INFORMATION COMMUNICATION TECHNOLOGY ADOPTION AND SUPPLY CHAIN PERFORMANCE OF PARASTATALS IN THE KENYA'S ENERGY SECTOR

BY

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DECLARATION

I declare that this project is my original work and has not been presented for a degree in any other university.

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D61/60796/2013

This project has been submitted for examination with my approval as the University Supervisor:

Signature: …… Date: ……

Dr. J.T. Kariuki

DEDICATION

I dedicate this work to my entire family, all my lecturers and my classmates for their support, encouragement and patience during the entire period of my study and their continued prayers towards successful completion of my course.

ACKNOWLEDGEMENT

I remain indebted in gratitude to my supervisor Dr. J.T. Kariuki whose support; advice, supervision, dedication and time have contributed to successful completion of my work. I also wish to express my sincere to my family, particularly my wife Peris Muthoni who has been my source of encouragement and support throughout my studies. Thanks to the Almighty God for his guidance and providence which enabled me to undertake this project.

ABSTRACT

This study was geared towards interrogating the effects of information and communication technology adoption and supply chain performance of parastatals in the Kenya's energy sector. To achieve the objective of the study, descriptive survey was used to determine the effects of information communication technology adoption. The target population of the study was all the nine parastatals of the Kenya's energy sector. The study used primary data which was collected by a semi-structured questionnaire. The data was collected from ICT managers, supply chain managers, ICT support staff and procurement officers from parastatals in the Kenya's energy sector using a drop and pick-later method. Data was analyzed using descriptive statistics and regression analysis. The study established a strong relationship between ICT adoption and supply chain performance of the Kenya's energy sector. The study also established that ICT adoption challenges are caused by inability of staff to adapt to changes lacks support from the top management and the limited quality of training to staff. The study therefore recommends that deployment of ICT in supply chain is necessary and should therefore be encouraged because there are inherent advantages such as accuracy in forecasting during production scheduling, good business to business collaboration and effective management of risks. Proper training should be done to the staffs and top management should support ICT adoption and provide necessary resources.

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ABBREVIATIONS

ERC	-	Energy Regulatory Commission
ERP	-	Enterprise Resource Planning
GDC	-	Geothermal Development Company Limited
ICT	-	Information and Communication Technology
IPPs	-	Independent Power Producers
IT	-	Information Technology
KENGEN	-	Kenya Electricity Generating Company
KETRACO	-	Kenya Electricity Transmission Company Ltd
KPLC	-	Kenya Power and Lighting Company
MIS	-	Management Information Systems
MOCs	-	Multinational Oil Companies
REA	-	Rural Electrification Authority
RFID	-	Radio Frequency Identification
SC	-	Supply Chain
SCC	-	Supply Chain Collaborations
SCM	-	Supply Chain Management
SCRM	-	Supply Chain Risk Management
SMEs	-	Small and Medium Enterprises
SPSS	-	Statistical Package for Social Science
TAM	-	Technology Acceptance Model

CHAPTER ONE

INTRODUCTION

1.0 Background

The present business environment is rapidly changing owing to fast changes as a consequence of technological innovation; clients have become more aware and are therefore placing more demands. According to Melville (2011), the modern economy has a complex structure which will definitely rise as a consequence of market forces. ICT revolution has supported explosion of information which promotes business in global market place where customers are able to access information about products, make comparisons on quality and prices and support buying decisions. This is critical for growth of market of new products and services.

ICT has deeply influenced the business world today and its application among businesses is widespread. ICT has redefined every sector of doing business i.e. methodologies, habits of consumption between business entities and their clients. Black (2011) asserts that in the first world, there is a large number of SMEs who form the majority ownership of all businesses and majority of formal employment. ICT is increasingly being adopted nowadays by businesses due to its cost-effectiveness and affordability. Brewer and Speh (2012), maintains that ICT advances trade competitiveness with internet providing abundant prospects for small businesses to do business at par more established firms.

Several theories explain adopting of ICT and supply chain performance. This study will use diffusion of innovation theory and technology acceptance model. Diffusion of innovation theory was developed by Rogers (1995). This hypothesis puts forward the argument that adoption and diffusion of an innovation is influenced by perceptions of innovation characteristics, characteristics of the adopter, and contextual factors. The theory examines innovations as elements that employ particular vehicles of communication at a particular time and in a specific social system. Technology acceptance model (TAM) is intended to explain what influences certain end-user-computing technologies to be accepted (Davis, 1989). In addition, TAM is not only tightfisted it can afford experimental sustenance in an effort to understand what determines the use of ICT (Venkatesh, 2000). It envisages that a user will espouse ICT depending on how he intends to use it, and this is always influenced by what he believes the product can do and how he approaches it. Further, superficial practicality and how easily the ICT can be adopted also guides alteration in users' intent (Davis, 1989). In short, it can be resolved that TAM therefore highlights three key areas which sway the use of technology i.e. how users view it, how useful they perceive it and how easily they can use it.

