UPPLY CHAIN MANAGEMENT PRACTICES: THE CASE TUDY OF NUMERICAL MACHINING COMPLEX LTD

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DECLARATION

This project is my original work and has never been submitted for examination in any other university

Signed: _____ date: 31/10/07

Antipers Orukoh

D61/P/9126/01

This project has been submitted for examination with my approval as the university supervisor

Signed: _____ 07/11/07

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DEDICATION

This project is dedicated to my beloved wife, Susan Adoyo Orukoh, for her patience and understanding during the period that I was permanently away from home. Her unwavering support gave me the much needed energy to soldier on.

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I am also most grateful to all the respondents for their cooperation during the data collection stage of my project. Indeed, without their cooperation, it would not have been possible to successfully complete this project.

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ABSTRACT

This study was carried out on Numerical Machining Complex ltd., a manufacturing company located in Nairobi. The study had two primary objectives namely;

- Establishing the supply chain management practices in NMC and
- The experiences of NMC in supply chain management practices.

The study adapted a case study research design which involved an examination of the supply chain management practices in use in NMC itself, and in both upstream and downstream firms. The population of upstream firms was 21 and that of downstream firms 350. The 350 firms were identified from the list of customers of NMC. A study sample of 108 firms was purposely selected in a stratified manner out of the population of 350 firms.

Primary data for the study was collected using semi-structured self-administered questions that were delivered and collected later from the respondents. The target respondents in the study were assumed to posses the information sought in the study and also the questions were made simple enough so that even the respondents without background information on the supply chain management practices would be able to supply the needed information. The collected data were analyzed using descriptive statistics and summarized by use of tables and charts.

The study established that the company believes very strongly in supply chain management practices and is aware of the need to integrate with both suppliers and customers. This has however not been followed up with action in order to translate the practices into action by for example entering into stable relationships with both suppliers and customers. There is need for this to be done. The study therefore answered both study questions.

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Abbreviations

BPR	-	BUSINESS PROCESS REENGINEERING
CAM	-	COMPUTER AIDED MANAUFACTURING
EDI	-	ELECTRONIC DATA INTERCHANGE
ERP	-	ENTREPRISE RESOURCE PLANNING
GDP	-	GROSS DOMESTIC PRODUCT
GOK	-	GOVERENMENT OF KENYA
IMF	-	INTERNATIONAL MONETARY FUND
JIT	-	JUST-IN-TIME
KR	-	KENYA RAILWAYS
NMC	-	NUMERICAL MACHINING COMPLEX
SC	-	SUPPLIES CHAIN
SCM	-	SUPPLIES CHAIN MANAGEMENT
TQM	-	TOTAL QUALITY MANAGEMENT
UON	-	UNIVERSITY OF NAIROBI
WB	-	WORLD BANK

CHAPTER ONE

INTRODUCTION

1.1 Background

1.1.1 Manufacturing

Manufacturing is the transformation of raw materials into finished goods for sale. It can also be viewed as an intermediate process involving the production or finishing of semi-manufactured products. Manufacturing remains a huge part of the modern world economy (Coyle, 2003). It is a large branch of industry and secondary production. Over the years manufacturing organizations have played a big role in a country's economic development. Because of the importance of manufacturing, every country is making efforts to be the least cost producer of high quality goods. As a result of inter-country competition, companies the world over are making determined efforts to emerge the best in their respective categories of production. Nandi (1998) has noted that there is intense competition among established global players as they all try to emerge as leading manufacturers. Though companies have made efforts to boost industrial development, much still needs to be done by way of reducing costs, improving quality, offering more variety of products, and improved services (Kumar et al., 2006).

1.1.2 Importance of Manufacturing to Kenya

Kenya's economy is based on agriculture. Unfortunately, the country has largely been selling unprocessed or semi-processed agricultural outputs to the rest of the world. This has been occasioned by the relatively small manufacturing base which is relatively small in proportion to the Gross Domestic Product (GDP). According to Sessional Paper Number 2 (Industrial Transformation to the Year 2020), the manufacturing sector has not been dynamic enough to function as "an engine of growth" for the whole economy. Besides failing to contribute enough to foreign exchange earnings, the sector has had limited technological progress which reflects past input-substitution policy orientations. There has been some progress in this area, though. State-of-the art technological advances similar to those at the Numerical Machining Complex Limited (NMC) is currently being introduced in manufacturing organizations aimed at increasing the country's productivity and lifting its more than 43 percent citizens out of poverty. This can be achieved if manufacturing is strengthened and agricultural produce fully processed to add value. This would more than double the country's earnings and cause more people to be employed (GOK, Sessional Paper 2). It is only through rapid and sustained manufacturing that national wealth can be created, employment increased and income and viable enterprises created.

In the past, businesses in many developing countries have been sheltered from competition through policies of protectionism at home and government intervention abroad. Recent developments in the area of deregulation, globalization of markets and gradual acceptance of competition, are, however, making it

increasingly difficult to continue to protect local markets (Kennerly and Neely, 2003). In response to liberalization and globalization, business organizations are striving hard to introduce new approaches such as Total Quality Management (TQM), Just-In-Time (JIT), Business Process Reengineering (BPR), and Supply Chain Management (SCM), to enhance their performance and competitive advantage.

The structural adjustment programs pushed through by the World Bank (WB) and the International Monetary Fund (IMF) in the 1990s facilitated the entry of multinationals companies which brought with them new management concepts. In terms of supply chain management (SCM), this has led to significant attempts aimed at integrating the entire value chain aimed at enhancing the flow of goods and information from the end-user of manufactured goods. Market globalization, intensifying competition, and increasing emphasis on customer orientation are regularly cited as catalyzing the surge in interest in supply chain management (SCM) (Gunasekaran et al., 2004; Webster, 2002). Against this backdrop, effective supply chain management is seen as key to building a sustainable competitive edge through improved inter and intra-firm relationships (Ellinger, 2000). The government of Kenya intends that the Numerical Machining Complex (NMC) adopts these businesses as a means of responding to these global challenges.

1.1.3 The Numerical Machining Complex Limited

The Numerical machining Complex (NMC) was incorporated on 4th January 1994 to take over the functions of the former Nyayo Motor Corporation Ltd, a state corporation established in September 1990 to produce car components for locally produced Kenyan cars. NMC Ltd was established to utilize the assets and personnel of the car project. It is wholly owned by the Government of Kenya through the Kenya Railways (KR) (51 percent) and University of Nairobi (UON) (49 percent).

In the early period of its operations, NMC operated as a research institution, with research being its primary objective. With time, the research mission was changed and the company started to operate commercially to supply local firms with manufactured products hitherto imported. NMC currently produces automotive and industrial spare-parts, industrial replacement parts, sub-assemblies and assemblies for the local manufacturing industries. It employs the high precision technology of Computer Aided Manufacturing (CAM). The company is therefore important and plays a major role in facilitating the development and operation of other manufacturing industries. It therefore plays a critical role in the supply chains of many manufacturing firms in the sugar, cement, brewing, coffee, and tea industries among others.

1.1.4 Definition of Supply Chain Management (SCM)

A supply chain is a network that includes vendors of raw materials, plants that transform those materials into useful products, and distribution centers to get those products to customers. It is the sequence which involves producing and delivering of a product. The simultaneous integration of customer requirements, internal processes and upstream supplier performance is commonly referred to as supply chain management (Tan *et al.*, 1999). The terms "supply chain management" and "logistics management" are often used interchangeably. The Supply Chain Management Institute (formerly Chartered Institute of Logistics Management) reasons that logistics is stabilizing towards SCM because whereas logistics concerns itself with the infrastructure that supports the movement of material, storage, and inventory management, SCM has a larger scope covering issues related to purchase, partnerships, and customer satisfaction in addition to logistics related issues.

The supply chain, therefore, comprises all activities associated with the flow and transformation of goods from the raw material stage through to the end user (Handfield & Bechtel, 2002). A range of benefits have been attributed to SCM, including reduced costs, increased market share and sales, and solid customer relations. A significant number of organizations in America rank their supply chains as world class and view their supply chain as important, or critical to their organizational success (Thomas, 1999).

1.1.5 Supply Chain Management and Manufacturing

The manufacturing sector has undergone fundamental changes with respect to the approach adopted to manage its supply chain. In the past few years, manufacturers have invested in their supply chain to enhance performance through developing lasting and stable relationships. There is still, however, a lack of significant study of supply chain, adoption, practices and its performance in developing countries, in general (Barratt, 2004) and Kenya in particular. Manufacturing firms in the more developed countries analyze various issues important to supply chain management and provide broader awareness of supply chain principles and concepts (Zailani & Rajagopal, 2006; Wang et al., 2005; Varma et al., 2006). The role of planning and coordination in complex integrated systems and information technology to synchronize the supply chain is described in a framework that creates the appropriate structure and installs proper controls in the enterprise and other constituents in the chain.

1.2 Statement of Problem

This research sought to explore the adoption of SCM practices in a fairly modern Kenyan manufacturing firm, the Numerical Machining Complex Ltd. Supply chain management is seen to be the starting point for manufacturing companies intending to improve performance to higher levels. In developing countries like Kenya, the concept of supply chain management and in particular its performance and relevance is

increasingly becoming important. It was therefore important to attempt to establish what supply chain management practices and/ or its performance measures are set up in a company in the Kenyan context.

Manufacturing firms in Kenya need to focus on supply chain practices, identification and discussions on the main motives and determinants for the adoption and implementation of supply chain management concepts. There was need for reviewing the relevance of SCM and the measurement of performance of the supply chain in developing countries like Kenya. The role of SCM is also reinforced by the fact that the focus of supplier management is evolving from the usual tendering procedures and pre-qualification of suppliers to identifying partner-supplier relationships. Under the new model, the tendering seeks to build supply relationships to the extent that the supplier becomes a partner of the firm. This calls for adoption of such practices as benchmarking (to improve on quality) and company identification of best practices to manage and own the desired performance standards. The evolution of focus and the identification of key issues for consideration in supplier consideration have been the subject of recent studies. Davies and Kochahhr (2002) addressed issues of methodology necessary to improve the quality of supplier-buyer relationships in order to maximize company performance through the transfer of appropriate best practices to come up with a winning combination.

