the following benefits:

- Customer service: A compressed supply chain provides a differentiated level of customer service by making the right products available to customers in the right place at the right time. Many organisations with either substandard or non-differentiated service, find themselves vulnerable to periodic margin reductions from their customers. Companies with differentiated service often avoid this ongoing price-service vicious circle (Gattorna, 1998:158).
- Customer responsiveness: This enables organisations to adapt quickly to volatile and unplanned demand. Sales growth not only comes from capturing those previously neglected sales opportunities, but also, in the longer term, through taking market share from those less reliable suppliers. Increasing business through existing channels using existing fixed assets is a very efficient, low-risk and therefore profitable way to grow (Gattorna, 1998:159).
- Balance between supply and demand: Achieving a much closer match between supply and demand leads to a reduction in the wastage, caused by making or buying too much stock and having to write it off later. When supply and demand are not synchronised, spectacular order surges are often followed by significant order reductions. The mismatch between the supply and the demand encourages organisations to build more capacity than is required, only to see the capacity poorly used (Gattorna, 1998:159).
- Inventory levels: A major business goal is the reduction and even the possible elimination of the supply chain inventory, necessary in the traditional made-to-forecast model. Inventory ties up valuable working capital and chokes

business cash flow. Time compression programmes can often release sufficient working capital to fund the overall initiative, either partially or completely (Gattorna, 1998:160).

3.5.1 Strategic lead time reduction

Conventional wisdom was based on the assumption that long minimum lead times and minimal flexibility were needed. Just-in-time thinking challenged conventional wisdom by focussing on short lead times and a customer-service driven approach that required much more flexibility (Christopher, 1998:189).

The importance of strategic lead-time management is that it forces companies to challenge every process and every activity in the supply chain and to apply the acid test of 'does this activity add value for a customer or consumer or does it simply add cost?'(Christopher, 1998:116).

In many cases much of the non-value adding time in a supply chain exists, because it has been self-inflicted by the rules that have been imposed or inherited. Such rules include: economic batch quantities, economic order quantities, minimum order sizes, fixed inventory review periods, production planning cycles, and forecasting review periods (Christopher, 1998:115-116).

Supply chain pipeline management is concerned with the removal of the blockages and the fractures that occur in the pipeline and which lead to inventory build-ups and lengthened response times. The sources of these blockages and fractures are such things as extended set-up and change-over times, bottlenecks, excessive inventory, sequential order processing and inadequate pipeline visibility (Christopher, 1998:162-163).

Companies could reduce their lead-times by improving the frequency, accuracy and reliability of deliveries, together with the provision of an emergency quick-response back-up service (Christopher, 1998:121).

Companies are now recognising the fact that a reduction in lead-time not only provides quicker response to customers' demands, but also increases the stock turn and reduces the need for working capital (Gattorna and Walters, 1996:93).

The reasons for reducing lead times seem obvious, so one wonders why companies have not picked up these ideas more quickly. The reasons seem to be fourfold (Christopher, 1998:167):

- Few managers have a grasp of the entire process.
- The convenient way in which things get done, can reflect on the doers as a desire to protect functional boundaries and a lack of understanding of the consequences, both upstream and downstream of individual processes.
- Initiatives for change are largely functional and seldom reflect the total cost of the system.
- Lead times are protected by their custodians as a means of providing a buffer, and as a way of proving some hidden flexibility to respond.
- Systems hold lead times as parameters which are taken for granted. Few executives would dare to challenge the basic principles of the computer systems in the business, far less the accuracy with which they complete the task. As a result, systems regularly operate on outdated or inappropriate lead-time constraints which have not been reviewed for years.

3.5.2 Supply chain time compression approaches

The success of time compression is based on adopting the following new approaches:

3.5.2.1 Taking a holistic view

Organisations, trying to compress their supply chains, need to look beyond their own boundaries. The complete supply chain is likely to consist of different organisations, and supply chain reform requires a holistic and integrated approach with all participants playing a role (Gattorna, 1998:160).

3.5.2.2.1 Supply chain integration

The improved integration is the essence of supply chain management. Supply chain leaders are reconsidering the linkages, not only between functions within their own company, but with other organisations up and down the supply chain (Gattorna, 1998: xv).

The greatest opportunities for achieving cost reductions and attracting new business typically involve multi-enterprise interdependencies, such as continuous replenishment programmes, instead of companies trying to do their own internal supply chain management (Gattorna, 1998:102).

Supply chain integration implies process integration, both upstream and downstream. Process integration implies collaborative working between buyers and suppliers, joint product development, common systems and shared information (Christopher, 1998:231), (Gattorna, 1998:281).

3.5.2.2.2 Supplier programmes

Lower inventory starts with suppliers. In some cases, the actions of suppliers result in high inventory. Examples of this are:

- The high costs of production changeovers cause the production of large orders.
- Suppliers frequently make late deliveries due to the unnecessary time required to process the latest production schedule information into production schedules.
- Even when the most recent production schedules are available, deliveries are late, because a long run already in progress needs to be completed. It is impractical to interrupt a long run because of the penalty of increased changeover costs.

- Suppliers frequently deliver defective materials and components that must either be reworked in-house or returned to suppliers for repair or replacement.

Supplier programmes that focus on specific manufacturing process improvements should address all the root causes of large inventories.

3.5.2.1.3 Just-in-time supply programmes

Just-in-time practices offer important insight into how supply chains can be improved. Although the apparent focus of just-in-time is on reducing inventory, the true spirit of just-in-time is a systematic pursuit of quality, an aspect of which is eliminating any unnecessary complexity. One of the great contributions of just-in-time to supply chain management is to provide a clear demonstration of just how simple the basic flows can become (Taylor, 2004: 45).

Along with reducing complexity, the just-in-time philosophy of quality also seeks to reduce variability in every stage of production. Each operation is analysed, refined, and rehearsed until it can be completed both quickly and consistently. The result of just-in-time, in the case of supply chains, is that raw material inventories can be reduced to a fraction of their normal levels without causing shutdowns on the line (Taylor, 2004: 45).

Just-in-time can make supply chains so fragile that any interruption in the flow of supplies could bring the entire chain to a halt. Toyota, for example, had to close down its production lines for an entire week as a result of a fire at one of its suppliers. Ford was forced to close down five North American plants shortly after September 11, 2001 due to parts shortages, many of them due to delays in bringing trucks across the Canadian border (Taylor, 2004: 46).

Although just-in-time does an excellent job in reducing lead time and work-in-progress, it has a few drawbacks that need to be considered (Chase, Aquilano and Jacobs, 2001:680):

- It is limited to repetitive manufacturing.
- It requires at least a month's stable production level.
- Just-in-Time does not allow very much flexibility in the products produced. Products must be similar with a limited number of options.
- It still requires work-in-progress when used with Kanban so that there is "something to pull". Completed work must be stored on the downstream side of each workstation in order to be pulled by the next workstation.
- Vendors need to be located nearby, because the system depends on smaller, more frequent deliveries.

Just-in-time is not the right approach for every supply chain. It is not a good choice for low-volume products or for products with uncertain demand. Just-in-time effort illustrates how much can be done to reduce complexity and variability in supply chains by emphasising simplicity and consistency (Taylor, 2004: 47).

3.5.2.1.4 Retail customer replenishment programmes

The retail point in the supply chain is the first point at which changing consumer preferences are experienced. This is also the point where the chain becomes visible to the consumer (Taylor, 2004: 47).

Through consignment, producers retain both ownership and control over inventories of their products at a retailer's site. Consignment is an effective tool for selling products that retailers might not be willing to carry conventionally. Consignment is not the first choice for producers, because they have to wait longer before they get paid for their products (Taylor, 2004: 47).

In vendor-managed inventory approach, a producer receives continuous updates on a retailer's inventory level and replenishes it as necessary, with the retailer taking ownership of the goods on delivery. Producers are given better insight into the sales

of their products, helping them to anticipate demand and improve on their supply. The retailers also benefit, because they no longer have to track inventory levels or place orders. Retailers also save money, because they need fewer inventories (Taylor, 2004: 48).

The quick response program has combined some of the techniques of just-in-time with technologies for monitoring inventory in real time. Electronic point-of-sale systems automatically capture data about actual sales as they occur, and then transmit this data to producers using electronic data interchange connections. Producers can then respond with daily shipments of pre-tagged items that could go directly from the trucks to the selling floor (Taylor, 2004: 48).

Continuous replenishment is an extension of the quick response programme. Improved inventory control and joint forecasting is achieved by producers and retailers pooling their understanding of consumer demand to improve the prediction of future sales. Individual purchase orders are eliminated, further streamlining the replenishment process (Taylor, 2004: 49). In 1993, the grocery industry launched its own version of continuous replenishment, calling it the efficient consumer response program. The major contribution of the efficient consumer response program is the addition of category management, which organises promotion and replenishment activities around groups of products that consumers view as roughly equivalent in satisfying their needs. Category management helps grocery stores determine the best mix of products to put on their shelves, to make sure their consumers' needs are met, even if there are occasional shortages (Taylor, 2004: 50).

Retail replenishment programmes reflect a continuous effort to simplify and stabilise supply flows. The elimination of orders in continuous replenishment has removed a major source of time and cost that added no value to the end- consumer. Real-time data on sales allows retailers to respond quickly to variations in consumer buying patterns, and the addition of joint forecasting allows retailers to prepare for changes before they reach the stores (Taylor, 2004: 50).

The most ambitious replenishment programme to date is collaborative planning, forecasting, and replenishment, a multi-industry effort that was formalised in 1998.

This programme relies on advanced Internet- based tools to pool information about demand and supply, allowing trading partners to co-ordinate their inventory decisions and to smooth the flow of goods across the chain. It requires companies to make substantial investments in new technologies. The biggest obstacle is cultural differences: Companies are required to share highly detailed information about their operations, and many are reluctant to do that (Taylor, 2004: 50-51). The goal of collaborative demand planning is to generate a truer demand signal for all partners in the supply chain. Customer and operational data should be shared among all partners and joint decisions made in forecasting demand (Gattorna, 1998:200). The results of collaborative demand planning are lower forecast errors and a smoother flow of orders (Sagar, 2004:3).

A lean and demand-centric strategy forces the company to operate closer to the customer. The ideal is to bring customers directly into the company's system, through collaborative demand planning, as well as through execution (Reary, 2001).

3.5.2.1.5 The problem with supply chain programmes

A team of researchers at Ohio State University conducted a comprehensive analysis of the inventory levels reported by U.S. corporations over the past 20 years, and they reached a startling conclusion: The Great Inventory Reduction of the late twentieth century never happened. The study did reveal a modest overall decline in total inventory since 1980, but most of that was due to a small number of structural changes in the supply chains. For example, the elimination of distributors and retailers in the direct sales model, perfected by Dell, together with other advanced supply chain techniques, allowed the computer industries to cut total inventories in half over the 20 year-period. But for other industries, including apparel and grocery, that pursued retail replenishment programmes, inventory levels remained the same (Taylor, 2004: 51-52).

The problem with the retail replenishment programmes is that the inventory levels of the companies participating in those programmes have, in fact, dropped, but it appears that most of the reductions were achieved by displacing inventory within the

chain, rather than actually eliminating it (Taylor, 2004: 52). In the industries that serve mega-retailers such as Wal-Mart, inventories of finished goods have actually gone up over the last 20 years (Taylor, 2004: 53). The programmes may work well for the companies reporting success, but they do nothing to make the chains more efficient or competitive overall (Taylor, 2004: 52). The dramatic reductions in inventory up the chain at the retail level have come, to a large extent, from pushing inventory up the chain, not from taking inventory out of the chain (Taylor, 2004: 54).

The pattern of pushing inventory up the chain can also be found in just-in-time programmes. Here again, requiring suppliers to make precisely-timed deliveries and to respond rapidly to changing consumption, reduces a producer's inventory of raw materials at the cost of forcing suppliers to hold more finished goods, in order to buffer variability in demand. The standard response to this problem is for suppliers to adopt just-in-time as well, but that can only work if customers and suppliers precisely synchronise their operations. (Taylor, 2004: 54).

Just-in-time pushes inventory levels downstream, as well as upstream. The best example comes from the automobile industry. Having sorted out most of the supplier aspects of just-in-time, U.S. auto plants now operate with as little as three hours of inventory on hand. On the other hand, the inventory of cars and trucks at dealerships now runs as high as three months' worth of supply. Just-in-time may be successful for the automobile makers, but it does not make their supply chains any more efficient. Of all the ways in which the industry could inventory, finished goods are by far the most expensive (Taylor, 2004: 55).

When companies act as true trading partners, working together to pull time and cost out of the chain, they can create a situation in which everyone makes more money (Taylor, 2004: 56). The Ohio State University study found that the efforts to increase efficiency through exercising power simply changed the location of the inefficiency. The only way to get genuine improvement is to redesign the supply chain to increase its efficiency as a whole.

The dilemma is that the adjacent members of a supply chain may have very real opportunities to increase their shared profits, but the underlying tension concerning

how profits are to be divided can prevent them from realising these opportunities. The only way to overcome this problem is to somehow separate the effects of the co-operation from those of the competition, recognising that both exist and devising a way to distribute the profits from the co-operation in a manner that is fair to all parties. This could prove to be difficult, but the technique of game theory could make it a little easier (Taylor, 2004: 57).

3.5.2.2 Use of technologies

Many organisations taking a holistic approach to their supply chains are discovering that new and converging technologies offer unheard-of opportunities to compress, and even to eliminate some of the aspects of these chains. Internet book sites, for example, Amazon.com, do not restrict their customers' choice of titles, but offer easy search tools to locate books quickly and allow a much smaller investment to be made in centralised stock holding (Gattorna, 1998:161).

The biggest change taking place in supply chain software today is the transfer/shift to the Internet. The Internet does not, as was widely believed at the end of the 1990's, lead to a fundamentally different economy, nor does it alter the basic dynamics of supply chains. Physical goods still have to get from one place to another, and the Internet does not alleviate the need to choreograph that movement as precisely as possible. What the Internet does do, however, is provide a vastly improved communications medium for co-ordinating this movement of goods. Like the telegraph, the telephone, and the fax machine before it, the primary impact of the Internet is on speed, and not the nature, of the business (Taylor, 2004:122).

In the future, supply chain management will be transformed in a profound way. As XML and Web services become widely adopted, all the routine transactions required to run a supply chain will shift to the Internet. As a result of programmes communicating directly with other programmes, these transactions will occur below the level of human awareness and they will happen very quickly. Freed from the mundane tasks of placing orders and updating schedules, the people who run supply chains will be able to operate at a much higher level, setting goals for the chain and

analysing its performance. In effect, running a supply chain will become as automatic as walking; instead of thinking about how to get every muscle to move in just the right way, one will be free to focus on where one is going and how to get there (Taylor, 2004:126-127).

3.5.2.3 Cut out unnecessary steps

A revealing exercise is to measure the actual process time in supplying a product order as a proportion of the total order lead-time. Quite often the process time is a very small fraction of the overall order lead-time. Organisations need to examine all the opportunities to remove wastage and non-value adding processes. Many of the reasons for these extraneous processes reflect traditional divisions between functional areas, and the accompanying mistrust and lack of empowerment. Organisational realignment into cells is a powerful way to get over the functional issues (Gattorna, 1998:161-162).

3.5.2.3.1 Elimination of waste

The Japanese truly believe in eliminating waste. Waste in Japan, as defined by Toyota's Fujio Cho, is nothing other than the minimum amount of equipment, materials, parts, and workers or working time which are absolutely essential to production. Just-in-time defines seven types of waste that should be eliminated: waste from overproduction, waste from waste of waiting time, transportation waste, inventory waste, processing waste, waste of motion, and waste from product defects. The definition of just-in-time leaves no room for surplus or safety stock. No safety stock is allowed, because if one cannot use it now, one does not need it now; and that would be waste. Hidden inventory in storage areas, transit systems, carousels, and conveyors are key targets for inventory reduction (Chase, Aquilano and Jacobs, 2001:396).

Generally, waste elements in the manufacturing process, defined as non-value adding activities, account for around 96 percent (Gattorna, 1998:342). The causes of

waste in the manufacturing process fall into the following categories: motion, waiting, faster than necessary pace, correction, over-processing, over-producing, conveyance and inventory (Gattorna, 1998:343).

An analogy that is frequently drawn in Japan is that an organisation's investment in inventory is like a large, deep lake. Well below the surface of this lake are numerous jagged rocks, but because of the depth of the water, the captain need have no fear of striking one of the rocks. The comparison with business is simple: the depth of the water in the lake represents inventory and the rocks represent problems. The problems might include such things as volatile demand, inaccurate forecasts, unreliable suppliers, quality problems and industrial relations problems (Christopher, 1998:185).

The Japanese philosophy is that inventory merely hides the problem. Their view is that the level of water in the lake should be reduced. Now the captain of the ship is forced to confront the problems and not avoid them. In the same way, if inventory is reduced, then management must grasp the various problems, for example, forecast inaccuracy and unreliable suppliers (Christopher, 1998:185-186).

A company should deliberately force the inventory levels down, particularly in good economic times when problems can be exposed and corrected before they become more problematic. (Chase, Aquilano and Jacobs, 2001:398).

The Japanese developed the so-called 'Kanban' concept as a way of lowering inventory. Kanban is a pull system which is driven by the demand at the lowest point in the chain. By progressively reducing the Kanban quantity, i.e. the amount demanded from the supplying workstation, bottlenecks will become apparent. Management will then focus attention on the bottleneck to remove it by the most cost-effective means. The Kanban philosophy essentially seeks to achieve a balanced supply chain with minimal inventory at every stage and where the process and transit quantities of materials and stock are reduced to the lowest possible amount. The Japanese maintain that the ultimate aim should be the economic batch quantity of 1.

The Japanese logic does not necessarily conflict with the traditional view of how the economic batch or order quantity is determined. All that is different is that the Japanese are seeking to minimise the batch quantity by shifting the curve that represents the cost of ordering or the cost of set-ups to the left. This means that the Japanese focus on finding ways to reduce set-up costs and ordering costs (Christopher, 1998:186).

3.5.2.3.2 Reduce waste by pooling risk

The idea behind risk pooling is to combine the management of inventories that would otherwise be controlled separately so that variability in demand can be handled with less safety stock (Taylor, 2004:301).

Local variations in demand tend to cancel each other out. If the inventories for a few regions are pooled, then the same safety stock can cover the risk of high demand in any of the regions, reducing the total inventory requirements. Depending on conditions, it may be possible to reduce inventories and holding costs by 25 % to 35 % using risk pooling (Taylor, 2004:302).

Risk pooling does not require that inventory actually be located in the same place. All it requires is that inventory be managed as a common pool through a variety of techniques, including echelon inventory, multi-sourcing, transshipment and direct shipment (Taylor, 2004:303).

In the Echelon inventory approach, the set of facilities leading from the central facility through the central stock provides backup to the regional stock, which provides backup to the store stock in turn. As long as the delays in getting stock from the next level up the chain are tolerable to the customer, the total inventory can be greatly reduced (Taylor, 2004:303-304).

With multi-sourcing, instead of serving all the regions from a single central warehouse, each region is served by its own, but the warehouses backstop each other in the event of a stockout. The total inventory reduces as with the centralised

inventory, but it retains the customer proximity of the regional facilities (Taylor, 2004:304).

Shipping from more distant facilities takes longer and is more expensive, so it may be economically feasible to support all possible links between warehouses and regions. The solution to this problem is to divide the facilities into separate but overlapping risk pools (Taylor, 2004:304-305).

With transshipment, facilities exchange inventory themselves at a given level of the chain. Transshipment is more expensive than multi-sourcing, because products travel farther on average, but sometimes it is the only option. Transshipment is mostly used at retail level, because no downstream facilities exist to receive merged shipments (Taylor, 2004:305).

With direct shipment, one or two links of a supply chain are bypassed altogether and upstream facilities backstop the inventory of downstream facilities (Taylor, 2004:306).

Risk pooling can be used with any strategy. Inventory levels can be trimmed by as much as a third without compromising the service level. If a company's strategy is based on flexibility, it can respond to greater fluctuations in demand without increasing inventories (Taylor, 2004:306).

Risk pooling produces the greatest benefits when the demand is uncertain and relatively independent across regions. If the demand for a product is highly stable, then one does not need much safety stock, so there is less to be gained by reducing it. If the demand in the various regions rises and falls together, then risk pooling will not be very effective, because shortages in one region will most likely be accompanied by shortages in other regions (Taylor, 2004:307).

Risk pooling can be much harder to manage than a standard echelon distribution system, for example, goods can be pulled and received from multiple facilities and the alternatives may be limited to risk pools whose membership varies with every facility (Taylor, 2004:307).

Properly managed, risk pooling can improve the efficiency of a company (Taylor, 2004:307).

Customers will no longer tolerate failure and those organisations that fail to take up the challenge of time compression of the supply chain will lose their customers to those that do (Gattorna, 1998:168).

3.5.2.3.3 Increasing velocity

One of the simplest ways to improve the efficiency of a supply chain is to accelerate the flow of goods across the supply chain. Acceleration improves efficiency, because inventory does not stay in the chain so long, which brings down the cost of holding inventory. Acceleration also enhances flexibility, because it reduces the time required to change what is in the pipeline in response to changing demand (Taylor, 2004:298).

An obvious way to increase velocity is to switch to a faster mode of transportation. The increased transportation costs have to be more than offset by the financial benefits of decreased holding costs, improved sales, reduced write-downs, or some combination of these factors (Taylor, 2004:298).

A much more effective way to increase velocity is to improve the way the supply chain handles goods that are not in motion. Despite all the efforts to improve the efficiency of supply chains over the past few decades, inventory still spends the majority of its time waiting for something to happen (Taylor, 2004:298).

In short, a better way to increase the velocity of inventory is not to move it faster when it does move, but to get it to spend more of its time in motion. Achieving this goal is much harder than just changing the transportation mode. Systematic studies need to be conducted of how inventory moves across the supply chain, each stop must be examined, and ways to get it moving again must be found. To achieve higher velocities, a company needs to re-engineer its supply chain operations, applying techniques such as just-in-time, lean production, and related disciplines (Taylor, 2004:299).

One can identify slowdowns just by looking at the size of the queues in the supply chain. When a bottleneck is found, the first choice should be to find a way to increase the throughput of that operation, either by adding capacity or by improving the operation itself. If a way to fix the bottleneck cannot be found, scaling back the upstream operations that feed into the bottleneck should be tried. It may seem counterintuitive to accelerate the flow of inventory by slowing some operations down, but that is precisely the effect that will be achieved. By not pulling inventory into the chain until it has a clear path, one is making sure that inventory moves faster once it does enter the chain (Taylor, 2004:299-300).

The value-added and non-value added activities should also be reviewed. The only activities that add value are those that change the product in a way that increases its utility to the customer, usually by changing either its form or its location to bring it closer to the needs of the customer. The situation can get worse, because some activities actually reduce value (Taylor, 2004:300).

The flow of demand and cash also gains from the increase in velocity. The faster demand moves up the supply chain, the more quickly upstream suppliers can respond to changes in demand. Accelerating the demand signal is one of the most effective ways of eliminating demand amplification, which is the source of much disruption in supply chains. Finally, accelerating the flow of cash reduces the total cost of debt across the chain, further improving efficiency without impairing flexibility (Taylor, 2004:301).

3.5.2.4 Source with service in mind, as well as cost

Sourcing decisions should be viewed to achieve overall service improvement requirements. Some suppliers co-locate on their customers' premises. A second factor in effective sourcing is developing the right relationship with the supplier. Working together across seamless boundaries is a prerequisite for time compression (Gattorna, 1998:163).

3.5.2.4.1 Winning through collaboration

When trading partners compete with each other over a fixed sum of money, they are playing what game theorists call a 'zero-sum' game. In 'zero-sum' games, there is a fixed amount of money at stake, and players compete to see who can win the largest share (Taylor, 2004: 57).

Trading partners that want to improve their combined profits, rather than just fight over a fixed amount of money, can look for ways to change their relationship into a positive-sum game. In a co-operative game, the players focus on how to increase their total winnings and relegate the allocation of those winnings to a secondary concern. In a competitive game, the winnings are considered fixed and the allocation is everything (Taylor, 2004: 59-60).

The new competition between supply chains is not based on the effectiveness of individual links; it is based on the ability of the chain as a whole to bring better products to the market faster and cheaper than other chains (Taylor, 2004: 64).

The members of a team such as this, need to plan and act with the integrity of a single organisation, working together to simplify and stabilise the flow of demand, supply and cash across the chain. The pooling of interests, the synergy of planning and acting, is the essence of supply chain integration. It means that the members of the chain come together to form a larger whole, one in which the parts are carefully aligned and synchronised so that the chain behaves as a single, co-ordinated system (Taylor, 2004: 64). The current push for collaboration across the chain represents the natural convergence of two major trends in supply chain management. One trend is away from common ownership and towards independent companies. The other trend is away from ad hoc transactions and toward tighter integration. The goal of supply chain collaboration is where the two trends meet: a team of companies achieving a high degree of integration across the supply chain while retaining independent ownership and control (Taylor, 2004: 64).

3.5.2.4.2 Design products with the supply chain in mind

Products are not often designed with responsive supply chain management objectives in mind, but are often designed in a modular fashion to allow for quick customisation to the end product. Modules cannot only be made in bulk very efficiently, but this also ensures the flexibility to configure rapidly to a customer order requirement. It also allows the two operations to be decoupled and separated. The bulk items can be produced centrally for maximum efficiency and the customised items assembled just-in-time in a location close to the final customers to ensure maximum service effectiveness. An example of process innovation is a consumer goods manufacturer who has developed the technology to produce colourless, flavourless products and inject the necessary flavour and colour just before the product is packaged (Gattorna, 1998:162-163).

3.5.2.4.3 Designing for supply

In the past, engineers designed a product and then handed it over to manufacturing to figure out how to build it. The design for manufacturing and concurrent engineering approach ensured that manufacturing requirements were taken into account during the design process. Manufacturing companies designed products that were easier to build and therefore companies were able to simplify production, reduce costs and enhance quality (Taylor, 2004:307-308).

Today, design for manufacturing is being pushed outside the walls of the factory and applied to supply chains. The new movement called 'design for supply' takes the entire sequence of operations and movement into account to convert raw materials into usable products. The only change from the design for manufacturing to design for supply is the shift in focus from a single company to a coalition of companies (Taylor, 2004:308).

Two of the most basic design for supply techniques is simplification and commonality (Taylor, 2004:308). The goal of simplification is to reduce the number of alternative

assemblies by eliminating unnecessary options, even if that increases the cost of components (Taylor, 2004:308). The standardisation approach seeks out duplications in like items, which may be called for, either on the same or totally different specifications. Standardisations seek the one or few line items that can perform multiple tasks, thereby replacing a multitude of line items specifically designed for varied, yet similar functions (Kobert, 1992:91), (Harmon, 1992:170), (Hughes, Ralf and Michels, 1999:50), (Harmon & Peterson, 1990:x-xii), (Chase, Aquilano and Jacobs, 2001:151-152). Similarly, the goal of commonality is to reduce the number of similar components by reducing the choices available to designers (Taylor, 2004:308). This may cause a few products to have larger components than they need, but it streamlines production by reducing the variety of materials, and it reduces purchasing costs by combining inventories that would otherwise be handled separately (Taylor, 2004:308).

A more ambitious technique is the use of modularity in product design (Taylor, 2004:308-309). . Rather than designing each new product from the beginning; engineers design products as assemblies of pluggable components, using existing components wherever possible. Savings can be accomplished from re-using the same components across many different products. Customer options are also increased by allowing configurations to be assembled from a relatively small set of components (Taylor, 2004:309). Manufacturers can also produce the modules of a product simultaneously, rather than building the entire product sequentially (Taylor, 2004:309). Parallel production permits shorter lead times, improving customer service while reducing holding costs. Parallel production also permits greater flexibility in the choice of production sites by giving manufacturers the option of using specialised facilities for the various components (Taylor, 2004:309).

Another technique is designing products for convenient packaging. Low-density products are expensive to ship, because they cause vehicles to fill up before they reach their maximum carrying weight. These products are increasingly being designed in a modular fashion that allows final assembly to be postponed until late in the chain. An example is ready-to-assemble furniture, such as desks and shelves, which require final assembly to be performed by the customer (Taylor, 2004:310).

Another technique used in design for supply, in the case of retail products, is making sure the product will display well in stores. For example products are designed to fit on to the retailer's shelves. Even when there is no primary packaging, display characteristics have a big impact on design. Large plastic items, such as cans and storage containers, are now designed to nest inside each other when stacked reducing the precious retail space required displaying these low value-to-volume products (Taylor, 2004:310).

Another technique is to involve suppliers in the design of a product. Suppliers should be consulted concerning features, construction techniques and costing in an effort to improve the final product (Taylor, 2004:310).

The design-for-supply initiative is important as it reverses the roles of manufacturing and supply chain management. The needs and desires of the manufacturing group are often subordinated to the requirements of the supply chain as a whole. (Taylor, 2004:310-311).

The main obstacle to design for supply is not the demand of the technique itself, but the difficulties many production managers have in adjusting to the changing priorities. Any attempt to redesign the supply chain must therefore be embraced, supported, and actively managed by the most senior executives within the company (Taylor, 2004:311).

3.5.2.4.4 Customization

In the drive for reduced supply chain costs and improved efficiency, many companies have adopted a 'one-size-fits-all' mentality when it comes to providing logistics services (Gattorna, 1998:42).

3.5.2.5 Reduce forecast time and increase accuracy

A key factor in effective time compression is both reducing the forecast time and increasing forecast accuracy, preferably through the use of actual, rather than predicted demand. Businesses have remained with the made-to-forecast model, despite its obvious flaws, simply because alternative approaches appeared to be too costly. The forecast, more often than not, is singled out as the culprit leading to lost sales and possible expensive inventory write-downs and write-offs. Experiences differ by industry, but best-in-class companies struggle to improve their overall forecast accuracy above 80 to 85 per cent over their planning horizons. This, however, grossly overstates the accuracy level for the slow-moving products. These products experience much larger volatility with actual demand. Another factor, often overlooked, is the reduction of forecast accuracy over time. It is not uncommon for organisations to undertake significant commitments to inventory, capacity and other resources in the supply chain based on forecasts beyond their legitimate planning horizons. In order to cut back the forecasting time horizon and dramatically increase accuracy, organisations can actually delay the requirement for some demand information until key stages of the process have been reached. This can provide a greater level of responsiveness even where further shortening of the overall process is not feasible. It is necessary to have responsive systems that can supply the latest information to the point of need in a timely fashion. More responsive systems do not imply that systems have to work in real time, but only in shorter update periods than the individual process steps. The benefits of shorter and more accurate forecasting cycles are beginning to emerge. Some retailers in the UK, for example, are moving away from costly, on-value-added warehousing through better forecasting, smaller production batches and more emphasis on customer service (Gattorna, 1998:163-167).

3.5.2.6 Redesign production processes

Long production runs were traditionally necessary, because changeover processes were complex, time consuming and wasteful. Production processes can also be re-

engineered, difficult sub- assemblies can be ordered and built to forecast information, and can be quickly assembled into one of many customised end configurations when the final order arrives. The postponement approach, or delayed configuration (Christopher, 1998:136) (Gattorna, 1998:78), for example, is becoming the norm in the personal computer industry. Where a process cannot be broken into intermediate stages and insufficient capacity occurs to make the total requirement inside the response time, an alternative approach can be taken. By using historical information on the level of order fluctuation of a specific product, a confidence level can be established about what can safely be made in advance and what can be left until after the order has arrived. The challenge is to reduce the economic batch quantity to one by challenging the current changeover time and cost (Gattorna, 1998:167). By adding the desired variety features at the optimal point, demand can be pooled for the different product options and final configured inventories kept to a minimum (Gattorna, 1998:203).

3.5.2.7 Theory of constraints

The Theory of Constraints looks for the weakest link in the chain. Both the internal and external chains should be considered. The weakest link of the internal chain defines the maximum possible output with the current resource availability (Ptak and Schragenheim, 2000:19). Any realistic planning should focus on the resource that lacks the most capacity (Ptak and Schragenheim, 2000:19). When the market demand is lower than the capacity of the critical resource, then the pace of the whole system should be fully dictated by the market demand. When the demand approaches the limit imposed by the most loaded resource, this particular resource, in turn becomes a capacity constraint resource. It is the balance between the demand and capacity constrained resource that dictates the actual pace of the system.

The Theory of Constraints is based on the following three basic principles (Ptak and Schragenheim, 2000:18):

- An organisation has a goal to achieve.
- An organisation is more than the sum of its parts: There should be synergy between the various parts of the organisation; otherwise there is no value in staying together within one organisation. The aim of synergy is to synchronise many different resources and activities in order to create value in the eyes of the customer. The synchronisation of the various parts generates many dependencies within the organisation.
- The performance of an organisation is constrained by very few variables: The Theory of Constraints defines a constraint as anything that limits the performance of the whole organisation versus its goal. Only a few constraints can be active at a time.

