SUPPLY CHAIN TECHNOLOGY ADOPTION AND LARGE MANUFACTURING FIRMS PERFORMANCE IN NAIROBI

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DECLARATION

I declare that this is my original work and has never been presented to any other university for any academic credit purpose.

Signed:é é é é é é é é é é é é é é Date:é é é é é é é é é é é é é é ..

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This project has been submitted for presentation with my approval as the student supervisor.

Supervisor

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DEDICATION

This work is dedicated to my daughterôs Shirley Orembo and Sasha Orembo, my wife Monicah Orembo, my parents Mr. & Mrs. John Jela, for their support, encouragement and dedication during my study.

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ABSTRACT

The purpose of this study was to establish the drivers of supply chain technology adoption, the level of supply chain adoption and the relationship between extent of supply chain technology adoption and performance of manufacturing organizations. This study adopted an exploratory research design. The target population comprised of all 656 manufacturing firms operating in Nairobi as listed in the KAM directory of manufacturers and exporters 2013. Stratified sampling was applied to pick 66 respondents. A structured questionnaire was used to collect data. The quantitative data was analyzed using descriptive statistics. The study used simple linear regression to analyze the relationship between extent of supply chain technology adoption and performance of manufacturing organizations. From the findings, the study concludes that supply chain technology as a tool does not only improve the effectiveness and efficiencies of the operations but also act as a competitive weapon to the organization strategy. The study further concludes that supply chain technology adoption improved communication and productivity between the organization and suppliers and led to the reduction in costs it also increased efficiency across the extended supply chain and enhanced network relationships. The study recommends that to enhance supply chain effectiveness, the management should organize for staff training both internal and external through seminars and workshop which will go a long way in enhancing ownership of the process by employees. The organizations should enhance these practices as maintenance has to provide the required reliability, availability, efficiency and capability of production system in accordance to the need of these characteristics.

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LIST OF ABBREVIATIONS

4PLs	-	Fourth Party Logistics
CRM	-	Customer Relationship Management
DFM	-	Demand Forecasting Management
DRP	-	Distribution requirements planning
ERP	-	Enterprise Resource Planning
e-SCM	-	Electronic Supply Chain Management
GCTS	-	Geo-Coded Tracking Systems
GDP	-	Gross Domestic Product
ICT	-	Information and Communication Technology
IT	-	Information Technology
KAM	-	Kenya Association of Manufacturers
MES	-	Manufacturing Execution Systems
PDAs	-	Personal Digital Assistants
RFID	-	Radio Frequency Identification Systems
SCE	-	Supply Chain Event
SCM	-	Supply Chain Management
SCP	-	Supply Chain Planning
SCPS	-	Supply Chain Planning Systems
SCT	-	Supply Chain Technology
SKU	-	Store-Keeping Unit
SPSS	-	Statistical Package for Social Sciences
TAM	-	Technology Acceptance Model
TMS	-	Transportation Management Systems
WMS	-	Warehouse Management Systems

CHAPTER ONE: INTRODUCTION

1.1 Background

Competition in the market place has become intensified mainly due to the globalization and liberalization of markets. The market has become more international, dynamic, with more informed customers who are demanding more varieties, better quality, higher reliability and faster delivery; product life is shortening and product proliferation is expanding; technological developments are occurring at a faster pace (Li and Lin, 2006). Business conditions are therefore becoming more demanding. Even though companies could manage the increasing amount of purchased items, more and more of the purchasing time is being spent in the searching of new components and management of products. In view of the foregoing impediments and challenges a number of organizations have sought to adopt technology in their supply chains to automate most of the activities that were previously done manually especially in the ordering phases in order to increase the productivity of the purchasing and supply chain management function (Rantala,2005).

The management of supply chain as a result is characterized by high degrees of difficulty, due to the complexity of the multiple interactions between trading partners. These interactions are not just complicated by their volume and variation in processes, but also by the complexity and the dependencies that exists between parties in the supply chain (Power, 2006). In addition, companies have limitation in their ability to work with global partners because of language barriers and time differences (Leer, 2006). Using supply chain technology to handle most of the elements involved in supply chain management, including procurement and communication, makes the data exchange and the running of the supply chain become faster (Lee and Whang,

1998). SCM has therefore become more sophisticated and, the expectation for technology as a means of improving information flows has gradually improved (Byrd and Davidson, 2003).

1.1.1 Supply Chain Technology

Supply chain technology as a tool does not only improve the effectiveness and efficiencies of the operations but also act as a competitive weapon to the organization strategy. Adoption of Supply chain technology is critical to reduction of costs and enhancement supply chain competitiveness, especially in the wake of globalization and liberalization of economies that spurred competition (Ravendran, 2002).

Although supply chain technology has been widely studied and documented, there is no commonly available definition of supply chain technology. According to Perez (2003), supply chain technology is technology or a system that is used in coordinating and integrating information flows electronically throughout the supply chain network of trading partners and customers in both directions so as to generate effective and efficient business transactions, quick access to information, allow better customer service, reduce paperwork, allow better communication, increase productivity and save time.

Technology therefore plays an important role in the success of supply chain management. According to Peterson (2003) technology is a supply chain management enabler whose importance cannot be understated and that supply chain technology and supply chain management is complementary in nature. Previously with no internet application companies having difficulty to obtain information because they were not able to receive or to send updates, feedback, or other important information in a timely manner (Ravendran, 2002).Thus, to keep on

competition, firms within supply chain routinely communicate with each other. The development of supply chain management requires that members of the chain co-ordinate their production and logistics activities. This type of co-ordination can be facilitated by adoption of technology, particularly when these technologies are used to span the traditional boundaries of supply chain firms (Sanchez and Perez, 2003).

The classifications of supply chain technologies are not ñblack and whiteò. However the generic types of supply chain technologies include, enterprise resource planning (ERP), supply chain planning (SCP)systems, manufacturing execution systems (MES), warehouse management systems (WMS), transportation management systems, extranets, radio frequency identification systems (RFID), Product data management, customer relationship management, automated quality control systems, computer-aided design systems, geo-coded tracking systems (GCTS), bar-coding technology, e-commerce technologies, supply chain event management (SCE), demand forecasting management (DFM), ERP and Supply chain planning systems(SCPs) Patterson et al. (2003), Helo and Szekely (2005) and Forger (1998).

1.1.2 Technology Adoption

Recent years have seen the introduction of a wide variety of supply chain technologies ranging from devices, music players, tablet PCs, net books, personal digital assistants (PDAs) just but to mention a few . Given this environment, it is critically important that organizations understand the determinants of technology adoption by consumers. The most widely accepted model for adoption is the technology acceptance model. The technology acceptance model (TAM) was, introduced by Davis in 1989.Other common theories include the innovation and diffusion theories. TAM suggests that two beliefs, namely, perceived usefulness and perceived ease of use, are instrumental in explaining userôs attitude and intention to use new technology. Underlying

the TAM are three major concepts of the technologyôs perceived usefulness, the perceived ease of use of the technology, and the compatibility of the technology and the need for interactions.

In diffusion theory, technology adoption is often conceived as the dependent variable. Adoption is a component of the diffusion process that refers to the evaluation of the results of a trial use of the innovation and decision to continue using the innovation (Rogers, 1990) According to Russell and Hoag (2004) Diffusion theory is quite relevant to the adoption of a new innovation within the supply chain

Adoption occurs when the organization decides to invest in and put into use an innovation .The adoption of innovations is conceived to encompass the generation, development and implementation of new ideas or behaviors. An innovation can be new products or service, a new production process technology, a new structure or administrative system, or a new or program pertaining to organizational members. Roberts (1999) defined innovation as any idea, practice or object that is perceived as new by the adopter.

1.1.3 Need for Supply Chain Technology in Organizations

Companies can achieve competitive advantage through acts of innovation including both new technologies and new ways of doing things. According to Raymond, (2005), technology plays an increasingly critical role in businesses large and small .Techno savvy firms are at an advantage. Research in the past has shown a positive impact on technology adoption on small businesses, by helping firms enhance their operational efficiency .Technology adoption drives business growth and integrates businessôoperations with strategies (Roger 2003).

Supply chain technology is defined as a technology or a system that is used in coordinating and integrating information flows electronically throughout the supply chain network of trading

partners and customers in both directions so as to generate effective and efficient business transactions, quick access to information, allow better customer service, reduce paperwork, allow better communication, increase productivity and save time. Supply chain technology can be categorized into functional technologies and integrative technologies. Functional technologies are referred to systems that are used to accomplish a particular functional area such as warehouse management systems (WMS) and transportation management systems (TMS). Meanwhile integrative technologies refer to activities relating to coordinating and integrating information flows and activities within and/or between firm boundaries

Companies have limitation in their ability to work with global partners because of language barriers and time differences (Power, 2006). Using the supply chain to handle such elements like procurement and communication makes the running of the supply chain faster. In this context, as SCT has become more sophisticated and accessible, the expectation for technology as a means of improving information flows has been high.

Technology therefore plays an important role in the success of SCM. Previously with no internet application companies having difficulty to obtain information because they were not able to receive or to send updates, feedback, or other important information in a timely manner (Power and Simon, 2004). Thus, to keep on competition, firms within supply chain routinely communicate with each other. The developments in supply chain management requires that members of the chain co-ordinate their production and logistics activities. This type of co-ordination can be facilitated by adoption of relevant technology, particularly when these technologies are used to span the traditional boundaries of supply chain firms (Shen et al., 2004).

1.1.4 Kenyan Manufacturing Sector

The manufacturing sector is a key industry in the Kenyan economy. The economic contribution of this sector is immense, with significance linkages to the manufacturing and services sectors. Given the significant challenges facing the industry, in particular globalization, liberalization and increasing competition, has resulted a considerable amount of pressure on Kenyan manufacturers to shorten time to market, increase customer service levels, provide higher level of conformance and quality, and offer more variety in product lines. Manufacturers must therefore enhance their resilience to remain competitive domestically and identify new potential for exploiting the local, as well as the global market. In order to achieve these aims, coping with supply chain technology (SCT) appears to be necessity Byrd and Davidson (2003).

The economic contribution of this sector is immense, with significance linkages to other sectors of the economy. Given the significant challenges facing the sector in particular globalization, liberalization and increasing competition, have resulted a considerable amount of pressure on large manufacturers in Kenya to shorten time to market, increase customer service levels, provide higher level of conformance and quality, and offer more variety in product lines. Kenyan manufacturers must enhance their resilience to remain competitive domestically and identify new potential for exploiting the other markets, as well as the global market at large. In order to achieve these aims, coping with supply chain technology (SCT) is not a choice for them.