A number of researchers (Lin et al., 2005; Reiner, 2005; Balasubraminian & Tewany, 2005; Bradford et al., 2004; Krajewski et al., 2005; Varma et al., 2006) contend that the number of studies relating to supply chain management practices in manufacturing has increased at a rapid rate over the last few years as companies strive to attain world-class manufacturing status. They do this by intensively searching for quality suppliers of goods and even integrating with them. This is probably because suppliers have at times been blamed for losses associated with poor quality, second grade and rejected goods. While it is true that some suppliers have traditionally contributed to the rejection of products, defective products, reworks, returned products and second degree quality, the onus is on the firm to assist the suppliers define quality and specify the delivery conditions of expected quality. Toyota realized this and took action to define the quality of products it expected from its suppliers. This action immediately contributed to the overall performance of Toyota's business (Dyer & Noboeka, 2000). Studies in the developed world have also shown that the pursuit of excellence is a direct result of the nurturing of this relationship as depicted by Toyota's integration with its suppliers.

SCM has been practiced and documented in the developed economies (Europe, America, and Japan) and in the newly industrialized countries of Asia. It has registered great success as a source of competitive advantage to many world–class organizations. Several studies have been conducted locally on the challenges facing Kenyan firms in the wake of globalization and exposure to the turbulent environment and how firms responded to such challenges. Many of the studies have concentrated on corporate

strategies, marketing strategies, specific best practices and case studies. But none of these has focused on the contribution of SCM practices to competitiveness of Kenyan firms.

Rwoti (2005) studied procurement performance measurement systems among large manufacturing companies in Nairobi. Wagwa (2005) did a survey of operations improvement practices among ISO 9001 certified companies in Kenya. Mwaniki (2005) researched on the purchase criteria of organizational buyers for network cabinets at Power Technics while Miyumo (2003) researched on change management practices in TQM implementation among ISO 9000 certified firms in Kenya. The only studies that came close to addressing SCM practices as means of gaining competitive advantage were those by Musau (2003) who examined the value chain management practices but only limited it to a survey of large manufacturing firms in Kenya and Mwanyota (2004) who did a survey on supermarkets in Nairobi integrating SCM and Enterprise Resource Planning systems.

To the best knowledge of this researcher no studies have been done in Kenya to establish the SCM practices in Kenyan manufacturing firms. This study, therefore, aims at establishing whether Kenyan manufacturing organizations (and in particular the Numerical Machining Complex) have realized the important role played by individual suppliers in the supply chain and have seen the need to assist them improve performance and thereby adopt SCM practices.

1.3 Objectives of the Study

A broad objective of the study was to survey supply chain management practices in a specific company – the Numerical Machining Complex Limited and the firms linked to it both upstream and downstream. The study focused on SCM practices as an instrument to increase efficiency and effectiveness of manufactured products delivery and also enable new possibilities, not feasible before, through integration within the supply chain network. This study had the following specific objectives:

1. Establishing the supply chain management practices in Numerical Machining Complex Limited;
2. Establishing the experiences of Numerical Machining Complex Limited in supply chain management.

1.4 Importance of the Study

The study is expected to generate knowledge and understanding of SCM practices in manufacturing firms. This would be beneficial to the following:

1.4.1 Manufacturing Organizations

Manufacturing firms and NMC in particular would realize the important roles played by the members in the supply chain; the unique situations in the suppliers' processes and how SCM can help in continuous

improvement of performance through continuous learning and embracing better methods in integrating with suppliers and consumers.

1.4.2 Scholars and Researchers

This study would be useful to scholars because it is expected to expand their knowledge in the supply chain process. It would also be useful as a guide for further exploratory and confirmatory research into SCM practices in Kenya's manufacturing firms.

CHAPTER TWO
LITERATURE REVIEW

2.1 Introduction

Market globalization, intensifying competition and an increasing emphasis on customer orientation are regularly cited as catalyzing the surge in interest in supply chain management (Gunasekaran *et al.*, 2004; Webster, 2002). Against this backdrop, effective supply chain management is treated as key to building a sustainable competitive edge through improved inter and intra-firm relationships (Ellinger, 2000). A range of benefits have been attributed to supply chain management, including reduced costs, increased market share and sales, and solid customer relations (Ellinger, 2000). An international study of modern manufacturing practices reported moderate uptake and perceived effectiveness of supply chain management (Chen and Paulraj, 2004). It has been argued that measuring supply chain performance can facilitate a greater understanding of the supply chain, positively influence actors' behavior, and improve its overall performance (Chen and Paulraj, 2004). The challenges associated with getting a product to the right place at the right time intensified as competition in the 1990s did. In today's manufacturing environment, one of the key challenges is to be both efficient and contribute to high effectiveness. If the 1980s were about vertically aligning operations with business strategy (Hayes and Wheelwright, 1984), the 1990s have been about horizontally aligning operations across processes(Chen and Paulraj, 2004).

In this globalized era, most industries will not be able to survive by simply optimizing internal structures and infrastructures based upon business strategy. The most successful manufacturers seem to be those that have carefully linked their internal processes to external suppliers and customers in unique supply chains. The trends in today's dynamic era, e-business and supply chains are integrated and play a vital role towards an organization's competitive advantage and sustenance. Manufacturing organizations' orientation towards customer satisfaction has brought to the fore the potential benefits and importance of strategic and cooperative buyer-supplier relationships. Organizations began to involve strategic suppliers in resource management decisions (Morgan and Monczka, 1996). Instead of relying on tools such as acceptance sampling to establish the quality of incoming materials and component parts, manufacturers now prefer to purchase from a more limited number of qualified or certified suppliers. Many producers have embraced the concept of supply base management, hoping to reduce costs by cutting inventory and improving efficiency throughout the supply chain at the lowest delivered total cost (Watts and Hahn, 1993, Krause, 1997). The objective of SCM is to improve the entire process rather than focusing on local optimization of particular business units (Heikkilä, 2002).

During the past few years, supply chain excellence, optimization, and integration have become the focus and goal of many organizations worldwide. This is because progressive firms are focusing on revenue growth instead of merely striving to meet annual cost reduction targets. Strengthening management of the

supply chain is perceived by many firms as enhancing customer satisfaction and enabling profitable growth (Zailani & Rajagopal, 2006). Partnering with the supplier of raw materials, spares and goods has since contributed to productivity improvement, quality improvement, costs reductions, delivery improvement, safety and hygiene factors consideration, employee morale boosted and finally a satisfied customer in various forms. The satisfied customer is defined by the ability of the supplying firm to supply quality products, meet delivery period, be dependable, be very flexible and still be very cheap.

Research carried out elsewhere indicates that operational, design or strategic decisions made were as a result of proper consideration of supply chain analysis (Lin et al., 2005). The operational studies developed mathematical models for improving the performance of the supply chain (Lin et al., 2005), whilst design studies aimed to optimize performance through redesigning the supply chain. The latter include deterministic analytical models (Chen & Paulraj, 2004), stochastic analytical models (Reiner, 2005), economic models and simulation models (Hwang et al., 2005). Supply chain strategic studies evaluated how to align the supply chain with a firm's strategic objectives (Balasubramanian & Tewany, 2005). Other researchers focused on how conflict and power affected the performance of supply chain networks (Krajewski et al., 2005).

Information is increasingly available through modern means of technology, i.e. customer relationship management (CRM) e-business, and supply chain management (SCM) solutions, which increases the possibility of serving customers individually with customized bundles of goods and services. However, overly focused customization would ruin efficiency. On the other hand, too rigid an approach to SCM would risk customer satisfaction. Therefore, there is need to have a balance between good customer satisfaction and supply chain efficiency. In order that operations managers begin their improvement efforts, it is crucial to start by gaining an understanding on the situation and need in distinct customer segments (Varma et al., 2006). The final step is to take the relationship characteristics into consideration and develop a joint improvement agenda together with the customer. This way, it would be possible to develop optimum operative efficiency within the constraints set by the objectives important for the customer. If the joint improvement agenda is implemented in good co-operation, high customer satisfaction will follow (Heikkilä, 2002).

2.2 Supply Chain Management (SCM)

The simultaneous integration of customer requirements, internal processes and upstream supplier performance also commonly referred to as supply chain management (Tan *et al.*, 1999). The terms "supply chain management" and logistics are often used interchangeably. However, logistics is confined to movement of material, storage, and inventory management, whereas SCM has a larger scope covering issues related to purchase, partnerships, and customer satisfaction in addition to logistics related issues.

Supply chain management is a major issue in many industries as firms realize the importance of creating an integrated relationship with their suppliers and customers. Managing the supply chain has become a way of improving competitiveness by reducing uncertainty and enhancing customer service. SCM focuses on the supply component. SCM is a network of members formed by autonomous entities and their systems by collaborating and collective efforts to solve a common problem. While companies pay attention towards the supply component, the demand component is increasingly playing a vital role as more and more companies realize the potential benefits when owning an efficient chain management system. The supply chain is also frequently referred to as the logistic network in the literature. The supply chain management emphasizes the overall and long-time benefit of all parties in the chain through cooperation and information sharing (Yu *et al.*, 2001). Supply chains comprise all activities associated with the flow and transformation of goods from the raw material stage through to the end user (Handfield and Bechtel, 2002).

From the perspective of filling customer orders, no single part of the value chain working alone can significantly reduce customer lead-time (Zhang *et al.*, 2002). Only cross-functional and cross-company efforts to increase flexibility and eliminate uncertainties can create the level of performance needed to create competitive advantage. By the early 1990s, business communities realized the importance of creating alliances with their upstream and downstream activities. Today many firms have taken bold steps to break down both inter- and intra-firm barriers to form alliances, with the objective of reducing uncertainty and enhancing control of supply and distribution channels (Gunasekaran, 2004). This concept is known as supply chain management or strategic management. Consequently, business communities expanded their strategic view beyond the boundary of their organizations to achieve higher performance and enhance customer satisfaction. This interest has opened the door to a new world of opportunities within the supply chain companies. These companies are looking to develop competitive advantages in areas such as delivery, flexibility, and innovation (Vokurka *et al.*, 2003). The integration of the internal capabilities of firms, suppliers, and customers, for example, can enhance manufacturing performance and the flexibility of an organization (Yu, 2001).