The Theory of Constraints is based on DBR Methodology, i.e. Drum-Buffer-Rope. The Drum must be protected from Murphy's Law. All the other parts of the system have enough flexibility to support the Drum, because of their excess capacity. Buffer, according to the Theory of Constraints, is designed to protect only the critical areas, those areas that control the performance of the whole system. In the Theory of Constraint terminology, they are the physical constraints of the system. The rope is the mechanism that guards that no materials will be released before the scheduled time. The Theory of Constraints logic points out that there is no point in fully utilising resources that have excess capacity (Ptak and Schragenheim, 2000:20-21).

There are normally two ways of dealing with bottlenecks. Firstly, a buffer inventory should be kept in front of the bottleneck to make sure that it always has something to work on. Because it is a bottleneck, its output determines the throughput of the system. Secondly, communicate back stream what the other production areas downstream have produced in order for the areas downstream to provide only the required volume. This keeps inventory from building up. This communication, called the rope, can either be formal, such as a schedule, or informal, such as a daily discussion (Chase, Aquilano and Jacobs, 2001:675).

It is the understanding and management of constraints within the manufacturing process that will provide the key to successful implementation of synchronous manufacturing. The throughput of the entire process is totally dependent on the rate of the slowest resource, or bottleneck. Bottlenecks govern both throughput and inventories (Gattorna, 1998:340).

According to the Theory of Constraints, the goal of a company is to make money (Chase, Aquilano and Jacobs, 2001:665). From an operations standpoint, the goal of the firm is to increase throughput while simultaneously reducing inventory and reducing operating expense (Chase, Aquilano and Jacobs, 2001:667).

3.5.2.8 Unbalanced capacity

In the past most manufacturers tried to balance capacity across a sequence of processes in an attempt to match capacity with market demand. However, unbalanced capacity is better (Chase, Aquilano and Jacobs, 2001:668).

In synchronous manufacturing thinking making all capacities the same is viewed as a bad decision. Such a balance would only be possible if the output times of all manufacturing stations were constant or had a very narrow distribution. A normal distribution in output times causes downstream stations to have idle time when upstream stations take longer to process. On the other hand, when upstream stations process in a shorter time, inventory builds up between the stations. The effect of statistical variation is cumulative. The only way to smooth the statistical variation is by increasing the work-in-progress to absorb the variation or by increasing the capacities downstream to be able to make up for longer upstream times. The rule is that capacities within the process sequence should not be balanced to the same levels.

Attempts should rather be made to balance the flow of product through the system. When flow is balanced, capacities are unbalanced (Chase, Aquilano and Jacobs, 2001:668).

3.5.2.9 Supply chain throughput efficiency

In general, most of the time spent in a supply chain is non-value adding time. To begin to make significant improvements in throughput efficiency firstly requires a detailed understanding of the processes and activities that comprise the total supply chain. A useful tool here is supply chain mapping (Christopher, 1998:113).

A supply chain map is a time-based representation of the processes and activities that are involved as the materials and products move through the chain. In these supply chain maps, it is usual to distinguish between horizontal time and vertical time. Horizontal time is time spent in process, for example, in-transit time, manufacturing or assembly time, time spent in production planning or processing. Vertical time, on the other hand, is time when nothing is happening and therefore the material or product is standing still as inventory. No value is being added during vertical time; only cost (Christopher, 1998:113-114).

3.5.2.10 Process throughput reduction

Critical processes are subject to the well-known rule that time is money. For example, the longer a customer waits, the more likely it is that he will switch to a different vendor. The longer material is kept in inventory, the higher the investment cost. Unfortunately, critical processes often depend on specific limited resources, resulting in bottlenecks (Chase, Aquilano and Jacobs, 2001:107).

Throughput time can sometimes be reduced without purchasing additional equipment (Chase, Aquilano and Jacobs, 2001:107-108). The following are a few suggestions for reducing the throughput time of a process that will not require the purchase of new equipment:

- Perform activities in parallel: Most of the steps in an operations process are performed in sequence. A serial approach results in the throughput time for the entire process being the sum of the individual steps plus transport and waiting time between steps. Using a parallel approach can reduce throughput time by as much as 80 percent and produce a better result. A classic example

is product development where the current trend is toward concurrent engineering. Instead of forming a concept, making drawings, creating a bill of materials and mapping processes, all activities are performed in parallel by integrated teams. Development time is reduced dramatically, and the needs of all those involved are addressed during the development process.

- Change the sequence of activities: Documents are often transported back and forth between machines, departments, buildings, and so forth. For example, a document might be transferred between two offices a number of times for inspection and signing. If the sequence of some of these activities can be altered, it may be possible to perform much of the document's processing when it comes to a building for the first time.
- Reduce interruption: Many processes are performed with relatively large time intervals between each activity. For example, purchase orders may be issued only every other day. Individuals preparing reports that result in purchase orders should be aware of deadlines to avoid missing them, because improved timing in these processes can save many days of throughput time.

By performing a value-added analysis, focussed on eliminating the non-value adding activities, the manufacturer can reduce customer order lead times, save cost and employee time per order and increase customer satisfaction.

3.5.2.11 Postponement

Many companies are now seeking to construct supply chains to enable them to support a marketing strategy of mass customisation. The challenge is to find ways of achieving the marketing goal of tailored solutions for their customers' requirements without increasing finished goods inventory and without incurring the higher costs of production normally associated with make-to-order.

Often this can be achieved by postponing the final configuration or assembly of the product until the actual customer requirement is known (Christopher, 1998:210). For example, Hewlett-Packard factories used to ship complete finished goods to distribution centres and then on to dealers. After adopting a policy of postponement,

products were shipped in a generic state. Local features were then added for each specific market segment at the point of distribution (Hughes, Ralf and Michels, 1999: 17).

The differentiation of products closer to customers is regarded as one of the seven principles of supply chain management (Berger & Gattorna, 2001: xiii).

Postponement, also called delayed differentiation or freeze-point delay, is the most exciting innovation towards design for supply. The basic idea of postponement is to build products in generic form at the plant, ship them to the distribution centres close to their destinations and then perform the final operations that result in a product. Postponement offers greater economies of scale in both production and transportation and also increases a company's flexibility to respond to changing demand (Taylor, 2004:311).

The postponement technique has several advantages. First, it allows products to be specialised to different markets without compromising economies of scale in production and transportation. Postponement allows specialisation to be done close to the customer. The manufacturing plant regains economies of scale by producing large batches of generic product and customers continue to get the variety they want (Taylor, 2004:312).

Another benefit of postponement is that it takes advantage or risk pooling to reduce inventory requirements. Postponement achieves risk pooling by combining the inventories for an entire family of products into a single pool, significantly reducing the total inventory that must be kept in each region (Taylor, 2004:313). Inventory can be held at a generic level so there will be fewer stock-keeping variants and hence fewer inventories in total. Because inventory is generic, a company's flexibility is greater, meaning that the same components, modules, or platforms can be used in a variety of end products (Christopher, 1998:136).

Postponement relies less heavily on forecasting. Production can be based on aggregate forecasts, which are always more accurate than detailed forecasts. Postponement allows the variations of a generic product to be pulled through the

chain by immediate demand, rather than being pushed down the chain based on uncertain, item-level forecasts. At the same time, postponement offers an economical way of increasing the level of customisation by allowing minor variations to be determined all the way out to the point of sale (Taylor, 2004:313). Forecasting is also easier at the generic level than at the level of the finished item. The last point is particularly relevant in global markets where the local forecasts will be less accurate than a forecast for worldwide volume (Christopher, 1998:136-137).

Postponement is a form of design for supply and therefore needs products to be designed and constructed in a modular way, making it easy for downstream facilities to assemble the final configuration. In the case of computer peripherals, for example, it may be necessary to redesign the power supply as a plug-in module rather than building it into the chassis (Taylor, 2004:313).

Postponement requires a change of the role of distribution centres. The role of distribution centres requires changing from the storage and handling operations to performing final product assembly. If the distribution centres lack the space, equipment, or skills necessary to perform the final assembly, converting to postponement can lead to increases in defects, delays and other production problems (Taylor, 2004:313-314).

If transforming distribution centres into final assembly is not a viable postponement option, it can still be applied within the main manufacturing plant. The increased flexibility that comes from delaying differentiation may still justify the change. Benetton, for example, changed the sequence of operations involved in making its sweaters, dyeing the final sweater rather than dyeing the wool prior to weaving. Although this change increased the cost of production by 10%, it produced net benefits, because it allowed the company to respond much more quickly to emerging preferences among colours (Taylor, 2004:314).

If the final configuration process is quite simple, or if retailers have special skills, it is possible to extend postponement to the point of purchase (Silver, Pyke and Peterson, 1998:474), (Taylor, 2004:314). Bicycles, for example, are specially configured for individual consumers. It is even possible for final configuration to occur

in the consumer's own home, as in the case of home entertainment systems (Taylor, 2004:314).

Postponement offers many potential benefits, but it is not without its costs and challenges. The challenges of postponement include quality and organisational problems when assembly is pushed down the supply chain. Modularisation of the product and the re-sequencing of operations may increase the cost of production. The challenge of postponement is that the technique should produce net savings (Taylor, 2004:314-315). The postponement technique works best if the variety of configurations from a common base product is large, and the demand across configurations is hard to predict. Postponement also works well with innovative products, such as clothing and consumer goods. Hewlett Packard, for example, even used postponement with desk jet printers which are relatively mundane products (Taylor, 2004:315).

The best effective approach is to use postponement selectively across product lines, applying it only where the advantages outweigh the cost. A company could keep the bulk of its production in its factories where it is cheaper and easier to manage, safety stock in downstream facilities could be reduced, and the ability to respond to unexpected demand at the point of sale is increased (Taylor, 2004:315-316).

To successfully use postponement, there are at least four enablers or building blocks that will help to make it easier (Gattorna, 1998:88):

Firstly, products or processes should be modular in structure. Product modularity is the ability to build and test the product in modules, rather than as a complete unit, and requires the module interface to be redesigned so that these modules can easily be assembled and tested as a total unit. Process modularity allows a process to be completed in sub-processes, often leading to shorter lead times and flexibility in meeting the demand of multiple end products (Gattorna, 1998:88).

Secondly, design engineers should be aware of the importance of supply chain management, so that they are keenly pursuing design for postponement opportunities (Gattorna, 1998:88).

Thirdly, postponement involves multiple functions or organisations in collaboration. For example, postponement may require a supplier to design a standard component. Logistics postponement may require distribution centres or the channel partner to take over some customisation steps that used to be carried out by manufacturing. Research and development functions also have to be involved. In some cases, pull postponement requires marketing to reposition the product in the marketplace (Gattorna, 1998:89).

Finally, the degree of postponement must be determined. To determine whether this would be best for the company, and to be able to justify it requires the ability to quantify the costs and benefits of postponement. Analytical models are often helpful as a means to help motivate or justify postponement (Gattorna, 1998:89).

3.5.2.12 Rethink distribution options

In the past, delivery frequencies were driven by transport economies. Product was shipped only when there was enough to fill the lorry or even the boat. Being responsive, however, requires that shipping corresponds, not only with distribution economies, but also with customer needs. A company can join a larger supplier of the same customer if the locations are convenient. Where other suppliers are not available, another option is to form a consortium with other smaller suppliers, to use a nominated carrier and share the costs. Third-party suppliers and service providers are increasingly able to provide a shared service with those inside and outside the industry and therefore provide the necessary economies of scale. Many supermarket chains are developing distribution service offerings, collecting suppliers' product from the factory gate in return for being charged just the factory gate price (Gattorna, 1998:168).

3.6 Improving visibility of demand

The extension of the customer's order cycle does not mean that customers have to be persuaded to wait longer for the delivery of their order. What is meant by extending the customer's order cycle is that we should seek to obtain significantly earlier warnings of the customer's requirements. The two problems are that, first of all, the demand penetration point is too far down the pipeline and secondly, that the demand is hidden from view and what one tends to see are orders (Christopher, 1998:172).

The demand penetration point is the point in the supply chain where the real demand meets the plan (Christopher, 1998:172). The decoupling point is the point that indicates how deeply the customer order penetrates into the goods flow. This is also the point where the order-driven activities meet the forecast-driven activities. It is the place where the independent demand is converted into dependent demand (Hoekstra & Romme, 1992:66). Ways must be identified to push the demand penetration point as far as possible upstream. Marketplace data, for example, can be shared with manufacturing and purchasing. Another route would be to shift the order penetration point upstream by postponing the final commitment of the product to its final form (Christopher, 1998:173).

Perhaps the greatest opportunity for extending the customer's order cycle is by gaining earlier notice of their requirements. In so many cases, the supplying company receives no indication of the customer's actual usage until an order arrives. If the supplier could receive feed-forward on what was being consumed, he would be able to anticipate the customer's requirements and better schedule his own supply chain activities. In a sense, the information we receive is like the tip of an iceberg. The area below the surface of the iceberg represents the ongoing consumption, demand or usage of the product which is hidden from the view of the supplier. It is only when an order is issued that demand becomes transparent (Christopher, 1998:173).

3.6.1 Causes of induced demand volatility

As businesses became more competitive and used promotions to increase demand, it became apparent in some industries, especially consumer packaged goods and retailing, that man, more than nature controlled what would happen in the future. Methods were used that would look at the past and determine man's impact on the demand. Once this impact was understood, it could be used to forecast the future. So the philosophy of today is primarily the one expressed by Leibniz and Chesterton: We can predict the future, for the most part, based on some understanding of peoples' effect on demand, which is expressed in seasonal and trend buying patterns and responses to promotions and business cycles. The term "for the most part" is fitting because while demand forecasting is largely about understanding the reasons behind fluctuations in demand; it is just as important, though, to recognise and cope with the uncertainty that remains. This involves such measures as contingency planning, inventory safety stock and excess capacity which are designed to deal with uncertainty in demand (Lapide, 1997).

Given the resultant cost and complexity, organisations have a real interest in identifying and addressing the causes of demand volatility. While organisations may never achieve a perfectly smooth demand curve, organisations can certainly understand and address their self-induced drivers of demand swings. The primary causes of demand volatility are terms of trade; promotions and pricing; specific company policies and distribution channel structure (Gattorna, 1998:143).

3.6.1.1 Terms of trade

Terms of trade or credit terms refer to the conditions under which organisations require customers to pay for their purchases (Gattorna, 1998:144).

By fixing a regular date of payment, organisations provide customers with an ideal regular date for purchase. In order to maximise credit terms, customers will order at the beginning of each month, effectively giving them 60 days credit instead of 30 days (Gattorna, 1998:144).

Organisations need to be clear about credit terms, communicate those terms effectively to customers, manage them to reduce volatility and plan their production and supply chain processes accordingly (Gattorna, 1998:145).

3.6.1.2 Promotions and pricing

Organisations have many reasons for offering price discounts or bulk purchase discounts for moving large quantities of product in a short period of time. Often, however, these discounts create demand disturbances that greatly distort the demand placed on organisations and do not represent the consumer's real end consumption or underlying demand (Gattorna, 1998:145).

A similar effect is created when organisations give customers, such as wholesalers, advanced warning of price increases. In this situation, customers will buy in bulk to lock in more purchases at a reduced cost, this again bringing forward future consumption (Gattorna, 1998:147).

The problem can further be exacerbated when the sales promotions are unplanned, thereby giving the supply chain insufficient time to plan replenishment and increase production to meet the increase in demand (Gattorna, 1998:147).

3.6.1.3 Specific company policies

Organisations frequently put in place policies that result in customers adjusting their buying behaviour in an attempt to maximise the benefit of these policies. The resulting effect is that the policies distort customer behaviour, causing demand volatility (Gattorna, 1998:147).

Minimum order quantities are a good example of policies which distort customer ordering behaviour and drive volatility (Gattorna, 1998:149).

Another way in which to reduce volatility is to reduce the production lot sizes and lead times of production and /or procurement. This is the secret behind Kanban or pull system replenishment systems (Ptak and Schragenheim, 2000:144).

3.6.1.4 Distribution channel structure

The longer the distribution channels, the greater the distance between supplier and end customers. As a result, intermediaries stagger their ordering and generate demand volatility. The greater the number of channel members, the greater the number of opportunities for demand to be distorted (Gattorna, 1998:149). Long lead times could create a vicious circle. The longer the quoted lead time, the more time we give the customer to change his mind which causes last minute changes. The impression might be that the quoted lead times are not long enough which prevents a company from cutting lead times (Goldratt, 1990:65).

Effective demand management is achieved when an organisation is no longer driving customer behaviour in a way that adversely affects organisational and /or supply chain performance. Some of the significant benefits of effective demand management include: reduced risk due to higher demand certainty; reduced inventory levels; improved customer service; improved visibility of real or end customer demand; reduced reliance on forecasting; improved forecasting accuracy and fewer staff required to cover demand peaks (Gattorna, 1998:151).

Customers will never be completely predictable, but organisations can ensure that they themselves are not creating volatile customer demand patterns. Effective demand management represents a significant and often unexplored opportunity for organisations to simplify their supply chain operations. The power of demand management lies in the fact that demand volatility is often induced by organisations through their own policies and procedures. Consequently, it is within a company's capability to control and influence the demand volatility for its own benefit (Gattorna, 1998:153).

3.6.2 Importance of supply chain communication

Communication is regarded as the most important skill in life (Covey, 1990:237).

The advent of information technology has made the exchange of information between supply chain partners easy and advantageous. The sharing of common information has resulted in a quicker response to market place changes with less inventory and lower risk of obsolescence (Christopher, 1998: 235).

Feedback is the lifeblood of supply chains, and many of the supply chain improvement initiatives are designed to improve the flow feedback up the chain (Taylor, 2004:86). One of the advantages of vendor-managed inventory, for example, is that it lets suppliers monitor inventory levels directly in distribution centres and retail outlets, giving them much earlier feedback on the flow of products and allowing them to tune their production accordingly. The use of point-of-sales systems in the quick response programme improves feedback by pushing the flow of information all the way out to the cash register and detecting the movement of goods the moment it occurs (Taylor, 2004:86), (Christopher, 1998:195), (Gattorna, 2000:387), (Jain, 1994:2).

The free exchange of information across the supply chain provides the feedback necessary to regulate the flow of supply, demand and cash across the chain (Taylor, 2004:86).

The great power of feedback in supply chains is that it reduces uncertainty by giving companies advance information about upcoming variations in demand and supply, allowing them to cope better with these variations. Without this advance notice, the only protection against variability in supply and demand is to hold enough inventory to handle the greatest demand and the lowest supply that are likely to occur, and inventory is a very expensive form of insurance (Taylor, 2004:86). The fact that information can reduce the need for inventory has led to systematic efforts within many industries to replace inventory with information wherever possible. Substituting information for inventory is one of the most vital aspects of supply chain management (Taylor, 2004:86-87).

The use of these logistics information systems has the potential to convert supply chains into demand chains in the sense that the system can now respond to knowing what the demand will be, rather than having to anticipate that demand through a forecast (Christopher, 1998:199).

3.6.3 Increasing pipeline visibility

One of the main reasons why any company carries safety stock is because of uncertainty. A key to improving reliability in logistics processes is enhanced pipeline visibility. It is often the case that there is limited visibility of downstream demand at the end of the pipeline. This problem is exacerbated the further removed from final demand the organisation or supply chain entity is (Christopher, 1998, 32).

Small disturbances in one part of the system can very quickly become magnified as the effect spreads through the pipeline. Many consumer product companies that are heavy spenders on trade promotions, like additional discounts and incentives, do not realise what the true costs of such activities are. In the first instance, there is a loss of profit through the discount itself, and then there is the hidden cost of the disturbance to the logistics system. The promotional activity can trigger the 'acceleration effect' and hence create a Forrester-type surge throughout the logistics pipeline (Christopher, 1998: 204). Such unpredictable changes in the production requirement add considerably to the unit cost of production (Christopher, 1998: 206).

The surge effect can be dramatically reduced by linking the retail checkout desk to the point of production by means of electronic data transfer (Christopher, 1998:207).

Sharing sales information has been viewed as a major strategy to counter the so-called 'bullwhip effect'. This is essentially the phenomenon of demand volatility amplification along the supply chain, from the retailers, distributors, manufacturer, and the manufacturers' suppliers, and so on. Demand distortion can create problems for suppliers, such as inaccurate demand forecasts, low capacity utilisation, excessive inventory and poor customer service. By letting the supplier have visibility

of point-of-sales data, the harmful effect of demand distortion can be minimised (Lee, So and Tang, 2002:626).

It is also noteworthy that most information- sharing takes place during a product's or product line's "middle life," when execution-type decisions involving suppliers, original equipment manufacturers, distributors, retailers and customers predominate. However, the biggest impact of advanced economic information- sharing is usually manifested at the beginning and at the end. Tighter collaboration at the design and launch stage, for example, might periodically change companies' decisions as to how much of a new product to make, where it should be made, or how it should be priced. Better communication at the tail end—the "retire" stage—could help avoid huge backlogs of unsold or heavily discounted product (Derrick, 2003).

Increased sharing of economic information can help align true customer demand with supply, thus removing variability—and therefore costs—from several major supply chain processes (Derrick, 2003).

The most well known implementation of demand information sharing is Wal-Mart's Retail Link programme, which provides an on-line summary of point-of-sales data to suppliers such as Johnson and Johnson and Lever Brothers (Lee, So and Tang, 2002:626).

Demand information by a downstream operator to his supplier is the cornerstone of initiatives such as Quick Response (QR) and Efficient Consumer Response (ECR) (Lee, So and Tang, 2002:626). Information- sharing is also embedded in programmes such as Vendor-Managed Inventory (VMI) or Continuous Replenishment Programmes (CRP) (Lee, So and Tang, 2002:626). By sharing information, supply chains are enabled to become demand chains and in so doing to deliver enhanced customer value (Christopher, 1998:239).

The power of Efficient Consumer Response lies in co-operation and the sharing of information and expertise between trading partners towards a common goal of increased consumer satisfaction (Gattorna, 1998:106). The two key drivers for inventory reduction through Efficient Consumer Response programmes in the

consumer supply chain are a smoother flow of products from manufacturer to retail shelf and better alignment of production quantities and retail sales (Gattorna, 1998:111-112).

Consumers are getting used to being provided with the products they want, when they want them and in the manner they want them. Even products that were once restricted by geographic coverage or higher pricing are now becoming widely available. Consumers can now buy goods via the Internet, consumer direct channels and home shopping television networks.

The shift in consumer expectations has two implications. Firstly, it is much more difficult to understand and predict consumer behaviour; and secondly, organisations have to manage the availability of their product lines effectively if they are to succeed in meeting customer requirements.

One way to achieve this goal is to get closer to consumers and tailor internal company processes to meet their needs. Once companies align their internal processes, further opportunities for improvement lie in integrating this information across all supply chain partners: contractors, co-packers and suppliers. Integration throughout the supply chain results in more positive decision-making, a shorter, consolidated supply chain, reduced inventory levels and more responsive customer service (Gattorna, 1998:123).

3.6.4 Managing the different demand streams

What a company is trying to forecast is the most fundamental question to resolve when dealing with forecasts. The usual answer is that it is trying to forecast customer demand, with demand defined as: what customers want and when they want it. A good forecast of demand, far enough into the future, allows the organisation to invest only in the facilities, materials, equipment and staffing that it needs (Gilliland, 2003:7).

If customers place orders to express their demand and if the organisation gives quality service to its customers by filling all orders in full and on time, then the demand is quite simply the order and shipment quantity. If both order and shipment data are readily available in the company's system, then the historical demand data is available and can be used in statistical forecasting models (Gilliland, 2003:7).

Unfortunately, few organisations give quality service to their customers. As such, orders are not a perfect reflection of true demand. When customer service is less than perfect, orders are subject to all kinds of gamesmanship (Gilliland, 2003:7-8). A few examples are:

- An unfilled order may be rolled ahead to another bucket. The demand or order appear in a time bucket later than when it was really required by the customer. Rolling unfilled orders causes demand to be overstated – the orders appear in the original time bucket, and again in future buckets until the demand is filled or the order is cancelled.
- If shortages are anticipated, customers may artificially inflate their orders to capture a larger share of an allocation. The customer in the second example, has advanced knowledge that product is scarce and will be allocated. The customer simply over-orders and ultimately may receive what was really required in the first place.
- If shortages are anticipated, customers may withhold orders, or direct their demand to alternative products or suppliers. The use of orders is contaminated and the true demand is not reflected. If a company is in a situation of chronic supply shortages, due to either supply problems or much higher than anticipated demand, customers may simply go elsewhere. Customers may truly want the product, so there is real demand, but the true demand will not be reflected in the historical data, because no orders were placed.

The ability to develop an operational definition of demand that fits its organisation is a serious problem for most companies (Gilliland, 2003:8).

For many years, monthly factory shipment data was the only type of demand information available to manufacturers for forecasting product consumption. Although

factory shipment data does not provide the best consumption forecasts, manufacturers were left with few alternatives. Other demand data better suited to forecasting consumption was either difficult or expensive to acquire (Kiely, 1999: 3).

The combination of new information technology and co-operative supply chain partnerships has made the sharing of consumption-based forecasting information possible in real time. The results of these developments have been traumatic: improvements in product-forecast accuracy, reductions in supply chain inventories and efficiency in product distribution (Kiely, 1999: 3).

Instead of monthly forecast shipment information, manufacturers have begun to use four other types of demand data to drive demand planning systems. Alternative data comprise the following: (1) customer forecasts, (2) consumer purchases, (3) customer warehouse withdrawals, and (4) customer orders (Kiely, 1999: 3). Collectively, this customer-supplied data can be used to form the basis for bottom-up product forecasts which, when aggregated and rolled back up the supply chain, more accurately predict independent demand than do factory shipment-based forecasts (Kiely, 1999: 3).

Independent demand forecasts are typical projections of historical demand patterns. As such, it is assumed that independent demand is derived from point-of-sale based consumption data, since consumption is beyond the control of suppliers, manufacturers and retail customers. The primary reason for using customer-supplied point-of-sale information, as opposed to factory shipment data, is to drive the demand planning system with independent demand. Demand planning systems driven by point-of-sale based forecasts are best suited for synchronising supply chain plans with consumer demand (Kiely, 1999: 3-4).

Dependent demand, on the other hand, is directly related to, or derived from the bill of material structure of other items or distribution requirements. Dependent demand needs to be forecasted, since it can be calculated through Material Requirements Planning (MRP) or Distribution Requirements Planning (DRP) (Kiely, 1999: 4).

3.6.4.1 Customer-supplied forecasts

The first type of customer-supplied information is demand forecasts. Some retailers, instead of supplying raw demand data, provide ready-made forecasts to their manufacturers. Wal-Mart and Target, for example, have established collaborative forecasting and replenishment programmes whereby a simple four-week moving average of sales data output from their IMB INFOREM inventory re-order point systems is sent to the manufacturer via EDI. Manufacturers can then compare these forecasts with their own to arrive at consensus forecasts. Customer-supplied forecasts are based upon point-of-sale data derived directly from the retailers' checkout counters. Consequently, point-of-sale based forecasts of consumption produced by customers are more accurate than those derived by vendors that do not use point-of-sale data (Kiely, 1999: 4-5).

3.6.4.2 Point –of-sale data streams

Research has shown that statistical forecast models based upon point- of- sale time-series- data are the best for predicting consumption. The major benefit of using customer point- of- sale data is that it captures consumer take away; and as such, it reflects true independent demand. Real time, high frequency data can be extremely useful for examining performance of new product launches. By comparison, syndicated consumption data suffers a delayed effect. It requires long lead times of up to 21 days to collect, process and transmit consumption data to its subscribers. (Kiely, 1999: 5).

Point- of- sale data generally does not contain erratic fluctuations, which are typical of demand patterns that occur at points further upstream in the supply chain. Customer demand captured further upstream exhibits more variation since this is where the disturbance due to special promotions and trade deals originate (Kiely, 1999: 5).

Point- of- sales data does have some disadvantages that must be considered. One is that it can sometimes be unreliable, due to inaccurate scanning at the check out

counter. Improperly scanned point- of- sale data must be cleared before loading into historical demand database tables. Another challenge of point-of-sale data is the need to extrapolate total demand from data collected from only a few key accounts, particularly when the market share is fluctuating (Gattorna, 1998:129).

The greatest disadvantage of point- of- sale data is the extreme amount of detail, which renders it unusable for most Material Requirements Planning (MRP) or Distribution Requirements Planning software applications. For use in a manufacturer's demand planning system or retail store point- of- sales data needs to be aggregated (Kiely, 1999: 5).

Where point-of-sale based customer forecast information is not available, aggregated point- of- sale information is the next best data stream which can be used to forecast consumption (Kiely, 1999: 5).

3.6.4.3 Customer warehouse movement data

Where aggregated point- of- sale data is not available, customer warehouse movement data is the next best alternative for forecasting consumption (Kiely, 1999: 6).

The major disadvantage of using warehouse movement data to forecast independent demand is that it reflects dependent demand. Another disadvantage is that some vendor- managed inventory customers transmit warehouse withdrawal data in higher units of measure, for example cases or pallets. This is because warehouse movement demand data is one step away from the final point of consumption, and the higher variation reflects the way in which the retailers pull cases or pallet quantities from the warehouse racking for store replenishment (Kiely, 1999: 6).

3.6.4.4 Customer order data

When a manufacturer cannot obtain point- of- sale data or warehouse movement data, either directly through customers' systems or indirectly through third parties, customer order history could be used as an alternative for independent demand (Kiely, 1999: 6). A major advantage of using customer order data is that it is easily obtained by daily or weekly capturing through the company's order management system (Kiely, 1999: 6).

There are primarily three disadvantages of using order history to predict consumer demand (Kiely, 1999: 6):

Firstly, like warehouse movement data, customer order data reflects dependent demand and does not capture consumer take away in the current period. Rather, order data reflects what the customer believes his product stocking requirements will be to meet consumer demand adequately in the future. Consequently, customer order quantities include safety stock requirements, as well as expected sales. Customer order history therefore, is more useful if the forecasting objective is to predict customers' warehouse replenishment quantities (Kiely, 1999: 6).

Secondly, order data is normally transmitted in customer units of measure, such as cases or pallets, which increase variation. Order data-based forecasts have larger errors than those that are based on point- of- sale data (Kiely, 1999: 6).

The third disadvantage of using purchase order history is that in a no backorder environment, order quantities that cannot be filled during the current order cycle are cut from the purchase order. Customers tend to over- compensate for poor product supply by adding the current order cycle's cut order quantity to the next cycle's purchase order. If product supply problems continue for many weeks, customers tend to continue re-ordering accumulated quantities in an attempt to replenish depleted inventories. It becomes necessary, therefore, to clean order history that is captured during stock out periods (Kiely, 1999: 7).

Despite its disadvantages, order data is still preferable to factory shipment data for predicting consumer demand, because it is closer to the final point of sales (Kiely, 1999: 6).

3.6.4.5 Factory shipment data

Factory shipment data has two advantages when used for purposes other than forecasting consumption: The first advantage is that factory shipments provide a good financial cash flow forecast. Once shipments are released, one can estimate the timing and quantity of account receivables. The second advantage of using factory shipment data is that it is inexpensive and easy to obtain from the invoicing system (Kiely, 1999: 8).

However, when used to forecast independent demand, factory shipments suffer from three disadvantages (Kiely, 1999: 8):

Firstly, factory shipments represent movements in product supply, not changes in demand. By forecasting shipments, demand plans ignore what is actually demanded and consider the vendor's ability to fulfil the demand (Kiely, 1999: 8).

Secondly, shipment data is very volatile for manufacturers that have synchronised production with consumption. The factors that create fluctuations in the demand patterns are erratic customer inventory levels, irregular customer order quantities, highly variable replenishment lead times and rapid inventory building at the customer distribution centres in anticipation of promotions. These factors that create fluctuations in the demand patterns are very difficult, if not impossible to decompose, isolate, and remove from the shipment history (Kiely, 1999: 8). Companies should consider the impact of predicting demand using constrained historical demand (Langabeer & Stoughton, 2001:9).

Thirdly, the underlying seasonality of shipment data may not be a true representative pattern of consumer purchases, but rather created artificially by the pipeline push

strategies that some manufacturers employ to meet corporate financial targets (Kiely, 1999: 8).

Large errors are often associated with consumption forecasts that are based on factory shipment data. The traditional approach to compensating for such errors has been to carry enough safety stock, the cost of which far outweighs the savings incurred by accessing and storing shipment information (Kiely, 1999: 8).

Factory shipment data should only be used as a last resort to forecast consumption and to drive production plans when other types of customer demand data is not available (Kiely, 1999: 8).

3.7 Conclusion

This chapter describes the importance and challenges for supply chains to align supply and demand. Matching supply and demand is the fundamental cornerstone of the logistics process. (Christopher and Peck, 2003:85). Retailers and manufacturers in many product categories have struggled to put together a match between supply and demand (Gattorna, 1998:171). The costs of a mismatch between the supply and demand, measured as the combination of inventory carrying costs, markdown costs and stockout costs, are growing in many industries. Companies have tried to reduce these costs through better demand forecasting, improved production and inventory planning, increased production capacity and reduced set-up and transportation lead times. Companies have also tried to manage the demand process through pricing policies intended to smooth the arrival pattern of customers. These approaches, while useful, have failed to address a number of drivers of supply-demand mismatch (Gattorna, 1998:172).