Lai (2006), noted that adoption of ICT in the Kenyan's energy sector is not only applicable for oil companies in their competitive drive to stay ahead in technological progress, but also has a direct proposition for the small local companies in the industry.

Unlike in the 1990's, the majority of oil companies in the industry have developed and have built up substantial financial resources and competence. However, they still have to tackle issues such as the lack of experienced human resources, and the need for improved awareness of cutting - edge technology expertise, and business processes. The coming on of modern internet-based ICTs in the 1990s has increased the attention of energy-sector players in their aspiration to keep pace with their peers.

Several measures have been taken by the Kenyan Government to diversify the economy for sustainable development. Transforming Kenya into a digital society is one of the major steps. ICT adoption will have substantial positive significances on businesses and subsequently on the economy of Kenya. Therefore, through this research, the effects of ICT adoption on supply chain performance in parastatals in the Kenya's energy sector will be determined.

1.1.1 Information Communication Technology

According to Vine (2012), ICT is a group of technologies used to disseminate, store and process information enabling the execution of information-related human actions, and serving both public institutions and the private sectors. Also ICT is a general term that is used to define merging of a wide collection of new technologies presently being used in the creation, processing and transmission of information in supply chain management within corporations as well as between traders in the business to business relationship

(Lai, 2011). ICT greatly impacts the modern business environment. Nevertheless, it is not always clear how ICT affects supply chains in many organizations.

The business world today has been highly impacted by applications of ICT as a pillar of success which facilitate good customer reach, fast changes to suit ever changing customer requirements and understanding of good practice in the global business arena (Beamon, 2009). Globally, information flows through ICT platforms which advise production planning, manufacturing and distribution among enterprises is rapidly changed by the ICT. According to Denni (2012),it is imperative that every corporation adopts ICT for its own good. This enables the industries to do business globally through enhanced competence, and closer consumer and businessmen relationships (Chong, 2011)

The way businesses operate has been affected by the evolution of technology. The industry structures have been changed to enhance efficiency realized by adoption of ICT systems. This has also positively impacted on the competitive business environment by enabling the industries which have embraced ICT to be more profitable. Business operations have also been positively affected by adoption of ICT. This change induces companies to implement ICT platforms in their business progressions to adapt to the dynamics of businesses surroundings (Ongori, 2008). According to Matlay (2011), any business that aims to progress and persist must adopt and implement ICT.

ICT uses computer hardware, software and network to connect to the internet (Apiyo, 2012). The reimbursements of adoption of ICT and use by companies create new avenues

and eases reach of markets while improving efficiency thus making initiatives more economical and efficacious (Prasad, 2010).

A great latent for growth, productivity and effectiveness is offered by ICT. To adopt ICT systems, elements and strategies, the paybacks must outweigh investment and upkeep costs. Further, ICTs are operating tools useful in promoting communications externally and improving service quality to clients in firms (Lukas, 2005). ICTs' adoption supports the process of managing information, diminishes transactions cost and upsurges the swiftness of connections for transactions. ICT's value is in its capability to connect and building associations between businesses. ICT adoption by companies in their supply chain makes it possible for them to leverage on information suitably in decision making (Costello, 2009).

1.1.2 Supply Chain Performance

Supply Chain Performance (SC) is commonly referred to as total supply chain's ability to edify the client's needs by availing the necessary products and timely delivery and response (Cai, 2008). SC cuts across the entire organization's functions such as marketing, manufacturing, procurement, distribution and sales as well as research and development. It involves each function's performance as well as relationship between the functions through integration. SC needs continuous improvement which calls for development of performance measures or metrics to be used to determine level of efficiency in operations. Tools such as statistical process controls are also used to detect

and mitigate errors automatically using modern ICT procedures. Thus organizations compete through their SCs to ensure a competitive edge in the business environment.

For a business to achieve its objectives to fulfill its consumers, the two most essential magnitudes of performance are efficiency and effectiveness. ICT adoption by organizations is applied to retain these competences by operative evidence sharing for decision making. So the performance of the all-inclusive supply chain is affected by how well ICT has been adopted and used in their operations to achieve its desired output (Lai, 2011). The implementation and incorporation of ICT in firms creates new openings for inter-business alliance and linkage. (Acker, 2011).