As a discipline, supply chain management first appeared in the literature in the mid-1980s, but as Cooper *et al.* (1997) (as quoted by Zailani & Rajagopal, 2006), suggest it is based on fundamental assumptions emanating from managing organizational operations, which in turn can be traced back to channels and systems integration research in the 1960s and, more recently, work on information management and inventory control. Members of The International Centre for Competitive Excellence in 1994 defined supply chain management as the integration of business processes from end-user through original suppliers that provide products, services and information and add value for customers.

The concept of supply chain partnership extends the perspective of operations from a single business unit to the whole supply chain. Under this partnership, relationships are formed between two independent members in supply channels through increased information sharing for the mutual benefit of achieving goals and benefits shown in reductions in total costs and inventories. It is a set of practices aimed at managing and coordinating the supply chain from raw material suppliers to the final user-customer to gain win-win situation (Gattorna, 1998).

Supply chain management is the coordination and management of a complex network of activities involved in delivering a finished product to the end-user or customer. It is a vital business function and the process includes sourcing raw materials and parts, manufacturing and assembling products, storage, order entry and tracking, distribution through the various channels and finally delivery to the customer. A company's supply chain structure consists of external suppliers, internal functions of the company, and external distributors, as well as customers (commercial or end-user) (Gekonge, 2006). Firms may be members of multiple supply chains simultaneously. The management and coordination is further complicated by global players spread across geographic boundaries and multiple time zones. The successful management of a supply chain is also influenced by customer expectations, globalization, information technology, government regulation, competition and the environment (Cousins and Stanwix, 2001).

A number of researchers suggest that better performance can be achieved by consolidating customer and supplier bases, removing unnecessary steps in the chain, speeding up information and material flows, and creating long-term partnerships with major customers and suppliers to leverage the capabilities of several companies in the chain. Previous management theory in the area of SCM can be broadly divided into two main categories. The first category studies primarily the chain structure (Gattorna, 1998; Lee *et al.*, 1992; Towill, 1997; William, 2002). The second group is primarily about industrial networks and the relationships between organizations in the chain (Lee, 2000, 2002).

2.3 Supply Chain Structure

Time-based management and the relationship between speed of operations and efficiency has been one of the key issues in operations management literature during the 1980s and 1990s (Stalk *et al.*, 1992; Womack and Flowers, 1999). Stalk *et al.* (1992) describe how time has become one of the most important sources of competitive advantage in manufacturing industries. He describes the background for "Japan's secret weapon" (Womack and Flowers, 1999) or "lean thinking" (Womack and Jones, 1994) by illustrating how the competitive advantage of Japanese manufacturing industry evolved from low labor costs-through scale-based strategy, focused factory and flexible manufacturing-to time-based competitive advantage.

Stalk et al. (1992) described companies as systems where competitive advantage can be achieved by breaking the "debilitating loop strangling traditional manufacturing planning". This means that traditional manufacturing requires long lead-times to resolve conflicts between various jobs or activities that require the same resources. The long lead-times require sales forecasts to guide planning. Long lead-times make the accuracy of sales forecasts decline. Forecasting errors increase inventories and the need for safety stocks at all levels. Errors in forecasts mean more unscheduled jobs in the production line, increasing the lead-times for the scheduled jobs. The planning loop expands, drives up costs, increases delays, and creates system inefficiencies. Holmstrom (1989) empirically studied the efficiency potential of speed in operations. His main results being empirical indications of a strong positive correlation between speed and efficiency in manufacturing and that a focus on speed of operations helps expose and remove self-induced sources of uncertainty. He claims that the main contributor to uncertainty in slow operations is distorted communication in the activity system. Based on his findings of a "speed threshold" he suggests that inventory commitment needs to be reduced to a point where demand distortion is diminished and a synchronization of production with demand is possible in order to improve performance by speeding up operations.

One of the main system issues in supply chains is industrial dynamics and management of the bullwhip (or Forrester or whiplash or whipsaw) effect. This refers to the phenomenon where orders to the supplier tend to have larger variance than sales to the buying organization (i.e. demand distortion), and the distortion propagates upstream in an amplified form (variance amplification). This phenomenon is related to the information flows among the members in the supply chain. Information flows in terms of orders have a direct impact on the production scheduling, inventory control and delivery plans of individual members in the supply chain. Information-feedback systems owe their behavior to three characteristics-structure, delays and amplification. The structure of a system tells how the parts are related to one another. Delays exist in the availability of information, in making decisions based on the information, and in taking action on the decisions. Amplification usually exists throughout systems and it is observed when an action is more forceful than might seem to be implied by the information inputs to the system.

The crucial flow of information occurs from the marketplace to the chain. The critical decisions about capacity and inventory are not about minimizing costs but where in the chain to position inventory and available production capacity in order to hedge against uncertain demand. Suppliers should be chosen for their speed and flexibility, not for their low cost (Fisher, 1997). The first step in designing a responsive supply chain is to accept that uncertainty is inherent in innovative products. Cutting lead-times and increasing the supply chain's flexibility so that it can produce to order or at least assemble the product at a time closer to when demand materializes and can be accurately forecast can avoid uncertainty.

Recent SCM and relationship marketing research has attempted to increase understanding of the conditions for win-win partnerships, i.e. customer-supplier relationships in which close long-term co-operation simultaneously increases the value produced by the demand chain and decreases the overall cost of the chain. Several researchers have come to the conclusion that companies need to divide their customer-supplier relationships into classes along the continuum from "arms-length" relationships to true partnerships (Lambert *et al.*, 1998). While true strategic partnerships create new value, they are costly to develop, nurture and maintain. Also, they are risky given the specialized investments they require. The number of real partnerships a company can build and maintain is limited. Therefore, partnership type of relationships cannot be expected to be built with a large number of customers or suppliers, and focusing the resources on building the right relationships requires careful planning and decision-making. Suppliers and customers can form joint development teams to improve various aspects in the supply chain or suppliers can suggest changes that may lead to quality or cost improvements (Clark and Wheelwright, 1993). Information quality includes such aspects as the accuracy, timeliness, adequacy, and credibility of information exchanged.

Some manufacturers have pointed out the inherent hazards of not fully integrating with upstream suppliers and downstream customers (Lee *et al.*, 1993; Hammel and Kopczak, 1993). Fisher (1997) highlighted the critical role of balancing supply and demand across the supply chain. Handfield and Nichols (1999) argued that manufacturers must not only manage their own organizations but also be involved in the management of the network of upstream and downstream firms. Dyer and Ouchi (1993) similarly pointed out that those firms "who have traditionally been structured as independent businesses will increasingly have to configure operations on a shared basis". SCM is considered to be an important element in a firm's endeavor to improve firm performance (Hayes and Wheelwright, 1984; Skinner, 1969). Superior SCM performance leads to competitiveness. In this respect, there are two necessary steps which a firm must undertake to excel in manufacturing competitiveness. First, it must determine what its manufacturing competitive priorities are, and where it stands on these aspects relative to its major competitors. Second, the firm needs to understand what critical manufacturing practices determine superior manufacturing.

2.4 The Strategic Importance of Supply Chain Integration

Over the past decade there has been a growing consensus concerning the strategic importance of integrating suppliers, manufacturers, and customers (Lummus *et al.*, 2001; Van Hoek *et al.*, 2001; Lowson, 2003; Power *et al.*, 2001; Barratt and Oliveira, 2001; Barratt, 2004) (as quoted by Zailani and Rajagopal,2006). As Carothers and Adams (1991), Langley and Holcomb (1992), and Shapiro (2001) convincingly argued in Zailani and Rajagopal, (2006) the once narrow subject of logistics has become a comprehensive topic that now spans the entire value system from suppliers to customers. Reinforcing

this point, Ragatz *et al.* (1997) in Zailani and Rajagopal, (2006) noted that the "effective integration of suppliers into product value/supply chains will be a key factor for some manufacturers in achieving the improvements necessary to remain competitive". For practitioners, the strategic importance of integration is similarly reflected in the Supply Chain Council's popular Supply Chain Operations Reference (SCOR) model that assumes all businesses include sourcing, making, and delivering processes strategically linking suppliers and customers to manufacturers (see www.supply-chain.org).

Many of the theoretical arguments for closely integrating operations between manufacturers and suppliers and customers come from the process reengineering literature (Hammer and Champy, 1993; Hammer, 1996; Fliedner and Vokurka, 1997). Typically, the goal is to create and coordinate manufacturing processes seamlessly across the supply chain in a manner that most competitors cannot very easily match (Anderson and Katz, 1998). As Birou *et al.* (1998) pointed out; the opportunity to use process integration across functional boundaries is now considered a key to competitive success. Davis (1993), and Dyer and Ouchi (1993) similarly echoed the importance of integrating suppliers and customers into supply chains for developing new products and processes.

2.5 Implementing Effective Supply Chain Management Strategies

The primary purpose in establishing supply chains is to minimize the flow of raw materials and finished products at every point in the pipeline in order to enhance productivity and cost savings (Cohen, 1996; Cooper and Ellram, 1993). Successful supply chain ventures manage an individual business unit, or a division/function, and/or the whole (the entire supply chain). It also serves to increase the clout in the channel because these firms are recognized as leading edge and are treated with respect. Attaining competitive advantage in the channel comes with top management support for decreased costs, waste management, and enhanced profits (Cohen, 1996). Many firms want to push costs back to their supplier and take labor costs out of the system. These cost reducing tactics tend to increase the competitive efficiency of the entire supply chain.

2.6 Supply Chain Integration and the New Millennium

The history of operations management in the twentieth century can in some ways be seen as leading to the current emphasis on supply chain integration as the way to compete, since that history has largely been concerned with ever-increasing spans of control. From Taylor's pioneering work of 1911 to lean production article in the 1980s, the era of "Taylor to Toyota" (Voss, 1995) has seen the unit of investigation expand from the task of an individual to the activities of a network of firms. Scientific management was concerned primarily with direct labor productivity and thus the article of work methods. It also looked beyond the firm to its suppliers and customers. For example, controlling product quality requires manufacturers to work with suppliers, just as controlling demand patterns requires them to work with their customers. In this millennium, enhanced competitiveness not only in control but also

in issues such as product design will require that manufacturers increasingly open out their arcs of integration and collaborate within a network of organizations.