Most organisations face a fundamental problem: the time it takes to procure, make and deliver the finished product to a customer is longer than the time the customer is prepared to wait for it. This is the basis of the lead-time gap (Christopher, 1998:167). This gap could be reduced by shortening the logistics lead time whilst simultaneously

trying to move the customer's order cycle closer by gaining earlier warning of requirements through improved visibility of demand (Christopher, 1998:169). The benefits of reducing the lead-time gap within a supply chain include higher customer service, higher customer responsiveness, an improvement in the balance between supply and demand and a reduction in inventory (Gattorna, 1998:158-160).

Firstly, a company should investigate various options to reduce the demand lead-time within its supply chain. Most of the demand volatility within a supply chain is often induced by organisations through their own policies and procedures. Consequently, it is within a company's capability to control and influence the demand volatility within its supply chain (Gattorna, 1998:153). Sharing sales information, for example, could counter the so-called 'bullwhip effect' which is essentially the phenomenon of demand volatility amplification along the supply chain, from the retailers, distributors, manufacturers, and the manufacturers' suppliers, and so on. (Lee, So and Tang, 2002:626).

By sharing information, it enables supply chains to become demand chains and in so doing to deliver enhanced customer value (Christopher, 1998:239). A company should consider the benefits and costs of using different demand data to drive demand planning systems carefully. Examples of the various alternative demand data streams include customer forecasts, consumer purchases, customer warehouse withdrawals and customer orders (Kiely, 1999: 3). Factory shipment data, for example, should only be used as a last resort to forecast consumption and drive production plans when other types of customer demand data is not available (Kiely, 1999: 8).

A supply chain should move from supplying customers indiscriminately according to forecasted demand, to supplying customers with precision according to their actual demand and their stated requirements (Gattorna, 1998:41). If information on actual customer usage of a product is linked directly to a company's logistics system, the need for the forecast is reduced. This is the concept of substituting information for inventory. A company's total response time can be reduced by capturing information at the point- of- sale and swiftly transferring the details to the point of production (Christopher, 1998:263).

Secondly, a company should investigate various options to reduce the supply lead-time within its supply chain. Examples of strategies that could reduce supply lead time include the following: removing activities that only add cost (Christopher, 1998:116); improving the frequency, accuracy and reliability of deliveries (Christopher, 1998:121); pooling risk and inventory of various stock locations (Taylor, 2004:301); removing slowdowns and queues in the supply chain (Taylor, 2004:299); simplification, commonality and standardisation throughout the supply chain (Taylor, 2004:308), (Kobert, 1992:91), (Harmon, 1992:170), (Hughes, Ralf and Michels, 1999:50), (Harmon & Peterson, 1990: x-xii), (Chase, Aquilano and Jacobs, 2001:151-152); the use of modularity in product design (Taylor, 2004:308-309); balancing the flow, and not the capacities, of product through the system (Chase, Aquilano and Jacobs, 2001:668); and postponing the final configuration or assembly of the product until the actual customer requirement is known (Christopher, 1998:210). There is a fundamental shift in supply chains from the economies of scale, which is volume-based and implies long production runs with few change-overs, to the economies of scope which is based upon producing small quantities of a wider range, hence requiring more change-overs (Christopher, 1998:209). The management review of the future will focus on performance, rather than profitability. The main reason is that performance drives profitability. Therefore, if the performance improves, the profit will also improve (Christopher, 1998:261-262). A customer service- focussed company, for example, should identify the costs and profitability of giving quality service to customers (Christopher, 1998:262).

The companies that have succeeded in breaking down the functional silos are now looking to forge ever closer linkages with their supply chain partners. A key to supply chain integration is the open flow of information from one end of the pipeline to another. By sharing information, supply chain partners are able to respond more rapidly to known demand and to do with less inventory in the system as a whole and, hence, at lower costs (Christopher, 1998:248). The key to effective supply chain management is in closing the gap between day-to-day changes in the supply chain and the company's ability to recognize and respond to them. Specifically, companies must be able to identify these changes as they occur, to quickly understand their potential impact and to act immediately to deal with them (Valdero, 2002).

In practice, the objectives of the various parties involved in a supply chain are often in conflict with each other. If the conflicts are not detected and eliminated, a company will work against itself, exerting greater effort but reducing its ability to make any real progress (Taylor, 2004:239-240). The only way to do this is to align objectives across all the groups involved in managing the chain. (Taylor, 2004:241). A company should align the individual, departmental and organisational goals within the company (Kaplan and Norton, 1996:139).

Matching supply and demand is the fundamental cornerstone of the logistics process. Conventional business uses the forecast in an attempt to predict demand. However, because today's market place is considerably more volatile and, as a result, less predictable, it has become necessary to seek alternative approaches to demand management. The way forward is to substitute information for inventory and in the process become more responsive to real demand (Christopher and Peck, 2003:85).

CHAPTER 4: THE SUPPLY CHAIN OF KRAFT FOODS SOUTH AFRICA

4.1 Introduction

For over two hundred years, many companies have united to make Kraft Foods what it is today. The story begins with a business that is older than the United States. It started before the Revolution, in Dorchester, Massachusetts, when, in 1765, a local physician, Dr. James Baker, went into partnership with a young Irish chocolate-maker, John Hannon. It was America's first chocolate mill, where, in 1780, they made a blend of quality chocolate called BAKER'S® chocolate. BAKER'S chocolate was the first of a long list of companies that joined Kraft Foods, Inc., in making good food for busy families (Kraft, 2004).

Kraft has many highlights in its long history. See below just some of the highlights from Kraft's product and corporate history.

TABLE 4.1: HIGHLIGHTS OF KRAFT'S HISTORY

Year	Key points in Kraft's corporate history
1765	BAKER'S® chocolate
1880	Production starts for PHILADELPHIA BRAND Cream Cheese
1889	CALUMET® baking powder launched
1892	MAXWELL HOUSE® coffee launched.
1895	POSTUM®, the cereal beverage, launched
1897	GRAPE-NUTS® cereal launched on the market.
1897	JELL-O® brand gelatine launched
1899	Rights to the JELL-O brand gelatine bought from Mr. Wait
1902	"America's most favourite Dessert" for JELL-O gelatine launched
1903	J.L. Kraft establishes a wholesale cheese business in Chicago.
1905	John Arbuckle creates a blend of coffee which he calls YUBAN® coffee.
1906	Oscar Mayer® is one of the first meatpackers to obtain the Federal Meat Inspection approval.

Source: Kraft Foods Inc., 2005

TABLE 4.1 CONTINUED

Year	Key points in Kraft's corporate history
1907	Legend has it that when President Theodore Roosevelt is served a cup of MAXWELL HOUSE® coffee, he says that it is "GOOD TO THE LAST DROP."
1908	C.W. Post introduces POST TOASTIES® corn flakes.
1914	J.L. Kraft & Bros. Co. opens its first cheese factory in Stockton, Illinois. A year later, they begin producing process cheese in tins.
1917	J.L. Kraft & Bros. supplies cheese in tins to U.S. government for the armed forces in World War I.
1927	KOOL-AID® powder beverage launched.
1927	Start selling SANKA® decaffeinated coffee (first sold in the U.S. in 1923).
1928	Kraft introduces an American favourite, VELVEETA® process cheese.
1933	Kraft introduces MIRACLE WHIP® salad dressing at Chicago's Century of Progress World's Fair.
1936	Little Oscar and the WIENERMOBILE make their first appearance for Oscar Mayer & Co.
1937	The KRAFT® Macaroni and Cheese Dinner is introduced with the slogan, "Make a meal for 4 in 9 minutes."
1946	MAXWELL HOUSE instant coffee is introduced after it was used by the armed forces in World War II.
1949	MINUTE® Rice is rolled out for national distribution.
1950	KRAFT® Deluxe process cheese slices - the first commercially packaged sliced process cheese - are introduced.
1952	CHEEZ WHIZ® pasteurised process cheese spread is introduced (goes national in 1953).
1954	Kraft introduces CRACKER BARREL® brand natural cheese.
1957	General Foods Corp. introduces TANG® breakfast beverage crystals.
1963	The "wiener jingle" first appears in Oscar Mayer commercials.
1965	General Foods Corp. introduces SHAKE 'N BAKE® coating mix into test markets
1966	General Foods Corp. introduces COOL WHIP® non-dairy whipped topping.
1972	STOVE TOP® stuffing mix is introduced.

Source: Kraft Foods Inc., 2005

TABLE 4.1 CONTINUED

Year	Key points in Kraft's corporate history
1973	GENERAL FOODS INTERNATIONAL COFFEES® flavoured coffees are introduced.
1981	General Foods Corp. acquires Oscar Mayer & Co.
1983	Kraft introduces LIGHT N' LIVELY® low fat yoghurt six-pack, the first in the U.S. to use this convenient design.
1985	General Foods Corp. becomes part of Philip Morris Companies Inc.
1986	Kraft acquires Tombstone Pizza Corp. of Medford, Wisconsin (est. 1962).
1988	Kraft, Inc. becomes part of Philip Morris Companies Inc.
1988	Oscar Mayer introduces LUNCHABLES® Lunch Combinations line of convenient lunchtime meals which include meat, cheese and crackers.
1989	Philip Morris Companies combines Kraft, Inc. and General Foods Corp. to form Kraft General Foods, the largest food company in the U.S.
1989	DI GIORNO® brand refrigerated pastas and sauces are introduced.
1993	Kraft General Foods acquires NABISCO ready-to-eat cold cereals from RJR Nabisco.
1995	Kraft General Foods is reorganized into one operating company -- Kraft Foods, Inc.
1995	DI GIORNO® RISING CRUST® pizza is introduced in test markets in February.
1996	In September, Kraft Foods launches the KRAFT INTERACTIVE KITCHENTM, an Internet site devoted to good food and good food ideas.
1996	BREAKSTONE'S® snack-size cottage cheese (a four pack of 4 ounce cups) is introduced in Autumn These are the first of their kind in the cottage cheese category.
1997	POST Cranberry Almond Crunch cereal is available nationally, and POST Honey Nut Shredded Wheat cereal is introduced in regional markets.
1997	Sparkling White Grape flavoured JELL-O gelatine is introduced in celebration of the brand's 100th anniversary.

Source: Kraft Foods Inc., 2005

Table 4.1 CONTINUED

Year	Key points in Kraft's corporate history
1998	STOVE TOP OVEN CLASSICS dinners are introduced.
1998	KRAFT introduces EASY MAC macaroni and cheese dinners, a microwavable, single-serve product.

Source: Kraft Foods Inc., 2005

Kraft Foods South Africa is a subsidiary of Kraft Foods International, a global leader in branded foods and beverages with 2003 net revenues of more than \$31 billion. Built on more than 100 years of quality and innovation, Kraft has grown from modest beginnings to become the largest food and beverage company headquartered in North America and second largest in the world, marketing many popular brands in more than 150 countries. Kraft Foods' vision captures the essence of the company's existence and passion: Helping people around the world eat and live better. The mission, undisputed global food leadership, is the overall objective and measurement of achievement (Booyens and Rozkydal, 2004:8).

Templeton (2004) adds that Kraft Foods South Africa, on the other hand, is still a young organisation. It was only established at the end of 2002. To understand the Kraft Foods South Africa of today, one needs to understand its history prior to 2002. A few of the major events in Kraft Foods South Africa's history were:

- Royal Baking Powder (Pty) Limited was a well-established company in South Africa and was owned by Standard Foods in the USA.
- Standard Foods USA was bought by Nabisco in 1980.
- Lifesavers International, with their head office in New York USA, traded in South Africa as Beechnut Lifesavers. Beechnut Lifesavers had a factory in Dundee Natal.
- Nabisco USA bought Lifesavers International in April 1982.
- Nabisco USA and Lifesavers International merged in South Africa and the company was renamed Royal Beechnut (Pty) Limited.
- The factory in Dundee, Natal, was closed in 1985 and moved to Chloorkop, Johannesburg.
- In 1989 Nabisco disinvested in South Africa and sold Royal Beechnut to the Imerman family.

- The Imerman family bought various brands including Manhattan confectionery, Lecol beverages; Del Monte canned fruit and fruit juices and various Fed Foods' biscuits brands.
- During 1985 to 1991 Royal Beechnut also operated various franchises, including Tambrands and self-medication products such as Cutacura face washes and Regulets laxatives.
- On 14 March 1991, Royal Beechnut (Pty) Limited listed 50 % of its shares on the Johannesburg Stock Exchange as Royal Foods Limited. The remaining 50 % of the shares of Royal Beechnut was still owned by the Imerman family.
- On 1 September 1995, Nabisco purchased 50 % of Royal Beech-Nut and took over management control. Nabisco also had an option to purchase the remaining 50 % of Royal Beechnut's shares.
- On 20 May 1996, the company name Royal Beechnut was changed to Nabisco South Africa.
- On 18 March 2002, Kraft Foods International announced the purchase of Nabisco International.
- The original 50 % share- holding of Royal Beechnut, trading as Royal Foods Limited was de-listed on the Johannesburg Stock Exchange at the beginning of 2002.
- Kraft Foods Inc bought the remaining 50 % of Royal Beechnut shares from the Imerman family at the beginning of 2002.
- On 5 July 2002, Kraft Foods International purchased the remaining 50 % of Nabisco South Africa. Kraft Foods South Africa was then fully owned by Kraft Foods Inc.
- On 1 November 2002, the company name changed from Nabisco South Africa to Kraft Foods South Africa.

The name change to Kraft Foods South Africa marked a new beginning, as the company was now part of Kraft Foods Inc.

4.2 Focus of Kraft Foods Inc.

Kraft Foods Inc. is the largest branded food and beverage company with its headquarters in the United States. Prior to June 13, 2001, Kraft was a wholly owned subsidiary of the Altria Group Inc. On June 13, 2001, Kraft completed an initial public offering of 280 000 000 shares of its Class A common stock at a price of \$31 per share. After the initial public offering, Altria Group Inc. owned approximately 83.9 % of the outstanding shares of Kraft's capital stock through its ownership of 49.5 % of Kraft's Class A common shares and 100 % of Kraft's Class B common shares. By December 31, 2003, Altria Group Inc., held 97.9 % of the combined voting power of Kraft's outstanding capital stock and owned approximately 84.6 % of the outstanding shares of Kraft's capital stock (Kraft Foods Inc, 2004:23).

Kraft Foods Inc. conducts its global business through two subsidiaries: Kraft Foods North America Inc. and Kraft Foods International Inc. Kraft Foods North America manages its operations principally by product category, while Kraft Foods International manages its operations by geographical region. From 2001 through to 2003, Kraft Foods North America's segments were cheese, meals and enhancers; biscuits, snacks and confectionery; beverages, desserts and cereals; and Oscar Mayer and Pizza. Kraft Foods North America's food service business within the United States and its businesses in Canada, Mexico and Puerto Rico were reported through the cheese, meals and enhancers segment. Kraft Foods International segments were Europe, the Middle East, Africa; Latin America and Asia Pacific (Kraft Foods Inc, 2004:23).

4.3 The challenges of Kraft

Kraft Foods Inc. is subject to a number of challenges that may adversely affect its businesses. These challenges include:

- Fluctuations in commodity prices.
- Movements of foreign currencies against the U.S. dollar.

- Competitive challenges in various products and markets, including price gaps with competitor products and the increasing price consciousness of consumers.
- A rising cost environment.
- A trend towards increasing consolidation in the retail trade and consequent inventory reductions.
- Changing consumer preferences.
- Competitors with different profit objectives and less susceptibility to currency exchange rates.
- Consumer concerns about food safety, quality, and health, including concerns about genetically modified organisms, trans-fatty acids and obesity (Kraft Foods Inc, 2004:26).

To confront these challenges, Kraft continues to take steps to build the value of its brands, to improve its foods business portfolio with new product and marketing initiatives, to reduce costs through productivity and to address consumer concerns about food safety, quality and health. In July 2003, Kraft Foods Inc. announced a range of initiatives addressing product nutrition, marketing practices, consumer information, and public advocacy and dialogue (Kraft Foods Inc, 2004:26).

4.4 The sustainable growth plan of Kraft

On 23 January 2004, Roger Deromedi, Chief Executive Officer, Kraft Foods Inc., announced a four-point sustainable growth plan for Kraft Foods Inc. (Kraft Foods Inc, 2004:5)

Firstly, to build superior brand value, Kraft must deliver more product benefits for the price paid for competitive products (Kraft Foods Inc, 2004:5). The first element of the plan is to build brand value by continuing to improve its products, to use more value-added packaging, to develop innovative products, to effectively manage price gaps and to build closer relationships with consumers (Kraft Foods Inc, 2004:26).

Secondly, to transform the product portfolio, Kraft is aligning its products with key consumer and customer trends, retail channels and demographic groups (Kraft Foods Inc, 2004:5). The second element of the plan is to accelerate the shift in Kraft's brand portfolio to address growing consumer demand for products meeting their health and wellness which concerns their desire for convenience (Kraft Foods Inc, 2004:26). Kraft is reducing the trans-fat in its products, identifying its products that are low in carbohydrates, introducing more sugar-free products, and emphasizing positive nutrition products. Examples of Kraft's response to health and wellness include products like Triscuit crackers with zero grams trans-fat; Kool Aid Jammers 10 with only 10 calories per serving; and Tang Plus with fortification and flavours tailored to the nutritional needs and taste preferences of different countries' groups (Kraft Foods Inc, 2004:5). Kraft is also addressing convenience needs by offering more convenient packaging, such as single-serve and resealable packaging, and products requiring reduced preparation (Kraft Foods Inc, 2004:26). Examples of Kraft's response to meeting the growing trend for convenience include products like single-serve Philadelphia Minis in Europe, nutritionally balanced Lunchables Fun Fuel in the U.S., and the launch in France later in 2004 of Tissimo, the innovative new, on-demand, hot beverage system groups (Kraft Foods Inc, 2004:5). Kraft is also offering packaging that is customised to suit the needs of the growing alternative channels of distribution such as super centres, mass merchandisers, drugstores and club stores. Kraft also plans to shift its portfolio to reflect changing demographics, for example, by expanding the availability of Hispanic products and bilingual packaging (Kraft Foods Inc, 2004:26).

Thirdly, to expand the global scale in fast-growing developing countries, Kraft is capturing the growth potential of the core categories in markets where they already operate, and building infrastructure in new high-potential markets (Kraft Foods Inc, 2004:5). The developing markets account for 84 % of the world's population and 30 % of its packaged food consumption, but only 11 % of Kraft's net revenues. The sustainable growth plan calls for Kraft to capture the growth potential of its core categories in existing markets and to expand these into new markets (Kraft Foods Inc, 2004:26).

And fourthly, to reduce the costs and asset base, a major cost-restructuring programme that goes beyond ongoing productivity efforts and that will help fund growth initiatives. Over the next three years, Kraft anticipates closing up to 20 production facilities and reducing the global force by approximately 6 %, or about 6000 positions across all levels of the organisation (Kraft Foods Inc, 2004:6). The restructuring program has the objectives of leveraging Kraft's global scale, realigning and lowering the cost structure and optimising capacity utilisation (Kraft Foods Inc, 2004:26). The fourth part of Kraft's sustainable growth plan is focussed on doing things at the lowest cost, i.e. the plan focuses on efficiency (Chase, Aquilano and Jacobs, 2001:335). The aim of the sustainable growth plan is to deliver consistent results in the long term (Kraft Foods Inc, 2004:6).

The fourth point of Kraft's sustainable growth plan is based on the interrelationship between save, invest and grow. This is the continuous cycle that drives long-term, sustainable results (Kraft Foods Inc, 2004:15).

Productivity and the steady flow of savings will continue to be the hallmark of Kraft. Although savings can come from many sources, two areas offer particular opportunity for ongoing cost savings:

The first cost saving opportunity is supply chain initiatives, where Kraft will leverage its global procurement scale and rationalise less profitable product variations further, in order to help achieve greater production and distribution efficiencies.

The second cost saving opportunity is through advances in technology. Kraft will continue to automate its plants and distribution centres, formulate products at lower costs that improve or maintain its product quality, and seek out alternative, lower-cost packaging.

The actions that are taken to reduce the costs today will provide financial stability to fund its future success.

4.5 Kraft Foods South Africa's supply chain organization

Kraft Foods believes that a Supply Chain organisation must be based on three key pillars in order to meet its vision (Booyens and Rozkydal, 2004:1-68):

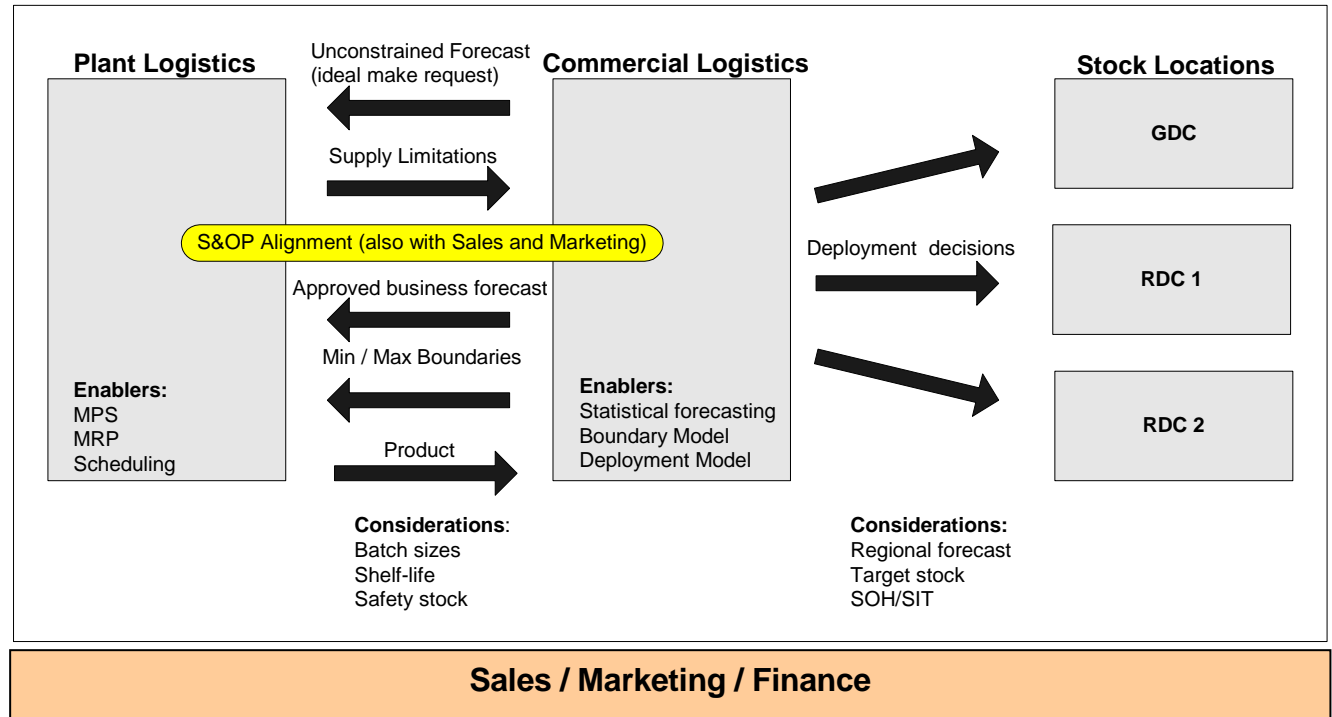
1. Customer Service manages order-to-cash and drives supply chain partnership with customers.
2. Logistic Operations manages distribution, warehousing and transportation activities/costs.
3. Demand Planning and Replenishment leads the forecasting process, supply chain management and replenishment from plants.

Booyens and Rozkydal (2004:1-68) also add that these three pillars form an integral part of Supply Chain Management, which is the practice of co-ordinating the flow of goods, services, information and finances as they move from raw materials to parts supplier to manufacturer to wholesaler to retailer to consumer. The supply chain process includes order generation, order taking, information feedback and the efficient and timely delivery of goods and services. The supply chain plays an important role in achieving the vision and objectives of Kraft Foods South Africa of obtaining high levels of customer service. In short, the successful management of the supply chain is dependent on the 7 S's for Supply Chain Management: Strategy, Skills, Structure, Staff, Systems, Style and Shared Values.

4.6 Role players in Kraft Foods South Africa's supply chain

Booyens and Rozkydal (2004:15-16) states that Kraft Foods South Africa's supply chain consists of two major components: Plant Logistics and Commercial Logistics. The diagram below depicts the relationship between these two entities:

FIGURE 4.1: RELATIONSHIP BETWEEN PLANT AND COMMERCIAL LOGISTICS



Source: Booyens and Rozkydal, 2004:15-16

As can be seen from the diagram, commercial logistics are responsible for completing the unconstrained demand. Plant logistics then run this through Master Production Schedule (MPS) and Materials Requirement Planning (MRP) to calculate the capacity and material constraints. A realistic supply plan is then generated. All participants then meet in the Sales and Operations Planning (S&OP) meeting to decide on a realistic and realisable forecast plan. This is known to the business as the approved and aligned forecast. Demand planning provides and reviews, if necessary, the minimum and maximum boundaries which will govern the production batch sizes per Stock Keeping Unit (SKU). Based on the approved and aligned forecast plant logistics plan, the daily production activities and produce are scheduled accordingly. Commercial logistics are then tasked with the deployment decisions. The arm of commercial logistics responsible for deployment decisions is Logistics and Operations. These are based on regional requirements that are measured by forward forecast.

This diagram only describes the function of commercial and plant logistics. It does not discuss the crucial role that Sales, Marketing and Finance need to play to ensure

that the demand is correctly quantified and that the deployment is accurately executed. Their involvement is a holistic one and thus it is presented below the diagram and transcends the supply chain operations.

4.7 Sources and product range in Kraft’s supply chain

Booyens and Rozkydal (2004:12) indicate that Kraft South Africa sources product in three ways:

- Locally manufactured by Kraft at the Tunney factory.
- Manufactured by local 3rd party manufacturers.
- Manufactured by international Kraft business units.

The following is a list of the different categories, product groups and products that make up the Kraft product range:

TABLE 4.2: KRAFT FOODS SOUTH AFRICA PRODUCT RANGE

Category	Product Group	Product	Manufacturer
Local geographic sales area			
Confectionery	Chewing Gum	Beechies	Don Products, Gaborone, Botswana
		Beechies Sugar Free	Don Products, Gaborone, Botswana
	Rolls	Compressed / Boilings	Kraft Foods South Africa
	Gels	Gums / Pastilles	Kraft Foods South Africa
	Mallows	Jet Puffed Mallows	Kraft Foods South Africa
Beverages	Squash	Lecol	Kraft Foods South Africa
	Cordials	Lecol	Kraft Foods South Africa
	Light Squash	Lecol	Kraft Foods South Africa
	Squeeze ‘n Drink		Kraft Foods South Africa
	Pure Lemon Juice		Kraft Foods South Africa
	Tang		Kraft Foods, Casablanca, Morocco

Source: Booyens and Rozkydal, 2004:12

TABLE 4.2 CONTINUED

Category	Product Group	Product	Manufacturer	
Local geographic sales area				
Beverages	Sweet-Aid		Kraft Foods South Africa	
Other Grocery	Baking Powder	Royal Baking Powder	Kraft Foods South Africa	
	Baking Aids		Kraft Foods South Africa	
	Desserts	Royal Instant Puddings	Kraft Foods South Africa	
	Sweetener	Sweet 'n Slim	Kraft Foods South Africa	
Biscuits	Savoury	Crackermates	Kraft Foods South Africa	
	Generics	Bells, Chips Ahoy	Kraft Foods South Africa	
	Oreo		Kraft Foods South Africa	
	Riviera		Kraft Foods South Africa	
	Granola Bars		Kraft Foods South Africa	
Kraft (Non-manufactured)	Jacobs Coffee		Kraft Foods, Bremen, Germany	
	Cheese and Dips		Kraft Foods, Ryebrook, USA	
	Spoonables	Miracle Whip Mayonnaise	Mullins, Johannesburg	
	Imported confectionery	Cote d'Or		Kraft Foods, Halle, Belgium
		Toblerone		Kraft Foods, Bern, Switzerland
Export sales area				
Source products from all over the world				

Source: Booyens and Rozkydal, 2004:12

4.8 Geographical layout of Kraft's supply chain

Booyens and Rozkydal (2004:16) states that Kraft Foods South Africa's Business Unit, which is the combination of Finance, Marketing, Sales, Customer Service, Supply Chain Management and Human Resources departments, is based at the head office in Woodmead, Johannesburg, where central planning takes place. The only manufacturing facility is situated in Tunney, Johannesburg. 79% of total KFSA

sales are manufactured finished goods, while only 21% consist of products that are sourced from external parties.

The supply chain of Kraft Foods South Africa sources products from the following locations:

- Bremen, Germany
- Bern, Switzerland
- Casablanca, Morocco
- Ryebrook, USA
- Gabarone, Botswana
- Mullins, City Deep, Johannesburg (local)

Kraft Foods South Africa currently has the following four distribution centres:

1. Gauteng Distribution Centre (GDC), Boksburg
2. Durban Distribution Centre
3. Port Elizabeth Distribution Centre
4. Cape Town Distribution Centre

All products, manufactured and purchased, are first sent to the Central Distribution Centre, Gauteng's Distribution Centre (GDC), before being distributed to the regional distribution centres. The only exception to this rule is that cheese and dips from USA are sent directly to Patleys, Johannesburg. However, every opportunity is utilised to encourage direct shipments from Gauteng's Distribution Centre (GDC).

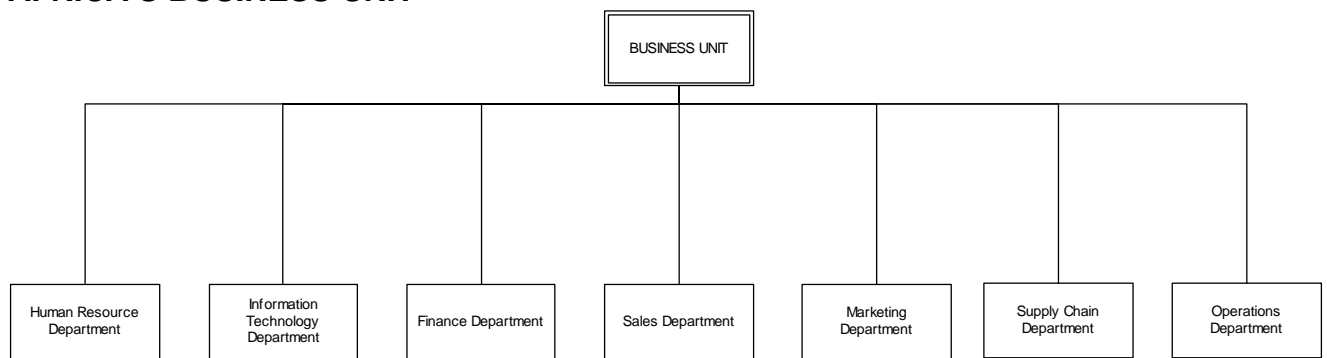
In some cases, make-to-order finished goods are supplied in Kraft Foods South Africa's supply chain. The make-to-order finished goods include:

- Cheese and dips sourced from Kraft Foods, Ryebrook, USA on order from Patleys, Johannesburg.
- Jacobs' coffees from Kraft Foods, Bremen, Germany on order from exclusive distributors in Cape Town and Windhoek, Namibia.
- Chocolates from Kraft Foods, Halle, Belgium and Kraft Foods, Bern, Switzerland on order from Brooks Sales, Johannesburg.
- Locally manufactured products for the export market.