The manufacturing sector in Kenya was responsible for 16.3% of the Nations nominal GDP an estimated $29.964 billion in the year 2010/2011. This makes the manufacturing sector third in the overall stake after agriculture and service firms. These firms straddle across the various sectors of the economy. The sector is dominated by established multinational firms who

command a large percent of the market share. Worth noting is that that, most of these firms have their country offices and manufacturing plants located in Nairobi.

1.2 Research Problem

Supply chain technology and supply chain management have attracted attention from many researchers as two separate research areas, however few other researchers have combined those (Shen et al., 2004). Although a considerable number of studies have been done supply chain technology, none of the studies has focused on the identification of the factors that affect adoption supply technology in Kenyan manufacturing sector. Therefore this study sought to breach this important gap in knowledge. To achieve the intended objectives, the study sought specific answers to the following questions; what are the drivers of supply chain technology adoption, what are the challenges that face the adoption of supply chain technology? And does supply chain technology adoption impact on manufacturing organizationsô performance?

1.3 Research Objectives

The general objective of this study was to establish the challenges affecting technology adoption in the Kenyan manufacturing sector. However specific objectives of the study were to:

i. Establish the drivers of supply chain technology adoption.
ii. Determine the level of supply chain adoption.
iii. Establish the relationship between extent of supply chain technology adoption and performance of manufacturing organizations.

1.4 Value of the Study

The findings of the study will be useful to various institutions and individuals: Scholars and academicians will find the study results useful as a source of reference. The study is also expected to contribute significantly to supply chain as a body of knowledge by giving more insight into supply chain technology adoption.

Supply chain managers may also find the study results useful as a tool for decision making. This study will also identify the relevance of technology adoption factors and to explore how it can influence suppliers of manufacturers to adopt the supply chain technology within their organizations.

CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction

This chapter introduces the review of contextual and theoretical literature relating to supply chain technology adoption in the manufacturing sector. The section documents the critical points knowledge and attempts made in this line by other scholars.

2.2 Supply Chain Technology

The internet has brought about a revolution in supply chain thinking. The low cost and ease of use of the internet has greatly enhanced attempts to connect supply-and-demand chains across the organizations (Davenport and Brooks, 2004). Organizations are motivated for cost-cutting reasons to increase efficiency across the extended supply chain and to enhance customer service and network relationships. Supply chain management (SCM) is an important success factor for companies challenged by weakened economies, the proliferation of globally sourced products, improved functional integration, and rapid technological change (Kerr, 2001).

The most common SCTôs include Enterprise resource planning (ERP), supply chain planning (SCP), systems, manufacturing execution systems (MES), warehouse, management systems (WMS) and transportation management systems (TMS),Extranets, ERP and radio frequency identification systems (RFID), Product data management, customer relationship management, automated quality control system, computer-aided design systems, geo coded tracking systems (GCTS), bar-coding technology, e-commerce technologies, supply chain event management (SCE), demand forecasting management (DFM) and Supply chain planning (SCP) systems

2.2.1 Radio Frequency Identification Systems (RFID)

The RFID technology is based on the interaction of three major components, that is, RFID tags , which are electronic databases that can be attached to or embedded in a physical item/product, and RFID readers which are fixed or mobile devices . They can also communicate with the tag without requiring a line of sight, retrieve information from the tag and send it to a RFID middleware.

According to Curtin et al., (2007), the RFID has a middle ware, which is used to manage the whole system, and it is the place where all firm business are configured in order to automatically choreograph the execution of intra- and-inter-organizational business processes. Once a RFID tag is embedded into a product, it becomes ñsmartò or ñintelligentò , communicating component of the firmôs overall information infrastructure. RFID technology has the potential to transform the entire SC for real-time optimization.

2.2.2 Enterprise Resource Planning (ERP)

In the late 1990 the internet allowed organizations to share data in a relatively straightforward manner. Software firms were quick to take advantage of this new opportunity and new enterprise applications emerged. These included electronic supply chain integration, procurement and logistics all of which could be integrated with the organizationôs enterprise resource planning (ERP).

Enterprise resource planning (ERP) is a system that includes the core accounting functions of accounts payable, accounts receivable, and general ledger, coupled with logistics functions, to manage the distribution and manufacturing components of the organization. Lysons and Farrington (2006) have defined ERP as a business management system that, supported by multimodal application software, integrates all the departments or functions of an enterprise.

In essence, ERP is the newest generation of MRP systems. It becomes the facilitator of the organization, moving data from one function to another and managing the data centrally. Organizations that have implemented ERP systems need to reflect on whether they want to take advantage of new technologies and extend their business processes over the internet. Extended ERP refers to the inclusion of additional modules such as CRM, supply chain planning, integrated e-commerce, sales force automation, decision support and human resources to the core foundation modules of internally focused established ERP systems (McKie, 2001).

According to Edwards et al., (2001), ERP systems can bring benefits in operational efficiency and reduced costs to organizations and enforce discipline of best practice and consistency. Organizations that initially improved internal processes through ERP are now examining how ERP and the internet can help them improve processes which extend beyond the enterprise to their customers and suppliers. However, little research attention has been focused on combining ERP and internet technologies in organizations. Most organizations today, are harnessing ERPs technologies to enhance performance and improve competitiveness.

Organizations can derive value from their ERP implementations through a program of continuous business improvement both within the enterprise and by extending processes to partners. With respect to supply chain integration, internet technologies have opened enormous possibilities for organizations to share data. However, the adoption of an integrated approach throughout the supply chain requires a trade-off between autonomy and control between each supply partner relationship (Graham and Hardier, 2000). Partners in virtual integration need to be willing to allow partners to view their systems and processes in order for the end-to-end process to work correctly and organizations also need to understand the implications of integration across the entire supply chain (Venkatraman and Henderson, 1998) Organizations wishing to extend

their processes will have to develop more trusting and collaborative relationships with their business partners.

2.2.3 Distribution Resource Planning (DRP)

DRP systems (DRP I and DRP II) are time-phased models that include demand forecasts, purchase orders, and customer orders for a facility. They translate MRP logic to a distribution system. Distribution requirements planning (DRP I) is defined by Stock and Lambert (2001) as a system for determining demands for inventory at distribution centers, consolidating the demand information backwards, and acting as input to the production and materials system. It applies the time-phased DRP I logic to replenish inventories in multi-echelon warehousing systems.

DRP II is an extension of DRP I. It extends DRP I to include the planning of key resources in a distribution system-warehouse space, manpower levels, transport capacity (tracks, railcars, etc.), and financial flows. Logistics requirements drive the master schedule which in turn drives the bill of materials, which controls material requirements planning.

Accurate forecasts are essential ingredients to successful DRP II systems. A DRP II system translates a forecast of demand for each SKU (store-keeping unit) at each warehouse and distribution center into a time-phased replenishment plan. If the SKU forecasts are not accurate, then the plan will not be accurate.

2.2.4 E-procurement

E-procurement is more than just a system for making purchases online. A properly implemented system can connect companies and their business processes directly with suppliers while managing all interactions between them. This includes management of correspondence, bids,

questions and answers, previous pricing, and multiple e-mails sent to multiple participants (Burt et al., 2003).

E-procurement can take place in an e-marketplace by use of telematics, which means mechanisms of market-typical exchange of goods and services, which support all phases of the transactionò (Schmid, 1993)) or directly between two organizations and the software automates the purchasing process using internet technologies. Requisitioners can access the system via a standard browser where they are routed to company approved catalogues either internal or external (Burt et al., 2003)

According to a 1999 survey of over 200 global corporations by Deloitte Consulting (1999) some of reasons organizations are adopting e-procurement and the benefits include: transaction cost reduction, self-service approach and integrated supplier management. The survey found that despite the advantages of ERP systems, procurement processes were still problematic and inefficient. Fragmentation of the supply base and the user community are a significant problem as they can reduce the organizationôs ability to take advantage of corporate contracts, partnership arrangements and established infrastructure. Organizations also reported that employees were spending significant amounts of time on low value add purchasing transactions rather than strategic activities such as vendor management and that e-procurement application have generally been targeted at indirect goods. One of the key challenges facing e-procurement is the impact of net markets (Pawar and Driva, 2000).

While linking to internal catalogues or the suppliersô external catalogues helped the procurement process, software vendors realized that an aggregated model would be far more efficient. This allows buyers to access several sellers by accessing a single external e-marketplace. While net markets are still very much in their infancy, their promise is virtually unlimited. However, there

are many difficulties these e-marketplaces face. First, business processes need to be extended across the entire market, i.e. all participants need to sign up to an agreed way of doing business. Secondly, the participants need to reflect these processes in their systems, i.e. integrate with their existing back office (ERP) systems. Markets face the classic chicken-and-egg syndrome in that they require scale to show that they can provide real value to participants and in order to attract participants they must demonstrate that they can add value (Berryman and Heck, 2001).

2.2.5 Customer Relationship Management (CRM)

Supply chain systems contain vast amounts of data about customers and integration. Proper integration can provide the ability to access any customer information, including service issues to avoid being blind-sided by complaints when making a sales call (James and Wolf, 2000). The benefits include: Organizations can control who sees what, when, and why, allowing them to improve customer segmentation, up-sell, and limit or eliminate risk. Second, organizations can improve the communication and productivity between suppliers, partners and customers. The list of other benefits included speed time-to-market, speed delivery times, improved customer service, satisfaction, order management, decision making, forecasting and warehouse/distribution activities, reduced paperwork and inventory, added value to commodity products, shortened cycle times and strengthened partnerships.

Organizations face a number of integration, interoperability, and performance challenges when they link their CRM solutions to back-office systems. A successful CRM strategy must include access to back-office information must be merged with the functionality of CRM (Pender, 2001).

2.2.6 Electronic Supply Chain Management (e-SCM)

e-SCM focuses on the management of information flows and represents a philosophy of managing technology and processes in such a way that the enterprise optimizes the delivery of

goods, services and information from the supplier to the customer. According to Norris et al., 2001). This requires change across the supply chain ï change in management practices, performance metrics and business processes. Two major factors underpin the success of e-SCM (Norris et al., 2001). First, all firms involved must view collaboration as a strategic asset and an operational priority in order to foster trust among trading partners and second, information visibility across the supply chain should be managed with strict policies, disciplines and monitoring.