New technology is already facilitating such developments. The Internet allows any member of a supply chain to connect to any other organization. In other words, the widest possible arc of integration has rapidly changed from a theoretical concept into an operational reality. Manufacturers can now link to customers using e-commerce on the sell-side of the Internet in what is popularly termed the "Dell direct" model. The more information that manufacturers have concerning end consumer's requirements, the simpler supply and demand decisions become (Poirer, 1999), and the lower the risks of stock-outs or obsolete inventory (Fisher, 1997). Conversely, on the buy-side of the Internet extensive electronic supply base, management is increasingly feasible. For many years now cost and delivery information has been shared between manufacturers and a few major suppliers using electronic data interchange (EDI). But these EDI systems, unlike the Internet, are generally incompatible with each other and expensive to develop and install. Internet technology, with its world-wide interconnectivity and ease of access, is far less costly and permits many more suppliers, even quite small ones, to be integrated electronically into a supply chain (Coyle *et al.*, 2003).

One consequence for supply chain integration of this cheaper, easier Internet communication may be to extend the types of information exchanged. Not only the delivery schedules and billing data of an EDI system, but also new product ideas, online product support material, training aids, and technical knowledge can be transferred. Thus, the nature of collaboration may increase in range and intensity, and a broad arc of integration will be defined in terms of more or different variables. A second consequence of Internet use for supply chain integration, related to the closeness of the relationship between firms, is harder to predict. By making collaboration easier and cheaper, the new technology means companies can integrate aspects of their operations more swiftly and collaborate more closely than before. But, the open architecture of the Internet means that many more potential suppliers can bid for business, and new collaborations, beyond the circle of favored "partners", are easily formed. EDI ties companies together with a proprietary link representing substantial investment, but the Internet makes such communications available to everyone. Supply requirements can even be posted on an electronic bulletin board or supplier network and rival bids easily compared, permitting new rivals to compete in the electronic marketplace. Thus, vendor switching may be as likely as partnership, for the Internet enables both approaches.

However, if it is assumed that the ultimate arc of integration is a web-enabled supply chain, then the challenge is to get there first. In many ways, the new millennium is shaping up as a race between the outward-facing companies and their less integrated rivals. It probably took the outward-facing companies many years to achieve their high degrees of integration, and today they still have the advantage. New internet technologies, however, such as e-procurement software and advanced supply chain planning

systems can greatly simplify implementation, so that manufacturers with traditionally narrow arcs of integration now have an opportunity to quickly catch up.

2.7 Supply Chain Management and Efficiency

The notion that organizations have supply chains that require active management to maximize efficiency is well recognized. Indeed across a number of industries, including the retail sector, supply chain efficiency has become a dominant corporate paradigm, driving firms' business models and at least in the short term delivering improved profitability. Indeed, from being an unfashionable backwater of management theory and practice, supply chain management has asserted considerable influence on operational and strategic thinking. This reflects the notion that an effective supply chain will ensure adequate customer satisfaction through reducing costs and therefore prices. Waller (1998) discusses "customer driven" logistics as an increasingly accepted concept; "...businesses begin to understand that their future existence depends upon the loyalty of the end-users of their products".

2.8 Variability Factors in Supply Chain Management

The influence of lead-time can be felt in the supply chain at any and/or all stages of its life cycle. The transformation of product through various stages in its life cycle brings out cycle time in its various manifestations, such as set-up time, process time, queue time, wait time, and idle time. One of the primary challenges in modeling waste management in the supply chain is to reduce variability of these cycle time elements. This is mainly accomplished by designing coordination mechanisms through sharing of information in the form of demand schedules, capacity plans, production schedules, etc. (Karmarkar et al., 1985). Inventory variability poses a serious challenge in the management of a supply chain. This is primarily because the material flow in a supply chain takes on many forms through its life cycle and thus assumes various inventory classifications. This phenomenon is described with an example drawn from the textile industry. A garment sold to a consumer at retail has a material flow from fiber, non-dyed fabric, dyed fabric, apparel, and finally a finished garment (Karmarkar et al., 1985).

Various types of inventories are created throughout the above material transformation. Fiber production is a continuous manufacturing process, where batches are introduced in order to achieve economies of scale and/or production efficiencies. However, batches of production cause inventory (or cycle stock). Production of textile fabric from fiber may impose sequence dependencies between processes, or create goods-in-transit for a multi-echelon assembly line set-up. Decoupling stocks may also be created, if, for example, an end product of one process (unprocessed goods) and a raw material for the next process (fabric coloring) are warehoused to achieve production economies. Material flow at the next stage is in the form of textile fabric components required to produce apparel. Anticipation inventories may be created for apparels with seasonal demand. Work-in-process inventories may be created for apparels

requiring assembly of various components. Finally, consumers' demand patterns, product characteristics, and customer service levels dictate maintaining safety stocks of apparel to avoid stock-outs. This principle prescribes that the relationship between lot size and lead-time should be closely managed in a manufacturing supply chain. Two types of effects that emerge from this relationship are batching effect, and saturation effect (Karmarkar *et al.*, 1985; Graves *et al.*, 1993; Sipper, and Bulfin, 1997).

Batching effect: The rationale behind this effect is that an increase in lot size should also increase lead-time. For example, a batch of one unit can immediately move to the next operation as soon as its processing is complete. However, a batch of five units does not move until all five units are completed. That is, the first unit waits until the other four units are completed before it moves to the next operation. A doubling of the batch size to ten units requires the first unit to wait for the processing of remaining nine units. The bottom line is that large batches will cause longer delays of parts waiting for the rest of the batch to be completed.

Saturation effect: The rationale behind this effect is that saturation effect works conversely to the batching effect. That is, when lot sizes decrease, and set-up is not reduced, lead-time will eventually increase. The reason is that, if demand stays the same, as lot sizes are reduced there will be more lots in the shop. This result in more time spent on set-ups and less time available for processing. As a result, demand becomes a relatively larger proportion of available capacity and congestion increases. Since the effects of the two phenomena are opposite, the aggregate behavior of lead-time as a function of lot size assumes a convex or a U-shape. In the final analysis, however, by making the transfer batch smaller than the production batch, production lead-time can be substantially reduced.

The rationale behind this principle is that, rather than balancing capacities, the flow of product through the system should be balanced. That is, the modeling of waste management should be designed to control throughput and work-in-process inventory simultaneously. This will require converting a bottleneck activity to non-bottleneck activity in the supply chain. This can be achieved by creating buffers due to time, inventory, lead-time, etc. so as to allow the bottleneck activity to be synchronized with the succeeding non-bottleneck activity. An approach that enables this to be done is the drum-buffer-rope (DBR) approach based on the theory of constraint (Cohen, 1988). A bottleneck operation becomes the control point whose production rate controls the pace of the system. This bottleneck beats the drum that enables execution of policies that create a buffer before the control point so that it gets a leeway to synchronize its actions with downstream operations in the supply chain. A rope in the form of feedback of information from the bottleneck operation to upstream operations enables the pipeline to maintain its throughput. Implementing the DBR approach is a key element of synchronous manufacturing in a supply chain.

2.9 Green Supply Chain Management

Several studies have considered the concept of ecological sustainability as a framework for studying management practices in both operational and strategic contexts (Sarkis and Rasheed, 1995; Klassen and McLaughlin, 1996; King and Lenox, 2001). As part of this effort, other studies have examined the greening of supply chains within various contexts including in product design (Allenby, 1993; Gupta, 1995), process design (Porter and Van der Linde, 1995a; Klassen and McLaughlin, 1996), manufacturing practices (Winsemius and Guntram, 1992), purchasing (Handfield *et al.*, 2002) and a broad mixture of these elements (Bowen *et al.*, 2001a). It is not surprising that GSCM finds its definition in supply chain management. Adding the "green" component to supply chain management involves addressing the influence and relationships of supply chain management to the natural environment. Motivated by an environmentally conscious mindset, it can also stem from a competitiveness motive within organizations. Since the Earth Summit in Rio de Janeiro in 1992, sustainable development has been a philosophy for overall economic development. Those companies that can conserve and manage their resources more efficiently will gain competitive advantage (Mohanty and Deshmukh, 1998). Under pressure from governments and general public as well as non-governmental pressures from abroad, an increasing number of enterprises are working to improve their environmental performance (Zhu and Geng, 2001).

2.10 Supply Chain Management: Issues and Challenges

SCM is a concept that originated in the manufacturing industries in the early-1980s. It was developed from innovations such as JIT (Vrijhoef and Koskela, 2000) and TQM (Wong and Fung, 1999). SCM can be seen as an example of evolutionary and cumulative innovation, which is often described as emanating from internal programs aimed at improving overall effectiveness (Saad *et al.*, 2002). The focus is not only limited to increasing the internal efficiency of organizations, but also has now been broadened to include methods of reducing waste and adding value across the entire supply chain (New and Ramsay, 1997; Christopher, 1998; Harland *et al.*, 1999).

SCM has shifted the emphasis from internal structure to external linkages and processes, and is dependent on the interaction between the organization and its external environment, with strong feedback linkages and collective learning. It is seen as a set of practices aimed at managing and coordinating the whole supply chain from raw material suppliers to end customers (Harland, 1996; Vollman *et al.*, 1997; Slack *et al.*, 2001), which develop greater synergy through collaboration along the whole supply chain (Lamming, 1993; New and Ramsay, 1997).

This holistic approach is associated with the effective management of the interfaces between all the organizations involved (Von Hipple, 1986), and the integration of both upstream and downstream processes (Harland *et al.*, 1999; Christopher and Juttner, 2000). This significant emphasis on co-

ordination and integration is strongly linked to the development of more effective and longer-term relationships between buyers and suppliers (Spekman *et al.*, 1998; Kosela, 1999). These new types of relationships are increasingly perceived as a means to utilize resources better through the whole supply chain (Dubois and Gadde, 2000). In addition, they can also lead to greater transparency in transactions, increased trust and commitment (Ali *et al.*, 1997). There are successful examples of where SCM is delivering significant performance improvements across the entire supply chain (Houlihan, 1985; Burgess, 1988; Holti, 1997). It can also be an important element in innovation in products, processes and organization (Edum-Fotwe *et al.*, 2001). Information can be more readily shared and knowledge identified, captured and disseminated throughout the organizations in the chain (Mowery, 1988). This has led to an increasing adoption of partnership approaches and inter-organizational alliances to achieve significant mutual benefits involving sharing resources, information, learning and other key assets (Akintoye *et al.*, 2000).