4.9 People in Kraft Foods South Africa's supply chain

Booyens and Rozkydal (2004:19) mention that Kraft Foods South Africa is a fairly flat, functionally orientated organisation. The Supply Chain Management activities are fragmented across the organisation, and therefore it is crucial to establish strong process orientated mindsets in order to manage the risk of 'silo thinking'. The organizational chart below illustrates the functionally focussed structure:

FIGURE 4.2: ORGANISATIONAL STRUCTURE OF KRAFT FOODS SOUTH AFRICA'S BUSINESS UNIT

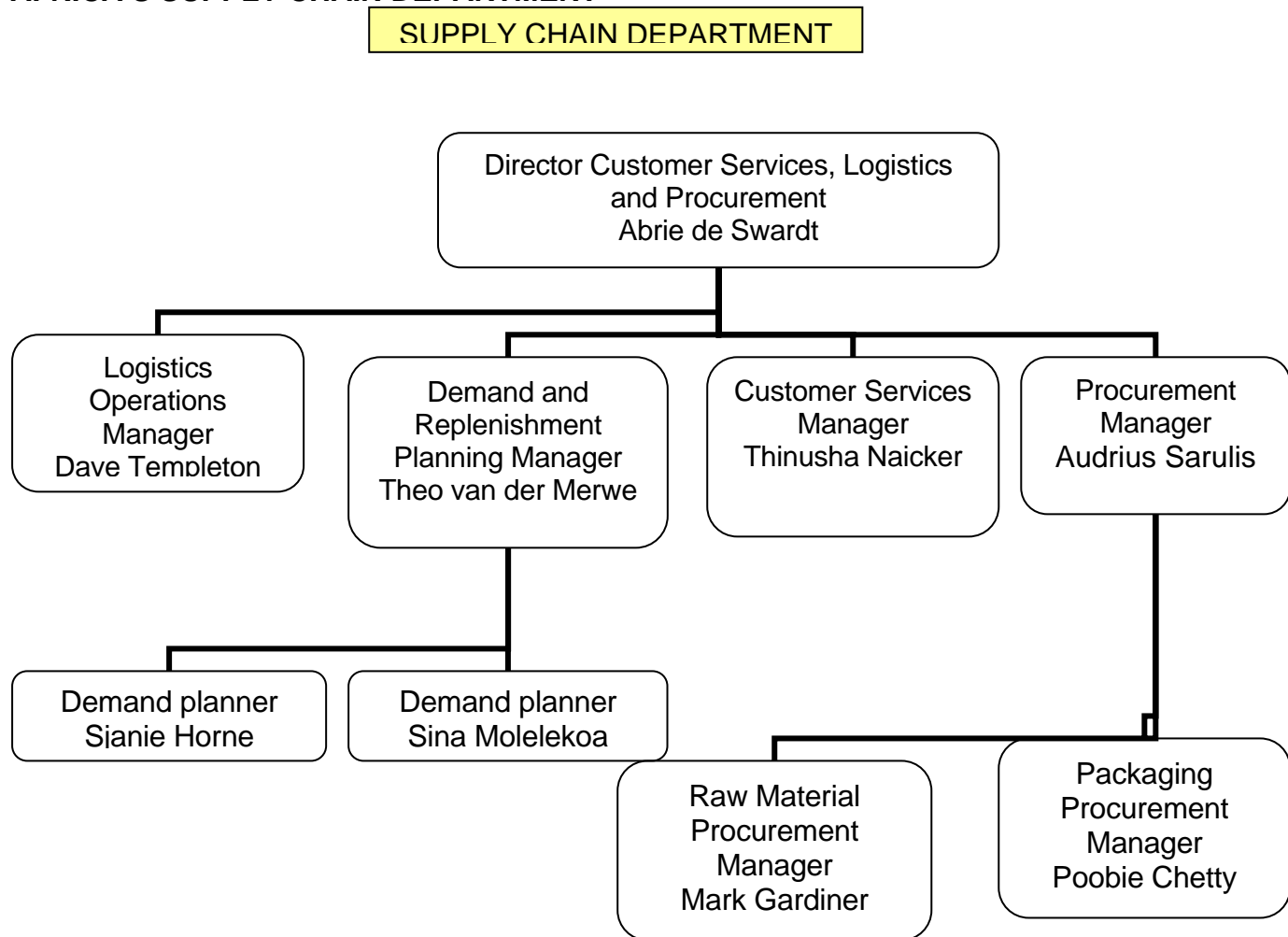


Source: Booyens and Rozkydal, 2004:19

The majority of demand and replenishment planning activities involves close interaction between the Supply Chain, Sales and Operations Department. Their individual organizational charts can be viewed below¹:

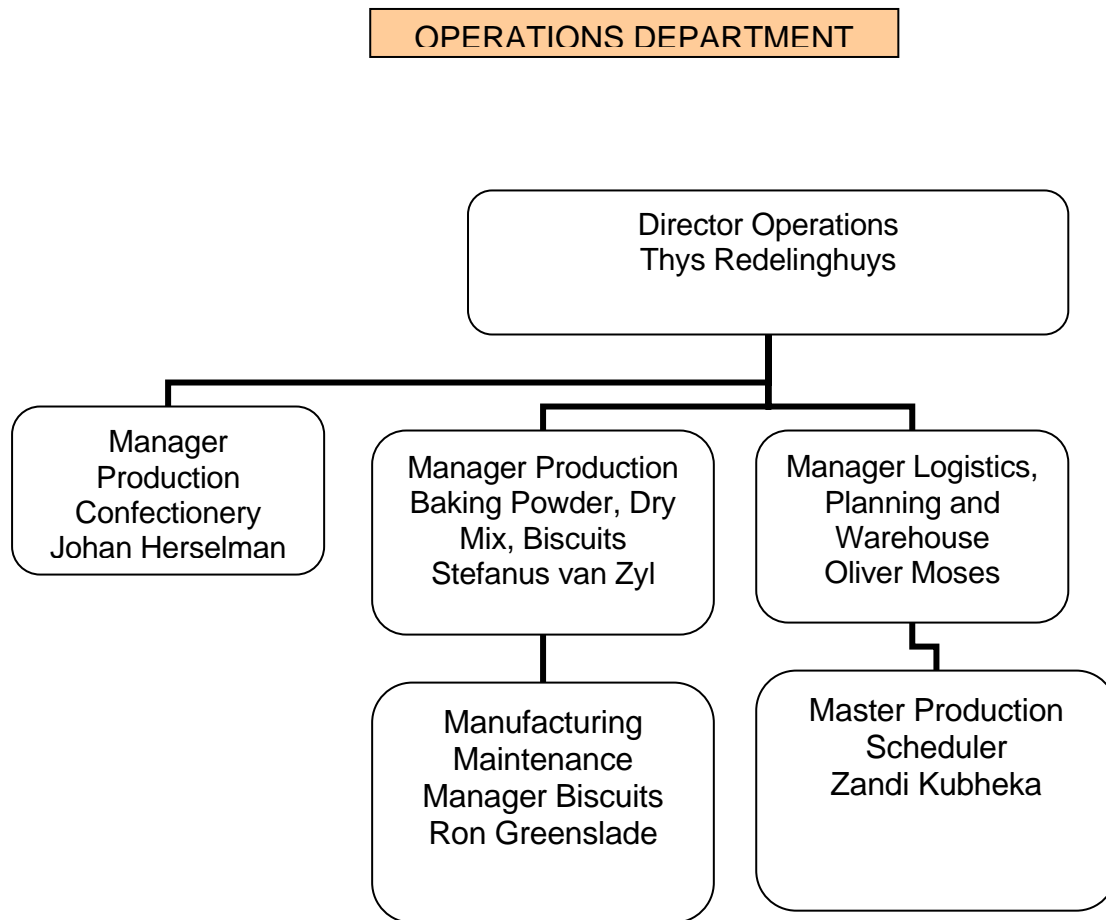
¹

FIGURE 4.3: ORGANISATIONAL STRUCTURE OF KRAFT FOODS SOUTH AFRICA'S SUPPLY CHAIN DEPARTMENT



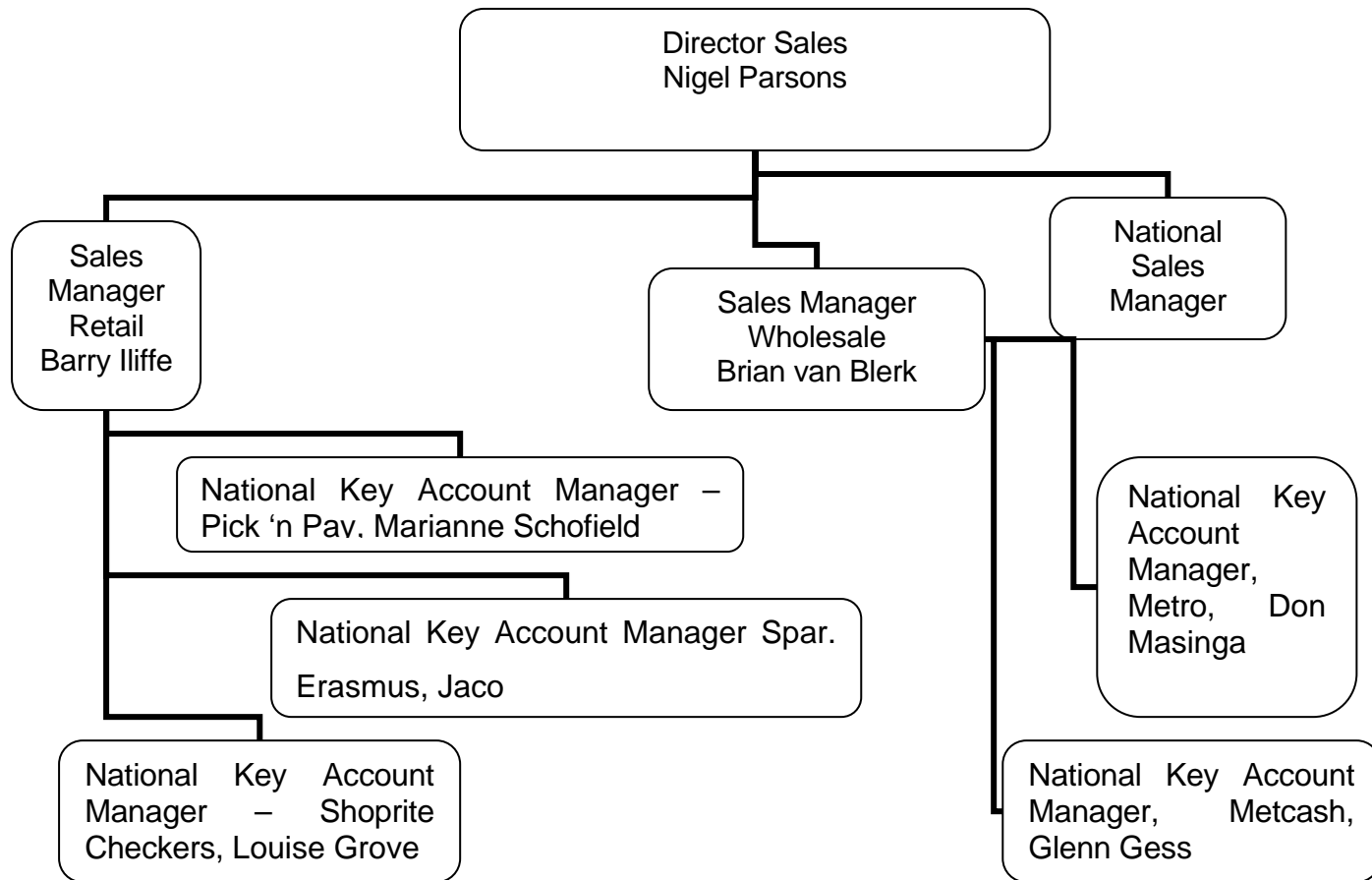
Source: Booyens and Rozkydal, 2004:20

FIGURE 4.4: ORGANISATIONAL STRUCTURE OF KRAFT FOODS SOUTH AFRICA'S OPERATIONS DEPARTMENT



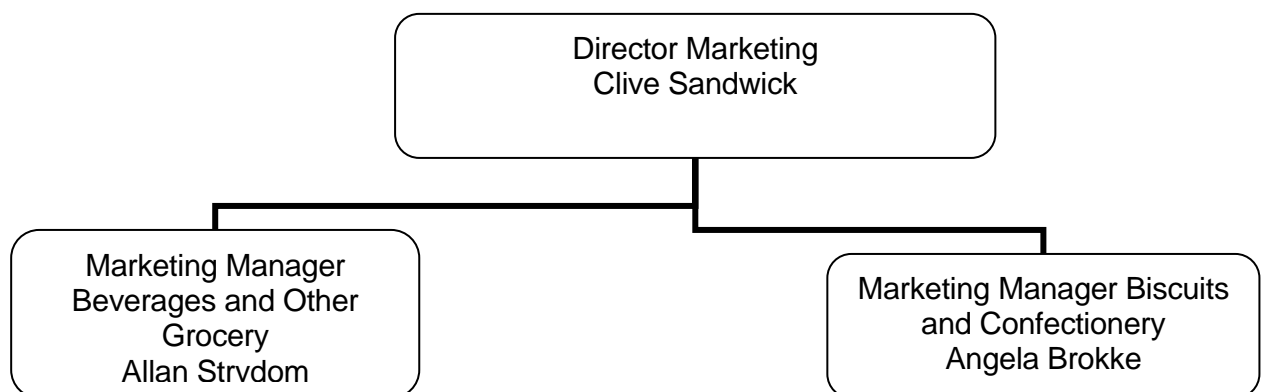
Source: Booyens and Rozkydal, 2004:20

FIGURE 4.5: ORGANISATIONAL STRUCTURE OF KRAFT FOODS SOUTH AFRICA'S SALES DEPARTMENT



Source: Booyens and Rozkydal, 2004:21

FIGURE 4.6: ORGANISATIONAL STRUCTURE OF KRAFT FOODS SOUTH AFRICA'S MARKETING DEPARTMENT



Source: Brokke, 2005

4.10 Functional involvement in the planning processes

Booyens and Rozkydal (2004:1-68) indicate that various functions are involved in the planning within Kraft Foods South Africa's supply chain. Each function has a contribution to the overall planning. The contributions of each department are listed below:

Demand planning is responsible for:

- Co-ordinating the forecasting process.
- Constructing the consolidated forecast.
- Setting the maximum and minimum boundaries (boundary model).
- Co-ordinating the boundary review process.
- Procurement of finished goods.

Production is responsible for:

- Providing a supply plan.
- Input into aligning supply and demand.
- Planning production.
- Scheduling production.

Logistics and Operations are responsible for:

- Deciding where to deploy stock.
- Priority allocation decisions if insufficient stock exists.
- Redeployment decisions if required.

Sales are responsible for:

- Providing input into the forecast process.
- Providing input into the decomplexity process.
- Providing input into the priority allocation decision.

Marketing is responsible for:

- Providing input into the forecast process.
- Providing input into the decomplexity process.
- Providing input into the priority allocation decision.

Finance is responsible for:

- Suggesting gap closures to align the financial forecast to the base-line forecast.
- Providing input into the decomplexity process.

Procurement is responsible for:

- Ensuring contracts are in place and that timeous replenishment occurs.
- Providing input into the decomplexity process.

4.11 Technology involved in Kraft's supply chain

Booyens and Rozkydal (2004:1-68) indicate that technology must be seen as an enabler. It is crucial that the underlying processes are sound and well adhered to before technology is introduced. Technology assists people in completing the processes more efficiently and accurately.

The following technology is utilised in Kraft Foods South Africa's supply chain:

- ERP System: Currently Kraft South Africa utilises JBA in the business. A move to MFG Pro is planned for 2005. The advantages and increased functionality are currently being investigated.
- SCORE: Currently rSCORe (remote SCORe) is used in the business. The functionality is limited to procurement planning and the execution of finished goods from international Kraft business units on SCORE. The complete SCORE package functionality includes demand and inventory replenishment planning, as well as deployment planning. Currently no definite plans have been formulated for the full SCORE implementation; however, the aim is to have the system and processes implemented by the end of 2005.
- Forecast Pro: This is an independent statistical forecasting tool that can be used in the demand planning process to calculate the base-line projection. Plans for acquiring Forecast Pro in the first quarter of 2005 exist. An Excel-based interim solution will be considered.
- Excel and Access: The business is currently dependent on Microsoft Excel and Access as their main enabler of the planning process. Most models are

large and unwieldy and not easily re-usable by external stakeholders. Business risk does exist in this regard.

4.12 Supply and demand alignment in Kraft's supply chain

According to Templeton (2004), the supply and demand is currently not properly aligned. The table below shows 2004 full year-end results up and until December 2004.

TABLE 4.3: 2004 YEAR-END RESULTS FOR KRAFT FOODS SOUTH AFRICA

Sales Forecasting Accuracy (SFA) Non-Weighted	
Product Category	2004 FYE
Beverages	43.0%
Biscuits	34.9%
Confectionery	36.6%
Other Grocery	27.9%
Grand Total	35.2%

Case Fill Rate (CFR)	
Product Category	2004 FYE
Beverages	75.6%
Biscuits	79.3%
Confectionery	64.1%
Other Grocery	61.0%
Grand Total	63.9%

Days Inventory Forward Cover (DIFC)	
Product Category	2004 FYE
Beverages	48.6
Biscuits	50.7
Confectionery	36.2
Other Grocery	25.5
Grand Total	37.3

Source: Templeton, 2004

Days Forward Inventory Cover is an indication of the level inventory in a stock holding point based on demand. Case Fill Rate indicates the service level between Kraft Foods South Africa and its customers. Sales Forecast Accuracy represents the

percentage of correctly forecasted stock keeping units, within a $\pm 25\%$ tolerance range, versus the total stock-keeping units.

Although Kraft Foods South Africa had 37.3 days of stock on hand, it could only deliver 63.9 % of customer order volume. The situation was made worse with a sales forecast accuracy of only 35.2 %, which was the result of selling different volumes than the forecasted volume.

CHAPTER 5: RESEARCH DESIGN AND METHODOLOGY

5.1 Introduction

The research design and methodology chapter documents the design and methodology followed during the fieldwork (Moutton, 2001:123).

Research could have many purposes depending on the research topic and objectives. The purposes of research are regarded as mainly threefold (Welman & Kruger, 2001):

- To describe how things are, that is, to define the nature of the object being studied.
- To explain why things are the way they are. In some cases one thing has caused another to change. The aim can also be to explain the relationship between things.
- To predict phenomena, such as human behaviour in the workplace, with the aim of using this information, for example, to screen job applicants.

5.2 The purpose of studying research methods

The study of research methods provides a researcher with the knowledge and skills to solve the problems and meet the challenges of a fast-paced decision-making environment. Business research can be defined as a systematic inquiry with the objective of providing information in order to solve managerial problems (Cooper and Schindler, 2003:5).

Three factors stimulate an interest in a scientific approach to decision-making (Cooper and Schindler, 2003:5):

1. Managers have an increased need for more and better information.
2. The availability of improved techniques and tools to meet the need for more and better information.

3. The resulting information overload if discipline is not employed in the process.

The trend towards complexity has increased the risk associated with business decisions, making it more important to have a sound information base. The following factors, which characterise the complex business decision-making environment, demand that managers have more and better information on which to base decisions (Cooper and Schindler, 2003:6):

- There are more variables to consider in every decision.
- More knowledge exists in every field of management.
- Global and domestic competition is more vigorous, with many businesses downsizing to refocus on primary competencies, reduce costs, and make competitive gains.
- The quality of theories and models to explain tactical and strategic results is improving.
- Government continues to show concern regarding all aspects of society, becoming increasingly aggressive in protecting these various members of the public.
- The explosive growth of company sites on the World Wide Web, e-commerce, and company publications via desktop and electronic publishing have brought the prospect of extensive new arrays of information, but information quality is increasingly suspect.
- Workers, shareholders, customers and the general public are demanding to be included in company decision-making; they are better informed and more sensitive to their own self-interests than ever before.
- Organisations are increasingly practicing data mining, learning to extract meaningful knowledge from volumes of data contained within internal databases.
- Computer advances have allowed businesses to create the architecture of data warehousing which comprises, electronic warehouses where vast arrays of collected, integrated data are ready for mining.

- The power and ease of use of today's computers have given us the capability to analyse data to deal with today's complex managerial problems.
- Techniques of quantitative analysis take advantage of increasingly powerful computing capabilities.
- The number and power of the tools used to conduct research have increased, corresponding with the growing complexity of business decisions.
- Communication and measurement techniques within research have been enhanced.

To cope in such an environment, one needs to understand how to identify quality information and to recognise the solid, reliable research on which high-risk management decisions are based (Cooper and Schindler, 2003:6).

5.3 Research design

There are many definitions for research design, but together they provide the following essentials (Cooper and Schindler, 2003:146):

- The design is an activity and time- based plan.
- It is always based on the research question.
- It guides the selection of sources and types of information.
- It is a framework for specifying the relationships among the study's variables.
- It outlines procedures for every research activity.

A number of different research design approaches exist, but unfortunately, no simple classification system defines all the variations that must be considered. The following eight different descriptions classify research:

5.3.1 Degree of research question crystallization

A research study may be viewed as exploratory or formal. Exploratory studies tend toward loose structures with the objective of discovering future research tasks. The immediate purpose of exploration is usually to develop hypotheses or questions for further research. The formal study begins where exploration leaves off – with a hypothesis or research question and involves precise procedures and data source specification. The goal of a formal research design is to test the hypotheses or answer the research question posed (Cooper and Schindler, 2003:146).

This research project is exploratory in nature as it attempts to determine the causes and solutions of aligning supply and demand in a supply chain.

5.3.2 Method of data collection

The different methods of classification distinguish between monitoring and interrogation or communication purposes (Cooper and Schindler, 2003:147).

When monitoring, the researcher inspects the activities of a subject or the nature of some material without attempting to elicit responses from anyone (Cooper and Schindler, 2003:6). In each case the researcher notes and records the information available from observations (Cooper and Schindler, 2003:147).

In the interrogation or communication study, the researcher questions the subjects and collects their responses by personal or impersonal means. The collected data may result from one or a combination of the following:

- Interview or telephone conversations (Cooper and Schindler, 2003:6).
- Self-administered or self-reported instruments sent through the mail, left in convenient locations, or transmitted electronically or by other means. (Cooper and Schindler, 2003:147, 149).
- Instruments presented before and/or after treatment or stimulus condition in an experiment (Cooper and Schindler, 2003:149).

This research project starts by monitoring the theoretical framework available on the subject of aligning supply and demand. The research is concluded with a communication study, whereby stakeholders are interviewed to test the findings of the theoretical framework.

5.3.3 Researcher control of variables

In terms of the researcher's ability to manipulate variables, the research designs can either be experimental or ex post facto designs (Cooper and Schindler, 2003:149).

In an experiment, the researcher attempts to control and/or manipulate the variables in the study. Experimental design is appropriate when a researcher wishes to discover whether certain variables produce effects in other variables. Experimentation provides the most powerful support possible for a hypothesis of causation (Cooper and Schindler, 2003:149).

With an ex post facto design, researchers have no control over the variables in the sense of being able to manipulate them. They can only report what has happened or what is happening. It is important for the researcher who uses ex post facto design not to influence the variables in order to avoid bias (Cooper and Schindler, 2003:149).

This research project is based on an ex post facto design, as the researcher can only report what has happened or what is happening within the supply chain of the fast moving consumer good's company.

5.3.4 The purpose of the study

The essential difference between descriptive and causal studies lies in their objectives. Descriptive research studies are concerned with finding out who, what, where, when and how much (Cooper and Schindler, 2003:149). A descriptive study

tries to discover answers to the questions who, what, when, where and sometimes, how. The researcher attempts to describe or define a subject, often by creating a profile of a group of problems, people or events (Cooper, 2003:10).

Causal research studies, on the other hand, are concerned with learning why or how one variable produces changes in another (Cooper and Schindler, 2003:149).

This research project is a descriptive research study as it attempts to find the causes and solutions of aligning the supply and demand within a supply chain.

5.3.5 The time dimension

Cross-sectional studies are carried out once and represent a snapshot of one point in time. Longitudinal studies are repeated over an extended period. The advantage of longitudinal study is that it can track changes over a certain time (Cooper and Schindler, 2003:149).

While longitudinal research is important, the constraints of budget and time impose the need for cross-sectional analysis. Some benefits of a longitudinal study can be revealed in a cross-sectional study by skilful questioning about past attitudes, history and future expectations. Responses to these kinds of questions should be interpreted with care, however (Cooper and Schindler, 2003:150). This research is a cross sectional study as it represents a snapshot of the alignment of the supply and demand within Kraft Foods South Africa's supply chain.

5.3.6 The topical scope

The statistical study differs from the case study in several ways. Statistical studies are designed for breadth rather than depth. They attempt to capture a population's characteristics by making inferences from a sample's characteristics. Hypotheses are tested quantitatively. Generalisations about findings are presented based on a typical sample and the validity of the design (Cooper and Schindler, 2003:150).

Case studies place more emphasis on a full contextual analysis of fewer events of conditions and other interrelations. Although hypotheses are often used, the reliance on qualitative data makes support or rejection very difficult. An emphasis on detail provides valuable insight into problem solving, evaluation and strategy. The detail is secured from multiple sources of information. Evidence can be verified and missing data can be avoided (Cooper and Schindler, 2003:150).

A single well-designed case study can provide a major challenge to a theory and provide a source of new hypotheses (Cooper and Schindler, 2003:150).

The research study is a case study of Kraft Foods South Africa's supply chain.

5.3.7 The research environment

The research design also differs as to whether it occurs under actual environmental conditions, called field conditions, or under staged or manipulated conditions, called laboratory conditions (Cooper and Schindler, 2003:150).

Simulations are increasingly used in research, especially in operations research. The major characteristics of various conditions and relationships in actual situations are often represented in mathematical models (Cooper and Schindler, 2003:150).

The research is done under actual environmental conditions, called field conditions.

5.3.8 Participants' perceptions

The usefulness of a design may be reduced when people in a disguised study perceive that research is being conducted. Participants' perceptions influence the outcomes of the research in subtle ways. Although there is no widespread evidence of attempts by participants or respondents to please researchers through successful hypothesis guessing, or evidence of the occurrence of sabotage, when participants

believe something out of the ordinary is happening, they may behave less naturally.

There are three levels of perception (Cooper and Schindler, 2003:151):

:

1. The participants perceive no deviation from everyday routines.
2. The participants perceive deviations which are unrelated to the researcher.
3. The participants perceive deviations as researcher- induced.

Participants' perceptions serve as a reminder to classify one's study by type, to examine validation strengths and weaknesses, and to be prepared to qualify results accordingly (Cooper and Schindler, 2003:151).

The research design and methodology chapter provides full details of the data collection process, including gaining access to the subjects, data collection techniques and procedures used, and dates and settings of data gathering (Moutton, 2001:123).

The research methodology indicates how the researcher intends to conduct the fieldwork (Moutton, 2001:46).

5.4 Research design and methodology

There are differences between the research design and methodology which any researcher must understand and recognise.

Research design focuses on the end product, i.e. what kind of study is being planned and what kind of result is aimed at. Research methodology focuses on the research process and the kind of tools and procedures to be used (Moutton, 2001, 56).

The point of departure of research design is the research problem or question. The point of departure of research methodology is specific tasks to collect and sample the data at hand (Moutton, 2001, 56).

Research design focuses on the logic of research to determine the kind of evidence required to address the research question adequately. Research methodology focuses on the individual steps in the research process and the most objective or unbiased procedures to be employed (Moutton, 2001, 56).

Research techniques entail the specific things that researchers use to sample, measure, collect and analyse information (Welman, 2001:2). Research methodology considers and explains the logic behind the research methods (Welman, 2001:2).

5.5 Secondary versus primary research data

Data can be defined as the facts presented to the researcher from the study's environment (Cooper, 2003:87). Data can be collected from either primary or secondary data sources.

The first step in exploratory study is a search of the secondary literature. Studies made by others for their own purposes represent secondary data. It is ineffective to discover anew through the collection of primary data or original research what has already been done and reported at a level sufficient for management to make a decision. With secondary data exploration, a researcher should first start with an organisation's own data archives. The second source of secondary data is published documents prepared by authors outside the sponsor organisation. Searching through secondary sources will supply excellent background information, as well as many good leads (Cooper, 2003:152-153).

There are a number of reasons why the review of the existing scholarship is so important (Moutton, 2001:87):

- To ensure that one does not merely duplicate a previous study.
- To discover what the most recent and authoritative theorising about the subject is.
- To find out what the most widely- accepted empirical findings in the field of study are.

- To identify the available instrumentation that has proven to be valid and reliable.
- To ascertain what the most widely accepted definitions of key concepts in the field are.
- To save time and avoid duplication and unnecessary repetition. A good review of the available scholarship not only saves one time to avoid making the same errors and duplicating previous results unnecessarily, but secondary data also provides clues and suggestions about which avenues to follow.

Data reflects truthfulness by means of its closeness to the phenomena. Secondary data has had at least one level of interpretation inserted between the events and its recording. Primary research is very close to the truth (Cooper, 2003:87). The reason for the preference of primary data versus secondary data is that with each transfer from one source to another, the information may be inadvertently or deliberately distorted (Welman, 2001:179).

Secondary data is an interpretation of primary data. Examples of secondary data include encyclopaedias, textbooks, handbooks, magazine and newspaper articles, sales analysis summaries, investor annual reports, monographs, conference proceedings, reference materials, journal articles, newspapers, magazines, reports, theses and dissertations and unpublished research reports (Cooper, 2003:282), (Moutton, 2001:88), (Welman, 2001:17). The main categories of search tools are (Moutton, 2001:89):

- Online databases.
- CD-ROM databases.
- Internet.

Libraries are no longer the only source of information. The development of the Internet and electronic publishing has had an enormous impact on research supervision, peer review of publications and general communications capabilities, and has changed the way researchers work (Welman, 2001:34). Even the World Wide Web is a source of information. But searching the Web and retrieving reliable information from it is a great deal more problematic than searching a bibliographic

database. There are no standard database fields, no carefully defined subject hierarchies, called controlled vocabulary, no cross-references, no synonyms, no selection criteria, and in general, no rules. There are many search engines and they all work differently, but how they work is not always easy to determine. Nonetheless, the convenience of the Web and the extraordinary amount of information to be found on it are compelling reasons for using it as a source of information (Cooper, 2003:290-291). The Web search engine or portal that the researcher selects may well be determined by how comprehensive the results should be. For normal searches, one of the major sites could be used, for example, Yahoo. If, however, the researcher is interested in gathering comments and opinions that focus on Usenet groups, a more inclusive search engine such as Northern Light could be used. If the researcher is interested in comprehensiveness, more than one search engine could be used (Cooper, 2003:292).

Information from the Internet is considered less reliable than that of printed sources, because web pages can be updated and changed on a daily basis. A researcher should even consider including a printed hard copy of the Internet source with the research paper as an appendix. This will ensure that the factual information used cannot later be contested (Welman, 2001:34).

It is the researcher's responsibility to keep abreast of the research reported on the research topic up to at least the time that the research report is concluded. This practice will prevent the research from becoming outdated or irrelevant the moment it is published. In this sense, literature research on a topic is a never-ending process (Welman, 2001:34-35).

Primary sources have more value than secondary sources, and secondary sources have more value than tertiary sources. If the information is essential to solving the management dilemma, it is wise to verify the information in a primary source (Cooper, 2003:282-283).

The literature review should not consist of mere compilation of separate, isolated summaries of the individual studies of previous researchers. The researcher should

clearly show how the studies relate to one another and how the proposed research ties in with them (Welman 2001:35).

As a researcher begins to collect information about the topic, he should conduct a source evaluation. Information sources are evaluated and selected based on five factors that can be applied to any type of source, whether printed or electronic. These factors are purpose, scope, authority, audience and format (Cooper, 2003:284).

5.5.1 Purpose

The purpose of the source is to determine what the author is trying to accomplish. Once one has determined the purpose of the source, the researcher will also want to determine whether or how it provides a bias to the information presented. Bias is the absence of a balanced presentation of information. A researcher can expect sources offered by independent organisations to be more balanced, presenting both positive and negative information about relevant organisations, without favouring one or the other (Cooper, 2003:284).

5.5.2 Scope

Tied closely to the purpose of the source is its scope. Issues that should be considered include the date of publication, the time period covered and the width and depth of the coverage. If the researcher does not know the scope of the information sources, essential information might be missed by relying on an incomplete source (Cooper, 2003:284).

5.5.3 Authority

The primary information sources are the most authoritative. In any source, both the author and the publisher are indicators of the authority. The author and the author's credentials should be given both in the printed and the electronic source. If

credentials are not given, then it is best to check a biographical source. Credentials may include the author's educational background, position, or other published and reviewed work. Credentials alone are not enough. Most scholarly articles are validated by a system called peer review in which colleagues from other institutions are asked to comment anonymously on the research presented (Cooper, 2003:286).

5.5.4 Audience

Audience is also an important factor in evaluating an information source and it, too, is tied to the purpose of the source. When evaluating the plausible audience of a source, the researcher should look for key indicators including vocabulary, types of information, and the questions or directions that guide the research (Cooper, 2003:286).

5.5.5 Format

Format factors may vary from one source to another, but in general they relate to how the information is presented and how easy it is to find a specific piece of information. In a printed source, the arrangement of the information, for example, alphabetical, hierarchical or chronological, nearly always has an impact on the retrieval of information (Cooper, 2003:287).

5.6 Criteria for a good literature review

There are some criteria that should be applied when putting the literature review together (Moutton, 2001:90-91):

- The literature review should be exhaustive in its coverage of the main aspects of the study. It is obviously impossible to do a review that includes every single article or contribution ever written on a particular topic. However, the supervisor may expect the review to be exhaustive in terms of its coverage of

the main aspects or themes of the study. The researcher knows that he has obtained adequate literature coverage when the following apply:

- When the researcher finds a repetition of references and authors.
- When no new themes or viewpoints emerge.
- When secondary reviews, commentaries or book reviews confirm what the researcher has found so far.
- A good review is fair in its treatment of others. A study should never be approached with a pre-set interpretation. The researcher should always aim to do justice to the author's arguments and reasoning before starting to criticise the article.
- The literature review should be topical and not dated. The researcher should consult the supervisor for advice in terms of the time period that should be covered.
- A literature review should not be confined to Internet sources. The bulk of the scholarship, however, is still published in standard scientific journals and books and these should be the first choice.
- A good literature review should be well organised. A literature review is not a mere compilation, summary or list of information sources. It should be based on the research problem being studied. The literature is not simply driven by the research questions, the opposite also applies: the more the researcher reads, the more clarity he gets, which often leads to a change in the formulation of the research problem.