1.1.3 Parastatals in the Kenya's Energy Sector

The Kenya's energy sector is established in line with the Session Paper No.4 of 2004 and the Energy Act No.12 of 2006. One of the key areas in which the Kenya's public sector plays a key role is in service provision and economic development in the energy sector. It is a major ingredient of the achievement of Kenya's economic blue print, Vision 2030. Parastatals in the Kenya's energy sector are the Rural Electrification Authority (REA), Kenya Petroleum Refineries Limited, Kenya Electricity Generating Company Limited (KenGen), Kenya Power and Lighting Company (KPLC),National Oil Corporation of Kenya (NOCK), Kenya Pipeline Company (KPC), Kenya Electricity Transmission Company Limited (KETRACO), Electricity Regulatory Commission (ERC) and Geothermal Development Company (GDC) (Ministry of Energy, 2015). The country

generates electricity from numerous sources ranging from hydro, geothermal, thermal and wind.

KenGen generates over 70% of electricity and supplies to the national grid (Brewer, 2012). It is listed at the Nairobi Stock Exchange with the government holding 70% stake while 30% is held privately. (KPLC) distributes and supplies power. It is supplied in bulk by KenGen and other Independent Power Producers (IPPs). KETRACO is government owned and it plans, designs, constructs, owns, operates and maintains the infrastructure that transmits high voltage electricity to the national grid and regional interconnection. The government fully owns GDC as it was established to hasten the process of developing geothermal energy in Kenya. Currently there are six IPPs operating in the country which contribute about 12% of the effective generating capacity of eclectic power in the country.

The sector which constitutes the nine parastatals and the parent ministry has adopted ICT platforms both for individual use internally and integration with partners where necessary. The electricity based parastatals which are ERC, GDC, KETRACO, KenGen, KPLC and REA have integrated their ICT systems because of their interdependence. This facilitates sharing of data and information which is critical to their shared business of providing power to the public. Petroleum sector parastatals have also integrated their systems accordingly.

1.2 Research Problem

Parstatals in the Kenya's energy sector have implemented ICT systems with a view of delivering quality services to the public. The adopted systems have various components which are important to specific functions. This research focuses on supply chain function and the effects of ICT adoption to its performance.

Hult (2008), points out that, effective supply chains combined with operations efficiency is critical in risk management and that this is only possible with the adoption of ICT and related technology. ICT is supposed to create a conjoint alliance of supply chain management activities and IT strategies of organizations.

There are several concerns about success of ICT adoption by parastatals in the Kenya's energy sector since the expected level of their performance is not commensurate to the investment of the requisite systems. This has been noted through disruption of services to the customers due to supply of sub-standard products, late deliveries of critical components such as power transformers among others. Basnetet (2010), points that the main role of supply chain is to meet the consumer requirements through providing the client with the right product, of right quality and quantity, from a right source, at a right price and finally utilizing the right technology. When appraising the performance of the government sector on this basis, it will show that the parastatals in the Kenya's energy sector do not meet the above criteria successfully. There is need therefore for the

parastatals in the Kenya's energy sector to adapt ICT in their supply chain practices in order to remain competitive and provide effective services to their customers.

Various studies have been done on ICT adoption in both the public and the private sectors of economies in Africa to determine effectiveness. Olatunji (2015), did a study on the impact of ICT on small and medium scale enterprise productivity in Nigeria. The study found out that the introduction of ICT in the operations of small and medium scale enterprise operations changed the processes and productivity which in turn boosted profitability. Pikas (2006), did a research on the impact of ICTs on informal scholarly scientific communication. The study concluded that ICT has not changed the scientific social structure although new forms of remote collaboration and has seen slightly higher productivity.

Kinuthia and Ibrahim (2015), studied on the effects of ICT adoption on procurement process in Kenya's oil industry. The study found that the industry had not adopted more complicated e-business applications. Mobegi (2012), did an analysis of ICT adoption and performance, of rural based business projects (case of Kibwezi district in Makueni County). The findings showed that adopting ICT plays a role in allocating of resources since it is automated.

Gataua (2013), did a research on determinants of ICT adoption by small and medium enterprises in Thika municipality: a case of selected SMES. The results showed that communication is most important factor that influences ICT adoption by SMEs. Mobile

phones, computers and other ICT tools are used for enhancing communication. Other ICT characteristics which contributed significantly were enhancing of efficiency followed by cost reduction and enhancing of innovation in that order.

All the above studies have covered adoption of ICT in several different sectors of the economy. Although research has been done on energy sector in Kenya none has focused on ICT adoption and supply chain performance of parastatals in the Kenya's energy sector. Therefore the study sought to bridge this gap and sought to answers the research question; what are the effects of information communication technology adoption on supply chain performance of parastatals in the Kenya's energy sector?

1.3 Objective of the Study

The study endeavored to establish the effects of information and communication technology adoption and supply chain performance of parastatals in the Kenya's energy sector.