In respect to the first of these factors, organizations wishing to integrate their supply chains need to embrace e-SCM collaboration. Organizations that are already communicating with each other need to move to the next phase where they are co-coordinating on a timely basis before they can collaborate, i.e. share information electronically. Collaboration implies visibility of internal activities and metrics by external parties. An organizationôs ability to perform is therefore a lot more transparent, and therefore puts pressure on the organization. People throughout the organization need to be able to manage the impact of having a faster flow of information.

According to Scalet (2001) the main challenges organizations face when implementing e-SCM is the partnership challenge, as they do not have control of their partnerôs systems. Relationships with business partners are therefore of paramount importance to the success of e-SCM initiatives. All parties need to recognize that success for one part of the supply chain means success for all. e-SCM provides organizations with significantly increased strategic options for achieving long-term flexibility and adaptability. With the growth of e-commerce, customers are demanding faster turnaround and greater customization than ever before., organizations are looking for innovative ways to obtain sustainable competitive advantage and e-SCM is one strategy to achieve this.

2.3 Technology Adoption Model

The Technology Acceptance Model (TAM) is an information systems theory that models how users come to accept and use a technology. The model suggests that when users are presented with a new technology, a number of factors influence their decision about how and when they will use it. Luaren and Lin (2005) used the technology acceptance model in an effort to understand customer intention to use technology. Pedersen (2005) favored the use of the decomposed theory of planned behavior in his study on internet usage. He further points out that there exists few studies based on information systems theories applied to supply chain technology .On the other hand Lauren and Lin (2005) employed the technology acceptance model in his study because he views technology as an innovation for an organizations.

According to Yan et al (2009), the technology acceptance model (TAM) is a widely used model in information system field and presents a theoretical contribution towards understanding technology acceptance. TAM aims to provide an explanation of the determinants of the technology acceptance that are general, capable of explaining user behavior across a broad range of technologies and user populations while at the same time being both parsimoniously and theoretically justified(Davis et al.,1989).

TAM focuses on the attitudinal explanations of intention to use specific technology (Nysveen et al 2005). Five variables are included in TAM which are; perceived usefulness, perceived ease of use, attitude towards using, behavioral intention and actual use. The two specific variables namely perceived ease of use and perceived usefulness are hypothesized to be the fundamental determinants of user acceptance (Davis, 1989).Perceived usefulness is defined as the expectation that the technology will enhance job performance and service delivery and perceived ease of use is defined as the belief that using technology will be free of effort (Davis 1989).

2.4 Impact of Supply Chain Technology Adoption

According to Tippins and Sohi, (2003) Technology adoption in supply chain can defined as the extent to which a firm adopts the most advanced available technology and involves proactive adoption of the state of art IT to build new technical solutions for supply chains. Supply chain technology embraces the degree of diffusion of information technology within a firmôs activities. However, Supply chain technology adoption is a distinctive concept from information technology. Supply chain technology enables a firm to adopt new technologies ahead of competitors.

Barney (2004), points out that supply chain technology adoption cultivates organizational capabilities that enable the firm to outperform their competitors. However, adoption of information technology alone may not be a source of competitive advantage because of their wide availability in the market, only when the information technology is embedded into organizational processes (e.g. strategy making), it is expected to offer sustainable benefits.

The increasing role of supply chain technology has contributed to the evolution of the competitive supply chain management. According to Regan and Song (2001), the following trends are evident as a consequence of the impact of technology adoption in supply chain management, development of new services, new functions, formation of new alliances etc.

One of the first visible effects associated with the increasing dissemination of supply chain technology in service industry is the integration of traditional services such as transportation and warehousing with information based services like booking, freight rate computation, routing and scheduling. Over the last few years such companies have made significant progress in the adoption of new technologies, particularly those linked to the internet. Today, the main transport

and logistics service firms are able to provide a variety of information via the internet and to secure transactions online with customers through their web sites (Ellinger et al., 2004).

The dissemination of supply chain technology has opened up new opportunities for the development of new roles in the supply chain. Their main purpose is to give added value to supply chain functions through greater efficiency and information transparency. They run internet portals which bring together various members of the supply chain (UNCTAD, 2000).

Another feature emerging alongside the internet and supply chain technology is the creation of a new category of service provider called fourth party logistics (4PLs). A 4PL is a supply chain integrator who assembles and manages the resources, capabilities and technology of its organization with those of complementary service providers to deliver a comprehensive supply chain solution (Bade et al., 1999). The 4PLs enable customers to outsource the management of the entire logistics network to a single organization and to re-engineer supply chain processes. Often 4PLs have been set up through alliances formed with management consulting companies, financial Service companies and technology providers. According to Regan and Song (2001) with the emergence of 4PLs, there is an ongoing trend in the logistics service industry to form alliances with firms operating in other industries.

2.5 Factors Influencing Chain Technology Adoption

There are three main important factors which include organizational and external factors such as organizational structure, supply chain member pressure, organizational size and organizational complexity. These factors are with specific reference to the manufacturing sector.

2.5.1 Organizational structure

Organizational structure also has been considered as an important factor to technology adoption. However, an organizationôs culture and structure can either hasten or impede innovation adoption (Russell and Hoag, 2004). According to Lai and Guynes, (1997) the relationship between centralization adoptions of innovation has been found to be positive in some cases, yet negative in others .Centralization means the degree to which control and decision-making rests with a few powerful member of the organization or decision making is made by top management.

According to Ettlie et al. (2004), organizations with centralized structures were more likely to adopt new technologies. Williams (2006) concurred with this findings and further pointed out that a centralized structure facilitates faster and more efficient adoption than a decentralized structure because senior managers can adopt technologies despite the resistance of lower level managers

Organizations that have adopted a flatter, more decentralized structure would be expected to have adopted more innovative and cutting edge technology in order to enhance communication and coordination within the organization as well as with supply chain members (Bowersox and Daugherty, 2005). Russell and Hoag (2004) noted that centralization (e.g. decision-making authority rests with upper levels of management; employee empowerment is discouraged) would be less likely to innovate even though the decision makers are creative and innovation oriented. IT knowledge changes rapidly, flows from numerous sources and otherwise cannot be diffused if required to flow through narrow channels.

2.5.2 Pressure From Other Supply Chain Members

According to Premkumar et al., (2007).Pressure from supply chain members involves the cooperation and commitment of all the participating members. These participants may have complex economic and business relationships between themselves that result in a number of social, political, and economic factors influencing the adoption of inter organizational supply chain technologies. Tan et al. (2008) asserts that with the implementation of SCT, the narrow focus of managers and the adverse relationship between logistics providers, suppliers, and customers are slowly being eliminated, while strategic alliances and long term cooperative relationships are established, thus viewing suppliers and customers as partners instead of rivals. Channel partner can be suppliers, third party service provider and customers (Williams, 2004)

2.5.3 Size of the Organization

According to Williams (2004) the larger the organizations, the more financial and technology resources are available to invest in new technologies the more it absorb the associated risk. Larger organizations have greater slack in resources and are therefore able to experiment with new innovations. They are also able to mobilize more easily adequate financial resources required for implementing innovations .Large size organizations may have some advantages which allow for economies of scale and the ability to generate in-house also specialists (Currie, 2006). Additionally, large organizations tend to be leaders in adopting electronic commerce (e-commerce), as they possess the IT resources and capability to leverage IT investments over a large revenue base (Thatcher et al., 2006).The larger organizations are expected to possess the financial resources and risk capacity necessary for new technology investment and will be associated greatly with SCT.

However according to Patterson et al.,(2003), smaller organization are more likely to be innovate because of the flexibility afforded by smaller size and fewer level of bureaucracy Resource poverty results from various conditions unique to small businesses, such as operating and services. Small organization can more readily adapt to changes in the technology, manufacturing processes, and market forces than larger firms. Smaller companies, although they often lack of financial resources, tend to be more innovative, flexible, responsive, and less bureaucratic therefore they have greater incentive to adopt and integrate SCT (Iskandar et al., 2001).

2.6 Challenges in Supply Chain Technology Adoption

Adoption of a new technology may require new infrastructure and nascent skills that are beyond individual control, it becomes necessary for researchers to investigate the factors that affect technology adoption for an entire organization. In addition, Russell and Hoag (2004) cited that organizational complexityôparticularly the size and decentralize organizational structure.

SCT adoption encompasses the implementation of the technologies. The implementation also refers to the application or degree of the extent of the usage of the SCT in the supply chain activities. one of the major problems often in adoption of supply chain technology in SCM is the inadequate implementation knowledge of IT in SCM organizations that have been ultimately successful experienced substantial difficulties is during the implementation stage (Sohal and Singh, 2002).

Moreover, organizations adopting SCT do not use the SCT on regular basis. For example, some firms may have purchased SCTs e.g. enterprise resource planning (ERP) software but the staffs

in the firm do not use it, this means that the firm has adopted SCT (ERP) but they are not implementing or using it (Ngai, 2004).

2.7 Empirical Studies

The trend of literature shows a positive impact of supply chain technology adoption on performance. The findings have enabled the providers to make policies that support their growth and performance. Although many researchers have shown significant interest in supply chain technology prompting substantial studies both locally and internationally, none has sought to establish the adoption of supply chain technology and its impact on the manufacturing firmôs financial performance in Kenya.

Nagery (2012) carried out a study on Information Technology and supply chain integration strategy at British American Tobacco Kenya Ltd and found out that adoption of ICT at British American Tobacco Kenya Ltd has increased the information processing capabilities of suppliers, thereby enabling or supporting greater relationship in addition to reducing uncertainty. He also found that automating business transactions will also drive down costs of the manufacturer/supplier relationship. Ijomba (2010) studied the effects of integrated supply chain on the performance of Nairobi Bottlers and the major finding was that the organization really benefited from integrated supply chain on its operations which was evident on increased profitability and increased customer satisfaction since its adoption. Ayugi (2007) sought to find out the effectiveness and efficiency of the Supply chain model in the Wrigley Company (East Africa) limited.

Magutu (2012) investigated challenges associated with adoption of Supply Chain Information Systems for inventory tracking among logistics service providers in Kenya and found out that supply chain information system helps improve on the inventory tracking, efficiency in business

operations; improved agility of supply network and improved customer service. Gituro et al., (2007) investigated the supply chain management best practices used by large private manufacturing firms in Kenya. Nyakoe (2007) examined the adoption of information communication technology in human resource management among large manufacturing organizations in Nairobi, he found out that a large proportion of these enterprises have not fully adopted information communication technology in human resource management. These organizations attributed this to lack of sufficient financial, technical and employee skills.Mose (2012) carried out a study on the adoption of e-procurement among large scale manufacturers in Nairobi, Kenya; the study revealed that majority of the large scale manufacturers in Nairobi, Kenya has adopted e-procurement.