5.7 Experience Survey

While published data is a valuable resource, no more than a fraction of the existing knowledge in a field is usually put into writing. A significant portion of what is known about a topic, even though it may be in writing, may be proprietary to a given organisation and thus unavailable to an outside researcher. Internal data archives are rarely well organised, making these secondary sources, even when known, also difficult to locate (Cooper, 2003:153).

A researcher will thus benefit by seeking information from persons experienced in the area of study, tapping into their collective memories and experiences. When persons in an experience survey are interviewed, the researcher should endeavour to find out what their ideas about important issues or aspects of the subject are and discover what is important across the subject's range of knowledge. The investigative format used should be flexible enough so that avenues that emerge during the interview can be explored (Cooper, 2003:154).

5.8 Actions that guarantee good research

Good research generates dependable data, being derived from practices that are conducted professionally and that can be used reliably for managerial decision-making. In contrast, poor research is carelessly planned and conducted, resulting in data that a manager cannot use to reduce the decision-making risk (Cooper and Schindler, 2003:14).

Good research follows the standards of the scientific method. Several characteristics of the scientific method are listed below (Cooper and Schindler, 2003:14):

5.8.1 Purpose clearly defined

The purpose of the research, the problem involved or the decision to be made, should be clearly defined. The statement of the decision- problem should include its scope, its limitations and the precise meanings of all the words and terms significant to the research. Failure to do this adequately may raise legitimate doubts in the minds of research report readers as to whether the researcher has sufficient understanding of the problem to make a sound proposal attacking it (Cooper and Schindler, 2003:14-15).

5.8.2 Research process detailed

The research procedures used should be described in sufficient detail to permit another researcher to repeat the research (Cooper and Schindler, 2003:16).

5.8.3 Research design thoroughly planned

The procedural design of the research should be carefully planned to yield results that are as objective as possible. A survey of opinions or recollections ought to be used when more reliable evidence is available from the documentary sources or by direct observation. Bibliographical searches should be as thorough and as complete as possible. Efforts should be made to minimise the influence of personal bias in selecting and recording data (Cooper and Schindler, 2003:16).

The threat of bias should be given more emphasis. The business researcher often knows from the beginning what results the sponsor would like to have. To combat this potentially biased influence, it may be necessary to secure an understanding between manager and researcher before stating that the objective is to uncover reality – wherever that leads (Cooper and Schindler, 2003:18).

5.8.4 High ethical standards applied

Careful consideration must be given to those research situations in which there is a possibility of physical or psychological harm, exploitation, invasion of privacy, and / or loss of dignity. The need for the research must be weighed against the potential for adverse effects (Cooper and Schindler, 2003:17).

5.8.5 Limitations frankly revealed

The researcher should report, with complete frankness, flaws in procedural design and estimate their effect on the findings. There are very few perfect research

designs. Some of the imperfections may have little effect on the validity and reliability of the data; others may invalidate it entirely. A competent researcher should be sensitive to the effects of imperfect design, and the researcher's experience in analysing the data should provide a basis of estimating the influence. As a decision-maker, the value of the research should be questioned where no limitations are reported (Cooper and Schindler, 2003:17).

Despite the limitations and challenges, the research for this project was completed within the available time and with the resources available.

5.8.6 Adequate analysis for decision- maker's needs

Adequate analysis of the data is the most difficult phase of research for the novice. The data should be classified in ways that assist the researcher in reaching pertinent conclusions and clearly reveal the findings that have led to those conclusions (Cooper and Schindler, 2003:17).

5.8.7 Findings presented clearly

Some evidence of the competence and integrity of the researcher may be found in the report itself. For example, language that is restrained, clear and precise; assertions that are carefully drawn and hedged with appropriate reservations; and an apparent effort to achieve maximum objectivity, tend to leave a favourable impression of the researcher with the decision- maker. Generalisations that outrun the evidence on which they are based, exaggerations and unnecessary verbiage tend to leave an unfavourable impression. Such reports are not valuable to managers wading through the minefields of business decision- making. Presentations of data should be comprehensive, easily understood by the decision- maker, and organised so that the design- maker can readily locate critical findings (Cooper and Schindler, 2003:17).

5.8.8 Conclusions justified

Conclusions should be limited to those for which the data provide an adequate basis. Researchers are often tempted to broaden the basis of their conclusions by including personal experience and their interpretations thereof, which would be data that has not been subjected to the controls under which the research data was gathered. Equally undesirable is the frequent practice of drawing conclusions from a study of a limited population and applying them universally. Researchers may also be tempted to rely too heavily on data collected in a prior study and use it in the interpretation of a new study. Such practice sometimes occurs among research specialists who confine their work to clients in a small industry. These actions tend to decrease the objectivity of the research and weaken readers' confidence in the findings. Good researchers always specify the conditions under which their conclusions seem to be valid (Cooper and Schindler, 2003:17).

5.8.9 Researcher's experience reflected

Greater confidence in the research is guaranteed if the researcher is experienced, has a good reputation in research and is a person of integrity. Where it is possible for the reader of the research report to obtain sufficient information about the researcher, this criteria perhaps would be one of the best bases for judging the degree of confidence a piece of research warrants and the value of any decision based upon it. For this reason, the research report should contain information about the qualifications of the researcher (Cooper and Schindler, 2003:17-18).

The research report should cover information on all individuals involved in the research project. It should also cover the professional research competence, for example, relevant research experience, the highest academic degree held, and memberships in business and technical societies; as well as relevant management experience (Cooper and Schindler, 2003:103).

5.9 Investigative questions

Once the research question has been selected, researcher- thinking moves to a more specific level, that of investigative questions. Investigative questions reveal the specific pieces of information the manager requires to answer the specific research question (Cooper and Schindler, 2003:75).

Investigative questions are questions the researcher must answer to satisfactorily arrive at a conclusion about the research question. To formulate them, the researcher takes a general research question and breaks it into more specific questions about which data to gather (Cooper and Schindler, 2003:75).

Target questions address the investigative questions of a specific study. These questions may be structured or unstructured. Structured questions present the participants with a fixed set of choices, often called closed questions. The closed question restricts the answers to a small set of responses and requires the questionnaire designer to have a fair knowledge of the range of options the subjects might have in this area. Unstructured questions do not limit responses, but provide a frame of reference for participants' answers, sometimes referred to as open-ended questions. The open-ended question has the merit of not imposing restrictions as to the possible answer, but it is harder to aggregate and to computerise. Open-ended questions offer rich and deeper responses (Cooper and Schindler, 2003:362), (Riley 2000: 95).

The type of interview also affects the question structure. In extremely unstructured interviews, the interviewer's task is to encourage talking in-depth about a set of topics. The in-depth interview encourages participants to share as much information as possible in an unconstrained environment. The interviewer uses a minimum of prompts (Cooper and Schindler, 2003:362).

5.10 Deduction versus induction

To induce is to draw a conclusion from one or more particular facts or pieces of evidence. The conclusion explains the facts, and the facts support the conclusion (Cooper and Schindler, 2003:37). One form of inductive inference is retroductive reasoning, whereby inferences from observations or data are used to construct or infer an explanation of the observation. Retroductive inferences involve the creation of hypotheses that provide plausible accounts and explanations of observed events and data (Moutton, 2001:118).

Deduction is a form of inference. The conclusion must follow the reasons given. The reasons are said to imply the conclusion and represent proof. For a deduction to be correct, it must be true and valid. Premises or reasons given for the conclusion must agree with the real world and the conclusion must necessarily follow from the valid premises (Cooper and Schindler, 2003:36). Phrases that usually indicate deductive reasoning include “following this”, “on the basis of the aforementioned”, “hence”, “thus”, “therefore”, “this leads to” (Moutton, 2001:117).

5.11 Surveys

Once the researcher has determined that surveying is the appropriate data collection approach; various methods may be used to secure information from individuals. A researcher can conduct a survey by personal interview, telephone, mail, computer, or a combination of these.

5.11.1 Personal interviewing

A personal interview is a two-way conversation initiated by an interviewer to obtain information from a participant. The interviewer and participant can be strangers, and the interviewer generally controls the topics and patterns of discussion (Cooper and Schindler, 2003:323).

There are real advantages, as well as clear limitations to personal interviewing. The greatest value lies in the depth of information and detail that can be secured. Personal interviewing far exceeds the information secured from telephone and self-administered studies via intercepts, mail surveys, or computer, both intranet and Internet. The interviewer can also do more things to improve the quality of the information received than with another method (Cooper and Schindler, 2003:325).

In order to have a successful personal interview, three broad conditions must be met (Cooper and Schindler, 2003:326):

- The participant must possess the information being targeted by the investigative questions.
- The participants must understand their role in the interview as the providers of accurate information.
- The participant must be adequately motivated to participate.

The interviewer's introductory explanations should be no more detailed than necessary. Too much information can introduce a bias (Cooper and Schindler, 2003:329).

5.11.1.1 Gathering personal interview data

A difficult task in interviewing is to make certain the questions adequately satisfy the question's objectives. It is important to know the objectives of questions, because many first responses are inadequate even in the best-planned events (Cooper and Schindler, 2003:330). Interviewing cannot begin until decisions have been made about who to interview and what questions to ask (May, 2002:204).

The technique of stimulating participants to answer fully and relevantly is termed probing. There are several different probing styles (Cooper and Schindler, 2003:326):

- A brief statement of understanding and interest. The comments from the interviewer can tell the participant that he is listening.
- An expectant pause will suggest to the participant that more information is required.

- Repeating the question. This is particularly useful when the participant appears not to have understood the question or has strayed from the subject.
- Repeating the participant's reply. Hearing thoughts restated often promotes revisions of further comments.
- A neutral question or comment makes a direct bid for information. Examples are: "Why do you think this is so?" or "Anything else?"
- Question clarification. When the answer is unclear or is inconsistent with something already said, the interviewer may suggest to the participant that he has failed to understand fully.

5.11.1.2 Recording personal interviews

While the methods used in recording will vary, the interviewer usually writes down the answers of the participants. Some guidelines can make this task more efficient. Responses should be recorded as they occur. If the researcher waits until later, much of what has been said could be lost. Another technique is for the interviewer to repeat the response while writing it down (Cooper and Schindler, 2003:331). A researcher should not wait until all the data has been collected before starting to analyse it. He should thus write up or record the field notes as soon as possible (Moutton, 2001:111).

5.12 Findings, summary, conclusions and recommendations

The objective with the findings section is to explain the data, rather than draw interpretations or conclusions. When quantitative data can be presented, this should be done with charts, graphics and tables (Cooper and Schindler, 2003:664).

The researcher does not need to include all the data collected. However, he should show findings that are unfavourable to the hypotheses, as well as those that support it (Cooper and Schindler, 2003:664).

The summary, on the other hand, is a brief statement of the essential findings. Sectional summaries may be used if there are many specific findings (Cooper and Schindler, 2003:665).

Findings state facts; conclusions represent inferences drawn from findings. A writer is sometimes reluctant to make conclusions and leaves the task to the reader. The researcher is the best informed about the factors that critically influence his findings and conclusions (Cooper and Schindler, 2003:665).

In academic research, the recommendations are often further study suggestions that broaden or test understanding of the subject area. In applied research, the recommendations will usually be for managerial action, rather than for research action. The writer of the research report may offer several alternatives with justifications (Cooper and Schindler, 2003:665).

5.13 Reducing interview subjectivity

Awareness of what problems subjectivity presents, should help the interviewer to use and explore subjectivity during the interview. The challenge, however, comes at the interpretation stage when the researcher is faced with tape recordings or transcripts of the interview. The three areas that should be covered are relativity, point of view and context (Moutton, 2001:130).

5.13.1 Relativity

When people make statements they often make relative judgements and thus comparisons, either directly or by inference. Comparisons can be seen on two dimensions - subject and time. When the subject is making a comparison with the past or future, it is important to understand the meaning they attribute to what they are describing (Moutton, 2001:131).

5.13.2 Point of view

There are three aspects to point of view that must be considered by the researcher (Moutton, 2001:131):

- The subject's perspective, his own perspective or the perspective of another role, for example a manager.
- The knowledge of the subject used when making the statement.
- The expertise of the subject. The level of knowledge or ignorance that lies behind a statement plays a part in its interpretation.

5.13.3 Context

When people speak, there is always an implied background or situation even if it not mentioned specifically. The background is important to understand what is being said. The researcher should be on the look out for implied comparisons, changes in point of view and implied contexts as part of good interviewing practice (Moutton, 2001:131).

5.14 Credibility of qualitative research

The credibility of the qualitative inquiry depends on three distinct, but related inquiry elements (Patton, 2002:543-544):

- Rigorous methods for doing fieldwork that yield high-quality data that is systematically analysed with attention to issues of credibility (Patton, 2002:543). Qualitative research depends from the beginning on astute pattern recognition. The researcher should approach the topic with the approach of searching for alternative themes, divergent patterns, and rival explanations which enhance credibility. The mind-set of the researcher should not be focussed on attempting to disprove the alternatives; rather to look for data that support alternative explanations (Patton, 2002:543).
- The credibility of the researcher, which is dependent on training, experience, track record, status, and presentation of self (Patton, 2002:543). Since the

researcher is the instrument in the qualitative inquiry, a qualitative report should include some information about him, for example, the experience, training, and perspective the researcher brings to the field; who funded the research and what arrangements were made with the researcher; how did the researcher gain access to the study site; what prior knowledge did the researcher bring to the research topic; what personal connections does the researcher have to the people, programme, or topic studied (Patton, 2002:566).

- Philosophical belief in the value of qualitative inquiry, that is, a fundamental appreciation of naturalistic inquiry, qualitative methods, inductive analysis, purposeful sampling, and holistic thinking (Patton, 2002:543). The use of qualitative methods can be quite controversial. The controversy stems from the long-standing debate in science concerning how best to study and understand the world. How the debate is framed depends on the perspectives that people bring to it and the language available to them to talk about it (Patton, 2002:571). Subjective data imply opinion rather than fact, intuition rather than logic, impression rather than confirmation. Even so, the ways in which measures are constructed in psychological tests, questionnaires, cost-benefit indicators, and routine information management systems are no less open to the intrusion of biases than making observations in the field or asking questions in interviews. Numbers do not protect against bias; they merely disguise it. All statistical data is based on someone's definition of what to measure and how to measure it (Patton, 2002:574).

5.15 Limitations of the research

People viewing qualitative research findings through different paradigmatic lenses will react differently just as researchers and evaluators vary in how they think about what they do when the word is studied (Patton, 2002:543).

The research has had the following limitations which need to be mentioned:

- Limited experience: The researcher has had limited experience in the subject of aligning the supply and demand within a supply chain. The previous work

experience includes some parts of the demand and supply side of the supply chain, but no extensive experience of aligning the supply and demand within the supply chain.

- Limited access to other companies: Due to the sensitive nature of the research and information, the research was limited to academic research, as well as reports published by Kraft Foods for internal and external use.
- The research was limited to Kraft Foods South Africa. The principles of the demand and supply alignment could be applied to other Kraft units, the fast moving consumer goods industry, as well as other industries battling with the challenges of supply and demand alignment.
- No previous research on the supply and demand alignment within Kraft Foods South Africa has ever been done. Secondary research material concerning Kraft Foods South Africa was therefore very limited. Much of the secondary research material is also not available to the public, because of confidentiality and the sensitivity of the information.

Despite the limitations of the research, it was completed on time and will add valuable knowledge to the understanding of supply and demand alignment within a supply chain.

5.16 Conclusion

This chapter describes the study of the research methods that provide a researcher with the knowledge and skills to solve the problems and meet the challenges of a fast-paced decision-making environment (Cooper and Schindler 2003:5).

This research study was a descriptive research study as the researcher attempted to describe or define a research subject, by creating a profile of a group of problems, people or events (Cooper, 2003:10). During the interrogation or communication part of the research study, the researcher questioned the subjects and collected their responses by personal and telephonic interviews (Cooper and Schindler, 2003:6).

The research design was an ex post facto design, because the researcher had no control over the variables and simply reported what has happened or what is happening within Kraft Foods South Africa (Cooper and Schindler, 2003:149). All responses to all questions were carefully interpreted (Cooper and Schindler, 2003:150). The research can also be regarded as a cross-sectional study as it represents a snapshot of the alignment of the supply and demand within Kraft Foods South Africa's supply chain.

The case study of Kraft Foods South Africa's supply and demand alignment placed more emphasis on a full contextual analysis of fewer events of conditions and other interrelations (Cooper and Schindler, 2003:150). The research design was done under actual environmental conditions, called field conditions, for example, up-to-date supply chain results were reported and interviews were done with all the parties that were involved in Kraft Foods South Africa's daily operations (Cooper and Schindler, 2003:150).

The first step in the exploratory study was an examination of the secondary literature. The aim of the secondary research was to use previously published studies or information about supply and demand alignment within a supply chain (Cooper, 2003:152-153). As the researcher collected the information about the topic, the sources were evaluated and selected based on the following five factors: purpose, scope, authority, audience, format (Cooper, 2003:284). The researcher tried to ensure that the literature review was exhaustive in its coverage; fair in its treatment of others; that the research material is topical and not dated; and that the literature is well-organised (Moutton, 2001:90-91).

While published data is a valuable resource, no more than a fraction of the existing knowledge in a field is put into writing. A significant portion of what is known concerning a topic, while in writing, may be proprietary to a given organisation and thus unavailable to an outside researcher. Also internal data archives are rarely well-organised, making secondary sources even when known, difficult to locate (Cooper, 2003:153).

Experience surveys or structured interviews were therefore conducted with key people within Kraft Foods South Africa's supply chain to determine the cause and solutions of supply and demand alignment within the supply chain (Cooper and Schindler, 2003:362). During the interviews various open and closed questions were asked to determine the answers for the research study (Riley 2000: 95).

Researchers are often tempted to broaden the basis of induction by including personal experience and their interpretations; however, the researcher limited the conclusions to those for which the data provided an adequate basis (Cooper and Schindler, 2003:17).

The research study was completed even though, the following limitations were experienced: the researcher had limited experience in the subject of aligning the supply and demand within a supply chain, as well as previous research work; limited access to other companies due to the sensitive nature of the research and information; the research was limited to Kraft Foods South Africa; and finally no previous research has been done on the alignment of supply and demand within Kraft Foods South Africa's supply chain.

CHAPTER 6: RESEARCH FINDINGS

6.1 Introduction

While published data is a valuable resource, no more than a fraction of the existing knowledge in a field is put into writing. The structured in-depth interviews will essentially be experience surveys. A significant portion of what is known on a topic may be proprietary to a given organisation and thus unavailable to an outside researcher (Cooper and Schindler, 2003: 153). The aim of the structured in-depth interviews was to seek information from people experienced in the area of the research study, tapping into their collective memories and experience (Cooper and Schindler, 2003: 154). The structured in-depth interviews were conducted with key people within Kraft Foods South Africa that were involved in the alignment of supply and demand on a daily basis. The interviews, which were split into demand and supply management, were conducted with the following people:

Demand management:

- Nigel Parsons, Sales Director, Kraft Foods South Africa. Personal interview.
- Barry Iliffe, Retail Sales Manager, Kraft Foods South Africa. Personal interview.
- Brian van Blerk, Wholesale Sales Manager, Kraft Foods South Africa. Personal interview.
- Alan Devraj, National Sales Manager, Kraft Foods South Africa. Personal interview. Alan Devraj is responsible for the smaller customer accounts not covered by the national key account managers.
- Marianne Schofield, National Key Account Manager – Pick ‘n Pay, Kraft Foods South Africa. Telephonic interview.
- Louise Grove, National Key Account Manager – Shoprite Checkers, Kraft Foods South Africa. Telephonic interview.
- Don Masinga, National Key Account Manager – Metro, Kraft Foods South Africa. Personal interview.

- Glenn Gess, National Key Account Manager – Metcash, Kraft Foods South Africa. Personal interview.
- Jaco Erasmus, National Key Account Manager – Spar. Kraft Foods South Africa. Personal interview.
- Abrie de Swardt, Director Customer Services, Logistics and Procurement. Kraft Foods South Africa. Personal interview.
- Dave Templeton, Logistics Operations Manager. Kraft Foods South Africa. Personal interview.
- Thinusha Naicker, Customer Services Manager. Kraft Foods South Africa. Personal interview.
- Sjanie Horne, Demand Planner. Kraft Foods South Africa. Personal interview.
- Sina Molelekoa, Demand Planner. Kraft Foods South Africa. Personal interview.
- Clive Sandwick, Marketing Director. Kraft Foods South Africa. Personal interview.
- Allan Strydom, Marketing Manager – Beverages and Other Grocery. Kraft Foods South Africa. Personal interview.
- Angela Brokke, Marketing Manager – Biscuits and Confectionery. Kraft Foods South Africa. Personal interview.

Supply management

- Thys Redelinghuys, Plant Director, Kraft Foods South Africa. Telephonic interview.
- Oliver Moses, Production Planning Manager, Kraft Foods South Africa. Telephonic interview.
- Zandi Kubheka, Master Production Scheduler, Kraft Foods South Africa. Telephonic interview.
- Ron Greenslade, Manufacturing Maintenance Manager Biscuits, Kraft Foods South Africa. Telephonic interview.
- Stefanus van Zyl, Production Manager, Kraft Foods South Africa. Telephonic interview.
- Johan Herselman, Production Manager, Kraft Foods South Africa. Telephonic interview.

- Dave Templeton, Logistics Operations Manager. Kraft Foods South Africa. Personal interview.
- Abrie de Swardt, Director Customer Services, Logistics and Procurement. Kraft Foods South Africa. Personal interview.
- Audrius Sarulis, Procurement Manager. Kraft Foods South Africa. Telephonic interview.
- Mark Gardiner, Raw Material Purchasing Manager. Kraft Foods South Africa. Telephonic interview.
- Peggie Chetty, Packaging Purchasing Manager. Kraft Foods South Africa. Telephonic interview.

The personal structured interviews were conducted in the meeting rooms of Kraft Foods South Africa's new office at Woodmead, Johannesburg. The researcher, as well as the sales and supply chain departments, are based at the Woodmead offices which allowed for personal interviews. The supply management staff members are based at the Tunney factory in Elandsfontein, Johannesburg, which is about half an hour's drive away from the administrative head office at Woodmead. Not all the supply management staff members could be interviewed at the same time. Telephonic interviews were thus conducted with most of the supply management staff members due to the distance between the Woodmead and Tunney offices, and to cater for the different times people were available for interviews. The interviews were conducted between December 2004 and May 2005. Some of the interviews were conducted during and after working hours depending on the availability of the various people interviewed. The interviews, which were planned for November 2004, were postponed to December 2004 as a result of a visit from Kraft Foods' Regional Director in November 2004.

At the beginning of December 2004, a research document was distributed to the key people involved in the demand and supply alignment of Kraft Foods South Africa. The research document contained an introduction, aim of the research and a detailed list of the questions. The document explained the background and purpose of the

research. The list of questions allowed people to prepare for the interviews. The responses from the people who were available for the interviews were very positive.

The interviews were split into the two main areas of the research, demand and supply management, and were conducted with people that were involved in each area. Some of the questions were interrelated and the interviews were concluded with an overview and status of the current supply and demand alignment within Kraft Foods South Africa. Printed copies of the interview questionnaire were provided. The researcher asked the questions and the responses were immediately recorded on paper. When necessary, clarifying questions were added to ensure that the responses were understood. In some cases, the responses were repeated to ensure that they were recorded accurately. In some cases, a general example was provided to evoke additional responses, for example, supply management staff members were asked if they believed local raw materials and packaging would speed up the response of the factory to demand changes.

6.2 Outcome of structured interviews

The costs of a mismatch between supply and demand, measured as the combination of inventory carrying costs, markdown costs and stockout costs, are growing in many industries (Gattorna, 1998:172). The benefits of reducing the supply-demand mismatch are enormous. An improvement in the alignment between supply and demand can lead to a significant increase in profits, better customer service and therefore additional sales (Gattorna, 1998:172).

The aims of the structured interviews were to determine the following:

- To identify the causes of the misalignment between the supply and demand within Kraft Foods South Africa's supply chain.
- To identify potential solutions that could improve the alignment between the supply and demand within Kraft Foods South Africa's supply chain.

The interviews were split between demand and supply management, in order to focus on the interviewee's area of expertise and to identify individually and overall what the solutions to improving the alignment between supply and demand are.

6.2.1 Demand management

6.2.1.1 Focus of demand forecast

Kraft Foods South Africa is currently trying to forecast the factory shipment data (Van Blerk, 2005), (Erasmus, 2004), (Gess, 2004), (Devraj, 2004), (Parsons, 2004) (Templeton, 2004) (Sandwick, 2005) (Molelekoa, 2005), (Ilfie, 2005), (Masinga, 2005), (Grove, 2005), Schofield, 2005), (Horne, 2005), (Naicker, 2005), (Strydom, 2005) (Brokke, 2005). The factory shipment data is the actual volume shipped from Kraft Foods to the customers, for example, Checkers distribution centres or individual customer stores.

Other alternative demand data, which is available and should be considered, are for example:

- Van Blerk (2005) indicated that point- of- sales data is already available for the top-end retail channels like Pick 'n Pay, Shoprite and Spar. According to van Blerk (2005), the wholesale channel normally does not sell its point- of- sales data; however, the information can be obtained through negotiation and at a cost.
- Van Blerk (2005) also indicated that consumer sales trends are also published by market research companies like AC Nielsen, who use consumer-scanning data obtained from top-end retail and wholesale sales channels.
- The aim of the demand forecasting, is to determine the true demand (Erasmus, 2004). In order to determine the future demand, Erasmus (2004) suggested that the following adjustments be made: increasing Kraft's historical actual sales with a reasonable percentage of lost sales; future growth expectations from the customer accounts and /or product category; sales volume expectations from planned and confirmed activities such as in-store

activities; consumer consumption trends and not chain fill. Erasmus (2004) warned that the customer sales rate patterns for the various demand streams should be considered, for example, smaller Spar stores would normally order every week, while Spar distribution centres would place an order every 4 to 6 weeks.

- Erasmus (2004) pointed out that the demand data for the all the other demand streams are available for Spar, for example customer supplied forecasts, point- of- sales data, customer warehouse movement data, customer order data and factory shipment data. One simply has to request the data.
- Gess (2004) indicated that point- of- sales data can be obtained from Massmart's SAP system. There is no additional cost involved. In the case of Massmart, we simply have to request the data. Gess (2004) pointed out that initially Massmart may have concerns about sharing confidential information, and they may also fear that Kraft will contact their biggest customers directly.
- Devraj (2004) also indicated that point- of- sales data is available from our major customers, for example EPOS – Pick 'n Pay, B2B – Shoprite, E3 – Metro, EDI –Spar.
- Templeton (2004) raised the concern that the forecast unit of measure should change from tons to units. The factory and our customers both use unit volumes and not ton volumes. Checkers Shoprite can only supply customer-supplied forecasts for its distribution centres.
- Brokke (2005) warned that the specific customer profile should be considered when using customer supplied forecast. Forecasts submitted by store owners, for example Spar franchises, are more accurate than corporate stores, for example Pick 'n Pay stores where managers and not the owners submit the forecasts.

Customer supplied forecasts have been obtained in the past, for example baking powder, jellies' and desserts' forecasts for October to December 2004 (Van Blerk 2005), (Erasmus, 2004), (Gess, 2004), (Devraj, 2004), (Parsons, 2004), (Templeton, 2004). Kraft's major customers, however, do not supply the information on a regular basis, because of Kraft's low service levels.

In some cases, the business used a combination of the various demand data streams during certain periods of the year (De Swardt, 2005). Customer supplied forecasts, for example, were obtained from Checkers Shoprite for Easter 2005, while a combination of customer order data and factory shipment data was used for items with low service levels in order to determine the historical baseline data.

Iliffe (2005), Strydom (2005) and Brokke (2005) mentioned that the business should move from determining what the customers want to what the consumers want. Iliffe (2005) added that more information is required to understand the various demand streams, for example, who is the real shopper of the products, who is the real consumer, how often does the shopper buy – daily, weekly, monthly. One of the implications of focussing on factory shipment data is incorrect stock levels (Brokke, 2005). Too high stock levels result in stock freshness issues and too low stock levels result in lost sales. The demand distortions created by customer push strategies can be reduced by focussing on true consumer pull (Brokke, 2005). De Swardt (2005) also added that Kraft Foods Inc. was already considering using more actual customer and consumer demand data in future, for example, some trade channels in Europe and the United States have started pilot projects on vendor management inventory and radio frequency identification.

6.2.1.2 Supply chain trigger: order versus forecast

The trigger for Kraft Foods South Africa's supply chain is currently the forecast (Van Blerk, 2005), (Erasmus, 2004), (Gess, 2004), (Devraj, 2004), (Parsons, 2004), (Templeton, 2004), (Sandwick, 2005), (Molelekoa, 2005), (Iliffe, 2005), (Masinga, 2005), (Grove, 2005), Schofield, 2005), (Horne, 2005), (Naicker, 2005), (Strydom, 2005) (Brokke, 2005) (De Swardt, 2005). The participants also mentioned that the ideal situation would be that the supply chain should be triggered with a customer order in the future. In a made-to-order situation, however, the supply chain can be triggered by a customer order (Naicker, 2005). De Swardt (2005) mentioned that the business should move gradually from customer forecasts to customer orders. However, the business is still very far from realizing this and this will also require significant improvements in the collaboration with key customers.

The major reasons for using the forecast as the trigger for the supply chain are:

- Kraft's Supply chain can currently not react to a customer's order requirements, such as nominated delivery dates and 48 to 72 hour delivery windows. The result is that the forecast is used to provide the supply chain with sufficient time to react to customer orders (Van Blerk, 2005) (Erasmus, 2004).
- Some of the systems used by our customers such as Massmart, only allow for a maximum of one-week delivery. Where orders are not executed, they are removed from the system. Where deliveries can take place after one-week delivery lead-time, new orders have to be confirmed by the customers (Gess 2004).

6.2.1.3 Involvement of customer and suppliers in planning

Kraft's customers have a limited involvement in the planning. Suppliers are not involved at all at this stage (Van Blerk, 2005), (Erasmus, 2004), (Gess, 2004), (Devraj, 2004), (Parsons, 2004) (Templeton, 2004) (Sandwick, 2005) (Molelekoa, 2005), (Iliffe, 2005), (Masinga, 2005), (Grove, 2005), Schofield, 2005), (Horne, 2005), (Naicker, 2005), (Strydom, 2005) (Brokke, 2005).

Van Blerk (2005) and Iliffe (2005) reflected on some initiatives to obtain customer supplied forecasts from Shoprite Checkers and Metro regarding baking powder, jellies and desserts for October to December 2004. Iliffe (2005) indicated that the customers supplied forecasts were currently limited to the distribution centre customers and the high peak seasons of Easter and Christmas. Van Blerk (2005) added that customers were willing to share forecasts in order to secure orders and force allocated stock. Customer business plans are jointly compiled by Kraft and its key customers. The customer business plans cover topics such as strategic intent, SWOT analysis, 3-year historical trend, activity priorities, and objectives per product categories, action plans per product categories, concerns, barriers, promotional grids and profit and loss statements.

Customers have very little involvement at the moment. Kraft's low customer service levels have had an impact on the company's credibility with the trade. The low service levels have resulted in limited support from the customers. Some of the customers are willing; however, Kraft's commitment has been questioned (Erasmus (2004). Customer supplied forecasts data can be obtained, however the historical sales pattern is distorted due to low service level to fulfil customer orders (Masinga, 2005). Brokke (2005) also mentioned that the other complication in the past has been that Kraft is not a product category leader as is the case in other markets around the world. Customers, for example, have not accepted category management planograms so easily in the past because they regarded Kraft less of a priority in certain categories, for example biscuits.

Gess (2004) suggested that we involve our customers more and more. He also suggested using exclusive imported lines, such as chocolates, to obtain commitment from the trade. The exclusivity would act as an incentive for the selected trade partners to take part in the planning. The other benefit of exclusive distribution is that price becomes less of an issue during negotiations. Standard items, that are widely distributed, are regarded as commodities.

Templeton (2004) indicated that some of our customers are actually part of the planning processes. Made-to-order products forecasts are provided by Patleys for Cheese and Lufil provide forecasts for Spoonables like Miracle Whip.

De Swardt (2005) warned that the business should implement the basics first before considering involving customers and suppliers in the planning and execution. Some collaboration with customers has taken place, for example Shoprite Checkers provided Kraft with their Easter 2005 forecast, while quarterly performance reviews between Spar and Kraft are planned for later in 2005. Some collaboration with suppliers has also taken place, for example, lower minimum production minimum order quantities were negotiated with the supplier of Beechies chewing gum which resulted in an improvement in working capital. The suggested supply orders for a longer forecast period were also shared with some suppliers to reduce the "bull whip effect", for example the required supply orders for Miracle Whip mayonnaise have been shared with the supplier Mullins as from January 2005, which allowed the supplier to plan their

procurement and production in anticipation of an increase or reduction in forecast. Measurement should be part of all the planning and execution activities with customers and suppliers, for example customer service levels per stock keeping unit per store and sales forecast accuracy per item should be reviewed with customers.