1.3.1 The Specific Objectives of the Study were:-

i. To determine the extent to which ICT has been adopted in supply chain by parastatals in the Kenya's energy sector;
ii. To determine the relationship between ICT adoption and supply chain performance of parastatals in the Kenya's energy sector;
iii. To determine the challenges facing ICT adoption in supply chain by parastatals in the Kenya's energy sector.

1.4 Value of the Study

This study will enable stakeholders to gain knowledge on importance of using information communication technology in driving businesses. The findings in this study will provide supply chain managers with critical information on the need for ICT in enhancing the efficiency of their functional processes. The study provides insights for supply chain managers on the centrality of adopting best practices supply chain management practices as a critical success factor in enhancing supply chain and organizational performance.

The study will be of importance to the Energy Ministry as it will influence policy decisions which are aimed at increasing effectiveness and efficiency of energy sectors in the country. Technological services learn how to hasten the level of growth of the industry and hence improved economy. The study is be significance to the general public since it brings out a whole picture on how Government owned entities in the energy sectors enhances transparence and strengthening of key parameter areas on the side of suppliers which enhance quality for selection.

The research will also benefit students involved in supply chain profession and those researchers willing to expound on areas that may require further investigations in this field. The study will contribute to similar materials written in the area of supply chain. Findings of this research are of useful reference to other researchers or for further research in the same field.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter comprises of an overview literature considered important to this study i.e. the effects of information communication technology adoption on supply chain performance. The chapter also provides the theories underpinning the study.

2.2 Theoretical Foundation

The study was guided by the following two theories; technology acceptance model and innovation theory.

2.2.1 Technology Acceptance Model

Technology acceptance model (TAM) is intended to explain what influences certain end-user-computing technologies to be accepted (Davis, 1989). In addition, TAM is not only tightfisted it can afford experimental sustenance in an effort to understand what determines the use of ICT (Venkatesh, 2000). It envisages that a user will espouse ICT depending on how he intends to use it, and this is always influenced by what he believes the product can do and how he approaches it. Further, superficial practicality and how easily the ICT can be adopted also guides alteration in users' intent (Davis, 1989). In short, it can be resolved that TAM therefore highlights three key areas which sway the

use of technology i.e. how users view it, how useful they perceive it and how easily they can use it.

TAM tries to identify causes of handicaps in adoption of ICT with a view of managing them to ensure effective use of ICT platforms thus creating avenues for better performance of business in organizations. Conservativeness in Communication can be broken by the TAM model as one of the factors for technology use is perceived performance. Davis (1989), defined perceived usefulness as the degree of belief in a person with regard to the use a specific information systems and how it would improve the accomplishment of a job. Further, perceived ease of use refers to the feeling that using an information system will require less effort. Such beliefs will always influence the uptake of technology in that a favorable attitude will mean increased while the reverse is true (Gefen, 1997). Usefulness in this study will be taken to mean the degree to which ICT usage would be useful in improving the performance of parastatals in the Kenya's energy sector.

The theory is relevant to the study because it proposes that the peripheral variables incidentally affect personalities' approach toward adoption of information communication technology acceptance by persuading superficial practicality and professed ease of use. External variables might include specific user attributes, social factors or those related to their job tasks. Successions of studies found that the theory is the best model in examining employees' acceptance of e-business technology because it

is dedicated in information technology, it is well-researched, and it is a prevailing model for inspecting the degree to which technology is accepted (Szajna, 1996).

2.2.2 Innovation Theory

Rogers (1995) developed diffusion of innovation theory. The theory examines innovations as elements that employ particular vehicles of communication at a particular time and in a specific social system (Legris, 2003). It suggests three main functions that affect the adoption and diffusion of an innovation, i.e. perceptions of innovation characteristics, characteristics of the adopter, and contextual factors. Entities are seen as retaining different degrees of inclination to adopt inventions, and thus it is normally perceived that the number of people who adopt modernism is nearly normally dispersed over intervals.

Rogers (1995), comes up with five ways of judging an innovation, i.e. relative advantage, compatibility, complexity, triability and observability. Relative advantage is the degree to which an innovation is seen as better than that which it is replacing. Relative advantage refers to the economic, social or other benefits that will be gained. Triability refers to how many times an innovation may be put to experiment. Complexity refers to the extent to which an innovation believed to be difficult to use. Compatibility refers to the innovation's ability to be in line with the values of the person adopting it. Observability envisages the how the results of an innovation can be seen by other people.

The innovation process in establishments takes different forms. It usually touches on varied classes of people i.e. those who are in favour of the idea and those who are not but who participate in the decision of adopting the innovation (Hommen, 1999). This theory has guided the study of the adoption of various information communication technologies in businesses. It however does not give with regard to the assessment of how innovations appear. It also lacks specificity (Sanson, 2004). This theory argues that innovation spreads progressively through time and people bringing about a number of adopter categories.