The literature has shown quite a number of studies have been done in the both locally and internationally on supply chain management issues , however among the studies reviewed none has sought to investigate the effect of supply technology adoption performance of manufacturing firm in Kenya. The main shortcoming of these studies has been their inability to aptly come up with an empirical link between the adoption of supply chain technology and financial performance of the manufacturing firms and link such performance to the adoption of supply chain technology. This work therefore differs from previous works in terms of its scope. It focuses mainly on the adoption supply chain technology and examine the performance of those before and after this adoption vis-à-vis other determinants of performance.

2.8 Conceptual Framework

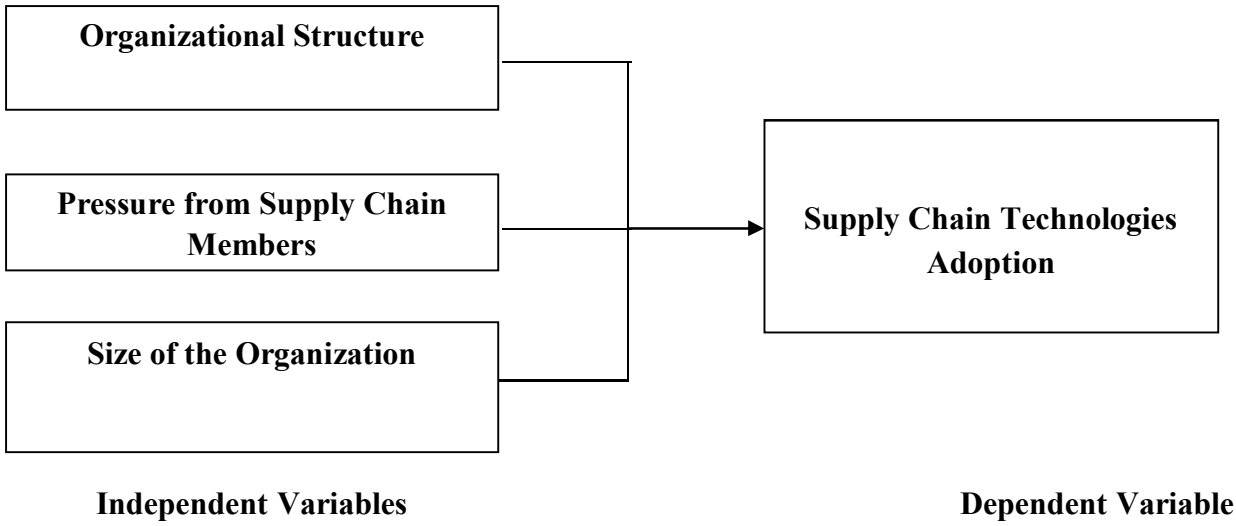
During the implementation of SCT, one firm may initiate the adoption and pressures other organization in the supply chain to adopt it in order to standardize the data format and improve the coordination and communication within and between organizations of the supply chain. For

similar reasons, other SCT that standardizing data formats and enhancing information sharing may be adopted by organizations because of the influence from partners in chain in order to streamline transactions and improve inter-firm communication.

It is theorized that the larger the organizations have the financial and technology resources to invest in new technologies the more it absorb the associated risk (Teo et al., 2003). Conversely smaller companies, often lack of financial resources, tend to be more innovative, flexible, responsive, and less bureaucratic therefore they have greater incentive to adopt SCT (Iskandar et al., 2001).

In the implementation of SCT, one firm usually initiates the adoption and pressures other organization in the supply chain to adopt it in order to standardize the data format and improve the coordination and communication within and between organizations of the supply chain. In their study Teo et al. (2003), indicated that mimetic pressure, coercive pressure and normative pressure play a significant role on adoption of SCT systems in Singapore. Similarly, other SCT that standardize data formats and enhance information sharing may be adopted by organizations because of the influence from partners in chain in order to streamline transactions and improve inter-firm communication.

Figure 2.1:Conceptual Framework Model



Source: Researcher (2012)

CHAPTER THREE: RESEARCH METHODOLOGY

3.1 Introduction

This chapter outlines the overall methodology that was used to carry out this study. It outlines the research design, population under consideration, sampling design that was engaged, sampling frame, sampling techniques, sample size, data collection methods and instruments, data analysis and presentation. The main objective of this study was to investigate supply chain technology adoption in the Kenyan Manufacturing sector.

3.2 Research Design

According to Kerlinger (1986), a research design is a plan and the structure of investigation so conceived as to obtain answers to research questions and it includes an outline of what the research, right from hypothesis development to data analysis. It constitutes the blue print for collection, measurement and analysis of data. According to Borg and Gall (1983) a research design is a detailed plan for how research study was conducted. It is a plan according to which data are collected to investigate the research hypothesis or question in an economical manner

This study adopted an exploratory research design. Kothari (2003) asserts that an exploratory research design is a flexible design that allows the researcher to consider many different aspects of a problem hence helping the researcher to gain new insights and ideas about a problem. Saunder et al (2003) further posits that an exploratory research is used principally to gain a deeper understanding of something. Other scholars such as Kamariah et al(2008) used exploratory design in his study on supply chain technology adoption in the Malaysian automotive sector.

3.3 Target Population

According to Mugenda and Mugenda (2003), a population is an entire group of individuals or events or objects having common observable characteristics that conform to a given specification. Lumley (1994) defines population as a collection of all the subjects from which a sample is drawn. The target population entails the specific population that the researcher intends to carry the study. For this study, the target population comprised of all 656 manufacturing firms operating in Nairobi as listed in the KAM directory of manufacturers and exporters 2013.

3.4 Sampling

According to Nachmias and Nachmias (1996) a sample is any subset of sampling units from a population. The purpose of sampling is to gain an understanding about some features or attributes of the whole population, based on the characteristics of the sample (Lucy, 1996). The target respondents for this study constituted the supply chain managers, logistics managers, suppliers and their staff from which a sample of 10% of the target population was taken (Mugenda and Mugenda) giving a sample size of 64.

Stratified sampling was applied to pick 64 respondents such that each of the sectors were adequately represented in the study. The choice of the sectors was expected to reduce the study cost for the researcher and itôs expected that the sector provided a sample that represent adequate elements of the manufacturing sector in Kenya .The industry under study was divided into 12 main sub-sectors. These were listed below;

Table 3.1: Sampling frame

Sector	Population	Sample (10%)
Building, Mining & Construction	23	2
Chemical and Allied	70	7
Energy, Electrical and Electronics	39	4
Food and Beverages	172	17
Leather and Footwear	10	1
Metal and Allied Sector	71	7
Motor Vehicle and Accessories	40	4
Paper and Board Sector	64	6
Pharmaceutical and Medical Equipmentôs	24	2
Plastics and Rubber	64	6
Fresh Produce	2	0
Textile and Apparels	60	6
Timber, Wood and Furniture	17	2
Total	656	64

Source (KAM, 2013)

3.5 Data Collection

A combination of data collection methods were used in this study. A structured questionnaire consisting of both open and closed ended questions was used (Singleton et al., 1993).This method allowed for neutrality and provided rational responses (Punch, 1998)

The questionnaires were pretested on 10 respondents to allow for fine tuning and accuracy of responses (Kiros and Nyapela, 1997). The results of the pretested questionnaires were discussed

with the supervisors and revisions made to capture the missing information. To administer the questionnaires, the researcher relied on the help of three research assistants who were trained on testing all aspects of the research both before and after pretesting.

3.6 Data Analysis

At the end of data collection, the completed questionnaires were inspected for completeness, edited for errors and omissions before being coded and the data captured. Responses to the questionnaires were coded numerically, entered in an Excel spreadsheet for analysis and cleaned. Quantitative data was then imported into SPSS for further analysis.

In this study, data was organized and summarized using a combination of descriptive statistics and inferential statistics. Statistical tools like frequency distributions, measures of central tendencies like means, medians and modes; and measures of dispersion like range and standard deviation were used to summarize quantitative variables (Sprinthall, 1997).

Data measured on nominal and ordinal scales was summarized using frequency distribution with mode measuring central tendency (Norusis, 1991). Central tendency on interval and ratio data was measured using mean and median, with range and standard deviation measuring dispersion. This group of data was then categorically be analyzed to yield ordinal data that was finally summarized using frequency distributions.

The study used simple linear regression to analyze the relationship between extent of supply chain technology adoption and performance of manufacturing organizations. The analytical model showed how the dependent variable (performance) is affected by any changes in the independent variable (supply chain technology adoption).The equation to be used was as follows;

$Y = \beta_0 + \beta_1 X_1 + \mu$

Where;

Y ï Performance of manufacturing organizations

ß0 ï constant variable

X_1 ï Supply chain technology adoption

Ůï Error term

CHAPTER FOUR: DATA ANALYSIS AND INTERPRETATION

4 1 Introduction

This chapter presents the analysis of data and discussion of the research findings. The chapter outlines the findings based on the research objectives. The purpose of this study was to establish the drivers of supply chain technology adoption and determine the level of supply chain adoption. SPSS was used to generate the descriptive statistics and to establish the relation between the dependent and the independent variables of the study. The research findings were presented in form of tables and graphs. Tabulation helped to summarize the data whereas graphs were used to present the study results.

4.2 General Information

The researcher targeted a sample size of 64 respondents from which 58 filled in and returned the questionnaires making a response rate of 90.62%. This response rate was excellent and representative and conforms to Mugenda and Mugenda (1999) stipulation that a response rate of 50% is adequate for analysis and reporting; a rate of 60% is good and a response rate of 70% and over is excellent.

From the findings,25.9% of the respondents were in food and beverages sector,10.3% of the respondents were in paper and board sector, Pharmaceutical and Medical Equipmentôs, Plastics and Rubber and Textile and Apparels sectors, respectively,8.6% of the respondents were in Chemical and Allied and Metal and Allied Sector, respectively,6.9% of the respondents were in Energy, Electrical and Electronics and Motor Vehicle and Accessories, respectively,3.4% of the respondents were in Building, Mining & Construction, Pharmaceutical and Medical Equipmentôs

and Timber, Wood and Furniture sectors , respectively while 1.7% of the respondents were in the Leather and Foot ware sector.

According to the findings,43.1% of the respondents indicated that there were between 101-500 employees in the organization,39.7% of the respondents indicated that there were between 501-1000 employees in the organization,8.6% of the respondents indicated that there were between 51-100 employees in the organization,6.9% of the respondents indicated that there were over 1000 employees in the organization while 1.7% of the respondents indicated that there were between 21-50 employees in the organization.