6.2.1.4 Causes of demand variability

The demand variability is caused mainly by non-supply or over-supply to our customers (Van Blerk, 2005), (Erasmus, 2004), (Gess, 2004), (Devraj, 2004), (Parsons, 2004) (Templeton, 2004), (Sandwick, 2005), (Molelekoa, 2005), (Iliffe, 2005), (Masinga, 2005), (Grove, 2005), Schofield, 2005), (Horne, 2005), (Naicker, 2005), (Strydom, 2005) (Brokke, 2005) (De Swardt, 2005). Erasmus (2004) indicated that the non-supply is caused by Kraft's historical inability to supply against demand. The over-supply, on the other hand, is caused by push sales strategies according to Erasmus (2004). (Erasmus, 2004) and Sandwick (2005) indicated that reactive sales target gap closure plans have been initiated to achieve overall sales volume targets. Erasmus (2004), Naicker (2005) and Strydom (2005) added that the reactive sales target gap closures, in most cases, do not reflect true customer and consumer demand, for example, high volumes are sold to customers just before price increases are implemented with the trade. One of the implications of push sales strategies is that customers will adapt their buying pattern based on their expectations of a repeat of promotions, for example, customers will delay their buying in anticipation of a potential annual price increase by Kraft. Horne (2005) and Strydom (2005) added that the inconsistent supply from the local Tunney plant has also affected the demand variability pattern.

Price increases should not be implemented across all sales channels at the same time. One option, for example, is to implement a price increase in wholesale first and then later in retail. Wholesalers may react and buy 4 to 8 weeks of stock, while retail buys 2 to 4 weeks of stock. The gradual implementation of price increases across all sales channels will ensure that the price increase and subsequent demand variability is spread more smoothly across all accounts (Gess, 2004).

Devraj (2004) indicated that economies of scale and payment terms also play a role in demand variability. Customers buy in bulk in line with their requirements for the next couple of weeks. Dedicated delivery dates also play a role in bulk buying as deliveries to customers do not take place on a daily basis. Various deliveries are combined to meet the required delivery dates. The customer payment terms also alter customers' normal buying patterns. Customers know that Kraft's financial month-end is the middle of the calendar month, for example, Kraft December 2004 month-end was on 15 December 2004. Customers delay orders until the start of a new Kraft financial month-end, in order to benefit from extended trade terms. Customers, for example, delayed orders until 16 December 2004, the start of the Kraft January 2005 month, to take advantage of an extra month's credit terms.

Demand variability is also caused by the lack of detail provided for future promotions. The promotional grids only indicate the timings of future promotions. They do not indicate the volume expectations. Demand expectations are updated too close to the implementation of promotions which puts a lot of pressure on supply to react to the demand expectations. The risk is that money has been invested, in the form of advertising and promotional stands, while the business is unable to provide sufficient supply. The ongoing and proactive alignment of the demand and supply is crucial especially for long lead-time items. The demand forecast for the Sensations Chocolate range, for example, was reviewed and increased 4 weeks before the trade launch, while the normal supply lead time is 8 to 10 weeks from the date of placing purchase orders at overseas Kraft plants to take receipt of the product in South Africa. This mismatch of demand and supply resulted in lost sales (Templeton, 2004).

In other cases, the forecasts for new product launches were too low. The sales team tried rather to over deliver on the forecast due to the sales incentive plan linked to new product launches. The sales team has been penalised in the past for not achieving the sales volume forecasts (Sandwick, 2005).

The demand variability has been affected by the change in pack size configuration, for example Beechies, Manhattan Pre-Packs, Super C Rolls and Crackermates biscuits. During the early stages of implementing the pack size reduction of Super C

Rolls, the sales volumes increased in units, however the volumes decreased in tons (Brokke, 2005).

The combination of the various factors to drive demand is also distorting demand variability, for example price increases and promotions are done at the same time, it is very difficult to determine the impact of the various strategies (Brokke, 2005), (Strydom, 2005). One option to determine the impact of the various factors is to implement them at various intervals and not at the same time. The cell phone industry has used the strategy very well, for example, various special offers are provided at different times. If customers do react to certain specials, the impact can be determined. The airline industry and retail sector have implemented customer loyalty programmes which allow them to determine the impact of various special offers, for example the South African Airways Voyager Miles and Clicks loyalty card programmes (Brokke, 2005).

Other factors outside Kraft could also affect the demand variability, for example, competitive activity and seasonality. Nestle South Africa, for example, could not process all the customer orders during the first few months of 2005 due to the implementation of SAP. The out-of-stock situation at Nestle increased the demand for Kraft competitive products like mayonnaise and coffee. The out-of-stock situation with Maynard, a confectionery brand of Beacon, also increased the demand for Kraft's Manhattan confectionery range (Molelekoa, 2005), (Brokke, 2005). The demand variability for some Kraft products is normally very seasonal, for example more baking powder is sold during the Easter and Christmas periods (Molelekoa, 2005). Iliffe (2005) added that some of the retailers have also started importing cheap biscuits. Even negotiations with the trade could result in some variability in the demand, for example, a disagreement with the trade could result in the delisting of some of Kraft's products. New consumer trends towards food with low levels of carbohydrates and saturated fats have also affected the demand patterns of products. Other trends in the market place in South Africa include the increase in the aspiring new middle class, for example consumers switched from Minora to Gillette shaving blades and they started moving from spazas to shopping malls. Horne (2005) added that the demand variability is also normally higher before and during public holidays. Brokke (2005) warned that major changes in macro economic

conditions could also affect the demand variability of products, for example, if petrol prices increase, consumers will have less money available for their baskets. The impact of macro economic factors is normally gradual.

De Swardt (2005) added that there are other external factors that also have an impact on the demand variability. The business should concentrate on the factors within its control that cause demand variability. Kraft Foods, for example, cannot plan for the timing and impact of potential competitive price promotions. The power of retailers on the demand variability should also be considered, for example, job orders, retailer birthday orders and special orders could distort the demand pattern of products.

Parsons (2004) and Erasmus (2004) warned that the end result of all the demand variability created by all the promotional activities and pricing is that Kraft does not have a good understanding of its baseline business. The incremental event volumes and baseline volumes form part of the aggregated sales history. The lack of understanding of historical baseline demand volumes makes it very difficult to forecast and commit to future demand volumes, for example, if historical price promotions are not repeated, demand forecasts will not be achieved. De Swardt (2005) also mentioned that the inability of the business to forecast might result in further push sales strategies, for example selling short dated stock, which might distort the demand pattern even further.

The major causes of demand variability are caused by Kraft Foods South Africa itself, although seasonality and other external factors play a role (Van Blerk, 2005), (Erasmus, 2004), (Gess, 2004), (Devraj, 2004), (Parsons, 2004) (Templeton, 2004) (Sandwick, 2005), (Molelekoa, 2005), (Ilfie, 2005), (Masinga, 2005), (Grove, 2005), Schofield, 2005), (Horne, 2005), (Naicker, 2005), (Strydom, 2005) (Brokke, 2005).

6.2.1.5 Demand forecasting versus demand management

Kraft Foods is only forecasting demand at the moment. All parties indicated that demand should rather be managed than forecasted in future (Van Blerk, 2005),

(Erasmus, 2004) (Gess, 2004) (Devraj, 2004) (Parsons, 2004) (Templeton, 2004) (Sandwick, 2005) (Molelekoa, 2005) (Ilfie, 2005) (Masinga, 2005) (Grove, 2005), Schofield, 2005) (Horne, 2005) (Naicker, 2005) (Strydom, 2005) (Brokke, 2005). De Swardt (2005) warned that the business needed a combination of forecasting and managing demand. Demand forecasting allowed the business to produce in anticipation of future demand. The business had to manage the demand due to the low forecasting accuracy.

According to Erasmus (2004), Kraft requires the following to manage demand:

- A good understanding of the historical baseline volumes. Kraft must determine what the normal sales volumes would have been without any events such as supply shortages or promotional activity.
- A good understanding of the impact of activities on historical demand, for example, the impact of price increases.
- A good understanding of the expectations of planned activities, for example, volume expectations of planned product launches.

The above- mentioned should result in a better understanding of the historical and future demand with the aim of creating and managing a smoother demand line (Erasmus, 2004),

The business has tried in some cases to influence and manage demand. The internal focus has moved from high volume to high margin product groups, like Oreo, Royal baking powder and Manhattan Gells. The focus on high margin product categories has also resulted in a change in the sales mix in the trade which has ultimately resulted in a change in the consumer baskets (Ilfie, 2005). All promotions in the business have been aligned to the high margin product groups (Masinga, 2005) (Schofield, 2005). Where the business experienced out-of-stock situations, it tried to move customer orders to those items where the business had enough stock, for example, Kronung 100g was promoted during Winter 2005, while the business had no Kronung 200g stock (Horne, 2005).

Moving from forecasting to managing demand also has certain challenges. Gess (2004) warned that most fast moving consumer goods companies, even competitors

like Nestle, are trying to forecast and not manage demand. Most companies struggle to forecast demand and have not considered managing demand (Gess, 2004). Devraj (2004) pointed out that Kraft Foods South Africa's brands are not yet strong enough or well-enough established to move to a situation where demand is managed. Kraft Foods South Africa, for example, will not be able to implement a price increase across the wholesale and retail trade at different times. The wholesale and retail trade channels monitor the retail selling prices across all channels on a weekly basis based on data supplied by Adcheck. Major differences in pricing will thus be very difficult to negotiate and implement as the buyers from the wholesale and retail trade channels monitor the pricing variances on a weekly basis. Van Blerk (2005) adds that Kraft Foods South Africa is trying to maintain one window to the trade, which complicates the different strategies across the wholesale and retail trade. Some of the bigger customer groups also have wholesale and retail trade channels. Negotiating and implementing a different pricing strategy across the wholesale and retail trade with the same customer group would be a challenge. Naicker (2005) warned that the business should always be prepared to react to demand changes. Brokke (2005) mentioned that Kraft Foods South Africa should manage the demand when the business has high out-of-stock. The business should thus rather manage the supply and related demand issues, rather than simply focussing on forecasts only. Daily forecasts can be done if the product supply is consistent and reliable, for example bread sales forecasts are done daily by Albany Bakeries.

The normal sales budgets should focus on forecasting demand, while planned customer promotions should aim at managing demand. Planned customer promotions, for example, could be implemented earlier or later to influence the customer demand patterns. The requirement of a successful planned promotion is that it should also be aligned with the supply capabilities of the business, and vice versa. The trade launch of Oreo Project Iceberg, for example, was delayed in 2004, which resulted in additional warehousing costs (Templeton, 2004).

6.2.1.6 Information that increases forecast accuracy

Erasmus (2004) stated that consumer consumption data could improve forecast accuracy. The data for all the other demand streams, which could be obtained at a cost, would increase forecast accuracy. The demand streams include customer-supplied forecasts, point-of-sales data, customer warehouse movement data, customer order data and factory shipment data. The aim is to get the forecast as close as possible to the consumer consumption (Erasmus, 2004), (Gess, 2004) (Devraj, 2004), (Strydom, 2005).

Devraj (2004) warned that Kraft Foods should ensure that the various demand data differentiate between the promotional period, which is the time when the trade promotes the stock, and the inventory investment period, which is the time when the trade buys-in stock. The inventory investment period occurs before the promotional period. If Kraft only ensures stock availability during the promotional period, the stock will arrive too late in the trade. The delay in stock availability would result in lost sales. Molelekoa (2005) added that the cannibalisation of new products should be quantified.

The following information could increase forecast accuracy:

- A better understanding of base business and trends (Parsons, 2004)
- A better knowledge of promotional volumes from trade (Parsons, 2004).
- A better post- evaluation of promotions (Parsons, 2004).
- Historical sales data should be stated in units and not in tons. Tons is the standard unit of measure within Kraft, however, customers and the factory work in units. Where pack size changes are made, the impact in units is a better reflection of the demand forecast changes, for example, the unit weight per Super C roll has been decreased. A pack size reduction should result in lower volume in tons, because customers normally continue to buy the same amount of selling units (Templeton, 2004).
- The impact of lost sales should be added to the factory shipment data. This concern was also raised by Erasmus (2004) (Masinga, 2005).

- The Kraft sales team and customers should review their demand expectations closer to when the promotions occur. The demand review would allow Kraft to react to any potential demand changes before the start of the promotion (Templeton, 2004).
- The effect of competitive activity, for example, determines the potential increase in Kraft's coffee demand if Nestle experiences out-of-stock (Molelekoa, 2005).
- Consumer insight information, for example, which consumers use the brands, and determine the reasons why they switch brands (Iliffe, 2005).
- The impact of the various product life cycles, for example pack size changes could help when a product achieves maturity (Iliffe, 2005)
- The historical store discount levels and corresponding sales volumes could explain the change in demand pattern (Masinga, 2005).
- Stock levels and potential stock freshness risks of the various trade partners could also have an impact on the demand pattern (Masinga, 2005) (Strydom, 2005). Strydom (2005) also suggested that the impact of competitor stock levels and activity on Kraft's demand patterns should be analysed and understood.
- Post-evaluations on promotions can also increase sales forecast accuracy (Schofield, 2005). Strydom (2005) added that the forward share before and after major promotional events could indicate the impact of the various promotions on the demand variability.
- Additional and more in-depth market research in future could also improve sales forecast accuracy (Schofield, 2005). Brokke (2005) admitted that AC Nielsen market research is available; however the research only measures those trade channels where scanned consumer data is available.
- Brokke (2005) suggested that the key account sales managers obtain daily and weekly customer and consumer sales data in order to determine the sales-in and sales-out volume. If the consumer sales-out volume is much higher than the customer sales-in volume, the business could experience lost sales. If the customer sales-in volume is much higher than the consumer sales-out volume, the business could stock freshness issues. The concern is

that most of the in-depth sales analysis per store and per account is done by marketing and not sales.

- The business should also establish plans to react to supply changes (De Swardt, 2005). A better understanding of the factory dynamics would allow the business to include more flexibility in the supply plans which should increase the service levels.

Van Blerk (2005) warned that point- of- sales data could be obtained but at a high cost, for example, the cost of Pick 'n Pay consumer sales data was 0.5 % of the turnover in 2004 and the cost of Engen forecourt sales data was ZAR 200 000 per annum. Naicker (2005) added that Shoprite charge ZAR 5000 per month for access to consumer sales data. In other cases, for example, Metro and Spar consumer sales data can be obtained free of charge (Brokke, 2005) (Masinga, 2005). Van Blerk (2005) concluded that any company should consider the benefit and costs of additional demand data.

6.2.1.7 Costs and implications of misalignment between supply and demand

The misalignment of the supply and demand has resulted in too high or too low stock levels and poor service levels (Sandwick, 2005), (Molelekoa, 2005), (Ilfie, 2005), (Masinga, 2005), (Grove, 2005), Schofield, 2005), (Horne, 2005), (Naicker, 2005), (Strydom, 2005) (Brokke, 2005). Lost sales occurred where the stock levels were too low, while the business had to deal with stock freshness issues where the stock levels were too high.

Erasmus (2004) was very concerned that the total lost sales for 2004 was more than ZAR 100 million for Kraft Foods South Africa. The work in capital was also severely affected by the increase in inventory caused by stock being produced later than required by customers. The lost sales also affected the potential cash that could have been collected from customers. The lost sales claim from key customers was above ZAR 100 000 of which ZAR 40 000 was approved. Kraft was also forced to pay the Spar group a rebate of 1 % of the turnover, due to the lost sales value. The lost sales opportunities have also affected Kraft's credibility and relationship with the trade

(Erasmus, 2004) (Brokke, 2005). The danger and risk were that end users could have switched to competitive products. Schofield (2005) also warned that some of the trade investments could be wasted if promotions were not executed properly.

Gess (2004) was forced to approve lost sales claims of ZAR 7000 from the trade. The company's credibility lost with the trade could also have an impact on the commitment from trade on future promotions, for example, Game did not want to feature any Kraft products in promotional leaflets to avoid a risk of products being out of stock. One way of creating enthusiasm with the trade is to ensure that Kraft is the first to market a new product or that the trade is offered exclusivity.

The lost sales of ZAR 100 million was overstated, however, Kraft probably lost about ZAR 20 million in turnover. The losses associated with promotional claims are between ZAR 200 000 and 300 000 per annum (Devraj, 2004). Van Blerk (2005) also confirmed that Kraft was forced to pay for promotions; even though the stock for the promotions could not be supplied. Van Blerk (2005) and (Masinga, 2005) were also concerned about the impact on Kraft's credibility with the trade in the longer term. It is estimated that it costs about seven times more to win an old customer back (van Blerk, 2005). Masinga (2005) also added that the lost sales and profit affected Kraft, as well as the trade partners. Naicker (2005) warned that the future implication of lost sales should be considered. Where lost sales, for example, continue in trade, the loyalty of a customer and consumer towards a company's brand will decrease which could result in a reduction of allocated shelf space. (Brokke, 2005) also added that lost sales could also affect Kraft's ability to negotiate favourable trade terms and discounts with the retail and wholesale trade. Continuing lost sales may also result in a delay in receiving payment from its customers affecting the cash flow of the business.

Kraft wrote off ZAR 400 000 worth of inventory to the trade in 2004. The few examples of inventory written off, include the Oreo Hulk promotion stock that was written off after the promotion; Lecol 2 litre orange was written off after sales decreased their trade discounts; and biscuits, which have a shelf- life of 6 months and which are produced in large quantities because of the minimum batch sizes, were written off because the trade did not accept products with less than 4 months to

the date of expiry. Kraft was also forced to carry about 30 % of excess inventory at a cost of ZAR 3.6 million in 2004 (Templeton, 2004).

Iliffe (2005) warned that the misalignment between the supply and demand also affected the supply side of the business. The factory was sometimes required to arrange overtime for its labour force, while in other cases no labour or production was required. The aim should be to have more consistent and stable production. The misalignment of supply and demand also affected the distribution of products. Emergency transportation was used for urgent customer orders, however in other cases trucks returned empty from delivery routes (Iliffe, 2005) (Brokke, 2005) (Strydom, 2005). Schofield (2005) and Horne (2005) also mentioned the impact on inbound transportation and replenishment, for example, Tang powdered beverage stock had to be flown in at a huge cost from Morocco to fulfil customer orders due to higher than expected sales which depleted safety stock levels. The higher variable product costs could result in higher customer prices which could ultimately result in lower sales volumes (Brokke, 2005).

6.2.1.8 Alignment of departmental objectives and incentives

According to Erasmus (2004), all departments do not have the same objectives and incentives. All departments need to align themselves with the overall budget, objectives and incentives. The conflict of interests currently prevents departments from being aligned. The sales department, for example, is interested in higher service levels and quicker response to demand changes. The factory, on the other hand, is more interested in higher volumes and longer production runs. The sales and marketing department also do not share common objectives. Marketing, for example, does not discuss new product developments with sales. The result is that timings of launches are not met, while the rationale for product introductions is not well developed and understood. Additional SKUs have to be added for the sake of growth without proper rationale.

Gess (2004) is under the impression that the factory has no sense of urgency. Marketing also does not agree with their action plans and strategies with sales.

Marketing, for example, planned big promotions for Oreo Shrek in 2004 in the retail trade, without considering the needs of the wholesale channel. Some of the pack sizes are not suitable for all sales channels. Oreo 22g * 24 pack, for example, works well in the retail and wholesale trade; however, the wholesale trade prefer Oreo 100 g - 2 * 10 and not 1 *20.

Devraj (2004) also thinks that not all of the departments are aligned. The factory, which is measured according to overall plant compliance, can make a surplus of items that can be produced easily while neglecting the production of items actually needed. Parsons (2004) suggested that Kraft needs collective buy-in from departments. Van Blerk (2005) suggested that the factory should indicate in advance if they foresee any supply risks before committing to a production plan which cannot be delivered.

For performance measures and appraisal purposes, Templeton (2004) thinks that objectives are aligned. In reality, however, the objectives of the various departments are not aligned. The factory is not penalised if products are constantly in short supply. Sales incentive plans result in the sales force committing to numbers the company wants to hear instead of committing to more realistic numbers. In some cases, the sales department implement a volume gap closure program, ignoring the profit contribution and additional complexity for the supply chain to react to the last minute demand changes. Brokke (2005) also added that the objectives are generally aligned, but the detailed objectives and incentives were not aligned. The sales department, for example, agreed on the launch of Toblerone 4.5 kilogram in 2005; however the sales team did not agree amongst themselves who the exact target customers and regions would be. The sales department also demonstrated a weak understanding of the financial implications of a specific item, for example, the wholesale sales team wanted to decrease the sales price of Tendermints 1 kilogram in January 2005, while the item achieved a negative margin. When it comes to detailed plans, the sales team is more focussed on price and volumes, while the marketing team is focussed on profit margin.

The commitment of the various departments was also not aligned (Masinga, 2005). In April 2005, the sales and trade marketing team launched a new trade marketing

plan to ensure that Kraft achieved the sales and profit targets. No member of the marketing team, for example the brand managers, attended the launch and presentations, however where important sales and marketing meetings and launches are done, the key players in all departments should attend to ensure that the whole business is aligned to the same objectives and incentives. Grove (2005) also added that the marketing team is not under the same pressure as the sales team, to forecast and achieve the forecast. De Swardt (2005) suggested that sales forecast accuracy which is included in the performance goals of sales and supply chain should also be included in the goals of marketing. Sandwick (2005), on the other hand, mentioned that the sales team provided different trade marketing budgets to marketing which created financial forecast risks. The sales team, for example, provided marketing with the commitment that the operating budget for Oreo was sufficient to support the product for 6 months in the trade; however the sales team realised later than the budget could only support 2 months of trade marketing support.

Molelekoa (2005) and Horne (2005) also indicated that not all the objectives and incentives of all departments are aligned. Molelekoa (2005) indicated that the supply chain department is measured on sales forecast per stock keeping unit; however the sales department compile their sales forecast and strategies per product category. Another objective of the supply chain department is to reduce the amount of items in the business; however the objective of the marketing department is to introduce more items. New Tendermints items, for example, were launched in January 2005; however the Tunney factory did not have enough production capacity for the current Tendermints range. The supply chain department is also trying to reduce the finished goods inventory levels; however the factory is trying to increase the stock levels to achieve more economic production runs. Horne (2005) also added that the sales and marketing teams are satisfied if they constantly over achieve a forecast; however the supply chain department had to react to the overselling by replenishing and deploying additional stock. The sales and marketing departments did not constantly communicate with each other concerning the updates on forthcoming strategies, for example in May 2005 the regional sales managers were not aware that the business had already decided to phase out the Lecol Squeeze 'n Drink beverage business in the Western Cape and Port Elizabeth regions by the end of March 2005.

The organisational structure and objectives of some of the departments were not aligned. Strydom (2005) mentioned that the sales team was structured according to the sales channel. Each sales team thus sold the same portfolio of products to their relevant channels and customers. The marketing department, on the other hand, was aligned per brand. The marketing department was thus forced to deal with various sales people in order to clarify or follow-up on brand related issues. The sales incentives plans were also structured according to the Rand value per kilogram which could be measured on the average product portfolio sold. The marketing department, on the other hand, is measured according to their specific brand revenue and profit levels. The marketing department could thus not achieve their targets by changing the sales mix.

Iliffe (2005) mentioned that some efforts were being made in sales and marketing to align objectives and incentives. For 2005, for example, the sales and marketing team agreed on the same list of high margin brands for the promotional calendars and incentive plans. The sales and marketing departments worked together to convert the marketing plan into a trade marketing and sales plan. Naicker (2005) added that the supply chain and sales departments started working together on projects in 2005 to improve the business, for example, the service level recovery and invoice accuracy projects.

6.2.1.9 Frozen forecast

The forecast for the following month is always frozen. The reason for this is that it provides production with a more stable forecast and subsequently more stable production (Van Blerk, 2005) (Erasmus, 2004) (Gess, 2004) (Devraj, 2004) (Parsons, 2004) (Templeton, 2004) (Sandwick, 2005), (Molelekoa, 2005), (Iliffe, 2005), (Masinga, 2005), (Grove, 2005), Schofield, 2005), (Horne, 2005), (Naicker, 2005), (Strydom, 2005) (Brokke, 2005). Erasmus (2004) and Gess (2004) added that most branded companies have a frozen forecast for a period of one month. Gess (2004) and van Blerk (2005) did, however, point out that demand forecast changes should be the exception, made only if the business is aware of upcoming customers' orders

which are greater than the current demand forecast, for example, big export orders. Templeton (2004) indicated that the reasons for the frozen forecast period are the production constraints, long lead-time of imported items and lead-time from co-manufacturers and co-packers. The frozen forecast period allows the relevant sources to react to the original forecast.

Molelekoa (2005) mentioned that the business should move from one month to one week frozen demand forecast in line with Kraft Foods best practice. Horne (2005) and De Swardt (2005) added that the business had started considering and reacting to weekly demand forecast changes. Schofield (2005) warned that the lead time of the product item should determine the forecast horizon, for example, if the purchase order lead time is 7 weeks, the forecast horizon should be at least 7 weeks.

6.2.1.10 Supply chain complexity

Kraft Foods South Africa's supply chain is more complex than those of other Kraft units (Van Blerk, 2005) (Erasmus, 2004) (Gess, 2004) (Devraj, 2004) (Parsons (2004) (Templeton, 2004) (Sandwick, 2005), (Molelekoa, 2005), (Ilfie, 2005), (Masinga, 2005), (Grove, 2005), Schofield, 2005), (Horne, 2005), (Naicker, 2005), (Strydom, 2005) (Brokke, 2005) (De Swardt, 2005).

Erasmus (2004) supplies the following reasons:

- More delivery points. Kraft Foods South Africa have about 3500 delivery points, while most Kraft units in Europe only service a few hundred. De Swardt (2005) added that current customer base is quite complex, for example, 1200 of the 3500 customers only account for 4 % of the total volume and 80 % of the turnover is done through five powerful trade customers.
- Various routes to markets, sometimes even for the same customer. Kraft Foods have to deal with various routes to markets, while other Kraft units have a small and limited variety of routes to their markets. In South Africa, for example, customer orders to Metro, Pick 'n Pay, Shoprite and Spar could be shipped via distribution centres or directly to the various stores.

- Kraft Foods South Africa covers a bigger geographical area than most Kraft units.
- The support and system infrastructure of Kraft Foods South Africa is outdated and slower, and requires longer lead times. De Swardt (2005) indicated that imported chocolates from Belgium might take 10 weeks from the placement of the order to the receipt of the stock in South Africa.

Gess (2004) pointed out that Kraft Foods have more finished goods stock keeping units than most Kraft units, which adds complexity throughout the supply chain. Most of the customers in South Africa are not as advanced in processes and systems, for example, the independent stores which account for about 20 % of Kraft Foods South Africa's business have no formal systems in place. A few of the bigger customers, like Makro, do implement SAP. Van Blerk (2005) added that old and slow systems make Kraft Foods South Africa a more complex business to manage and the systems are also slow to react to changes.

The high staff turnover within Kraft Foods South Africa has also added complexity to the business. The new employees have to be trained and also require a settling-in period. In most cases, knowledge is lost as highly skilled people leave the business. Systems and processes are important, but any business needs skilled people to successfully implement strategies and manage the business on an ongoing basis (Van Blerk, 2005).

Van Blerk (2005) was also concerned about the additional complexity of promotions. Kraft Foods South Africa has tried to promote too many product items, or have even added additional items to the portfolio which has increased the complexity. Most of the products cater for the retail channel, which makes it very difficult to sell to the wholesale trade. The customer discount structure does not differentiate enough between the retail and wholesale trade. The result is that the sales force is forced to sell items to the retail and wholesale trade at almost the same price which makes trade negotiations more complex. The supply constraints of promotional items like baking powder, jellies and desserts, have also complicated the implementation of promotions. Demand forecasts were provided to the factory 3 months before the

promotion; however, the factory communicated supply constraints and risks just before the implementation of the promotions.

Templeton (2004) stated that the following logistics issues also add to the complexity:

- Order collections: In some countries, customers collect their orders from Kraft; however, Kraft Foods South Africa delivers directly to stores. Iliffe (2005) also added that Kraft delivers to distribution centres in the United States only.
- Made to order or forecast: In some countries, Kraft Foods make stock for customers based on their rolling forecast, however, Kraft Foods South Africa uses a forecast of 95 % of its projected sales volumes.
- Customer base and delivery points: Kraft Germany delivers coffee to about 100 customers, while Kraft Foods South Africa delivered to 3900 customers in 2004. Iliffe (2005) added that some customers prefer various delivery options, for example Pick 'n Pay might receive direct store deliveries, distribution centres and others may even be delivered with representatives.
- Transportation: Kraft normally uses long- haul primary transportation vehicles to deliver stock to customers, while a complex combination of primary and secondary transportation is used in South Africa. Molelekoa (2005) and de Swardt (2005) also mentioned that the logistics infrastructure was more complex due to the multiple warehouse locations and bigger geographical area.
- Production: Most of the overseas Kraft production facilities are dedicated plants, for example, Germany produces about 20 stock keeping units, while South Africa sells and produces 240 stock keeping units from various product categories and production technologies. Molelekoa (2005) also mentioned that the Tunney factory did not provide enough flexibility to meet demand forecast changes of sales and marketing. The Tunney factory also had quite a few production capacity constraints which limited the ability of the business to react, for example, the output through the Manhattan hot rooms and packing machines was constrained in 2004. Brokke (2005) added that the factory was not fully utilising all its equipment.

Iliffe (2005) and Horne (2005) added that the wide product range was adding complexity to Kraft Foods South Africa. Where other Kraft units could focus on coffee and chocolates only, Kraft Foods South Africa focussed on many different product segments, for example coffee, beverages, other groceries, biscuits and cheese. Kraft Foods South Africa handled about 250 stock keeping units, while most other Kraft units in Central Europe and Middle East did not handle more than 150 stock keeping units. Horne (2005) also warned that the wide variety of sourcing options was also adding complexity to the business. Products, for example, could be sourced locally from the Tunney plant, from local and imported third parties or imported from other Kraft units. The various factories also had various lead times which added complexity in the replenishment decisions. Strydom (2005) added that the sales team's job was more complex than that of other Kraft units. In South Africa, for example, the sales team had to handle confectionery, beverages, till point or commodities, as well as impulse or account lines. The sales team's efforts were also hampered because they did not have a focussed trade marketing team which could resolve a lot of sales and marketing issues.

Strydom (2005) mentioned that the relationship with the trade customers was less complex in other countries. Kraft Foods South Africa had to deal with the poor customer service levels and perception about Kraft. Customers were not so enthusiastic about collaborative planning and new product launches due to the poor track record of Kraft Foods South Africa.

6.2.1.11 Differentiation of service levels between products and customers

Erasmus (2004), Devraj (2004) and Iliffe (2005) indicated that Kraft Foods South Africa tries to maintain a higher service for its key customers in the following sequence: Pick 'n Pay, Shoprite and then the remainder of the customers. Erasmus (2004) added that the sequence is determined by the size of the business and the profits generated by the accounts. Currently, 80 % of the business is done through 5 key accounts. The risk of doing business in this way is the political pressure to maintain ever-increasing demands from the trade, for example longer shelf-life and longer payment terms. Kraft Foods South Africa regularly reviews its product

profitability, but also assumes the same profitability based on the product volumes purchased. The customer account profitability is thus not regularly calculated and reviewed taking into account rebates, credit notes and outstanding debtor days. Erasmus (2004) was confident that the customer profitability ranking would change if the customers' true profitability were to be considered. Erasmus (2004) concluded that Kraft Foods sells the correct product, but more work needs to be done to understand customer profitability.

Gess (2004) added that profitability is not considered when customer orders are executed. The account manager who does the most follow-ups will eventually receive the stock. The account managers thus review the stock levels on a regular basis to ensure that orders are executed. Where ranking is used to prioritise, the expected customer demand in volume and not profit is used. De Swardt (2005) also mentioned that Kraft should start to differentiate not just product but also customer differentiation, for example, providing smaller "C" customers with lower, yet acceptable service levels.

High volume products like baking powder, squashes and jellies are used as the basis to prioritise orders (Devraj, 2004), (Masinga, 2005), Iliffe (2005), Grove (2005), (Schofield, 2005) (Horne, 2005) (Naicker, 2005). Van Blerk (2005) was very sceptical and did not think Kraft Foods differentiated between customers. The main reasons are that Kraft does not understand its service levels and also does not try to manage its service levels with the customers. Templeton (2004) also does not think that Kraft differentiates between the service levels of its customers and products. Templeton (2004) suggested that Kraft should concentrate its efforts on key profit categories.

Molelekoa (2005) mentioned that the business did not properly differentiate between customers and products when forecasts are done. The key account forecasts, for example, have only been submitted per brand up and until April 2005. Supply chain, for example, was responsible to break the forecast down into a sales forecast per account per region per stock keeping unit.