2.3 ICT and Supply Chain Performance

ICT is a critical enabler of effective supply chain management (Kenneth, 2012). As businesses continue to migrate to the electronic platform, opportunities keep coming up, while the use of internet is deepening the curiosity in the use of IT (Wu, 2010). ICT provides an upper hand for a number of service organizations e.g. big retailers, transportation firms like DHL and airline companies (Prajogo, 2012). In SCM, time and opportunities are very important. Accurate and timely information gives the organization an increased level of service which results in lower costs and time taken to deliver service (Bottani, 2008).

ICT has also enabled faster and easier collaboration of Supply Chain participants hence supporting easy customer interaction. Achieving high performance requires; good ICT infrastructure supported by good ICT management practice (Mwania & Muganda, 2012)

Companies can develop Web-based sites or intranets for sharing information about new products, delays or changes. ICT enables individuals concerned to be inter-linked thereby, staying updated, which proves very efficient. If conditions are altered, resulting in increased inventory levels, then changes can be adopted to scale down manufacturing. This however doesn't seem to be the case in many firms since there is often a mismatch between the digital and the physical inventories (Stinglz, 2011). This creates inaccuracy which affects performance of the firm.

2.3.1 Procurement

According to Fleischmann (2012), procurement is the process that involving operations directed towards providing raw materials and resources needed for production from external source namely a supplier. The process ensures that customers receive goods, services or works at the best possible price, when characteristics such as location, quality, time, and quantity are compared. Companies employ processes envisioned to achieve fair and open competition for their industry while bringing down risk e.g. exposure to fraud and conspiracy (Barnes, 2009).

Organizations that reduce cost of doing business do better and record faster growth. According to Waller (2009), e-procurement systems should be implemented by every business procurement. This is because e-procurement improves transparency, accountability and access openly. Elimination of activities which do not add value e.g. telephoning and postage are makes the procedure shorter and more efficient. Vine (2012),

comes up with three types of e-procurement: i.e. Enterprise Resource Planning (ERP) used in coming up and approving purchases using the web, e-tendering which displays pricing data to suppliers via the internet and e-sourcing which identifies suppliers using ICT.

Procurement is the process of making items available (Martin, 2011). In the process of sourcing however, the items need to be got at the right price, quality and quantity and have timely delivery to. For procurement to meet all these criteria, these operations must be transparent as proposed in the PPDA (2005). Silver (2013), looks at procurement as a fundamental element of SCM. Other functions are the ultimate distribution of the finished products to the customer and also transforming materials into finished goods.

2.3.2 Production Scheduling

Production refers to the procedure of joining inputs in form of material and immaterial with the aim of coming up with something that can be consumed. Giffler (2012) puts it as the coming up with output, a good or service that is valued and provides people with utility. Computer based scheduling using computers assists manufacturers to reduce the time spent on deliveries, act quickly on clients' orders, and come up with manageable schedules hence it positively influences supply chain performance (Graves, 2011).

Human decision makers are relied on in production scheduling systems and a number of them require assistance in dealing with the complex world of scheduling.

Barabasi (2008) states that in order for you to succeed, you must employ defined scheduling techniques and mix them with other manufacturing planning systems. Defined scheduling employs actual shop floor conditions, including capacity constraints and the orders already released. However, only a quarter of the firms responding to the survey used this method for their operations. He concluded that computer based scheduling can assist manufacturers to reduce the time spent on deliveries, act quickly on clients' orders, and come up with manageable schedules.

2.3.3 Collaborations

Bryson, (2011) states that collaboration entails coming up with mutual goals; commitment; trust; skills and intellectual agility. Supply chain collaboration (SCC) delivers paybacks to the chain members, as a result, it is a household topic in business (Min, 2005). Collaboration is the main driver of effective supply chain management in today's complex competition business environment.

Addul (2009) asserts that collaboration is realized in different forms, though with the same goal; i.e. creating a transparent, visible demand pattern for use in the entire supply chain. SCM underscores the significance collaborating among traders in an effort to create a competent supply chain. Collaborative relationships among partners facilitate pooling of resources and hence proficiency processes. Organizations are tending towards ICT adoption in order to share resources and thereby manage supply chains activities efficiently (Flanagan, 2013). Nevertheless, SCM has its complications. These are;

unknown customer prospects, as well as costs and effectiveness inferences. It therefore makes sense to collaborate with other suppliers in order to provide a better consumer service to their customers (Jorion, 2011). In the context of this study, parastatals in the Kenya's energy sector would realize benefits through collaboration with suppliers so that they can share information for efficiency in deliveries which in turn reduce stock-out of critical items. This will improve service delivery to customers.