In determining the duration to which the organizations had been operating in the Kenyan market, all (100%) the respondents indicated that the organizations had been operating in the Kenyan market for over 5 years. These findings infer that the organizations had been operating in the market for a reasonable duration of time and therefore could well provide the information needed by the researcher.

4.3 Supply Chain Technologies Used in the Organization

The study sought to establish the extent to which supply chain technologies were used in the organization. Technology therefore plays an important role in the success of supply chain management. According to Peterson (2003) technology is a supply chain management enabler whose importance cannot be understated and that supply chain technology and supply chain management is complementary in nature.

Table 4.1: Supply Chain Technologies Used in the Organization

	Mean	Std. Deviation
Enterprise resource planning (ERP),	3.8378	.92198
Supply chain planning (SCP)	3.8103	.92636
Systems, manufacturing execution systems (MES),	3.9123	.68870
warehouse, management systems (WMS)	3.7414	.73890
Transportation management systems (TMS),	2.9828	.94575
Extranets, Intranets and Internet	4.4211	.73064
Radio frequency identification systems (RFID),	3.0172	.99985
Product data management	4.1429	.86189
Customer relationship management	3.7586	1.03127
Automated quality control system	4.0000	1.05963
Computer-aided design systems,	2.9138	1.31502
Geo coded tracking systems (GCTS)	2.8772	1.31026
Bar-coding technology	3.7241	1.38657
e-commerce technologies,	3.5345	1.09569
Supply chain event management (SCE)	2.8276	1.59096
Demand forecasting management (DFM)	3.8966	.78784

Majority of the respondents indicated that extranets, intranets and internet, product data management, automated quality control system, manufacturing execution systems (MES), demand forecasting management (DFM), Enterprise resource planning (ERP), Supply chain planning (SCP), Customer relationship management, warehouse, management systems (WMS), Bar-coding technology and e-commerce technologies were used In the organization to a great

extent as shown by mean scores of 4.4211, 4.1429, 4.0000, 3.9123, 3.8966, 3.8378, 3.8103, 3.7586, 3.7414, 3.7241 and 3.5345 respectively. The respondents also indicated that Radio frequency identification systems (RFID), Transportation management systems (TMS), Computer-aided design systems, Geo coded tracking systems (GCTS) and Supply chain event management (SCE) were used In the organization to a moderate extent as shown by mean scores of 3.0172, 2.9828, 2.9138, 2.8772 and 2.8276 respectively.

This is consistent with Perez (2003) who postulates that supply chain technology is technology or a system that is used in coordinating and integrating information flows electronically throughout the supply chain network of trading partners and customers in both directions so as to generate effective and efficient business transactions, quick access to information, allow better customer service, reduce paperwork, allow better communication, increase productivity and save time. Thus, to keep on competition, firms within supply chain routinely communicate with each other. The development of supply chain management requires that members of the chain co-ordinate their production and logistics activities. This type of co-ordination can be facilitated by adoption of technology, particularly when these technologies are used to span the traditional boundaries of supply chain firms (Sanchez and Perez, 2003).

4.4 Factors influencing the Uptake of Supply Chain Technology

The study sought to establish the factors influencing the uptake of Supply Chain Technology. According to Raymond, (2005), technology plays an increasingly critical role in businesses large and small .Techno savvy firms are at an advantage. Research in the past has shown a positive impact on technology adoption on small businesses, by helping firms enhance their operational efficiency .Technology adoption drives business growth and integrates businessô operations with strategies (Roger 2003).

Table 4.2: Extent that various factors influence the uptake of Supply Chain Technology

	Mean	Std. Deviation
Availability of Technology and innovation	3.8947	.72418
To gain competitive advantage	4.0893	.58081
To increase efficiency and effectiveness	4.0877	.54382
Reduce wastage and lead times	4.1786	.50837
The need to coordinate and integrate information flow and activities within and/or between firm boundaries	4.0517	.73562
To generate effective and efficient business transactions	4.0517	.73562
To enable quick access to information and records	4.0000	.68139
To allow better customer service	3.9649	.68046
Reduce paperwork, allow better communication	4.0345	.74846
The desire to increase productivity and savings	4.2321	.60275
To bridge the limitation in the ability to work with global partners e.g. language barriers and time differences	3.5345	1.14272
To enable members of the supply chain co-ordinate their production and logistics activities	3.9123	.78560
The desire by the organization for cost-cutting and increase efficiency across the extended supply chain	4.1930	.61058
Proliferation of globally sourced products	3.5172	1.27378
Rapid technological change	3.8793	.89986
To reduce transaction costs	3.4310	1.29929
The organizations desire to move towards self-service approach and integrated supplier management	3.4828	1.25993
To improve customer segmentation, up-sell, and limit or eliminate risk	3.9310	.76919
To improve communication and productivity between suppliers, partners and customers	3.9825	.69414
The need to enhance the speed time-to-market and speed delivery times.	4.3684	.81573
To improve order management and decision making	4.5088	.65799

From the findings, the respondents indicated that Supply Chain Technology was used to improve order management and decision making to a very great extent as indicated by a mean score of 4.5088.The respondents indicated that Supply Chain Technology was used to enhance the speed time-to-market and speed delivery times, to increase productivity and savings, for cost-cutting and increase efficiency across the extended supply chain and to enhance network relationships , reduce wastage and lead times, to gain competitive advantage, to increase efficiency and effectiveness to a great extent as indicated by a mean score of 4.3684, 4.2321, 4.1930, 4.1786, 4.0893 and 4.0877 respectively.

The respondents indicated that Supply Chain Technology was used to because of the need to coordinate and integrate information flow and activities within and/or between firm boundaries and to generate effective and efficient business transactions to a great extent as indicated by a mean score of 4.0517 respectively. The respondents indicated that Supply Chain Technology was used to reduce paperwork, allow better communication, to enable quick access to information and records, to improve communication and productivity between suppliers, partners and customers, to allow better customer service, to improve customer segmentation, up-sell, and limit or eliminate risk, to enable members of the supply chain co-ordinate their production and logistics activities, availability of Technology and innovation, rapid technological change, to bridge the limitation in the ability to work with global partners e.g. language barriers and time differences and proliferation of globally sourced products to a great extent as indicated by mean scores of 4.0345, 4.0000, 3.9825,3.9649, 3.9310, 3.9123, 3.8947, 3.8793, 3.5345 and 3.5172 respectively.

The respondents indicated that Supply Chain Technology was used because of the organizations desire to move towards self-service approach and integrated supplier management and to reduce

transaction costs to a great extent as indicated by a mean score of 3.4828 and 3.4310 respectively.

These findings are in line with Power (2006) who says that using the supply chain to handle such elements like procurement and communication makes the running of the supply chain faster. In this context, as SCT has become more sophisticated and accessible, the expectation for technology as a means of improving information flows has been high.

4.5 Supply Chain Technology Adoption and Performance

The study sought to establish the impact of supply chain technology adoption on manufacturing organizationsô performance. According to Tippins and Sohi, (2003), technology adoption in supply chain can defined as the extent to which a firm adopts the most advanced available technology and involves proactive adoption of the state of art IT to build new technical solutions for supply chains. Supply chain technology embraces the degree of diffusion of information technology within a firmôs activities. However, Supply chain technology adoption is a distinctive concept from information technology. Supply chain technology enables a firm to adopt new technologies ahead of competitors.

According to the findings, the respondents agreed that supply chain technology adoption led to better coordination and integration of information flow and activities within and/or between firm boundaries to a very great extent as indicated by a mean score of 4.5714. The respondents agreed that supply chain technology adoption improved communication and productivity between the organization and suppliers and led to the reduction in costs; increased efficiency across the extended supply chain and enhanced network relationships to a very great extent as indicated by a mean score of 4.5000 respectively.

Table 4.3: Level of Agreement with statements on supply chain technology adoption and performance

	Mean	Std. Deviation
Adoption of supply chain technology (SCT) in your organization has cultivated organizational capabilities that enable your firm to outperform its competitors	4.3571	.72434
The Adoption of SCT has led to the development of new services, new functions, formation of new alliances etc	3.9138	.88426
It has promoted the integration of traditional services such as transportation and warehousing with information based services like booking, freight rate computation, routing and scheduling	4.2807	.83995
It has opened up new opportunities for the development of new roles in the supply chain by giving added value to supply chain functions through greater efficiency and information transparency	4.2982	.73107
Reduced lead times and wastage	4.1250	.71510
Led to better coordination and integration of information flow and activities within and/or between firm boundaries	4.5714	.68376
Improved communication and productivity between the organization and suppliers	4.5000	.63246
Led to the reduction in costs; increased efficiency across the extended supply chain and enhanced network relationships.	4.5000	.66058

The respondents agreed that supply chain technology adoption had cultivated organizational capabilities that enable your firm to outperform its competitors, it has opened up new opportunities for the development of new roles in the supply chain by giving added value to supply chain functions through greater efficiency and information transparency , it has promoted the integration of traditional services such as transportation and warehousing with information based services like booking, freight rate computation, routing and scheduling, reduced lead times

and wastage and had led to the development of new services, new functions, formation of new alliances to a great extent as indicated by mean scores of 4.3571, 4.2982, 4.2807, 4.1250 and 3.9138 respectively.

These findings concur with Barney (2004), who points out that supply chain technology adoption cultivates organizational capabilities that enable the firm to outperform their competitors. However, adoption of information technology alone may not be a source of competitive advantage because of their wide availability in the market, only when the information technology is embedded into organizational processes (e.g. strategy making), it is expected to offer sustainable benefits.

4.6 Factor Analysis

4.6.1 Factor Analysis (Communalities)

Responses collected on the challenges affecting technology adoption in the Kenyan manufacturing sector were subjected to factor analysis. Communality is the proportion of variance that each item has in common with other items. The proportion of variance that is unique to each item is then the respective itemôs total variance minus the communality. The extraction method was the principle component analysis. Communalities are shown in the table below.