However, SCM is a long, complex and dynamic process. Its successful implementation needs to be associated with a thorough understanding of the concept itself (Whipple and Frankel, 2000; Savage, 1990; Neely, 1998). Its implementation is also seen as being closely dependent upon the ability to create, manage and reshape relationships between individuals, organizations and networks within the supply chain (New and Ramsay, 1997; Spekman *et al.*, 1998; Harland *et al.*, 1999). It requires new organizational arrangements and culture (Neely, 1998) which calls for considerable commitment, resources and time to develop. It is therefore important to recognize that SCM is complex and has proved to be difficult to implement. Because it is a multi-factor process, relying upon close and long-term relationships within and between organizations (Saad *et al.*, 2002), its overall success is associated with the challenging and difficult development of a new culture based on shared learning, greater transparency and trust. With this greater reliance on suppliers and the increasing emergence of outsourcing and fierce competition, the SCM faces the challenge of how to sustain and continuously improve the coordination and integration of all interactions and interfaces for the overall performance of the supply chain. Unfortunately, it is difficult to define what constitutes effective relationships with partners in the supply chain. In addition to this difficulty, the success of SCM is essentially reliant on less tangible factors on which current metrics of performance are not sufficiently adequate to measure.

CHAPTER THREE
RESEARCH METHODOLOGY

3.1 Research Design

The study sought to establish the supply chain management practices in a manufacturing organization in Kenya, namely: The Numerical Machining Complex Limited (NMC). The researcher decided to use the case study as the research design because this type of research design provides opportunity to obtain responses which are more accurate and factual. In addition to the advantages of case study method, the researcher also had a special interest in this particular organization because he works for the organization and would like to see the SCM practices implemented. It was therefore desirable that through this study, the researcher would understand and document the experiences of Numerical Machining Complex Limited in its position along the supply chain and how it links up with the other players who are upstream (suppliers) and downstream (customers).

3.2 Population and Sampling

This study involved an examination of supply chain management practices in NMC. It was necessary, therefore, that firms which supply raw materials to NMC and firms which receive finished or semi-finished products from the NMC be interviewed. This required that the study adopt a stratified random sampling methodology. The stratified random methodology had the advantage of taking into account other constituencies like the suppliers which would otherwise been ignored if any other methodology was adopted. The total number of firms supplying raw materials to NMC numbered twenty one (21). Because this is a small number, all of these were included in the study, i.e. a census approach was used. The firms which receive manufactured products from the NMC total three hundred and fifty (350). Since this number was big, it was decided to obtain a sample. The researcher settled on a purposive sample of at least a third of these firms, that is 108 firms. This sample size was bigger than that used by Ngure (2001) and Arithi (2001) whose sample sizes were 40 and 50 respectively. According to Ngure (2001) sample size can also be determined by the availability of resources which was also the case in this study although a little more resources was available. Dixon and Leah (1984) as quoted by Ngure (2001) advised that adequacy and resources consideration should determine the size of the sample.

The sample frame for firms supplied by NMC was obtained from the commercial office of NMC. It consisted of a list of all the 350 firms, arranged in an alphabetical order. The researcher obtained the required sampled by systematically selecting every third firm from the list after selecting the first firm randomly. This process was repeated until the entire list had been exhausted. The firms so selected comprised the downstream (i.e. customers) sample.

3.3 Data Collection

The researcher collected primary data using a semi-structured questionnaire. This was principally self-administered, though the researcher helped respondents complete the questionnaire whenever difficulties arose. Respondents included all the NMC staff in the logistics, supplies, and marketing functions. The organization's chief executive officer, departmental heads and other staff involved in the process of planning, development, management and implementation of supply strategies were also interviewed. Their views were considered important because they would be in a position to know the obstacles the firm faces in its attempt to implement various strategies. The other respondents were from organizations linked to NMC business (upstream and downstream). Upstream firms are those which supply raw materials while downstream firms receive manufactured products from the NMC.

The researcher administered the questionnaire to both upstream and downstream firms personally. Personal efforts were supplemented by a combination of drop and pick later method, e-mail and telephone follow ups. The researcher engaged the services of two assistants to speed up the process of administering questionnaires. In a few cases (where respondents were not enthusiastic), the researcher administered questionnaires in person, recording responses as appropriate.

3.4 Data Analysis

Data was organized for analysis by reading through the filled questionnaires in an effort to spot any inconsistencies or errors which may have occurred during data collection stage. Any problems identified were corrected as appropriate. The researcher also undertook inspection, correction and modification of the information given in each questionnaire so as to guarantee the correctness and adequacy of data on a common basis to the categories of reply. Data collected was classified into homogeneous groups so as to generate distinct groups on the basis of common characteristics.

The data was then coded and tabulated for analysis. The analysis was mainly descriptive. Descriptive data provided a general picture on how SCM practices are carried out and helped identify the specific practices, the extent of the improvement desired and the operational level in relation to SCM practices in the organization. Descriptive statistics was used to reveal general patterns of responses for the major supply chain practices. The analysis helped establish the experiences of NMC in supply chain management and how these practices have helped the company in its efforts to be a competitive manufacturing organization. Tables, charts and graphs, content analysis of key themes, as well as percentages and rankings were used to describe the first study objective. The descriptive measures were also useful in answering both the first and second study objective.

CHAPTER FOUR

DATA ANALYSIS, QUESTIONS AND DISCUSSIONS

4.1 Introduction

The study surveyed the supply chain management practices in Numerical Machining Complex Ltd. The survey analyzed and interpreted responses to questions relating to supply chain management practices at different levels of operations of the company. Responses were obtained from suppliers (who were given a set of questions based on supply operations and relationships with the NMC) and customers related to the supply chain operations within the supplying company itself. The responses varied widely but had general similarities with respect to supply chain management practices. The general similarities made it possible to construct suitable themes under which to study supply chain management practices. These themes are analyzed and discussed under various headings in the rest of this section.

4.1.1 Questions asked

Numerical Machining Complex's suppliers were asked questions relating to supply chain management practices as practiced by NMC. The questions were put in very simple language for ease of understanding and interpretation. The questions ranged from the method and process of engagement with NMC to the way NMC places orders, delivery conditions of the goods, NMC's input in the process of supply, and the role of NMC in designing specifications of goods as well as the processes of preparation of the goods.

The suppliers were asked to state how long they have supplied the company with goods and materials, how they obtained the supply contract and if they have a continuing supply contract with NMC. They were also interviewed on the NMC's role, if any, in designing specifications of goods to be supplied, the processes of preparation of the goods to be delivered, and how this is done (if at all). The NMC's managers, on their part, were interviewed on the institutionalization of supply chain management practices within the firm and how this has also been done for the case of suppliers upstream and downstream at the customers' end. On a 1-5-point Likert scale, respondents were asked to indicate the extent of their agreement (or disagreement) with various statements relating to supply chain management practices. Some of the questions related to the importance of supply contracts, the stability of the relationship among supply chain members, and the importance of measuring performance of supply chain. The questions also inquired into the extent supply chain management practices have played in facilitating a greater understanding among members in the chain and how this builds into quality of products supplied.

Respondents had to indicate their agreement with statements relating to the relationships between an effective supply chain and total quality management, the importance of sharing product information, and

whether internal processes should be linked to external processes. They also discussed their perception of the importance of supply chain management delivery, flexibility, and innovation. The importance of consolidating customer and supplier bases, the speeding up of information flows and creation of long-term partnerships to leverage capabilities were also considered. Respondents also discussed the importance of increasing inventory variability at different stages, reducing lead time variability and the elimination of bottlenecks. Environmental concerns were not left out. Respondents were asked to indicate their view of the role of "green" issues in supply chain management and how these issues impact on the overall efficiency of the entire supply chain. The NMC supply chain managers and the staff linked to supply chain management in NMC and customers were also asked questions related to supply chain management practices. These bordered on; the process of engagement with suppliers, supply contracts, working relationships with suppliers and customers, sharing of product information, coordinated strategies on supply chain and collaboration upwards and downwards. Other questions included; review of suppliers list, performance of suppliers, measurement of performance of suppliers and environmental issues.

4.1.2 Analysis of Responses obtained

Supply chain players' responses were analyzed quantitatively and qualitatively. These were then summarized into various mean scores for quantitative data, and under several themes in the case of qualitative data. The results were presented by various presentation tools. The data were interpreted and presented in narrative descriptions.

4.1.3 Interpretations and Discussions

The interpretations of the data established the experiences of the Numerical Machining Complex Ltd. The analyses indicated that the company believes in a strong, stable relationship with suppliers and customers. This is in-line with the expectations from a company practicing good supply chain management practices. However whereas the company understands well the supply chain management practices, it has not taken steps to draw its suppliers into a long-term stable relationship. The company does not offer its suppliers long-term supply contracts, a practice that is at variance with good supply chain management practices. It shows that the Numerical Machining Complex has not institutionalized a collaborative relationship with its suppliers geared towards establishing long-term alliances.

4.1.3.1 Survey Response Rate

Out of the total number of firms that supply NMC, all of them (21) were targeted for this study, but only 9 completed the survey instrument. This was because they were too busy and saw no benefit out of it. However This represents a response rate of 42.9%. The response rate from customers was almost similar to that of suppliers. In this category, 49 out of the surveyed 108 (or 45.4%) customers completed the survey instrument. The highest response rate (94.7%) was obtained from managers of the Numerical Machining Complex; the organization whose supply chain management practices was being studied. The

three categories of respondents studied comprise a critical network of the supply chain management. Experiences of these three players, put together, describe the overall status of the supply chain management processes and show the Numerical Machining Complex's experiences.