2.3.4 Risk Management

Rasmussen, (2012) defines risk management as a means of recognition, analysis and economical control of risks or probability of risks which can threaten the economic income of companies. Effective risk management is a central concern for businesses as it determines their survival in a competitive environment (Williams, 2013). Therefore the supply chain risk management (SCRM) has occurred is all the more important with the major aim of detecting the prospective sources of threats and proposing appropriate exploit plans to alleviate them. Effective SCRM program development is always a precarious task and involves abilities and proficiency in multiple capacities (Barabasi, 2008).

Scholars have attempted to examine the magnitude of threats and their influence on supply chain functioning. Norman (2013) studied computable models having stratagems to bring down the risks encountered during operations by addressing the challenges of

demand, supply and product management. Vanany et al. (2009), studied the SCRM unit of analysis and risk management processes.

2.4 Conceptual Framework

The conceptual framework is a diagrammatic representation of the dependent and independent variables of a study. In this study, the dependent variable was supply chain performance. It was dependent since the performance of any supply chain system depends on the ICT adoption. The independent variable in this case is the ICT adoption that affects the performance of the supply chain.

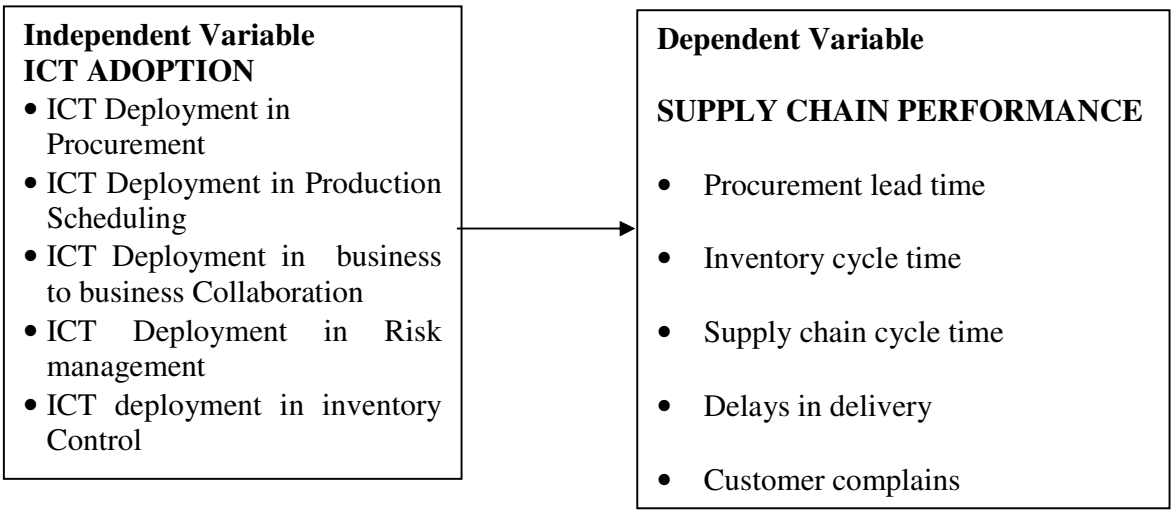

Figure 2.1: Conceptual Framework

Source: Researcher (2016)

2.5 ICT Adoption Challenges

In this constantly changing industry, third world countries do not possess enough skilled IT persons for designing, programming, installing, configuring and maintaining Information Technology. Lack of competent and globally renowned IT professionals is extremely obstructing IT adoption and expansion in most businesses in developing countries (Mathews, 2007). The prospective of ICTs have not been fully harnessed by organizations particularly in developing countries in spite of the vast profits of ICTs as a means of delivering quality customer services. This is due to difficulties of infrastructure access.

Alam (2009), argues that intra- and inter-organizational networks in some innovative countries act as a digital neural system of a firm. Alam (2009) said that communication for corporate tenacities have migrated from largely manual or physical documentary method to digital communication. Such access to ICTs has enhanced sharing of information with the larger world.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This chapter presents the research methodology used for the survey, research design, target population, data collection instrument and analysis.

3.2 Research Design

The study employed a cross sectional descriptive survey research design to establish the effects of adoption of ICT in supply chain performance of parastatals in Kenya's energy sector. Descriptive survey design was used because it allows a researcher to gather, analyze, present and interpret information for the purpose of clarification (Orodho, 2002). Mugenda and Mugenda (2003) state that descriptive survey enables the researcher to describe the characteristics of the variables of interest due to its suitability in data collection to answer the research questions. It is therefore considering that descriptive design was the most suitable for use in the study because the surveys are useful in describing the characteristics of the population.