Table 4.4: Factor Analysis (Communalities)

	Initial	Extraction
Systems, manufacturing execution systems (MES),	1.000	.896
warehouse, management systems (WMS)	1.000	.864
Transportation management systems (TMS),	1.000	.914
Extranets, Intranets and Internet	1.000	.915
Radio frequency identification systems (RFID),	1.000	.915

Product data management	1.000	.922
Customer relationship management	1.000	.932
Automated quality control system	1.000	.900
Computer-aided design systems,	1.000	.932
Geo coded tracking systems (GCTS)	1.000	.922
Bar-coding technology	1.000	.967
e-commerce technologies,	1.000	.947
Supply chain event management (SCE)	1.000	.909
Demand forecasting management (DFM)	1.000	.954
Availability of Technology and innovation	1.000	.893
To gain competitive advantage	1.000	.895
To increase efficiency and effectiveness	1.000	.933
Reduce wastage and lead times	1.000	.879
The need to coordinate and integrate information flow and activities within and/or between firm boundaries	1.000	.884
To generate effective and efficient business transactions	1.000	.900
To enable quick access to information and records	1.000	.920
To allow better customer service	1.000	.886
Reduce paperwork, allow better communication	1.000	.925
The desire to increase productivity and savings	1.000	.790
To bridge the limitation in the ability to work with global partners e.g language barriers and time differences	1.000	.944
To enable members of the supply chain co-ordinate their production and logistics activities	1.000	.933
The desire by the organization for cost-cutting and increase efficiency across the extended supply chain and To enhance network relationships.	1.000	.809
Proliferation of globally sourced products	1.000	.944
Rapid technological change	1.000	.959
To reduce transaction costs	1.000	.945
The organizations desire to move towards self-service approach and integrated supplier management	1.000	.942
To improve customer segmentation, up-sell, and limit or eliminate risk	1.000	.966
To improve communication and productivity between suppliers, partners and customers	1.000	.937
The need to enhance the speed time-to-market and speed delivery times.	1.000	.930
To improve order management and decision making	1.000	.871
Adoption of supply chain technology (SCT) in your organization has cultivated organizational capabilities that enable your firm to outperform its competitors	1.000	.887

The Adoption of SCT has led to the development of new services, new functions, formation of new alliances etc	1.000	.897
It has promoted the integration of traditional services such as transportation and warehousing with information based services like booking, freight rate computation, routing and scheduling	1.000	.893
It has opened up new opportunities for the development of new roles in the supply chain by giving added value to supply chain functions through greater efficiency and information transparency	1.000	.852
Reduced lead times and wastage	1.000	.870
Led to better coordination and integration of information flow and activities within and/or between firm boundaries	1.000	.864
Improved communication and productivity between the organization and suppliers	1.000	.912
Led to the reduction in costs; increased efficiency across the extended supply chain and enhanced network relationships.	1.000	.933

Extraction Method: Principal Component Analysis.

4.6.2 Factor Extraction (Total Variance)

The total variance of all the factors is presented in the table below. Principle analysis component was used to extract a total of 43 factors. Eigen values indicate the relative importance of each factor accounting for a particular set and hence those with small Eigen values were left out. From table below, only 3 factors were significant for the analysis.

Table 4.5: Factor Extraction (Total Variance)

Total Variance Explained						
	Initial Eigenvalues			Extraction Sums of Squared Loadings		
Component	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	35.498	82.553	82.553	35.498	82.553	82.553
2	2.508	5.832	88.385	2.508	5.832	88.385
3	1.079	2.510	90.895	1.079	2.510	90.895
4	.775	1.803	92.698			
5	.540	1.255	93.953			
6	.455	1.058	95.012			
7	.373	.867	95.879			

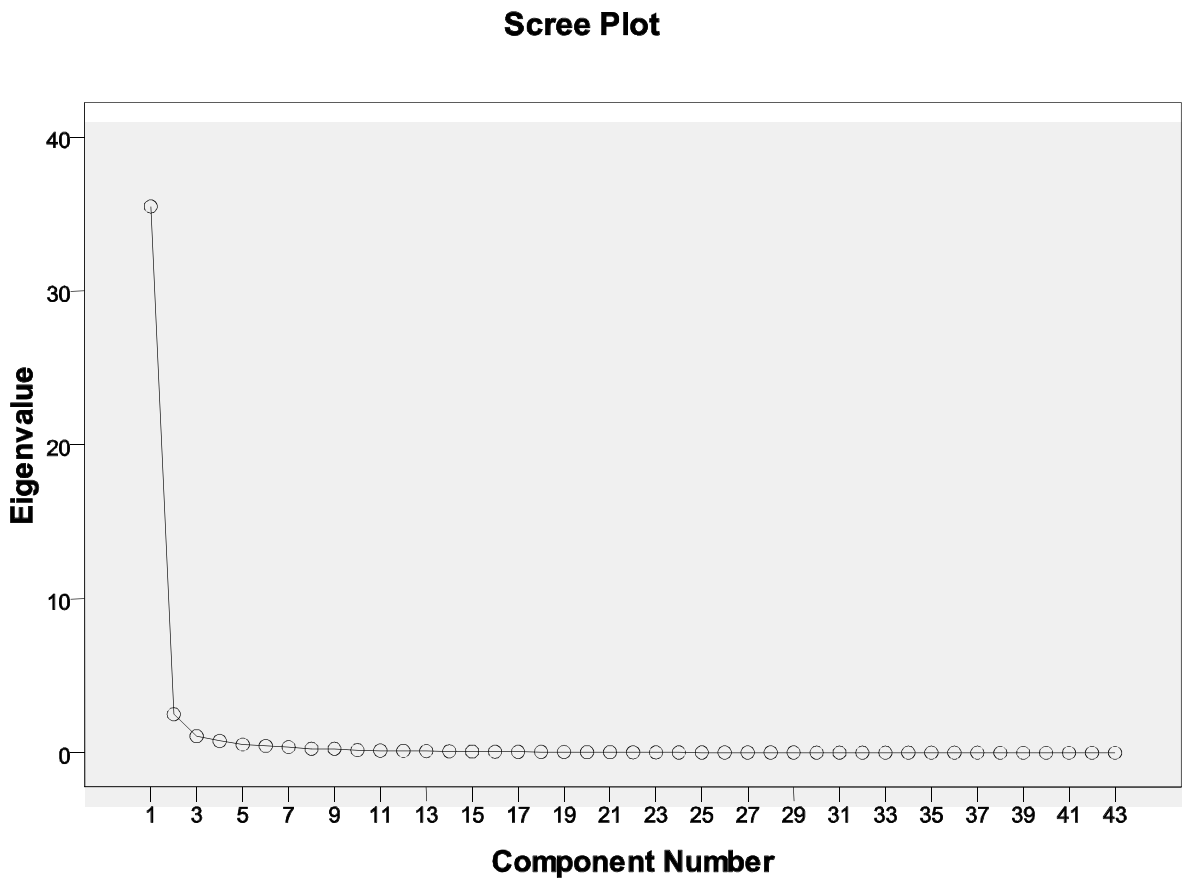
8	.259	.603	96.482			
9	.253	.589	97.071			
10	.169	.394	97.465			
11	.147	.342	97.806			
12	.124	.288	98.095			
13	.117	.273	98.368			
14	.098	.228	98.596			
15	.084	.196	98.792			
16	.078	.181	98.974			
17	.063	.146	99.119			
18	.061	.141	99.261			
19	.052	.120	99.381			
20	.039	.091	99.471			
21	.036	.085	99.556			
22	.028	.065	99.621			
23	.025	.058	99.679			
24	.023	.053	99.732			
25	.019	.043	99.776			
26	.016	.037	99.813			
27	.014	.032	99.845			
28	.012	.029	99.874			
29	.011	.025	99.899			
30	.008	.019	99.918			
31	.008	.018	99.937			
32	.007	.015	99.952			
33	.004	.010	99.962			
34	.004	.009	99.971			
35	.003	.008	99.979			
36	.003	.007	99.986			
37	.003	.006	99.992			
38	.002	.005	99.997			
39	.001	.002	99.999			
40	.000	.001	100.000			
41	4.253E-5	9.890E-5	100.000			
42	1.220E-16	2.838E-16	100.000			
43	-1.432E-16	-3.330E-16	100.000			

Extraction Method: Principal Component Analysis.

4.6.3 Scree Plot

This is a plot of the factor Eigen value against the component numbers. From the scree plot obtained, three factors were considered because the curve tends to flatten from the third component onwards due to relatively low Eigen values.

Figure 4.1: Scree Plot



4.6.4 Factor Analysis (Component Matrix)

Table below presents the factor analysis of the challenges affecting technology adoption in the Kenyan manufacturing sector; principle component with 3 components extracted. Each

component represents the correlation between item and the unrotated factor (e.g. correlation between Systems, manufacturing execution systems (MES) and factor 1 is 0.919 these correlations help formulate an interpretation of the factors of components. This is done by looking for a common thread among the variables that have large loadings for a particular factor or components.

Table 4.6: Factor Analysis (Component Matrix)

	Component		
	1	2	3
Systems, manufacturing execution systems (MES),	.919	.212	-.085
warehouse, management systems (WMS)	.888	.040	-.271
Transportation management systems (TMS),	.934	.160	.126
Extranets, Intranets and Internet	.902	-.291	-.129
Radio frequency identification systems (RFID),	.936	.148	.130
Product data management	.854	-.393	.196
Customer relationship management	.963	.059	-.041
Automated quality control system	.946	-.033	-.056
Computer-aided design systems,	.911	-.252	.196
Geo coded tracking systems (GCTS)	.918	-.147	.241
Bar-coding technology	.928	-.323	.047
e-commerce technologies,	.964	-.058	.116
Supply chain event management (SCE)	.820	.133	.468
Demand forecasting management (DFM)	.934	.232	-.164
Availability of Technology and innovation	.929	.169	-.020
To gain competitive advantage	.886	.298	.146
To increase efficiency and effectiveness	.887	-.362	-.126
Reduce wastage and lead times	.825	.434	-.103
The need to coordinate and integrate information flow and activities within and/or between firm boundaries	.812	.406	.243
To generate effective and efficient business transactions	.899	.297	-.061

To enable quick access to information and records	.927	.230	.087
To allow better customer service	.896	.240	-.159
Reduce paperwork, allow better communication	.908	.301	-.100
The desire to increase productivity and savings	.868	-.033	.190
To bridge the limitation in the ability to work with global partners e.g. language barriers and time differences	.969	-.055	.047
To enable members of the supply chain co-ordinate their production and logistics activities	.946	.189	-.057
The desire by the organization for cost-cutting and increase efficiency across the extended supply chain and To enhance network relationships.	.856	.250	.116
Proliferation of globally sourced products	.964	-.105	.056
Rapid technological change	.914	.237	-.261
To reduce transaction costs	.958	-.148	.072
The organizations desire to move towards self-service approach and integrated supplier management	.961	-.124	.050
To improve customer segmentation, up-sell, and limit or eliminate risk	.921	.273	-.207
To improve communication and productivity between suppliers, partners and customers	.906	.298	-.165
The need to enhance the speed time-to-market and speed delivery times.	.907	-.308	-.112
To improve order management and decision making	.871	-.284	-.182
Adoption of supply chain technology (SCT) in your organization has cultivated organizational capabilities that enable your firm to outperform its competitors	.897	-.278	.073
The Adoption of SCT has led to the development of new services, new functions, formation of new alliances etc	.947	-.027	.008

It has promoted the integration of traditional services such as transportation and warehousing with information based services like booking, freight rate computation, routing and scheduling	.921	-.194	-.086
It has opened up new opportunities for the development of new roles in the supply chain by giving added value to supply chain functions through greater efficiency and information transparency	.906	-.177	.016
Reduced lead times and wastage	.900	.005	.245
Led to better coordination and integration of information flow and activities within and/or between firm boundaries	.867	-.264	-.207
Improved communication and productivity between the organization and suppliers	.882	-.349	-.112
Led to the reduction in costs; increased efficiency across the extended supply chain and enhanced network relationships.	.887	-.362	-.126

Extraction Method: Principal Component Analysis. 3 components extracted.