6.2.1.12 Different forecast targets

Kraft Foods South Africa has different targets which create confusion within the supply chain (Van Blerk, 2005), (Erasmus, 2004), (Gess, 2004), (Devraj (2004), (Parsons, 2004) (Templeton, 2004) (Sandwick, 2005), (Molelekoa, 2005), (Iliffe, 2005), (Masinga, 2005), (Grove, 2005), Schofield, 2005), (Horne, 2005), (Naicker, 2005), (Strydom, 2005) (Brokke, 2005). Erasmus (2004) believes that the gap between the targets is closing and will eventually fall away. The key business decisions, like procurement and production, should be based on the more realistic business forecast (Devraj, 2004), (Masinga, 2005), (Strydom, 2005) (De Swardt, 2005).

Gess (2004) and Iliffe (2005) stated that the various Kraft forecast targets create a great amount of confusion throughout the business. The sales department, for example, are not sure which target they are supposed to achieve, i.e. first revised forecast, second revised forecast, third revised forecast, last estimate, operating budget or the business forecast. Kraft needs to focus on one set of numbers to avoid confusion and have clear expectations. Templeton (2004) added that Kraft will never have one set of numbers, as the financial forecast is normally very political and will not agree with the business forecast. Brokke (2005) also warned that Kraft Foods South Africa is too internally focussed on the various planning versions instead of focussing on micro-management which adds value. Sandwick (2005) mentioned that the various forecast versions created less confusion for the marketing team, because they could focus only on a few brands and categories per person. The sales team, on the other hand, had to handle all categories.

6.2.1.13 Reduction of the demand lead-time gap

Van Blerk (2004), Molelekoa (2005) and De Swardt (2005) suggested that the demand planners should meet with Kraft's national account managers. The demand planners and key account managers should also meet with the customers. The various meetings should also be followed up with debriefing meetings, where the key issues and priorities can be reviewed and agreed upon. Molelekoa (2005) and Iliffe

(2005) mentioned that the customers should also play a bigger role through collaborative planning. Strydom (2005) and Sandwick (2005) indicated that ongoing communication between sales, marketing, supply chain and the customers should reduce the lead time gap. Sandwick (2005) added that daily updates on the actual sale rate would allow the business to monitor and react to sales trends. The business should also focus on the high volume and profit categories. Brokke (2005) warned that a good relationship with the trade is required to obtain advance warning of demand. Kraft Foods South Africa, for example, is not the category champion in biscuits and beverages, which makes it more difficult to negotiate and obtain advance notification of customer orders.

Templeton (2004) indicated that the business will benefit if the customers inform Kraft in advance what they require. This will allow the business to base its decisions, not only on the forecast, but on the early notification of orders which will increase the forecast accuracy. Erasmus (2004) suggested that the national account managers should understand all their activities per account per region. The maximum forecast horizon for customers is 1 month, while made-to-order commitments for exclusive lines could be determined one year in advance. Gess (2004) also suggested fortnightly meetings with customers to review their forecasts. The 3 months forecast window could also be extended to 6 months based on the updated promotional grid, for example, Makro publishes a broadsheet planning calendar per supplier. Devraj (2004) said that the onus was on the key account managers to conclude their upcoming promotions with customers three months in advance. The commitment of volume and delivery dates would then be based on the mutual trust established. Erasmus (2004) and Parsons (2004) both agreed that Kraft needed to understand the base and incremental volume. Masinga (2005) added that high service levels were achieved on Metcash orders which were negotiated 8 weeks before the required delivery date and forwarded to customer services for execution. Some customers, like Checkers Shoprite, now allow Kraft to review historical sales and forecasts on their websites (Grove, 2005). Horne (2005) warned that Kraft should also consider and react to competitive opportunities and threats, for example, when Nestle experienced supply issues with the implementation of SAP during the latter part of 2000, the demand increased for Kraft coffee and mayonnaise. Where forecasts are not provided by customers and the sales team, statistical forecast

software, like Forecast Pro, could also provide a statistical sales forecast. Naicker (2005) even suggested that the customers forward the customer deal sheet to all parties within Kraft to ensure full transparency in potential orders.

6.2.1.14 Demand and supply alignment within a supply chain

Van Blerk (2004) pointed out that the demand and supply alignment was improving and becoming more professional. The risk was that Kraft tried to overcomplicate and over-analyse the numbers. Kraft has to make sure that it sticks to the fundamentals first. Molelekoa (2005) mentioned that the whole business was focussed on improving customer service levels and even included the recovery plan targets into the personal performance targets. Naicker (2005) was encouraged by the improvement in service as from February 2005 which resulted in a higher commitment from sales to improve and rectify the situation.

Erasmus (2004) also felt that some of the fundamentals were not in place yet. He expected the results to start improving only from the second quarter in 2005. Gess (2004) said that the baseline was still unknown as the national account manager team was only established during 2004. The results should be measured and tracked in future, in order to take corrective action, for example, if the actual sales are always higher than the forecast, the forecast should be increased to avoid an out of stock situation. Grove (2005) was impressed with the higher service level up and until March 2005, however consistent supply from the factory was required to maintain and improve the service level. Horne (2005) also suggested that the Tunney plant needed to focus on prioritising production and decreasing production batch sizes. Schofield (2005) warned that the business would need about a year of good service levels to understand the baseline for forecasting purposes.

Devraj (2004) indicated that the current process was very fragmented. He suggested that the future process should be more aligned. The lead times of items should also be considered before promotions are agreed upon, for example, the forecasts of imported items should be reviewed in advance to allow the supply chain to react to demand changes. Molelekoa (2005) and Masinga (2005) mentioned that the forecast accuracy would improve as more people become involved in the forecast process.

Iliffe (2005) also suggested that marketing should become more involved in the sales forecast process. The business also needed to start working with external suppliers and customers. Kraft needed to invest in additional tools to assist in the process, for example, Kraft should invest in Forecast Pro, the sales forecast statistical software, and MFG Pro, the enterprise resource planning software during 2005.

De Swardt (2005) concluded that the alignment between supply and demand has improved, however better results were required. The finished good stock cover has decreased from 66 days in December 2003 to 39 days in December 2004 and a reduction to 35 days was planned by December 2005. The results could improve through micro-management; a more optimum balance between stock cover, service level and sales forecast accuracy; and finally more supply flexibility, for example, reducing the minimum production batch sizes. The integration of supply and demand into the demand and replenishment planning function in the supply chain department also ensures that the alignment of the supply and demand is reviewed regularly and the appropriate corrective action is taken. The business needs to collaborate internally first before exploring collaboration opportunities with customers and suppliers.

Parsons (2004) and Templeton (2004) agreed that the immediate priority was to improve the service level of 60% and to align the business to high profit items. The improvement in the service level would also improve Kraft's profitability and credibility with the trade. Strydom (2005) indicated that the business should try to understand the real demand of consumers. The customer sales could include seasonal buy-ins, sell-in campaigns and price increase or decrease promotions. Brokke (2005) mentioned that the Tunney factory, which supplies the majority of the products, could delay the improvement process. The factory provided the business with the following challenges: low production compliance, high costs, under utilisation of some the equipment, long and slow processes and unionised labour force. In April 2005, for example, the Tunney factory had the lowest raw material costs in the world, however the highest factory costs.

6.2.1 Supply management

6.2.2.1 Differentiation of service levels between products and customers

Kraft Foods tries to maintain a better service level with key customers and high profit items (Moses, 2004), (Herselman, 2004), (Van Zyl, 2005), (Templeton, 2004) (Redelinghuys, 2005), (Chetty, 2005) (Sarulis, 2005) (Gardiner, 2005) (De Swardt, 2005). Chetty (2005) added that Kraft Foods South Africa started to communicate the actual service levels throughout the company from January 2005 which has improved the visibility and focus on the service level recovery plans. Kubheka (2005) and Greenslade (2004), on the other hand, were under the impression that Kraft tries to maintain a high service level on all products and to all customers.

6.2.2.2 Supply chain trigger: order versus forecast

The trigger for Kraft Foods' supply chain is the forecast (Moses, 2004), (Herselman, 2004), (Van Zyl, 2005), (Templeton, 2004), (Kubheka, 2005) (Greenslade, 2004) (Redelinghuys, 2005), (Chetty, 2005) (Sarulis, 2005) (Gardiner, 2005) (De Swardt, 2005). Kraft Foods is currently unable to react to the customer order in time. Moses (2004) also added that the situation is made worse because of the low forecast accuracy which is 35 %. The only time the factory sees the order is when the stock is made-to-order (Van Zyl, 2005). Redelinghuys (2005) also mentioned that the business is driven by the forecast; however the forecast is adjusted by the actual customer orders.

6.2.2.3 Reduction of supply lead time

The following are a few ideas suggested to reduce the supply lead times, which will allow the supply chain to react quicker to demand and demand changes:

- Moses (2004) and van Zyl (2005) suggested changing the sourcing of raw materials and packaging from international to local suppliers.

- Moses (2004) suggested that the factory should make smaller runs more often. Equipment needs to be calibrated and the formulas of some of the products need to be changed, for example, product formulas need to be adjusted if batch sizes are reduced.
- Longer production runs will decrease the scrap rate of the factory (Greenslade, 2004).
- Greenslade (2004) and Chetty (2005) suggested that an increase in forecast accuracy would allow the factories to plan and not to react. Kubheka (2005) and Chetty (2005) added that the business should communicate demand changes on a more regular basis to all parties, for example suppliers should receive a forecast update on a monthly basis and not just once a year.
- Packaging machine set-ups could be aligned with manufacturing, for example, packaging should be done from lighter to darker colours which would reduce the clean-up and change-overs of machinery (Greenslade, 2004).
- Van Zyl (2005) suggested the removal of small volume items which would result in bigger production runs more regularly, for example, Oreo 22 g needs to be produced with the 175 g or 150 g Oreo.
- Van Zyl (2005) also suggested that some of the production equipment needs to be upgraded, for example jellies and puddings. The current packing machines are old and unreliable. In some cases, the demand is much higher than the available production capacity, for example, jellies and puddings.
- Kubheka (2005) suggested that some of the production and packing machinery could be calibrated to allow for quicker changeovers. Herselman (2005) suggested that the speed on machines could be calibrated to allow for smaller minimum batch sizes. Templeton (2004) concluded that the business needed to move away from long production runs to flexible, more frequent production runs.
- Herselman (2005) mentioned that the supply chain would be able to react quicker if the business agreed to invest in more raw materials, packaging and finished goods inventory.
- The status of all purchase orders at suppliers should be constantly checked, for example, all outstanding purchase orders should agree between Kraft and its suppliers, purchase order volume and due delivery dates should be

confirmed and upcoming purchase order deliveries should be checked on a weekly basis (Chetty, 2005).

- Kraft should move to change the unique and customised specifications of raw materials to common, off-the-shelf raw materials. Unique raw materials can normally only be sourced from overseas suppliers which increases the supply lead time and decreases the ability of the factory to react to demand forecast changes (Gardiner, 2005).
- The factory should increase the capacity output to the level where the production output is not limited by the production capacity, but by the availability of raw materials and packaging (Redelinghuys, 2005).
- Kraft should also streamline its product portfolio and remove small volume items that add complexity and increase the supply lead-time. The smaller, less complex product range will allow Kraft to react quicker (Redelinghuys, 2005).
- The deployment from the central warehouse in Johannesburg to the regional warehouses in Durban, Cape Town and Port Elizabeth should be done in smaller batches and on a more regular basis. The business should determine the cost / benefit trade-off between the more regular deployment and keeping additional stock closer to the point of consumption (Redelinghuys, 2005).

6.2.2.4 Frozen production lead time

The production plan is frozen for a period of one month. The frozen production plan allows the factory to plan their production, for example, raw material and packaging sourcing, as well as labour. The machinery in the factory is very old with the result that long production runs and long changeovers are preferred (Moses, 2004), (Herselman, 2004) (Van Zyl, 2005) (Templeton, 2004) (Greenslade, 2004).

The factory was considering moving to a one week frozen forecast, which is the norm in other Kraft units (Moses, 2004) (Chetty, 2005) (Redelinghuys, 2005). Templeton (2004) added that the factory should be more flexible to cater for demand changes. Changes are not uncommon in the fast moving consumer goods markets and all companies need to react to changes on a monthly, weekly and even hourly basis 365 days a year.

Greenslade (2004) also indicated that the factory prefers long production runs which provide better production efficiency. The set-up and scrap- rate on biscuits, for example, increases from 1 % to 5 % if the production is planned for only one day versus a production run of 3 days non-stop.

Van Zyl (2005) mentioned that the factory will, by exception, consider weekly changes if there are big opportunities or risks that the business must react to, for example, trade de-listings if product is not delivered by certain dates.

6.2.2.5 Alignment of departmental objectives and incentives

The objectives of all departments agree broadly (Moses, 2004) (Herselman, 2004) (Van Zyl, 2005) (Templeton, 2004) (Greenslade, 2004) (Chetty, 2005) (Redelinghuys, 2005).

Moses (2004) indicated that there was a difference in the implementation of the different objectives. The objective of sales, for example, is the achievement of sales volumes targets and high sales forecast accuracy. The sales targets provided are volume targets per major product family or group and not per stock keeping unit. In order to achieve sales volume targets, sales deals are implemented at a product group level, ignoring the implication on service level and forecast accuracy at a stock keeping unit. The erratic swing in demand between stock keeping units within a product group resulted in a service level of 60 % and forecast accuracy of 35 % in 2004.

Greenslade (2004) indicated that the objectives of all departments are the same. Where actions were taken in the past which were in conflict with another department, it was not done deliberately. In order to survive, some departments like sales, implemented plans which were not aligned with those of the factory. Sales, currently, does not understand the factory and vice versa, for example, the production complexities involved to react to a sudden sales gap closure plan.

Van Zyl (2005) questioned the rationale of sales and marketing to implement promotions on products with production constraints, for example, baking powder, jellies and desserts. The additional promotional demand, which was not met during October to December 2004, resulted in large quantities of lost sales. Sales and marketing should not make commitments to the trade if they are aware of internal supply constraints. Kubheka (2005) suggested that sales and marketing should consult with the factory first before commitments are made with the trade. In the past, promotions and the volume expectations of promotions were communicated too late to the factory.

Herselman (2004) would also prefer more details on promotions from sales and marketing. The volume expectations are communicated, but not the exact timings of promotions. Some promotions, for example, were implemented over a trade month-end, while the factory did not plan any major production before the trade month-end. The factory was forced to react to the trade promotion at a high cost, for example, extra production shifts and over time. Gardiner (2005) also added that more information about upcoming sales and marketing promotions would allow the procurement and production team to react to business opportunities. In January 2005 the production and procurement teams only reacted to the finished goods, raw materials and packaging requirements based on the material requirements planning reports.

In the past, not all departments received incentives for adding value to the business (Chetty, 2005). The procurement team, for example, worked on the baking powder capacity problem in 2004 quarter 4. They worked closely with sales, marketing, production and packaging suppliers and implemented a packaging solution that resolved the capacity constraints at the Tunney factory. The procurement team's efforts to resolve a business risk were not recognised by the business. Only the sales and marketing team currently receive special performance incentives.

Redelinghuys (2005) concluded that the alignment between departments is much better than in the past. The key drivers for business success, for example, forecast accuracy, production compliance and product availability, have been included into people's business performance goals. Since January 2005, all departments have

initiated a big effort to improve the results and to avoid blaming individuals and departments.

6.2.2.6 Supply chain complexity

The supply chain of Kraft Foods South Africa is more complex than most of the other Kraft units (Moses, 2004) (Herselman, 2004) (Van Zyl, 2005) (Templeton, 2004) (Greenslade, 2004) (Chetty, 2005) (Sarulis, 2005) (Gardiner, 2005) (De Swardt, 2005) (Redelinghuys, 2005). Some of the factors that make the supply chain more complex are the following:

- More finished goods stock keeping units which add complexity throughout the supply chain, for example, more items to produce and pack (Moses, 2004).
- More different production lines, production processes and technologies (Moses, 2004). Some of the other Kraft units simply have a wide range of different pack sizes for the same product type, for example Kraft Switzerland produces different Toblerone pack sizes and Kraft Germany produce different Jacobs Kronung pack sizes (Chetty, 2005). Greenslade (2004) indicated that some of the other Kraft plants were more automated, for example, packing areas. Most of the equipment at the current Tunney plant is very old and the packing area requires a lot of manual labour. The current Tunney plant, according to Van Zyl (2005) and Redelinghuys (2005), is handling the production of about 7 different technologies, while most of the Kraft plants in Europe only handle one or two technologies, for example, the coffee plant in Germany only produces freeze-dried granular and filter coffee and the chocolate plants in Switzerland and Belgium only produce a limited range of chocolate items. The Tunney plant of Kraft Foods South Africa, on the other hand, handles the following technologies: gels (Manhattan brand), marshmallows (Manhattan brand), soft candy extrusion (Sugus and Tendermints brands), hard-boiled candy (Beechnut brands), bottled liquid (Lecol brand), dry mixes like baking powder, jellies and instant puddings (Royal brand), compressed (Super C brand) and biscuits (Oreo, Riviera and Crackermates brands).

- The long range of small volume items adds unnecessary complexity to the supply chain (Van Zyl, 2005) (Redelinghuys, 2005). The result is that the factory cannot achieve better economies of scale. A trade-off is required, because the volumes in small and large quantities are required for overhead fixed cost recovery.
- The business has to deal with more suppliers each handling small volume and high variety product ranges (Sarulis, 2005). The procurement team is currently focussing on the high volume and high profit items.

6.2.2.7 Streamlining customer and product portfolio

The customer base and product portfolio should be streamlined (Moses, 2004), (Herselman, 2004) (Van Zyl, 2005) (Templeton, 2004) (Greenslade, 2004) (Chetty, 2005) (Sarulis, 2005) (Gardiner, 2005) (De Swardt, 2005) (Redelinghuys, 2005). Moses (2004) added that Kraft Foods South Africa should focus on high volume and profit items and customers. De Swardt (2005) suggested that different sales strategies should be applied to different customers based on the cost to serve scenarios. To streamline the customer base, Templeton (2004) suggested that the business should implement a minimum case order size and minimum order value. Smaller customers should be allocated to agents. The amount of finished goods items should also be reduced. Some Kraft units have reduced their product range with small volume items, while maintaining the same volume which results in higher economies of scale. Kubheka (2005) warned that the business should understand the reason for an item's performance before the item is removed, for example, poor sales and marketing communication to create awareness and repeat purchases could result in poor sales. On the other hand, the sales and marketing team should try to increase the demand of products to match the high minimum production runs, for example, every minimum production run of Lecol Diet beverages and Bells Basic biscuits provides 10 weeks stock cover which increases the stock aging risk.

The best way to streamline the product portfolio is to prevent items being launched (Chetty, 2005). Oreo 22 g and Tendermints Spearmint were launched in 2004 and 2005, however soon after the product launches, the top management team

requested the procurement team to achieve cost savings to make the products more profitable and feasible. Products with less than the minimum required profitability should not be launched.

The business should focus on key brands and priorities and discontinue smaller volume items, for example, Oreo 22g dispenser and small volume Manhattan items (Chetty, 2005) Herselman (2005) (Redelinghuys, 2005). Other options are that as the business grows and the current volumes increase through sales and marketing, another business or factory may have to be acquired (Herselman, 2005). De Swardt (2005) added that the business had already reduced the amount of finished goods items from 301 in December 2003 to 220 by December 2004.

6.2.2.8 Supply chain bottlenecks

The Tunney production facility has a few supply bottlenecks, which include the following:

- Packing constraint: Moses (2004) and Van Zyl (2004) mentioned that the production capacity, in some cases, is far greater than the packing ability. Products that have a packing constraint include baking powder, desserts, jellies, biscuits and Lecol beverage. Compressed confectionery like Super C and Beechnut can sometimes only be packed two days after production due to the bottlenecks of the packing machines (Templeton, 2004). Templeton (2004) also added that the production speed and output of the biscuit ovens are higher than the packing speed of the biscuit line. Biscuits are stored on special trays until the packing machines are available. The same problem is encountered with jellies which are made in batches, stored in a hopper and then later packed when the packing machines become available, according to Kubheka (2005). The factory currently balances the production output and the speed of small and large bottles of Lecol beverages with the packing machines, in order to balance the output of the production process which is higher than the packing process (Herselman, 2005). The current packing machines are old and cannot meet the ever-increasing demand. In some cases, like baking powder refills, the packing is done manually (Moses, 2004).

Kubheka (2005) warned that the business should consider additional packing machines to avoid continuing lost sales.

- Production process constraint: Moses (2004) indicated that in other cases, the production process takes very long. The packing output is thus higher than the production output. The curing times of some of the Manhattan items in the hot rooms are between 24 and 48 hours (Templeton, 2004). There are currently also not enough hot rooms available to produce the full product range at all times (Moses, 2004). The production is prioritised based on the curing times, volumes and current stock cover. Other examples of production process limitations are Sugus, Tendermints and Manhattan marshmallows (Moses, 2004) (Van Zyl, 2005). The business should critically review the feasibility of some items (Greenslade, 2004) (De Swardt, 2005). Oreo 22 g, for example, cannot currently be produced on its own. Production is forced to also make 150 g or 175 g Oreo to achieve a minimum batch size. In some cases, the factory cannot react to an increase in demand in all the categories, for example Sugus, Tendermints and Boilings confectionery share the same cooking and pulling process, while Super C and Beechnut compressed share the same punching or pill forming process (Herselman, 2004). The factory should keep a balance between the available production capacity and the reliability of production equipment, for example, the machinery for jellies and desserts are old and less reliable which requires the factory to start building stock for high peak seasons (Redelinghuys, 2005).
- The major cause of stock build in the past has been the incorrect sales forecasts. Where products have been underselling, the raw material and packaging stock levels increased at the factory while the finished goods stock levels increased at all warehouses (Chetty, 2005). De Swardt (2005) added that the business was not proactively warned of potential supply or demand issues which resulted in the business constantly reacting to issues.

The supply side of the business is thus currently constrained, based on a mix of packing and production constraints.

6.2.2.9 Reaction of supply to demand changes

Assuming that raw materials and packaging material are available, the factory would normally be able to react to demand changes (Herselman, 2005). The normal production process and packing machine constraints would unfortunately still apply, for example, the slow output of Manhattan gels from the hot rooms and the slow process to cook and punch Tendermints (Herselman, 2005) (Chetty, 2005). Herselman (2005) added that the reaction to demand changes would also imply extra shifts and thus extra costs. It normally takes the factory an average of 8 working days to react to major demand changes. During peak seasons, the factory cannot react to major demand changes, for example Manhattan and Jellies (Herselman, 2005) (Redelinghuys, 2005). Moses (2004) and Templeton (2004) warned that the reaction time for imported finished goods and raw material and packaging is about 6 to 8 weeks, which limits the ability of the supply chain to react to demand changes. The risk of constantly reacting to demand changes is that the raw material and packaging safety stock cover, available for future demand, is reduced or cleared (Greenslade, 2004).

The following suggestions could help the supply chain to react quicker to demand changes:

- Herselman (2005) suggested additional or an upgrade of manufacturing and packing machinery, for example, additional hot rooms for Manhattan gels, additional cooking and punching machines for Sugus and Tendermints, additional bottle fillers for Lecol beverages and automated cooking machines for Sugus and Tendermints.
- Moses (2004) suggested changing from imported to locally sourced raw materials, packaging and finished goods.
- Changing the production machinery changeover settings to cater for shorter production runs (Moses, 2004).
- Van Zyl (2005) and Greenslade (2004) suggested an improvement in the forecast accuracy. Van Zyl (2005) added that a reduction in forecast fluctuations would result in more production planning stability and smoother supply to the market. The business should focus on planning, rather than reaction.

- A reduction in the finished goods product portfolio would remove complexity, for example, less production changeovers (Van Zyl, 2005).
- Research and development should change certain product ingredients to allow for quicker production turnarounds. Crackermates biscuits, for example, contain a great amount of fats and oils which take a long time to clean before the next biscuit production.
- Greenslade (2004) indicated that the complexity of the production process and materials in progress make it very difficult to react, for example, if biscuit dough has been made, it must be processed through the ovens to avoid scrapping all the dough. Production in progress can thus not simply be switched on and off. Kubheka (2005) also added that priority will always be given to the production in progress. It normally takes the plant a week to start working on new priorities.
- An increase in the raw material and packaging warehouse space would allow the factory to react quicker to demand changes (Chetty, 2005).
- Improving and maintaining a good relationship with raw and packaging material suppliers (Gardiner, 2005). Good supplier relationships have resulted in a reduction in lead-time, for example, the raw materials from flavour houses have been reduced from 65 to 14 days lead-time.
- De Swardt (2005) also suggested that the distribution company should be more flexible to demand and supply issues, for example stock should be replenished and deployed to the regional depots on a more regular basis.

6.2.2.10 Opportunities to pool risk

Herselman (2005), Moses (2004) and Redelinghuys (2005) mentioned that the factory does not carry the majority of the raw materials and packaging at the plant. The materials are kept at the suppliers and transferred to the factory when required. The suppliers normally carry about a month's stock. Moses (2004) and Greenslade (2004) added that the level of raw materials and packaging could decrease if the sales forecast accuracy of the finished goods increased. Kubheka (2005) stated that some of the suppliers of cartons could only react within 4 days. The lead-time of raw material and packaging sourcing is normally not a problem if the sourcing is planned.

In cases of low sales forecast accuracy and overselling, the factory cannot effectively plan and manage their supply and reduce their inventory.

The risk related to demand and supply fluctuations could be reduced by making the products simpler (Van Zyl, 2005). Examples of making the products simpler include the following:

- Using common packaging and common shrinks. Redelinghuys (2005) also mentioned that the procurement team should work with suppliers to reduce their minimum packaging order volume.
- Using simpler packaging, for example, jellies are currently packed in sachets, then an inner box and finally in a large outer box. Jellies could also be packed into a small soup box type of container and then finally into a big outer box making the process simpler and faster.
- Reducing the pack size variants, for example, jellies are sold in 80 g sachets, while instant puddings are sold in 90 g sachets. The production process could be simplified if jellies and instant puddings were to be sold in the same pack sizes.

Templeton (2004) and De Swardt (2005) also believed that the number of warehouses could be reduced. Kraft Foods currently have regional warehouses in Johannesburg, Durban, Cape Town and Port Elizabeth. Port Elizabeth, for example, could be changed to a transshipment warehouse and Durban to a transshipment and cross-dock warehouse. Transshipment implies that stock is picked up in bulk at the central warehouse in Johannesburg, shipped to Port Elizabeth, broken into the individual orders and finally shipped to the customer. Cross-dock, on the other hand, implies that the orders have already been picked up at the central warehouse in Johannesburg, and shipped to Durban via primary transportation and finally transferred to secondary transportation for final delivery to the customer. This could also entail in orders picked in Johannesburg and cross docked via the Distribution Centre of the customer, utilizing their network and/or fleet, which could reduce lead-times, handling and costs further. Except for the higher costs incurred, the number of warehouses should also be reduced in order to reduce inventory. The same level of safety stock is stored at each warehouse facility, for example, 4 weeks of safety

stock is carried at each regional warehouse. If the number of warehouses is reduced, there should also be a reduction in the inventory levels.

The Tunney factory should utilise all production equipment to its maximum available capacity and efficiency. Some of the production equipment, however, is running at less than 50 percent utilisation. The issues should be closely monitored and resolved. The relevant production equipment should be fixed, upgraded or replaced. The business should also determine if it makes business sense to move the production to an external production source (Chetty, 2005).

Templeton (2004) warned that Kraft Foods South Africa should reduce inventory gradually. A sudden reduction in inventory could result in a reduction in service levels and on-time deliveries, for example, if the problem of trucks breaking down were not resolved as well, there would be less stock in the supply chain to buffer against supply variability.

6.2.2.11 Product or production design changes

According to Moses (2004), Herselman (2004), van Zyl (2005) Templeton (2004) and Greenslade (2004), there are various product and production design changes that could make the supply chain of Kraft Foods South Africa more reactive, for example:

- The curing times of Manhattan gels could be reduced by changing to an ingredient called Pekten (Herselman, 2005). The texture would, however, change which would need to be agreed through test panels with sales, marketing and the final consumers.
- Moses (2004) and Templeton (2004) suggested that the pack sizes of items should be standardised. The production and packing process could be simplified if jellies and instant puddings were sold in the same pack size. Greenslade (2004) added that Kraft should consider standardising its biscuit sizes. The standardised products would result in less production changeovers, (Templeton, 2004).

- Moses (2004) and van Zyl (2005) suggested that packaging should be standardised within a product group, for example some biscuit brands are packed in boxes while others are flow-wrapped. A standardised packing method would reduce the packaging changeovers and would allow the factory to react quicker to demand changes. The packaging for all Riviera and Crackermates biscuits, for example, could change from boxes to flow-wrap. Van Zyl (2005) added that packaging for the same products should be simplified, for example, compressed Beechnut rolls' outer wrap and foil packaging should be reduced to one packaging material only. The more simplified the production process, the quicker the supply chain can react.
- Sales and marketing should investigate the option of increasing the units per selling unit and per case for certain products (Van Zyl, 2005). The units of jellies per selling unit, for example, could be increased from 6 to 12 as is the case with instant puddings. The packing output will thus increase as a result of the packing configuration adjustment.
- Moses (2004) also suggested that common packaging material should be used. Outer boxes, for example, could be standardised and different printed stickers could be applied at the end of the packing line.
- The business should also standardise its raw materials, for example, Sodium Bicarb could only be sourced from two international sources due to the unique specifications. If the business used a more standardised Sodium Bicarb specification, the procurement team would be able to source from 10 international suppliers. The increase in supplier base would increase the ability to negotiate better prices and also reduce any potential supply risks (Gardiner, 2005).
- Some of the products are very complex to manufacture (Van Zyl, 2005). A combination of automatic and manual labour is required for the production of biscuit shells for Riviera creamy chocolate biscuits. The complexity is increased when the manual labour is planned only for certain days.
- Greenslade (2004) suggested that granola bars could be changed from a coated biscuit to an enrobed biscuit. Some changes would need to be made to the biscuit ovens to handle the change in product design.

- The business should remove product items from its portfolio that have no differentiation versus other product offerings, for example, Kraft's Beechnut versus Nestlé's Wilson boilings or hard candy. The range of flavours and pack sizes should also be reduced to make Kraft's supply chain less complex. A complex supply chain reduces Kraft's ability to launch innovative products, for example, a jelly filled Manhattan marshmallow was mentioned at a product innovation workshop, however a year later the product has not yet been launched. Beacon, on the other hand, launched a jelly filled marshmallow during April 2005 to the trade (Chetty, 2005). The combination of finished goods flavours should also be streamlined. In 2004, the factory had to produce 5 different flavours of Sugus in order to complete the finished product. If the factory could reduce the flavour mix to 3, the production output would increase. Less variety could result in less complexity throughout the supply chain (Redelinghuys, 2005).

Production design changes would result in a more reactive supply chain:

- The biscuit oven speed and temperature could be increased resulting in higher output (Greenslade, 2004).
- Automating the packing lines was mentioned by Greenslade (2004).
- Herselman (2005) indicated that the factory was already producing from lighter to darker colours on the Lecol beverages filling line. Manhattan gel product was also being produced from lighter to darker colours in the following sequence: white, yellow, green, red and black. Templeton (2004) also added that manufacturing from lighter to darker coloured confectionery and beverages, for example, would require the plant to do less washing before the next production run. The supply chain could thus react to changes quicker at less cost. Kubheka (2005) mentioned that the lighter to darker production runs, would result in smaller changeovers between production shifts.
- Sugar, used in the manufacturing of sugar-coated confectionery, is reworked and re-used to save costs and reduce the lead time of production (Herselman, 2005)
- Herselman (2005) and van Zyl (2005) suggested that similar products should be made and packed at the same time, for example, Manhattan milk bottles

150 g and 400g pre-packs. The synergy in manufacturing and packing for the same product mix would reduce the changeovers in production.

- Van Zyl (2005) mentioned that the business should investigate new and automated packing machines. Baking powder refills, for example, are currently being packed manually. A special doy-bag packing machine would automate the packing, as the packing machine would make and pack the baking powder at the same time.
- Flavours could be added to savoury biscuits at the end of the production process instead of at the beginning to allow for flexibility and last minute changes if required (Greenslade, 2004). In the case of Oreo biscuits, more flavours could be introduced to cater for different needs or seasonal taste preferences or themes.
- Biscuit cookie cappers and automated wrapping machines for the biscuit lines could be introduced (Greenslade, 2004). The higher level of automation would result in a supply chain which could react quicker to demand changes.
- Kubheka (2005) suggested that the factory should introduce an ink injector for the Manhattan marshmallow production. At present, pink and white marshmallows are made in separate production runs and later combined at the packing line.
- Smaller production runs for biscuits could be considered, but the additional production and scrap costs would also need to be considered with the other potential supply chain cost savings (Greenslade, 2004).
- De Swardt (2005) also suggested more cross training of people between departments. Factory staff, for example, should be used for various production lines during different periods.

De Swardt (2005) concluded that all departments should consider the supply chain implications of their actions. The research and development team, for example, should design products with longer shelf life and shorter production curing times. Changes to the product and production designs could improve the alignment of supply and demand.