4.1.3.2 Engagement with Suppliers

Responses from suppliers show that the NMC has a long-term relationship with its upstream partners. The mean period these partners have worked with NMC is 8.89 years. In addition, more than half (or 55.6%) of all firms have supplied the NMC for ten years. A significant percentage, 88.9%, has supplied NMC for at least six years. These data show that a stable, long-term relationship exists between the organization and its suppliers. This is in-line with recommended supply chain management practices.

Table 4.1: Processes leading to engagement with NMC

Process leading to engagement with NMC	*Number of firms (N)*	*Percentage (%)*
Formal prequalification	2	22.2
Informal, cold-calling	7	77.8
Total	**9**	**100.0**

Source: Research Data

The table shows that the suppliers were introduced to NMC through a combination of formal and informal methods. Thus, there was both the formal prequalification and the informal, cold-calling method. This further indicates that NMC does not have a proactive approach to searching out its suppliers. In stead, it relies on suppliers themselves approaching it and proposing what they wish to supply. This is in conflict with supply chain management practices.

In all cases (100.0%), NMC assists in defining specifications for goods to be delivered. Also, the NMC describes processes of preparation of goods to be delivered (88.9%). It also oversees operations. This shows that the organization is intimately involved in defining processes and specifications for goods it receives from suppliers. Unfortunately, this involvement does not carry over into getting into contractual relationships with suppliers. Only 11.1% of suppliers have a long-term contract with the NMC. The rest have to rely on specific orders from NMC after which they proceed to manufacture and deliver their products. Suppliers indicate the following reasons as contributing to absence of contracts with NMC;

- The organization prefers to buy a fixed quantity only on need basis;
- NMC, for reasons unknown to suppliers, does not seem to encourage supply contracts;
- Demand for specific parts and components are always changing, thereby making supply contracts expensive, if not irrelevant.

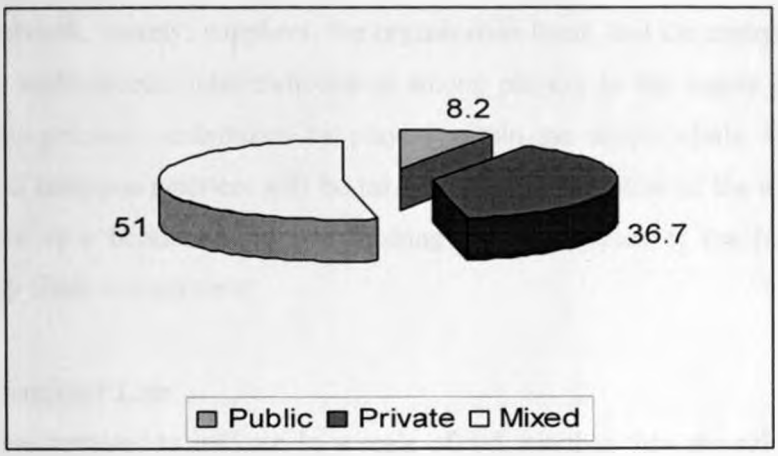
Even with these reasons, suppliers indicate desire for a more predictable supply regime available only through a regular supply contract. They believe that, based on the long period they have supplied the

NMC, it is possible for both the buyer (i.e. NMC) and the supplier to work out the demand needs and build these into a supply contract.

4.1.3.3 Firm ownership

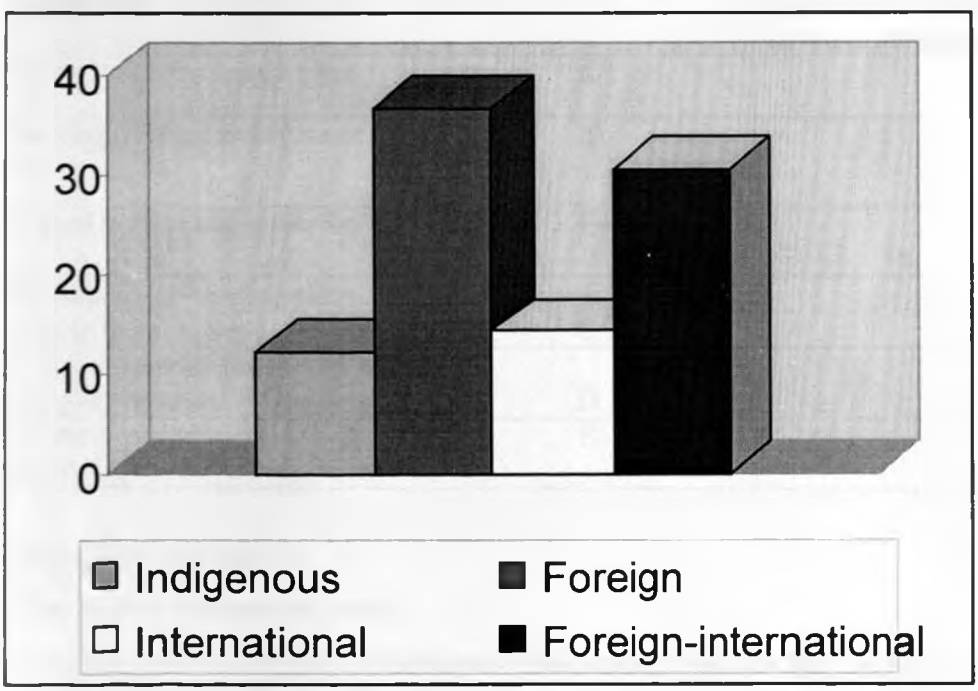
The scope of ownership is spread out among indigenous, foreign, international, and foreign-international. The nature of ownership of these firms is shown in the chart 4.1:

Chart 4.1: Type of ownership of customer firms



As chart 4.1 shows, slightly more than one-half (or 51.0%) of these firms describe them as mixed ownership. Privately and publicly-owned firms comprise 36.7% and 8.2% respectively.

Chart 4.2: Scope of customer firms' ownership



The scope of ownership is distributed among indigenous, foreign, international, and foreign-international with the percentages, 12.2%, 36.7%, 14.3%, and 30.6% respectively. Thus, foreign or foreign-

international firms account for slightly over two-thirds (67.3%) of customer respondents. Foreign and international firms constitute a significant percentage of these firms as shown in Chart 4.2. This is an indication that NMC has engaged a wide range of suppliers with mixed background. These include firms that are likely to be engaged with other firms that practice good supply chain management practices.

4.2 Supply Chain Management Practices

Supply chain management is a system that incorporates various practices undertaken by critical players within the supply network, namely: suppliers, the organization itself, and the customers. It is a process which gives rise to multi-faceted interrelationships among players in the supply chain. This section discusses the various practices undertaken by players within the supply chain. On the basis of this information, the most common practices will be taken to be representative of the manufacturing set-up. They will also serve as a benchmark for establishing the experiences of the Numerical Machining Complex with supply chain management.

4.2.1 Maintaining Supplier Lists

The respondents were required to indicate in a scale of 1-5 whether they strongly agreed or strongly disagreed with statements relating to keeping suppliers list, changing of suppliers frequently, reviewing of list, and development of suppliers. The responses were recorded in Table 4.2

Table 4.2: Supply chain practices relating to maintaining of supplier list

Supply chain practice relating to Supplier list	***Label***	***Mean Score represents extent of agreement (1=strongly agree, 5= strongly disagree)***
Important to keep supplier list	A	1.29
Changing of supplier list is not good	B	1.82
No need to review supplier list	E	1.96
Important to develop suppliers and help them improve	C	2.49
Approved supplier list should not needlessly be altered	D	2.96
Important to shop around for needed item	F	3.37

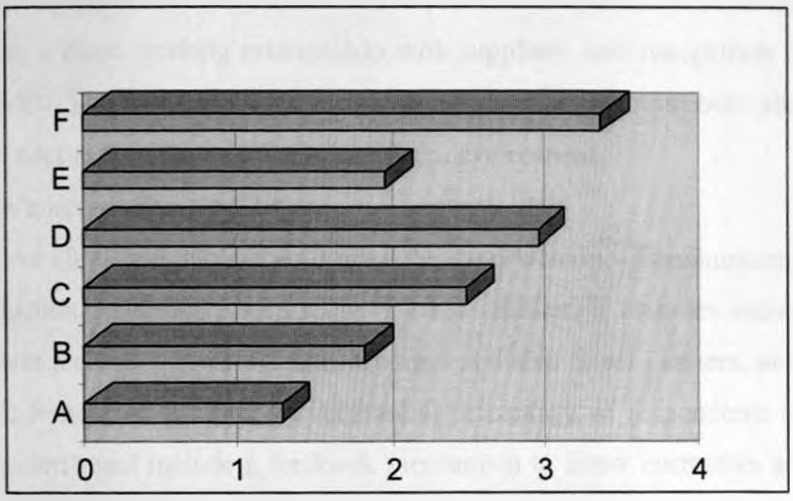
Source: Research Data

(Mean scores in ascending order)

The results read out from the table indicates that supply chain practices relating to maintaining a supplier list, i.e. the extent to which respondents think aspects of the supplier list is important. The table shows that supply chain members consider maintaining a supplier list as very important. Respondents also feel

that it is not good to keep changing suppliers, though it is quite appropriate to continuously review suppliers' list. The responses show that entrenchment of supply chain management practices is deep within NMC as shown in chart 4.3.

Chart 4.3: Supply chain practices (importance)



4.2.2 Creation and Maintenance of Partnerships across the Supply Chain

Respondents were also asked to indicate in a scale of 1-5 their agreement or disagreement with the importance of creation and maintenance of partnerships across the supply chain. The results were recorded in Table 4.3 below:

Table 4.3: Practices supporting creation and maintenance of partnerships

	Practice Description	*Mean Score*
	Important to have suppliers allied with organization	1.54
	Important to work closely with suppliers	1.80
	Important to develop suppliers and help them improve	1.96

Source: Research Data

Table 4.3 shows that the respondents viewed creation and maintenance of alliances across the supply chain as contributing greatly to successful relationships across the entire chain. Further, more than two-thirds of NMC respondents (68.4%) report that the creation of alliances should be aimed at consolidating customer and supplier bases. Supply chain management emphasizes creation of a network of partnerships among supply chain members. This study finds that chain members feel strongly about the importance of working together. Suppliers report that there is currently an absence of strong partnerships between the NMC and themselves. This is underlined by the unwillingness of the NMC to offer long-term supply contracts.