From the results in table below, all the variables that measured challenges affecting technology adoption in the Kenyan manufacturing sector in one way or the other are highly correlated with this factor.

Table 4.7: Factor Analysis (Rotated Component Matrix

	Component		
	1	2	3
Systems, manufacturing execution systems (MES),		.764	
warehouse, management systems (WMS)		.691	
Transportation management systems (TMS),		.666	
Extranets, Intranets and Internet	.833		
Radio frequency identification systems (RFID),		.658	
Product data management	.808		
Customer relationship management		.673	

Automated quality control system	.661		
Computer-aided design systems,	.745		
Geo coded tracking systems (GCTS)	.664		
Bar-coding technology	.837		
e-commerce technologies,	.656		
Supply chain event management (SCE)			.760
Demand forecasting management (DFM)		.816	
Availability of Technology and innovation		.719	
To gain competitive advantage		.723	
To increase efficiency and effectiveness	.873		
Reduce wastage and lead times		.862	
The need to coordinate and integrate information flow and activities within and/or between firm boundaries		.716	
To generate effective and efficient business transactions		.802	
To enable quick access to information and records		.723	
To allow better customer service		.795	
Reduce paperwork, allow better communication		.824	
The desire to increase productivity and savings	.559		
To bridge the limitation in the ability to work with global partners e.g. language barriers and time differences	.671		
To enable members of the supply chain co-ordinate their production and logistics activities		.756	
The desire by the organization for cost-cutting and increase efficiency across the extended supply chain and To enhance network relationships.		.681	
Proliferation of globally sourced products	.702		
Rapid technological change		.839	
To reduce transaction costs	.726		
The organizations desire to move towards self-service approach and integrated supplier management	.715		

To improve customer segmentation, up-sell, and limit or eliminate risk		.850	
To improve communication and productivity between suppliers, partners and customers		.843	
The need to enhance the speed time-to-market and speed delivery times.	.845		
To improve order management and decision making	.817		
Adoption of supply chain technology (SCT) in your organization has cultivated organizational capabilities that enable your firm to outperform its competitors	.779		
The Adoption of SCT has led to the development of new services, new functions, formation of new alliances etc	.644		
It has promoted the integration of traditional services such as transportation and warehousing with information based services like booking, freight rate computation, routing and scheduling	.766		
It has opened up new opportunities for the development of new roles in the supply chain by giving added value to supply chain functions through greater efficiency and information transparency	.724		
Reduced lead times and wastage			.574
Led to better coordination and integration of information flow and activities within and/or between firm boundaries	.806		
Improved communication and productivity between the organization and suppliers	.858		
Led to the reduction in costs; increased efficiency across the extended supply chain and enhanced network relationships.	.873		

Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.a. Rotation converged in 6 iterations.

4.6.5 Factor Isolation

Factor analysis involves isolating each of the variable factors and grouping them by these three extracted factors based on their factor loading on each set. Table below shows the results.

Table 4. 8: Factor Isolation

Factor Group	Variables
Factor 1	• Extranets, Intranets and Internet • Product data management • Automated quality control system • Computer-aided design systems, • Geo coded tracking systems (GCTS) • Bar-coding technology • e-commerce technologies, • To increase efficiency and effectiveness • The desire to increase productivity and savings • To bridge the limitation in the ability to work with global partners e.g. language barriers and time differences • Proliferation of globally sourced products • To reduce transaction costs • The organizations desire to move towards self-service approach and integrated supplier management • The need to enhance the speed time-to-market and speed delivery times. • To improve order management and decision making • Adoption of supply chain technology (SCT) in your organization has cultivated organizational capabilities that enable your firm to outperform its competitors • The Adoption of SCT has led to the development of new services, new functions, formation of new alliances etc • It has promoted the integration of traditional services such as transportation and warehousing with information based services like booking, freight rate computation, routing and scheduling • It has opened up new opportunities for the development of new roles in the supply chain by giving added value to supply chain functions through greater efficiency and information transparency • Led to better coordination and integration of information flow and activities within and/or between firm boundaries • Improved communication and productivity between the organization and suppliers • Led to the reduction in costs; increased efficiency across the extended supply chain and enhanced network relationships.

Factor 2	• Systems, manufacturing execution systems (MES), • warehouse, management systems (WMS) • Transportation management systems (TMS), • Radio frequency identification systems (RFID), • Customer relationship management • Demand forecasting management (DFM) • Availability of Technology and innovation • To gain competitive advantage • Reduce wastage and lead times • The need to coordinate and integrate information flow and activities within and/or between firm boundaries • To generate effective and efficient business transactions • To enable quick access to information and records • To allow better customer service • Reduce paperwork, allow better communication • To enable members of the supply chain co-ordinate their production and logistics activities • The desire by the organization for cost-cutting and increase efficiency across the extended supply chain and To enhance network relationships. • Rapid technological change • To improve customer segmentation, up-sell, and limit or eliminate risk • To improve communication and productivity between suppliers, partners and customers
Factor 3	• Supply chain event management (SCE) • Reduced lead times and wastage

From the table above, there are 3 extracted groups. Extracted group factors 1 and 2 had the most number of variable components which are the variables that measured challenges affecting technology adoption in the Kenyan manufacturing sector were subjected to factor analysis. On isolated, factor one comprised of Extranets, Intranets and Internet, Product data management, Automated quality control system, Computer-aided design systems, Geo coded tracking systems (GCTS), Bar-coding technology, e-commerce technologies, To increase efficiency and effectiveness, The desire to increase productivity and savings, To bridge the limitation in the ability to work with global partners e.g. language barriers and time differences, Proliferation of globally sourced products, To reduce transaction costs, The organizations desire to move towards

self-service approach and integrated supplier management, The need to enhance the speed time-to-market and speed delivery times, To improve order management and decision making, Adoption of supply chain technology (SCT) in your organization has cultivated organizational capabilities that enable your firm to outperform its competitors, The Adoption of SCT has led to the development of new services, new functions, formation of new alliances etc, It has promoted the integration of traditional services such as transportation and warehousing with information based services like booking, freight rate computation, routing and scheduling, It has opened up new opportunities for the development of new roles in the supply chain by giving added value to supply chain functions through greater efficiency and information transparency, Led to better coordination and integration of information flow and activities within and/or between firm boundaries Improved communication and productivity between the organization and suppliers, Led to the reduction in costs; increased efficiency across the extended supply chain and enhanced network relationships.

Factor 2 comprised of Systems, manufacturing execution systems (MES), warehouse, management systems (WMS), Transportation management systems (TMS), Radio frequency identification systems (RFID), Customer relationship management, Demand forecasting management (DFM), Availability of Technology and innovation, To gain competitive advantage, Reduce wastage and lead times, The need to coordinate and integrate information flow and activities within and/or between firm boundaries, To generate effective and efficient business transactions, To enable quick access to information and records, To allow better customer service, Reduce paperwork, allow better communication, To enable members of the supply chain co-ordinate their production and logistics activities, The desire by the organization for cost-cutting and increase efficiency across the extended supply chain and To enhance network

relationships, Rapid technological change, To improve customer segmentation, up-sell, and limit or eliminate risk and improvement communication and productivity between suppliers, partners and customers. Factor three comprised of Supply chain event management (SCE) and Reduced lead times and wastage.

From the findings most of the 43 factors listed in the questionnaire were grouped together by their correlation with each other and brought down to three main group factors. The most number of factor elements were grouped in the first two groups with few in the remaining factor group three.

4.7 Regression Analysis

Supply chain technology as a tool does not only improve the effectiveness and efficiencies of the operations but also act as a competitive weapon to the organization strategy. Adoption of Supply chain technology is critical to reduction of costs and enhancement supply chain competitiveness, especially in the wake of globalization and liberalization of economies that spurred competition (Ravendran, 2002). In this study, a multiple regression analysis was conducted to test relationship between extent of supply chain technology adoption and performance of manufacturing organizations. The research used statistical package for social sciences (SPSS V 21.0) to code, enter and compute the measurements of the multiple regressions.

Table 4.9: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.8403	0.7895	0.6894	0.4920

The adjusted $R^{2,}$ also called the coefficient of multiple determinations, is the percent of the variance in the dependent explained uniquely or jointly by the independent variables. 68.94% of the changes in performance could be attributed to the combined effect of the predictor variables (supply chain technology adoption).

Table 4.10: **Summary of One-Way ANOVA results**

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	15.335	1	15.335	4.265	.019[a]
	Residual	6.907	56	12.12		
	Total	22.242	57			

The probability value of 0.019 indicates that the regression relationship was highly significant in predicting how supply chain technology adoption affects performance of manufacturing organizations. The F calculated at 5% level of significance was 4.265 since F calculated is greater than the F critical (value = 3.1504), this shows that the overall model was significant.

Table 4.11: Regression coefficients of the relationship between supply chain technology adoption and performance

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	**Std. Error**	**Beta**		
1	(Constant)	3.942	.334		10.841	.001
	Supply chain technology adoption	0.662	.236	0.414	2.679	.013

As per the SPSS generated table above, the regression equation becomes:

$Y= 3.942 + 0.662X_1$

The regression equation above has established that taking supply chain technology adoption constant at zero performance will be 3.942. The findings presented also show that a unit increase in the supply chain technology adoption would lead to a 0.662 increase in the performance. At 5% level of significance and 95% level of confidence, supply chain technology adoption had a 0.013 level of significance showing that the variable is significant ($p<0.05$).