6.2.2.12 Demand and supply alignment within a supply chain

Herselman (2005) did not think that the supply and demand was properly aligned at present. More and quicker communication throughout the supply chain is required. The sales and marketing calendar and the relevant volume expectations need to be reviewed on a 3 month rolling basis.

Gardiner (2005) and Redelinghuys (2005) indicated that the demand and supply alignment principles and efforts to improve results were good; however the alignment processes had to be refined to deal with the practical problems. Gardiner (2005) mentioned that the procurement team would prefer more stability in their sourcing plans, however they had to react to raw material and packaging sourcing plan changes every week when the material requirements planning updates were done. Redelinghuys (2005) also added that the factory should focus its efforts on improving supply reliability, for example rebuilding production machinery and preventative maintenance programmes.

Greenslade (2004) suggested that the tolerances of the various performance measures should be standardised. Sales forecast accuracy per stock keeping unit, for example, is achieved if the actual sales are within 25 % tolerance of the forecasted sales. Production compliance per stock keeping unit, on the other hand, is achieved if the actual production is within 10 % tolerance of the planned production.

Moses (2004), van Zyl (2005), Greenslade (2004) and Templeton (2004) believe that the situation is improving, but the service level and sales forecast accuracy is still too low. More interaction between departments could improve the results even further (Chetty, 2005). Templeton (2004) mentioned that the first priority of the business should be improving the service level of 60% and focussing on high profit items.

6.3 Conclusion

The aim of this chapter was to present the results of the structured interviews conducted on the alignment of supply and demand within Kraft Food South Africa's

supply chain. The information was collected through personal and telephonic interviews with key supply and demand management staff members of Kraft Foods South Africa between December 2004 and May 2005. The aim of the structured interviews was to identify the causes of the misalignment between the supply and demand within Kraft Foods South Africa's supply chain and also to identify potential solutions that could improve the alignment.

The key findings of the interviews conducted regarding demand management were the following:

- Kraft Foods South Africa is currently trying to forecast the factory shipment data, which is the expected sales volume to be shipped from Kraft Foods to its customers. There are many differences and unnecessary volatility between the factory shipment data and the final consumer data. All parties interviewed suggested that the business should rather focus its forecast efforts on final consumer demand, which excludes adjustments like promotions and out of stock situations. The current trigger for the supply chain is the forecast and not the customer order. The supply chain is currently not able to react to the customer's order. Customers expect delivery of their orders within 72 hours.
- Customers have limited involvement in Kraft Foods South Africa's planning and suppliers are not involved at all.
- Most of the causes of demand variability are driven by internal causes created by Kraft Foods South Africa. These include financial forecast gap closure strategies, price increases, planned and unplanned promotions. The end result of all the demand variability created by all the promotional activities and pricing is that Kraft does not have a good understanding of its baseline business.
- Kraft is currently trying to forecast and not manage demand, because the company does not understand the difference between baseline and incremental volume. All the parties interviewed suggested, however, that Kraft Foods should rather manage demand proactively.
- Other alternative demand data, for example, final consumer sales, is available and can be obtained through negotiation with trade partners or needs to be

purchased from the trade. Kraft Foods also needs to establish a more reliable source of information with a split between baseline and incremental volume.

- The costs and implications of misalignment between supply and demand is very high, for example ZAR 100 million of lost sales in 2004 (Erasmus, 2004) and ZAR 0.4 million of stock write-offs in 2004 (Templeton, 2004). The misalignment between supply and demand has also adversely affected Kraft's credibility and relationship with the trade (Erasmus, 2004).
- Not all the objectives and incentives of all objectives are aligned, for example, the factory wants longer productions and a stable forecast while sales wants shorter production runs and a flexible forecast (Erasmus, 2004). Some of the performance measures are also not aligned, for example, the factory is not penalised for constantly producing less than planned (Templeton, 2004).
- The frozen forecast horizon is for a period of one month which provides stability to the factory in order to plan production (Van Blerk, 2005), (Erasmus, 2004), (Gess, 2004), (Devraj, 2004), (Parsons, 2004) (Templeton, 2004). The forecast is frozen for one month due to production constraints, long lead time of imported items and lead time from co-manufacturers and co-packers (Templeton, 2004).
- The supply chain of Kraft Foods South Africa is currently more complex than that of most Kraft units (Van Blerk, 2005), (Erasmus, 2004), (Gess, 2004), (Devraj, 2004), (Parsons, 2004) (Templeton, 2004). The main reasons for the additional complexity are more product items, bigger variety of product types and technology, more customer delivery points, various routes to markets, the bigger geographical area covered, the old and outdated systems, high staff turnover, complexity of promotions, transportation network and the local production dynamics and complexity.
- In some cases, Kraft Foods differentiates between the service levels of products and customers, for example, better service for key customers. The profitability of products is well understood while the productivity of customers is not. Kraft needs to maintain a better service level on high profit items.
- There are different forecast targets which create confusion throughout the supply chain.

- The demand lead time gap could be reduced, for example, customers could inform Kraft in advance what their estimated forecast is which could result in an increase in forecast accuracy for the company.
- The demand and supply alignment within Kraft's supply chain is improving, but a lot of work still needs to be done. The immediate priority is to improve the service level of 60% which will improve Kraft's credibility with the trade.

The key findings taken from the interviews conducted concerning supply management were the following:

- Kraft tries to differentiate between the service levels of products and customers, for example, better service levels for key customers and high profit items (Moses, 2004) (Herselman, 2004) (Van Zyl, 2005) (Templeton, 2004).
- The supply team also indicated that the forecast, and not the customer order, is currently the trigger for the supply chain, because Kraft is currently unable to react within 72 hours to the customer order alone.
- The supply lead time could be reduced, which would allow the supply chain to react quickly to demand changes, for example, Moses (2004) and van Zyl (2005) suggested changing the sourcing of raw materials and packaging from international to local suppliers.
- Moses (2004) indicated that the production lead-time for the Tunney factory is frozen for a period of one month. Moses (2004) added that the factory is considering moving to a period of one week frozen forecast, which is the norm in other Kraft units.
- The factory also agreed that not all the objectives and incentives of all the departments are aligned which is evident from the low service level of 60 % (Moses, 2004).
- The supply chain of Kraft Foods South Africa is more complex than that of most Kraft units for several reasons, for example, the high number of small volume items (Van Zyl, 2004).
- The customer and product portfolio of Kraft Foods South Africa should be streamlined, for example, small volume and profit items should be removed.
- There are a few bottlenecks in the supply chain, which vary between production and packing process constraints.

- The factory is able to react to demand changes, although it might take as long as a week. In order for the factory to be able to react to demand changes sooner, changes need to be made to product, production and packaging process designs which may require additional investment in machinery.
- The supply chain does have opportunities to pool risk, for example, regional warehouses could be closed and converted to transshipment and cross-dock warehouses (Templeton, 2004).
- Product and production design changes are required to make Kraft's supply chain even more reactive to demand changes (Greenslade, 2004).
- The supply management team also agree that the supply and demand alignment process needs to improve for Kraft Foods South Africa.

The supply and demand within Kraft Foods South Africa's supply chain needs to be aligned in order to increase the customer service level of 60%, restore credibility with the trade, improve the profitability of Kraft and reduce the working capital tied up in the supply chain.

CHAPTER 7: SUMMARY, CONCLUSION AND RECOMMENDATIONS

7.1 Introduction

The quality of a company's supply chain performance can mean the difference between business prosperity and failure (Gattorna, 1998: xiii). Cutting-edge supply chains are double-edged swords. Wielded with skill, they can slice open new markets. Improperly handled, they can lead to deep, self-inflicted wounds. For all the advantages from getting the supply chain right, getting it wrong could be catastrophic (Taylor, 2004:8).

7.2 Literature research review and research design

The aim of the descriptive research study is to find the causes and solutions of aligning supply and demand within a supply chain. The research study focuses specifically on the alignment between supply and demand within Kraft Foods South Africa's supply chain. The research design was done under actual environmental conditions.

There is extensive literature available concerning the importance of aligning the demand and supply side of the supply chain. Most of the literature identifies the major benefits of an improved alignment between the supply and demand within any supply chain. However, little research has been done on the alignment of the supply and demand within a supply chain (Cooper and Schindler, 2003: 152-153).

Secondary literature and structured interviews were used to collect research data on the alignment of supply and demand within a supply chain. The first step in the research study was to identify secondary literature inside and outside Kraft Foods South Africa involving the alignment of supply and demand within a supply chain.

Structured interviews were also done in order to seek information from people experienced in the alignment of supply and demand within a supply chain. Various structured interviews were conducted with key people within Kraft Foods South Africa's supply chain, to determine the causes and solutions of the misalignment between supply and demand within the supply chain. The structured interviews were conducted from December 2004 to May 2005 at the Woodmead and Elandsfontein offices with the following departments in Kraft Foods South Africa: sales, marketing, procurement, production, production planning, customer services and logistics operations. During the personal and telephonic interviews various open and closed questions were asked to determine the answers. The research conclusions were finally limited to those for which the data provided adequate answers.

The supply chain of Kraft Foods South Africa is struggling with the classic symptoms of a mismatch between supply and demand – low sales forecast accuracy, high and aging inventory, as well as low customer service. In 2004, for example, Kraft Foods South Africa lost ZAR 100 million in sales and also wrote off ZAR 0.4 million of finished goods stock (Templeton, 2004) (Erasmus, 2004). The misalignment between supply and demand has also adversely affected Kraft's credibility and relationship with the trade (Erasmus, 2004).

The difficulty of managing supply chains comes primarily from the complexity that creeps into their structure and the variability that characterises their flows (Taylor, 2004:21). Any business has to be willing to make hard choices about which customers and products are right for the supply chain, and also modify those practices that are deeply ingrained in the company's corporate culture (Taylor, 2004:278). The Pareto, or 80/20 rule, can provide the basis for developing a more cost-effective service strategy (Christopher, 1998:56). The highest service should be given to key customers and key products (Christopher, 1998:57). Most of the respondents indicated that the supply chain of Kraft Foods South Africa is currently more complex than most Kraft units. The main reasons for the additional complexity are more product items, bigger variety of product types and technology, more customer delivery points, various routes to markets, the bigger geographical area covered, the old and outdated systems, high staff turnover, complexity of promotions, transportation network and the local production dynamics and complexity. Most of the

respondents added that the customer and product portfolio of Kraft Foods South Africa should be streamlined, for example, small volume and profit items should be removed. Kraft Foods South Africa, for example, could differentiate between the service levels of products and customers, by providing better service levels for key customers and high profit items. Most of the respondents also mentioned a few bottlenecks in the supply chain that should be removed, which vary between production and packing process constraints. Some respondents also indicated that the supply chain does have opportunities to pool risk, for example, regional warehouses could be closed and converted to transshipment and cross-dock warehouses. The respondents also mentioned that most of the causes of demand variability are driven by internal causes created by Kraft Foods South Africa itself. These include financial forecast gap closure strategies, price increases, planned and unplanned promotions. The end result of all the demand variability created by all the promotional activities and pricing is that Kraft does not have a good understanding of its baseline business.

Most attempts to freeze the production schedule are relatively unsuccessful (Harmon & Peterson, 1990:215). Exceptional swings of market demand will always occur, and the superior manufacturer must be prepared to take exceptional action in response (Harmon & Peterson, 1990:216). It is thus better if the forecast is not frozen. If all the available information is utilised, if updates could be provided as soon as circumstances change, then inventories could be better managed, and ultimately, the customer could be better served (Riehm and Stephen, 1999:18). The true test of an inventory management system is not merely in the planning and forecast stage, but also in the ability to re-plan and react. The ability to re-plan and react is the essence of management control (Kobert, 1992:165-166). The respondents mentioned that the current frozen forecast horizon for Kraft Foods South Africa is one month. The forecast is frozen for one month due to production constraints, long lead-time of imported items and lead-time from co-manufacturers and co-packers. The respondents added that the factory is considering moving to a period of one week frozen forecast, which is the norm in other Kraft units.

The weak link in the build-to-stock model is a company's reliance upon sales forecasts. A build-to-order model, on the other hand, begins with the order and not

the forecasts (Chase, Aquilano and Jacobs, 2001:549). The respondents in the supply team warned that the forecast, and not the customer order, is currently the trigger for Kraft Foods South Africa's supply chain, because Kraft is currently unable to react within 72 hours to the customer order alone.

Although the phrase "supply chain management" is now widely recognised, it could be argued that it should really be termed "demand chain management" to reflect the fact that the chain should be driven by the market, not by the suppliers (Christopher, 1998:18). The aim of any company should be to convert its supply chain from push to pull by responding to customer demand. Technology is used to link the supply chain (Hughes, Ralf and Michels, 1999:163). Most respondents agreed that Kraft should move away from using factory shipment data as the basis for its forecast data to actual consumer sales, in order to plan and react to the real consumer trends. If demand is managed, Kraft will also be less dependent on forecasts which are always wrong.

The key to getting sustained cooperation across the supply chain is to align everyone's incentives (Taylor, 2004:272). The mission of supply chain management is to create a 'one-plan' mentality within the business which seeks to replace the conventional stand-alone and separate plans of marketing, distribution, production and procurement. Supply chain management is therefore an integrative concept that seeks to develop a system-wide view of the firm (Christopher, 1998:14). The respondents added that not all the objectives and incentives of the various departments within Kraft Foods South Africa are aligned, for example, the factory wants longer productions and a stable forecast, while sales wants shorter production runs and a flexible forecast (Erasmus, 2004). Some of the performance measures are also not aligned, for example, the factory is not penalised for constantly producing less than planned (Templeton, 2004). The respondents also added that the various and different forecast targets create confusion throughout the supply chain. A key to supply chain integration is the open flow of information from one end of the pipeline to another. By sharing information, supply chain partners are able to respond more rapidly to known demand and to do with less inventory in the system as a whole and, hence, at lower costs (Christopher, 1998:248). The respondents

agreed that customers and suppliers should play a bigger role in the planning and execution activities in Kraft Foods' supply chain.

Matching supply and demand is the fundamental cornerstone of the logistics process. (Christopher and Peck, 2003:85). Retailers and manufacturers in many product categories have struggled to put together a match between supply and demand (Gattorna, 1998:171). The costs of a mismatch between the supply and demand, measured as the combination of inventory carrying costs, markdown costs and stockout costs, are growing in many industries. Companies have tried to reduce these costs through better demand forecasting, improved production and inventory planning, increased production capacity and reduced set-up and transportation lead times. Companies have also tried to manage the demand process through pricing policies intended to smooth the arrival pattern of customers. These approaches, while useful, have failed to address a number of drivers of supply-demand mismatch (Gattorna, 1998:172).

Most organisations face a fundamental problem: the time it takes to procure, make and deliver the finished product to a customer is longer than the time the customer is prepared to wait for it. This is the basis of the lead-time gap (Christopher, 1998:167). This gap could be reduced by shortening the logistics lead time whilst simultaneously trying to move the customer's order cycle closer by gaining earlier warning of requirements through improved visibility of demand (Christopher, 1998:169). The benefits of reducing the lead-time gap within a supply chain include higher customer service, higher customer responsiveness, an improvement in the balance between supply and demand and a reduction in inventory (Gattorna, 1998:158-160).

Firstly, a company should investigate various options to reduce the demand lead-time within its supply chain. Most of the demand volatility within a supply chain is often introduced by organisations through their own policies and procedures. Consequently, it is within a company's capability to control and influence the demand volatility within its supply chain (Gattorna, 1998:153). Sharing sales information, for example, could counter the so-called 'bullwhip effect' which is essentially the phenomenon of demand volatility amplification along the supply chain, from the retailers, distributors, manufacturers, and the manufacturers' suppliers, and so on.

(Lee, So and Tang, 2002:626). The respondents mentioned various ways to reduce the demand lead time gap, for example, customers could inform Kraft in advance what their estimated forecast is which could result in an increase in forecast accuracy for the company. Most of the respondents also added that consumer demand data is currently available and could be obtained from most of the major trade customers of Kraft Foods South Africa.

Secondly, a company should investigate various options to reduce the supply lead-time within its supply chain. Examples of strategies that could reduce supply lead time include the following: removing activities that only add cost (Christopher, 1998:116); improving the frequency, accuracy and reliability of deliveries (Christopher, 1998:121); pooling risk and inventory of various stock locations (Taylor, 2004:301); removing slowdowns and queues in the supply chain (Taylor, 2004:299); simplification, commonality and standardisation throughout the supply chain (Taylor, 2004:308), (Kobert, 1992:91), (Harmon, 1992:170), (Hughes, Ralf and Michels, 1999:50), (Harmon & Peterson, 1990: x-xii), (Chase, Aquilano and Jacobs, 2001:151-152); the use of modularity in product design (Taylor, 2004:308-309); balancing the flow, and not the capacities, of product through the system (Chase, Aquilano and Jacobs, 2001:668); and postponing the final configuration or assembly of the product until the actual customer requirement is known (Christopher, 1998:210). There is a fundamental shift in supply chains from the economies of scale, which is volume-based and implies long production runs with few change-overs, to the economies of scope which is based upon producing small quantities of a wider range, hence requiring more change-overs (Christopher, 1998:209). The respondents agreed that the supply lead time could be reduced, which would allow the supply chain to react quickly to demand changes, for example, Moses (2004) and van Zyl (2005) suggested changing the sourcing of raw materials and packaging from international to local suppliers. The factory is able to react to demand changes, although it might take as long as a week. In order for the factory to be able to react to demand changes sooner, changes need to be made to product, production and packaging process designs which may require additional investment in machinery (Greenslade, 2004).

The alignment of the supply and demand within Kraft Foods South Africa should increase the customer service level from 60%, restore credibility with the trade, improve the profitability of Kraft and reduce the working capital tied up in the supply chain.

7.3 Research objectives revisited

The primary objective of the research was to identify the main causes of the misalignment between the supply and demand within Kraft Foods South Africa's supply chain. The result of an improved match between the supply and demand should result in a reduction in inventory, higher sales forecast accuracy and an increase in the customer service level.

The main issues identified that cause the misalignment between the supply and demand within Kraft Foods South Africa's supply chain were the following:

- Kraft Foods South Africa's supply chain is too complex. The business currently has a lot of small volume items and customers that simply add complexity but very little value and profit. The complex business model has resulted in higher inventory, as well as lower service levels and forecast accuracy.
- The demand pattern of Kraft Foods South Africa is too variable. The high variability in the supply chain has been created mostly by the internal push strategies to customers in order to achieve financial volume targets and sales incentives. The high variability results in the business carrying high inventory levels before peak sales periods followed by an increase in the warehousing and distribution costs.
- The supply chain of Kraft Foods South Africa has been designed around the sales forecast and is currently over dependent on the sales forecast, because the factory is unable to react to the customer order within the required delivery time. Forecasts are always wrong which results in the business either carrying too much or too little stock.

- The demand and supply forecasts for Kraft Foods South Africa's supply chain are frozen for a month. The business is unable to react to any major demand and supply changes, resulting in incorrect stock levels and poor customer service levels.
- Kraft Foods South Africa is using factory shipment data as the base for its demand forecast data. The factory shipment includes all the push sales strategy volumes and therefore does not agree with the actual customer and finally consumer demand. The supply chain of Kraft Foods will thus only react to the push sales strategy volumes and not to the customer or final consumer demand changes. The ongoing push strategies have resulted in poor customer service levels as the business is forced to sell what it makes because it cannot make what sells.
- All the stakeholders in Kraft Foods South Africa's supply chain do not have the same objectives and incentives. Companies, departments and individuals will aim to achieve their own targets and not the overall targets.
- Kraft Foods South Africa has several demand and supply plans and targets which create confusion amongst the stakeholders of the supply chain. The various stakeholders do not always know which business plan they have align to. A supplier, for example, could be making packaging for a finished goods item that Kraft wants to discontinue in the next few months.
- The demand and supply changes are not shared amongst the members of the Kraft Foods South Africa's supply chain. A sudden increase in the demand for a product of Kraft Foods South Africa, for example, is only shared with suppliers when purchase orders are placed, resulting in longer lead time and lower customer service levels.
- Kraft Foods South Africa does not have ongoing plans to increase the demand lead times and/or decrease the supply lead time of its supply chain. Kraft Foods South Africa, for example, only obtains customer sales forecasts for high peak periods. The sales forecasts

and subsequent supply plans for the other periods are thus a calculated guess.

The secondary objectives of the research were the following:

- To improve the supply and demand alignment for all partners within Kraft Foods South Africa's supply chain, including retail and wholesale customers, as well as suppliers.
- To identify the best practices that could add value to all Kraft units worldwide, in order to improve their alignment between demand and supply.

The research also identified the following opportunities within Kraft Foods South Africa's supply chain:

- All partners within Kraft Foods South Africa's supply chain need to establish and share objectives, incentives and information. Demand changes, for example, need to be shared with all partners to allow the total supply chain to react quickly and effectively.
- Best practices were identified for Kraft Foods South Africa, as well as for other Kraft units. These best practices form part of the recommendations.

7.4 Recommendations

Given the results of the research study, the following recommendations are feasible, practical, actionable and directly usable as inputs into the managerial decision-making.

7.4.1 Decrease complexity in the supply chain

It is recommended that Kraft Foods South Africa should decrease the complexity of its supply chain. Kraft should reduce and simplify its product range, customer base and different production technologies, especially those with low volume and

profitability levels. The reduction recommendations should be done using the 80/20 rule or Pareto Analysis. This will allow all resources within the supply chain to focus only on key products and customers that really add value instead of accumulating costs.

7.4.2 Decrease variability in the supply chain

Kraft Foods South Africa should work with all parties in the supply chain, internally and externally, to decrease the variability within the supply chain. Variability in the supply chain amplifies down the supply chain, while variability in demand amplifies up the supply chain. The only real solution to the variability problem is thus for Kraft to work together with its trading partners to remove variability across the chain, rather than trying to cope on its own. Kraft could, for example, start sharing rolling forecasts with its suppliers to reduce the variability of the supplier's demand pattern. On the other hand, Kraft should work together with its customers to obtain up-to-date customer forecasts, thereby reducing the variability in its supply chain. Kraft Foods should also critically review all business practices and policies that are the biggest contributor to demand volatility like trade terms, promotions and financial budget volume gap closure sales deals. By constantly sharing information, supply chain partners will be able to respond more rapidly to known demand with fewer inventories and at less cost.

7.4.3 Move from demand planning to demand management

Kraft is currently managing its demand reactively by focussing on demand planning. The aim should rather be to manage demand and not simply forecast demand. Customer price increases or promotions, for example, could be delayed if the factory is unable to meet the potential demand increase before a price increase or promotion. If demand is managed, Kraft will also be less dependent on forecasts, which are always wrong.

7.4.4 Changing the supply chain trigger from forecasts to actual consumer demand

The trigger for Kraft Foods South Africa's supply chain is currently the forecasts. Forecasts are always wrong; therefore the trigger for Kraft's supply chain will always be wrong, resulting in lost sales or over-stock situations. It is recommended that Kraft Foods South Africa should start using actual consumer demand data in its forecasting process, instead of factory shipment data. The actual consumer demand is hidden between the factory shipment data and the final consumer sales data; for example, factory shipment includes out-of-stock situations or special price promotions to influence the trade to buy more than usual. If actual consumer demand data is used, it will make Kraft's supply chain less dependent on forecasts that are always wrong. Kraft's supply chain will gradually be converted from a push to a pull supply chain where only the items that are selling are made. The actual consumer data could be obtained through negotiation or acquisition from the various trade partners. By obtaining actual consumer data, information could be used to replace inventory in Kraft's supply chain.

7.4.5 Unfrozen forecast horizon

It is recommended that Kraft should not have a frozen forecast horizon. Things do change on the supply and demand side. An unfrozen demand forecast will ensure that the supply side needs to be constantly aligned with the demand side of the supply chain. The constant and ongoing alignment between supply and demand will ensure that the business can react to business opportunities that arise and the supply side of the business will only make items that are really required. The true test of an aligned supply chain is its ability to re-plan and react to changes.

7.4.6 Aligning objectives and incentives of all participants in the supply chain

The objectives and incentives of all participants in the supply chain should be aligned. All internal and external supply chain partners should have objectives and

incentives that encourage supply and demand alignment in the supply chain. Sales, for example, should not receive incentives for selling more than the forecasted volumes, but should rather have sales forecast accuracy as an objective. The factory on the supply side, should also not try to achieve maximum plant compliance through long production runs. The plant should rather focus on making what is required in smaller batch sizes and should also receive incentives to react quickly to demand changes.

7.4.7 Create one plan

The business should combine the various financial and business forecasts into one realistic business forecast. This one plan will ensure that all parties within the supply chain are aligned to only one plan. All progress concerning this one realistic plan should be tracked on a regular basis and corrective action should be taken if necessary.

7.4.8 Reduce the supply chain lead time gap

It is recommended that Kraft should reduce the supply chain lead-time gap by reducing the supply lead-time, whilst simultaneously obtaining earlier warning of customer requirements through improved visibility of demand. Any reduction in lead-time will result in higher sales forecast accuracy and therefore alignment between supply and demand. Demand lead-time can be reduced by obtaining actual consumer sales data, thereby obtaining earlier visibility of actual consumer demand. Examples of strategies that could reduce supply lead time include the following: removing activities that only add cost, improving the frequency, accuracy and reliability of deliveries, pooling risk and inventory of various stock locations; removing slowdowns and queues in the supply chain; simplification, commonality and standardisation throughout the supply chain; the use of modularity in product design; balancing the flow, and not capacities, of product through the system; and postponing the final configuration or assembly of the product until the actual customer requirement is known.

The above- mentioned recommendations should improve the alignment between the supply and demand in Kraft Foods South Africa. The improved alignment will result in higher customer service levels, higher forecast accuracy, and an overall reduction in inventory and costs throughout the supply chain.

7.5 Limitations of the research

All research studies have certain limitations caused by financial budget, time or other constraints. Some of the limitations encountered during the research study were the following:

- Limited experience: The researcher has had limited experience in the subject of aligning the supply and demand within a supply chain. Previous work experience includes some parts of the demand and supply side of the supply chain, but no extensive experience of aligning the supply and demand of the supply chain.
- Limited access to other companies: Due to the sensitive nature of the research and information, the research was limited to academic research, as well as reports published by Kraft Foods for internal and external use.
- The research was limited to Kraft Foods South Africa. The principles of the demand and supply alignment could be applied to other Kraft units, the fast moving consumer goods industry, as well as other industries battling with the challenges of supply and demand alignment.
- No previous research on the supply and demand alignment within Kraft Foods South Africa has ever been done. Secondary research material on Kraft Foods South Africa was therefore very limited. Much of the secondary research material is also not available to the public, because of confidentiality and the sensitivity of the information.

7.6 Benefits of the study and future research

The research study on supply and demand alignment within a supply chain could be beneficial to the following individuals:

Academics could use the research study as a point of reference if they wish to expand their research on the topic. Only the key theoretical principles will be available to the public, due to the confidential nature of the study.

- The management team within the Centre of Excellence of Kraft Foods Inc. may decide to apply the findings and best practices to other Kraft Foods units.
- Decision- makers for small, medium and large companies struggling to align the supply and demand within their supply chains could apply the findings and recommendations.

It is foreseen that this research project will inspire future research projects. Some examples include the following:

- A follow-up research project to move from the design phase of supply and demand alignment to the implementation phase, for example, implementing collaborative demand and replenishment planning with a key trade partner.
- Developing a supply and demand alignment evaluation checklist, key performance indicators and corrective action for the fast moving consumer goods market and other interested industries.

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ANNEXURE A

University of Pretoria, Department of Business Management

QUESTIONNAIRE ON THE ALIGNMENT OF THE SUPPLY AND DEMAND WITHIN A SUPPLY CHAIN

Introduction

The costs of a mismatch between supply and demand, measured as the combination of inventory carrying costs, markdown costs and stock out costs, are growing in many industries (Gattorna, 1998:172).

The benefits of reducing the supply-demand mismatch are enormous. Fewer mismatches between supply and demand can lead to a significant increase in profits, better customer service and therefore additional sales (Gattorna, 1998:172).

The aim of the research

The aim of the research is to determine the following:

- To identify the causes of the misalignment between the supply and demand within Kraft Foods South Africa's supply chain.
- To identify potential solutions that could improve the alignment between the supply and demand within Kraft Foods South Africa's supply chain.

Structured Interview - Demand management

People interviewed:

- Nigel Parsons, Sales Director, Kraft Foods South Africa.
- Barry Iliffe, Retail Sales Manager, Kraft Foods South Africa.
- Brian van Blerk, Wholesale Sales Manager, Kraft Foods South Africa.
- Alan Devraj, National Sales Manager, Kraft Foods South Africa.
- Marianne Schofield, National Key Account Manager – Pick 'n Pay, Kraft Foods South Africa.
- Louise Grove, National Key Account Manager – Shoprite Checkers, Kraft Foods South Africa.

- Don Masinga, National Key Account Manager – Metro, Kraft Foods South Africa.
- Glenn Gess, National Key Account Manager – Metcash, Kraft Foods South Africa.
- Erasmus, Jaco, National Key Account Manager – Spar. Kraft Foods South Africa.
- Abrie de Swardt, Director Customer Services, Logistics and Procurement. Kraft Foods South Africa.
- Dave Templeton, Logistics Operations Manager. Kraft Foods South Africa.
- Thinusha Naicker, Customer Services Manager. Kraft Foods South Africa.
- Sjanie Horne, Demand Planner. Kraft Foods South Africa.
- Sina Molelekoa, Demand Planner. Kraft Foods South Africa.
- Clive Sandwick, Marketing Director. Kraft Foods South Africa.
- Allan Strydom, Marketing Manager – Beverages and Other Grocery. Kraft Foods South Africa.
- Angela Brokke, Marketing Manager – Biscuits and Confectionery. Kraft Foods South Africa.

Questionnaire - Demand management

1. Which demand are you trying to forecast and why? Which other demand data can be obtained?
 - Customer supplied forecasts.
 - Point- of- sales data.
 - Customer warehouse movement data.
 - Customer order data or
 - Factory shipment data?
2. What is the trigger for the supply chain - the customer order or forecast?
3. To what extent do we involve customers and suppliers in the planning and execution activities within our supply chain?
4. What are the causes of demand variability, for example, terms of trade, promotions and pricing, specific company policies, distribution channel structure, delays, and economies of scale?
5. Does the company try to forecast or manage demand?

6. Which additional information, if obtained, could result in an increase in forecast accuracy and decrease in inventory?
7. What are the costs and implications of the misalignment between supply and demand, measured as the combination of inventory carrying costs, markdown costs and stock out costs, versus target and have the costs increased or decreased over the past year?
8. Do you think the individual, departmental and organisational objectives and incentives of all departments are aligned? Why or why not?
9. Which portion of the demand forecast is frozen?
10. How complex is the supply chain versus other Kraft units, for example number of sourcing plants, number of items on promotion, number of finished goods SKUs, number of customers, number of warehouses?
11. Does the company differentiate service levels targets between products or customers?
12. Does the company have various forecast targets, for example, sales targets and financial targets, and which target is used to align supply and demand?
13. How can you reduce the demand lead-time gap, for example, earlier notification of demand?
14. Please give me your view on the demand and supply alignment in Kraft Foods South Africa?

Structured Interview – Supply management

People interviewed:

- Thys Redelinghuys, Plant Director, Kraft Foods South Africa.
- Oliver Moses, Production Planning Manager, Kraft Foods South Africa.
- Zandi Kubheka, Master Production Scheduler, Kraft Foods South Africa.
- Ron Greenslade, Manufacturing Maintenance Manager Biscuits, Kraft Foods South Africa.
- Stefanus van Zyl, Production Manager, Kraft Foods South Africa.
- Johan Herselman, Production Manager, Kraft Foods South Africa.
- Dave Templeton, Logistics Operations Manager. Kraft Foods South Africa.
- Abrie de Swardt, Director Customer Services, Logistics and Procurement. Kraft Foods South Africa.
- Audrius Sarulis, Procurement Manager. Kraft Foods South Africa.
- Mark Gardiner, Raw Material Purchasing Manager. Kraft Foods South Africa.
- Peggie Chetty, Packaging Purchasing Manager. Kraft Foods South Africa.

Questionnaire – Supply management

1. Does the company differentiate between service levels targets between products or customers?
2. What is the trigger for the supply chain - the customer order or forecast?
3. How can we decrease the supply lead-time?
4. Which portion of the production forecast is frozen?
5. Do you think the individual, departmental and organisational objectives and incentives of all departments are aligned? Why or why not?
6. How complex is the supply chain versus other Kraft units, for example number of sourcing plants, number of items on promotion, number of finished goods SKUs, number of customers, number of warehouses?
7. Is the supply chain serving the right customers with the right products or should the customer and product portfolio be streamlined?
8. Are there any major queues in the supply chain and why, for example, work-in-progress at certain stages of the production process?

9. How quickly can the factory react to demand changes? Which issues are preventing the factory to react quicker?
10. What opportunities exist to pool risk, for example reducing stock locations?
11. Which product or production design changes could result in a more reactive supply chain, for example, adding flavour at the end of the production process instead of at the beginning?
12. Please give me your view on the demand and supply alignment in Kraft Foods South Africa?