Table 4.3 further shows that the importance of collaborative relationships between the NMC and its suppliers is rated highly. A significant percentage (78.9%) of NMC managers report that it is important to invest in this type of relationships. And one of the best ways to achieve this is by entering into long-term contract relationships with suppliers. Doing this will create a good integration among all the supply chain members. The ingredients of successful development of network relationships include: assisting suppliers to improve, a close working relationship with suppliers, and recognition that suppliers are in alliance with the NMC. The mean score for each of these practices also has been shown the same Table 4.3: an indication of approval of the practice of network development.

4.2.3 Communication across Supply Chain

It is important to have clear communication across the supply chain. Communication is not limited to describing the production processes (mean score = 2.15). Rather, it includes such practices as regular meetings among chain members, written status reports circulated to all partners, and adequate briefings on what is expected from each partner. A substantial percentage of respondents (72.2%) believe that effective communication must include a feedback mechanism to allow corrective action in the event of material departures from the expected. Communication across the supply chain is expected to improve management of 94.4% all the processes undertaken within the chain.

A very significant percentage (89.5%) of NMC respondents believe that communication would be enhanced if all partners within the supply chain readily share product information. It has been said that there are few greater liberating forces than the sharing of information. It is important to ensue that information is available to all personnel within the supply chain. The importance of information is seen in the following aspects (Peters, 1987):

- It provides critical confirmation that the organization (NMC) sees partners in the supply chain as part and parcel of the problem solving mechanism;
- The widespread availability of information is the only basis for effective day-to-day problem solving, which abets continuous improvement programs;
- Visible posting of information radically speeds problem solving and action taking;
- Information sharing stirs the competitive juices;
- Sharing information on the front line inhibits the upper-level power game playing that is the prime enemy of flexibility and moving fast. This is because most power playing is born of information hoarding; and,
- Information abets flattening the organizational pyramid. Information availability inherently shifts skill and responsibility to the frontline and facilitates frontline communications across functional barriers. Information in and of itself is the chief substitute for first-line supervisors- and many staff experts too.

These advantages clearly show that it is necessary to cultivate a culture where information is shared across the supply chain. The gain of one partner is synonymous to the gain of all partners in the chain. In fact, information may make possible collaboration between rivals when such partnerships can provide access to new markets and technologies, or allow the creation of products that neither competitor could produce on its own.

4.2.4 Continuous Improvement

All members within the supply chain ought to commit themselves to embrace continuous improvement. In the increasingly dynamic world, improvement is mandatory if the supply chain partners are to deliver above-average results. To be successful, continuous improvement must be a chain-wide activity otherwise defects or failures from one partner in the chain will inevitably be passed to others downstream.

The elements of continuous improvement include measuring performance of supply chain partners based on recognition that the overall performance of the supply chain is important. The focus of continuous improvement should be to make all partners of world-class standards. The elements of continuous improvement, in order of importance, are shown in the table 4.4:

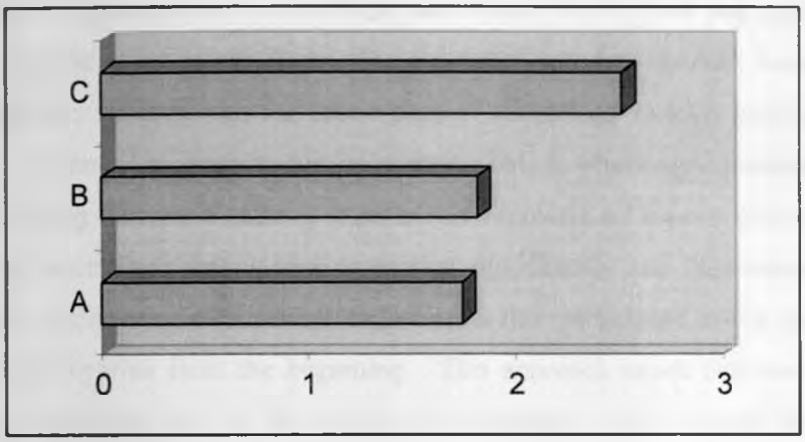
Table 4.4: Continuous improvement in the supply chain

Variable label	*Variable description*	*Mean score*
A	Performance of supply chain is important	1.74
B	It is important to measure performance of supply chain	1.82
C	Supply chain is world class	2.51

Source: Research Data

This information is also graphically shown in Chart 4.4:

Chart 4.4: Importance of continuous improvement processes



Respondents agree that performance of the supply chain is important. They also recognize that bottlenecks at one point will inevitably impact on others within the system. This makes it necessary to measure performance within the entire supply chain. Continuous improvement should not be a one-stop activity. It is to be seen as a never-ending journey. Experts contend that each day, each product or service is getting relatively better or relatively worse. It never stands still (Peters, 1987). To get on the fast-track to a systematic continuous improvement program, it has been suggested that firms set a target of 90 percent reduction in defects in three years to be backed by state-of-industry warranties *(ibid.)*

Respondents report that their supply chain is yet to attain the world class standard (mean score = 2.51). The table below shows the extent to which firms across the supply chain have tried to instill processes that contribute towards making them of world-class standard:

Table 4.5: Processes towards making supply chain members world class

Process	*Percentage agree/strongly agree (%)*
Increase of influence of batching effects variability	15.8
Opened out arcs of integration decrease collaboration	21.1
Significant increase in inventory variability	36.8
On-time delivery directly to customer's point of use	83.3

Source: Research Data

4.2.6 Agile Manufacturing

One of the world-class processes is agile manufacturing. This method emphasizes ultra-flexible production facilities and constantly shifting alliances among suppliers, subcontractors and partners. Under this system, suppliers increasingly become involved at the very earliest stages of product development, helping to plan and design new components. Only 5.3% of NMC managers felt that agile

manufacturing is not important. Slightly over one-quarter (26.3%) indicated that they are not sure if agile manufacturing is important while more than two thirds (68.4%) feel that agile manufacturing is important. Agile manufacturing makes it possible for faster speed to market. Increasing competition (both local and global) combined with the hectic pace of technology quickly make good ideas useless unless these can be converted to products for the market. This is where agile manufacturing comes into sharp focus. By bringing together a team of experts who represent all aspects of the product life cycle, agile manufacturing succeeds in cutting time to market significantly and improves quality at the same time. Simultaneous engineering calls for all departments that participate in the product development cycle to work closely together from the beginning. This approach saves time and money because it settles conflicts and problems early in the development process. This reduces the need for product modification and recirculation of the design through numerous iterations (Cotter, 1995).

4.2.6 Competitiveness

Supply chains have been known to add to organizational competitiveness. Respondents recognize that a supply chain that is not encumbered with bottlenecks has the potential to contribute to organizational success, increased market share, and reduction in costs. A well-functioning supply chain leads to a firm's success in the market because it leads to better quality of products. As quality goes up, costs go down. A large percentage of respondents (94.4%) consider that, as a driver of competitiveness, an effective supply chain is critical to building a sustainable competitive edge for all partners within the chain. This therefore calls for building of linkages among and between internal and external processes. The elements which respondents consider to contribute to competitiveness in the supply chain are shown in Table 4.6 below:

Table 4.6: Elements of competitiveness in supply chain

Competitiveness Process	*Mean score*	*Ranking*
Supply chain critical to firm's success	1.67	1
Supply chain reduces costs	1.87	2
Supply chain contributes to increased market share	1.92	3

Source: Research Data

4.2.7 Quality Control and Review

Quality should always be built within the supply chain. This can only be done if quality is continuously measured. Without measurement, it is not easy to improve quality. Poor-quality cost includes such items as manufacturing rework, warranty costs, cost of repair or return of poor goods from suppliers, and inspection costs. All respondents from the NMC believe that measuring performance of the supply chain facilitates greater understanding about the quality expected. Further, a significant percentage of these

same respondents (68.4%) believe that quality supplied to their firm must be of an acceptable standard as previously agreed with suppliers.

The study indicates that it is very necessary to inspect deliveries to ensure these conform to lay down standards. They also indicate that although current suppliers provide quality products (mean score = 2.35), it is still important to conduct inspections for quality. To improve the quality of products flowing through the supply chain, it is crucial that measurement begins at the outset of the quality improvement programs. Among other things, it will inject energy into the program as the size of the problem and opportunity comes into view. Experts concur that poor quality absorbs about 25 percent of all resources in the case of manufacturing organizations and 40 percent in service firms. Measurement should be visible with big charts and readable graphs accessible to all within the supply chain. Everyone (suppliers, customers, etc) must be a player in the quest for quality. Efforts at instilling a quality culture should be founded on a supply chain that is flexible and that cherishes innovation. All partners within the supply chain should ask themselves how they can meet the specifications expected by the customers downstream. The drive towards innovation in quality should always be considered in the customer's terms. It is the customer's perception of excellence. Continuous improvement should be ingrained in the culture of all supply chain members. No item in the improvement process is too small to use in generating the quality desired.

4.2.8 Environmental Considerations

Environmental issues have received recognition from both the business organizations and the wider community, of which these organizations are citizens. There is a general agreement that all partners in the supply chain should be concerned about the environment. Over half of NMC respondents (55.6%) report that it is important to inculcate "green" issues in the supply chain. However, although environmental issues are important, they are not nearly as important as issues that have a technical impact on the firms in the supply chain.

CHAPTER 5

SUMMARY, RECOMMENDATIONS AND CONCLUSIONS

5.1 Summary

This study has considered the experiences of the Numerical Machining Complex Ltd in its application of standard supply chain management practices. It finds that though the company believes in a strong, stable relationship with suppliers, the reality is different. Numerical Machining Complex has not taken steps to draw its suppliers into a long-term stable relationship. The company does not offer its suppliers long-term supply contracts, a practice that is at variance with good supply chain management practices. It shows that the Numerical Machining Complex has not institutionalized a collaborative relationship with its suppliers geared towards establishing long-term alliances.

The study notes that members of the supply chain can improve their relationships by institutionalizing such practices as creation and maintenance of partnerships among themselves, effective communication, and continuous improvement, adoption of a culture of competitiveness, and quality control and review.