3.3 Population of the Study

This study targeted all the nine parastatals in the Kenya's energy sector which are; Rural Electrification Authority (REA), Kenya Petroleum Refineries Limited, Kenya Electricity Generating Company Limited, Kenya Power Company, National Oil Corporation of

Kenya, Kenya Pipeline Company, Kenya Electricity Transmission Company Limited, Energy Regulatory Commission and Geothermal Development. The respondents were; ICT managers, supply chain managers, ICT support staff and procurement officers at each parastatal in the Kenya's energy sector. The target population was 36, which translate to 4 persons for each parastatal in the Kenya's energy sector.

3.4 Data Collection

Primary data was collected using semi-structured questionnaire. The questionnaire was considered most appropriate since it allow collection of data from many respondents within a short time and also provides a high degree of standardization and collection of generalized information from the population. The questionnaires were administered to the ICT managers, supply chain managers, ICT support staff and procurement officers from each parastatal in the Kenya's energy sector using a drop and pick- later method. The questions were in a Likert scale of 1 to 5 where (1 = Strongly Disagree, 2 = Disagree, 3 = Moderately Agree, 4 = Agree and 5 = Strongly Agree).

3.5 Data Analysis

The questionnaires were allocated serial numbers upon receipt to facilitate statistical analysis. The collected data was analysed using descriptive statistics to achieve the objectives of the study. The research yield both qualitative and quantitative data. Data collected was analyzed using SPSS version 20. It was presented using frequencies and percentages.

A regression analysis was conducted using a multiple regression as follows;

Multiple Regression: $Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \varepsilon$

Where;

Y = Supply Chain Performance

$\beta 0$= Constant Term;

Coefficients of respective ICT adoption, X_1= Procurement, X_2= Production Scheduling, X_3= Collaborations, X_4= Risk Management and ε = Error Term.

CHAPTER FOUR

DATA ANALYSIS, PRESENTATION AND INTERPRETATION

4.1 Introduction

The research objective was to establish effects of ICT adoption on supply chain performance of parastatals in the Kenya's energy sector. This chapter presents analysis, findings and discussion of the findings.

4.1.1 Response Rate

The study targeted 36 respondents where each of the nine parastatals would provide four respondents from ICT Management, Supply Chain Management, Procurement officers and ICT support staff. Out of the 36 targeted respondents, only 29 responded, making a response rate of 80.6%. This response rate was considered satisfactory for the analysis, in conformity with Mugenda and Mugenda (1999), 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.

Table 4. 1: Response Rate

	Questionnaires Administered	Questionnaires filled & Returned	Percent
Respondents	36	29	80.6

4.2 Demographic Information of the Respondent

In an effort to find out the suitability of the study respondents, their demographic information was captured as shown below.

4.2.1 Distribution of the Respondent by Designation/Position

The study sought to establish positions the respondent held in energy sector parastatals in Kenya. The respondents were asked to indicate their position and Table 4.2 shows the results.

Table 4. 2: Distribution of the Respondent by Designation/Position

Designation	Frequency	Percent
ICT Manager	9	31.0
Supply Chain Manager	7	24.1
ICT support staff	8	27.6
Procurement Officer	5	17.2
Total	29	100.0

From the finding most (31%) of respondents were working as a ICT Managers, 27.6% ICT support staff, 24.1% Supply Chain Manager and 17.2% Procurement Officer. This intimates that the data was fairly collected from each office.

4.2.2 Distribution of Respondents by Gender

The study sought to establish the gender category of the respondents. This was done in view of ensuring fair engagement of respondents in terms of their gender. Results are show in Table 4.3

Table 4. 3: Distribution of Respondents by Gender

Gender	Frequency	Percent
Male	17	58.6
Female	12	41.4
Total	29	100.0

From the research results, the study noted that majority of the respondents as shown by 58.62% were males whereas 41.38% females. This shows that the respondents of this study were mainly dominated by male gender.

4.2.3 Highest Level of Education Attained by Respondents

The respondents were asked to indicate their level of education. The responses were as shown on Table 4.4.

Table 4. 4: Highest Level of Education Attained by Respondents

Level of Education	Frequency	Percent
Certificate	0	0.0
College Diploma	4	13.8
Undergraduate level	11	37.9
Master	14	48.3
other	0	0.0
Total	29	100.0

On respondents' level of education attained, the study revealed that majority of the respondents as shown by 48.3% had attained a master's degree whereas, 37.9% of the respondents had attained undergraduate degrees and 13.8 % of the respondents had attainedcollege's diplomas. This implies that respondents were well educated and therefore were suitable study respondents.

4.2.4 Period of time the Respondent has Worked in the Parastatal

This study sought to find out the duration of time that an individual had worked in the company. The findings are shown in Table 4.5.