CHAPTER FIVE: SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This chapter presents a discussion of the findings, and conclusions drawn from the findings and finally recommendations for practice and further research on the problem. The purpose of this study was to establish the drivers of supply chain technology adoption and determine the level of supply chain adoption as well as establish the relationship between extent of supply chain technology adoption and performance of manufacturing organizations.

5.2 Summary

The study found that extranets, intranets and internet, product data management, automated quality control system, systems, manufacturing execution systems (MES), demand forecasting management (DFM), Enterprise resource planning (ERP), Supply chain planning (SCP), Customer relationship management, warehouse, management systems (WMS), Bar-coding technology and e-commerce technologies were used In the organization . According to Davenport and Brooks (2004) the internet has brought about a revolution in supply chain thinking. The low cost and ease of use of the internet has greatly enhanced attempts to connect supply and demand chains across the organizations. Organizations are motivated for cost-cutting reasons to increase efficiency across the extended supply chain and to enhance customer service and network relationships. Supply chain management (SCM) is an important success factor for companies challenged by weakened economies, the proliferation of globally sourced products, improved functional integration, and rapid technological change (Kerr, 2001).

The study revealed that Supply Chain Technology was used to improve order management and decision making to a very great extent as indicated by a mean score of 4.5088.The respondents

indicated that Supply Chain Technology was used to enhance the speed time-to-market and speed delivery times, to increase productivity and savings, for cost-cutting and increase efficiency across the extended supply chain and to enhance network relationships , reduce wastage and lead times, to gain competitive advantage, to increase efficiency and effectiveness. According to Lai and Guynes, (1997) the relationship between centralization adoptions of innovation has been found to be positive in some cases, yet negative in others .Centralization means the degree to which control and decision-making rests with a few powerful member of the organization or decision making is made by top management. According to Ettlie et al. (2004), organizations with centralized structures were more likely to adopt new technologies. Williams (2006) concurred with this findings and further pointed out that that a centralized structure facilitates faster and more efficient adoption than a decentralized structure because senior managers can adopt technologies despite the resistance of lower level managers

The study established that supply chain technology adoption led to better coordination and integration of information flow and activities within and/or between firm boundaries, that it improved communication and productivity between the organization and suppliers and led to the reduction in costs; increased efficiency across the extended supply chain and enhanced network relationships. According to Regan and Song (2001) the increasing role of supply chain technology has contributed to the evolution of the competitive supply chain management. One of the first visible effects associated with the increasing dissemination of supply chain technology in service industry is the integration of traditional services such as transportation and warehousing with information based services like booking, freight rate computation, routing and scheduling. Over the last few years such companies have made significant progress in the adoption of new technologies, particularly those linked to the internet. Today, the main transport

and logistics service firms are able to provide a variety of information via the internet and to secure transactions online with customers through their web sites

The study revealed that 68.94% of the changes in performance could be attributed to the combined effect of the predictor variables (supply chain technology adoption). The regression findings also show that a unit increase in the supply chain technology adoption would lead to a 0.662 increase in the performance. At 5% level of significance and 95% level of confidence, supply chain technology adoption had a 0.013 level of significance showing that the variable is significant ($p<0.05$).

5.3 Conclusions

From the findings, the study concludes that supply chain technology as a tool does not only improve the effectiveness and efficiencies of the operations but also act as a competitive weapon to the organization strategy. Adoption of Supply chain technology is critical to reduction of costs and enhancement supply chain competitiveness, especially in the wake of globalization and liberalization of economies that spurred competition.

The study also concludes that organizations that have adopted a flatter, more decentralized structure would be expected to have adopted more innovative and cutting edge technology in order to enhance communication and coordination within the organization as well as with supply chain members.

The study further concludes that supply chain technology adoption improved communication and productivity between the organization and suppliers and led to the reduction in costs it also increased efficiency across the extended supply chain and enhanced network relationships.

5.4 Recommendations for Policy and Practice

Foremost the study recommends that to enhance supply chain effectiveness, the management should organize for staff training both internal and external through seminars and workshop which will go a long way in enhancing ownership of the process by employees. The management should also support innovation to facilitate performance oriented culture. Further, there should also be clear and consistent communication among members of staff in the company.

Secondly, the study has established that supply chain technology adoption affects service delivery. This study therefore recommends that the organization should enhance these practices as maintenance has to provide the required reliability, availability, efficiency and capability of production system in accordance to the need of these characteristics.

The study also recommends that employees should understand the supply chain technology adoption processes in detail (process mapping) before developing an effective service delivery system.

5.5 Limitations of the Study

The researcher encountered various limitations that were likely to hinder access to information that the study was looking for. The main limitation of study was its inability to include more manufacturing firms across the Country. This was a study focusing on the large manufacturing firms in Nairobi. The study could have covered more institutions both big and small so as to provide a broader based analysis however time and resource constraints placed this limitation.

The respondents approached were reluctant in giving information fearing that the information sought would be used to intimidate them or print a negative image about their institution. The researcher handled the problem by carrying an introduction letter from the University and

assured them that the information they gave would be treated confidentially and it would be used purely for academic purposes. The small size of the sample could have limited confidence in the results and this might limit generalizations to other situations.

Reluctance to respond to questionnaires was another limitation in collecting the required data for the study. This was due to some reservations held by the target population. This hence would have led to generalization during the analysis and presentation of the data made from those who responded to represent the views of the rest of the respondents. The researchers countered the limitation by making prior arrangements with the respondents as well as making personal calls and visits to remind the respondents to fill in the questionnaire.

5.6 Suggestion for Further Research

This study concentrated on the supply chain technology adoption in large manufacturing firms in Nairobi. However, this is not conclusive for Kenya considering that there are other major manufacturing companies. Further studies should be undertaken in all other manufacturing companies so as to come up with exhaustive findings on supply chain technology adoption in manufacturing companies in Kenya and thus give conclusive recommendations that would be adopted countrywide.

Secondly, further studies should also be done on the factors that affect the adoption and successful implementation of performance practices among manufacturing companies in Kenya.

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APPENDICES

Appendix I: Research Questionnaire

I am conducting a research on ñsupply chain technology adoption in large manufaturing firms in the kenyaôs manufucturing sector. This study is being carried out in partial fulfillment of the requirements for the award of the Degree of Master of Business Adminstration, School of Business the university of nairobi.

Kindly answer the following questions:

Section A: (Profile of the respondent's Organization)

1. Name of the organizationé é

2. Sector

Building, Mining & Construction ☐ Chemical & Allied ☐ Food & Beverage ☐

Energy, Electrical & Electronics ☐ Leather & Foot ware ☐ Metal & Allied ☐

Motor Vehicle & Accessories ☐ Paper & Board ☐ Plastic & Rubber ☐

Pharmaceutical ☐ Fresh Produce ☐ Textile & Apparel ☐

Timber, Wood and Furniture ☐

3. Kindly indicate the approximate number of employees in your Organization?

Below 20 ☐ 21-50 ☐ 51-100

101-500 ☐ 501-1000 ☐ Above 1001

Others (Indicate)é é é é é é é é .....

4. How long has your organization been operating in the Kenyan market?

Below 2 years ☐

Between 2 and 5 years ☐

Over 5Years ☐

5. In the list provided below, kindly indicate by ticking () the extent to which the following supply chain technologies are used in your organization?

	Very Small Extent	**Small Extent**	**Some Extent**	**Great extent**	**Very great Extent**
Enterprise resource planning (ERP),					
Supply chain planning (SCP)					
Systems, manufacturing execution systems (MES),					
warehouse, management systems (WMS)					
Transportation management systems (TMS),					
Extranets, Intranets and Internet					
Radio frequency identification systems (RFID),					

Product data management					
Customer relationship management					
Automated quality control system					
Computer-aided design systems,					
Geo coded tracking systems (GCTS)					
Bar-coding technology					
e-commerce technologies,					
Supply chain event management (SCE)					
Demand forecasting management (DFM)					
Supply chain planning (SCP) systems					
Others 1.....					
2.....					
3.....					
4.....					
5.....					

Section B: (Drivers of supply chain technology adoption)

6. In the statements provided bellow, state the extent to which the following factors have influenced the uptake of Supply Chain Technology in your organization where (1) **Very Small Extent**, (2) **Small Extent** (3) **Some Extent,** (4) **Great extent** (5) **Very great Extent** (ã) as appropriate.

	Very Small Extent	**Small Extent**	**Some Extent**	**Great extent**	**Very great Extent**
Avalibability of Technology and innovation					
To gain competative advantage					
To increase efficiency and effectivemess					
Reduce wastage and lead times					
The need to coordinate and integrate information flow and activities within and/or between firm boundaries					
To generate effective and efficient business transactions					
To enable quick access to information and records					

To allow better customer service					
reduce paperwork, allow better communication					
The desire to increase productivity and save					
To bridge the limitation in the ability to work with global partners e.g language barriers and time differences					
To enable members of the supply chain co-ordinate their production and logistics activities					
The desire by the organization for cost-cutting and increase efficiency across the extended supply chain and To enhance network relationships.					
Proliferation of globally sourced products					
Rapid technological change					
To reduce transaction costs					
The organizatins desire to move towards self-service approach and integrated supplier					

management					
To improve customer segmentation, up-sell, and limit or eliminate risk					
To improve communication and productivity between suppliers, partners and customers					
The need to enhance the speed time-to-market and speed delivery times.					
To improve order management and decesion making					
Others.1.....					
2.....					
3.....					
4.....					
5.....					

Section C : Impact of supply chain technology adoption on manufacturing organizations' performance

7. In the section listed below, kindly indicate the extent to which you agree with the statements provided bellow, have improved the operations and performance of your organizationsô supply chain where (1) **Very Small Extent**, (2) **Small Extent** (3) **Some Extent,** (4) **Great extent** (5) **Very great Extent** (ã) as appropriate.

	VerySmall Extent	**Small Extent**	**Some Extent**	**Great extent**	**Very great Extent**
Adoption of supply chain technology (SCT) in your organization has cultivated organizational capabilities that enable your firm to outperform its competitors					
The Adoption of SCT has led to the development of new services, new functions, formation of new alliances etc					
It has promoted the integration of traditional services such as transportation and warehousing with information based services like booking, freight rate computation, routing and scheduling					

It has opened up new opportunities for the development of new roles in the supply chain by giving added value to supply chain functions through greater efficiency and information transparency					
Reduced lead times nd watage					
Led to better coordinaton and integration of information flow and activities within and/or between firm boundaries					
Improved communication and productivity between the organizarion and suppliers					
Led to the redduction in costs;increased efficiency across the extended supply chain and enhanced network relationships.					
Others.1.....					
2.....					
3.....					
4.....					