It is necessary for the NMC to make a shift from adversarial to cooperative relations with suppliers by dismantling structural barriers between it and the other partners. If the NMC commits itself to learning to work in a partnership relationship with suppliers and customers, it will be able to achieve full benefits of supply chain management. Indeed, the merits of partnering with others to gain added competitive capabilities have long been recognized by researchers. Thompson, et al (2005) for example, notes that partnerships can add to a company's arsenal of capabilities and contribute to better strategy execution. By building, continually improving, and then leveraging partnerships, a company enhances its overall organizational capabilities and builds resource strengths which deliver value to customers and consequently pave the way for competitive success.

The NMC can, for example, work closely with suppliers to shorten the cycle time for new parts, improve the quality and performance of those parts, and lower overall production costs. This close relationship must be based on integrating suppliers' activities with NMC's own requirements and expectations. The search for quality should be based on a program where annual improvement goals are set, periodic meetings to review progress against those goals are held, and suppliers become fully qualified and retained in the suppliers' list when they meet NMC's stated quality goals.

Communication is an important ingredient for successful relationships within the supply chain. Effective communication makes possible effective decision-making. It is widely known that world-class firms ensure their internal and external stakeholders have a full understanding of their strategy and how the supply chain fits into that strategy. This communication, other than being limited to interpersonal elements, can also be extended to machine-to-machine situations. New technologies can be utilized to

make possible machine-to-machine communication as is the case for computer-integrated manufacturing (CIM).

To develop competitiveness, partners in the supply chain must realize that this capability can only be obtained from the collective skills, knowledge, and abilities that their employees use to create products and services. More than this, structural arrangements that shape how and with whom they interact are important. In the context of the supply chain, the gains of partners upstream will impact positively the partners downstream. It is therefore important that a robust supply chain be created to unleash the correct capabilities to create unbeatable advantage in the market place for all members. The more world class a firm's capabilities, and the more they are interwoven into its products and services, the harder it will be for competitors to match its offerings.

5.2 Recommendations

This study recommends that NMC carries out research to implement substantial development of partnerships and collaborations with its suppliers. This will enable the organization to tap into strengths that come with strong collaborative arrangements. Since the NMC desires to develop a world-class capability, it needs to invest in a long-term process of continuous improvement and enhancement. It is possible, however, to shorten this process by borrowing capability from its partners. The dynamic environment calls for non-traditional business arrangements. All the partners in the supply chain must increasingly form alliances with others to shape and exploit new opportunities.

The Numerical Machining Complex should be proactive in developing strategic partnerships. Alliances and collaborative relationships with others will enable the company acquire capability more rapidly and cost-effectively than any other way. Effective collaborations will offer benefits to both NMC and its partners based on a common vision. The overall goal of partnering should be to have a compatible culture across the supply chain. It is also recommended that NMC implement a substantial communication program specific to its supply chain members. The company can make use of reports, newsletters, and web-based solutions to share information with all partners. NMC should conduct research to establish its communication channels with both suppliers and customers and establish to what extent this would affect competitiveness.

The company should institute a continuous improvement program aimed at improving its own internal processes as well as encouraging suppliers to adopt a mind-set of continuous improvement. When the process of improvement runs through the entire supply chain, then all partners within the system benefit. The NMC can start this drive by discussing with suppliers and other constituencies, what programs need to be implemented to make continuous improvement part and parcel of the supply chain culture. It might be necessary to adopt improvement, first on a pilot basis, with the understanding that successful efforts

will eventually be rolled-out within the entire organization, preparatory to being institutionalized across the supply chain. This is also an area that can be researched on.

Because of the ever increasing importance of quality in products made, this study recommends that NMC puts in place a proactive system-wide program that would integrate quality from suppliers, to the organization itself, and downstream to its customers. The NMC can begin by insisting that its management- from the lowest to the highest- embrace a "quality-consciousness" mindset. Top management commitment to quality will set the tone for all other staffers within the organization to take quality in products seriously. Management must be so committed to quality that it will persist with the challenge of institutionalizing this consciousness even in the case of resistance. NMC must deliberately promote this idea to its suppliers and customers and assure them that it will accept nothing short of stated quality.

The company may need to study how everyone can be trained to assess quality. It is suggested that a rudimentary cause-and-effect analysis and basic statistical process control training be provided to all personnel within the organization. This way, every employee, from the top management to the machinist on the factory floor, will become an advocate for high quality.

5.3 Conclusions

In this study, it is concluded that even though the players in the NMC supply chain appreciate the SCM practices, they have not fully embraced them in the operations of the company. This is evident from the way the supply chain members responded to the questions and the analysis arising thereof. This study has shown that NMC, while supporting the principles of effective supply chain management, is not currently practicing them. It is recommended that steps be made to put the practices identified into effect.

However despite lack of implementation of the SCM practices, there is high appreciation of the importance the SCM practices would play in the performance of the company. NMC should endeavor to fully embrace the practices and use them in driving performance to world-class operation level to ward off any competition.

Limitations of the Study

Low response rate on the part of suppliers and customers somewhat impacted the amount of data collected. However, the sample data obtained is believed to be representative of the general population and inferences obtained are applicable to across the population.

The time period covered by the study and the resources available to the researcher did not allow the researcher to collect enough data for comprehensive analysis. Also, some questionnaires were not comprehensively completed, partly because respondents did not have sufficient time to fill in requested information. This is a typical shortcoming of self administered questionnaires, which leave no room for clarification of issues. Face to face interviews are superior in this respect because clarifications can be sought and additional information can also be gained.

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APPENDIX I

QUESTIONNAIRE

The following questionnaire is intended to investigate Supply Chain Management practices in manufacturing firms in Kenya. Please ensure that you complete the questions as requested. Completion of this questionnaire is voluntary and all your responses will remain confidential.

SECTION A: TO BE COMPLETED BY NMC STAFF AND FIRMS SUPLIED PRODUCTS OR GOODS BY NMC (GENERAL)

1. Name of your firm (optional) _____
2. How would you describe the ownership of your firm? (Tick one) a. Public ( ) b. Private ( ) c. Both ( )
3. How can you describe the ownership of your firm? (Tick one)
   a. Indigenous ( ) b. Foreign ( ) c. International ( ) d. Foreign & international
4. How can you describe the ownership of your supplier firms? (Tick one) a. Local ( ) b. International ( )
5. For each of the following statements in TABLE I, please indicate if you strongly agree, agree, not sure, disagree or strongly disagree by ticking in the appropriate box

TABLE I

	Strongly Agree 1	Agree 2	Not sure 3	Disagree 4	Strongly Disagree 5
The company needs to keep a list of all your suppliers					
Changing suppliers frequently not good for the company					
No need to continuously review suppliers list					
Suppliers list must be one that has been approved and no need to alter it.					
Suppliers need to be developed and assisted to improve.					
It is ok to shop around every now and then for essential items					
It is important to work very closely with suppliers					
Developed suppliers always give you quality products					
A competitor's supplier usually performs better than an exclusive one					
Establishing more frequent contact with Supply Chain members					

	Strongly Agree 1	Agree 2	Not sure 3	Disagree 4	Strongly Disagree 5
Suppliers' processes once accepted no need to inspect deliveries					
It does not matter whether our supplier supplied our competitor					
It is important to describe the production process to the consumer during manufacturing at the suppliers					
It is important for the supplier to care about the environment					
A supplier is an alliance in business					
Supply chain contributes to some reduction in costs					
Supply chain contributes to an increase in market share and sales					
supply chain contributes to some solid customer relations					
The company's supply chains can be ranked as world class					
The supply chain is critical to a firm's success					
The relationship with a supply chain is best described as stable					
It is important to keep on advising suppliers on how to improve					
It is important to measure the performance of the supply chain					
The performance of the supply chain is important					

SECTION B: TO BE COMPLETED BY FIRMS SUPPLYING NMC WITH RAW MATERIALS OR GOODS

1. For how long has been supplying NMC with goods? _____
2. How did you get to start supplying NMC? _____

   _____
3. NMC assists in coming up with the specifications of the goods to be supplied (tick one) a. Yes ( ) b. no ( )
4. NMC describes the processes of preparation of the goods to be delivered (tick one) a. Yes ( ) b. no ( )

5. If they do (in above), how do they go about it?

_____

6. Do you have a supply contract with NMC? a. Yes ( ) b. no ( )
7. Explain your answer above

_____

SECTION C: TO BE COMPLETED BY NMC MANAGERS AND THE PEOPLE LINKED TO THE SUPPLY CHAIN

For each of the following statements in TABLE II, please indicate if you strongly agree, agree, not sure, disagree or strongly disagree by ticking in the appropriate box

TABLE II

	Strongly Agree 1	Agree 2	Not sure 3	Disagree 4	Strongly Disagree 5
The relationship between the firm and the supply chain is important.					
It is important to have supply contracts					
Integrating with the supply chain is important					
The relationship among the supply chain members must be stable					
Measuring performance of supply chain can facilitate a greater understanding of supply chain					
Measuring performance of supply chain can positively influence actor's behavior					
Measuring performance can improve overall performance					
Supplied product must always be acceptable to all parties					
It is important to invest in the supplier base					
Effective management of Supply Chain Management greatly improves performance just like TQM					
Supply chain members should readily share product information					
Supply Chain Management is key to building a sustainable competitive edge					
Internal processes should be linked to external processes					
SCM delivery, flexibility and innovation is important					

	Strongly Agree 1	Agree 2	Not sure 3	Disagree 4	Strongly Disagree 5
Consolidation of customer & supplier bases can increase performance					
removing unnecessary steps in supply chain can improve performance					
speeding up information flows & creating long-term partnerships leverage capabilities					
Reducing the influence of lead time variability is not productive					
Increasing influence of inventory variability at different stages & locations is significant					
Increasing influence of batching effects variability is productive					
Increasing influence of variability due to bottlenecks is chain efficiency					
No need to develop coordinated strategies					
Opened out arcs of integration decreases collaboration					
Greening the supply chain not relevant					
Green Supply Chain Management important					
Collaboration in Supply Chain Management members not cost effective					
Responsive supply chains is retrogressive					
On-time delivery directly to customers' point of use					
On- time delivery directly to your firm's point of use					
Contacting the end-users to get feedback					
Reducing response time across the SC					
Agile supply chains is just time wasting					