Table 4. 5: Period of Time the Respondent has worked for the parastatal

Period of Service	Frequency	Percent
Below 5 Years	2	7.0
5 – 10 Years	5	17.2
10 – 15 Years	13	44.8
Above 15 Years	9	31.0
Total	29	100.0

On period the respondent has worked in the parastatal, the study revealed that majority of the respondents at 44.83% had served in their respective parastatals for a period of between 10 and 15 years, followed by those who had served for more than 15 years at 31.03% while 17.24% of the respondents had served in their parastatals for a period of 5 to 10 years. Least of the of the respondents indicated to have served in the parastatal for a

period of less than 5 years at 7%. This showed that majority of the respondents had served for a considerable period of time in their respective parastatals. This suggested that they were in a position to give reliable information relating to this study.

4.2.5 Period the Parastatal has been in Operation

The research sought to establish the period of time the parastatals have been in operation. Table 4.6 shows the results.

Table 4. 6: Period the Parastatal has been in Operation

Period of existence	Frequency	Percent
Below 5 Years	0	0.0
5 – 15 years	3	10.4
15– 25 years	15	51.7
Above 25 Years	11	37.9
Total	29	100.0

From Table 4.6, the result shows that 37.9% of the respondent indicated that parastatals had been in operation for more than 25 years, Majority (51.7%) indicated 15-25 years and 10.4% indicated 5-15 years whereas no respondent indicated that the parastatal existed for a period below 5 years. This shows that most of the parastatals have been in existed for a good Period of time hence reliable for correct and accurate information.

4.3 Effects of Adoption of ICT

The researcher sought to establish effects of information communication technology adoption and supply chain performance in parastatals of the energy sector in Kenya. The respondents were asked to rate the statement in table 4.7 using a scale of 1-5, where 5= strongly agree; 4=Agree; 3=Neutral; 2= Disagree; 1=strongly Disagree. The average mean and standard deviations are shown in Table 4.7.

Table 4. 7: Effects of Information and Communication Technology Adoption

Effects of Adoption of ICT	Strongly Disagree (%)	Disagree (%)	Neutral (%)	Agree (%)	Strongly Agree (%)	Mean	Std. Deviation
ICT Deployment in Procurement							
E-Tendering application promotes information access to potential bidders.	13	8.5	27.6	31.8	19.1	4.17	1.07
E-payment application enables suppliers to receive payments in real time	13.6	12.5	19.9	38	16	4.03	1.13
E-Ordering application ensures accuracy of information during ordering	23.2	14.3	21.3	25.5	15.7	3.91	1.08
E-evaluation ensures that all bids are given same consideration since evaluation criteria is applied uniformly.	34	16.5	16.5	24.9	8.1	3.89	.93
E-awarding application enhances transparency and allows customers to access wide range of market information	16.4	22.3	24.7	27.2	9.4	4.06	1.09
ICT Deployment in Production Scheduling							
Enables a more accurate material planning for production activities.	15.7	12.2	20.2	39	12.9	3.77	0.88
Ensures that quality of products is monitored and controlled	16.4	13.2	17.1	29.3	24	3.83	0.94

Effects of Adoption of ICT	Strongly Disagree (%)	Disagree (%)	Neutral (%)	Agree (%)	Strongly Agree (%)	Mean	Std. Deviation
Ensures that production errors are minimized.	15.7	13.9	20.2	35.9	14.3	4.12	1.00
Promotes smooth flow of information from production floor to raw material storage and forward flow of material to the production floor	11.2	17.1	25.4	34.5	11.8	4.11	0.76
Ensures that over-production and under-production is mitigated by mapping material requirement to production planning to product storage.	12.9	15.7	12.2	20.2	39	4.12	1.00
ICT Deployment in Business to Business Collaborations							
Helps in tracking inventory movement from the supplier to the store.	18.8	4.2	17.1	25.4	34.5	4.17	0.93
Helps in tracking inventory movement from the supplier to the store.	33.7	3.5	11.5	21.3	30	3.90	0.59
Helps to create a transparent supply chain	35.5	2.8	9.4	15	37.3	3.86	1.13
Creates a visible demand pattern	15	13.9	22	33.4	15.7	3.97	0.91
Promotes information sharing	11.9	16.7	18.8	33.4	19.2	3.86	1.12
Promotes business to business relationships through resource pooling	18.8	4.2	17.1	25.4	34.5	4.14	0.69
ICT Deployment in Risk Management							
Helps monitoring operations and strategic processes	15.4	12.2	20.2	34.1	18.1	3.79	0.82

Effects of Adoption of ICT	Strongly Disagree (%)	Disagree (%)	Neutral (%)	Agree (%)	Strongly Agree (%)	Mean	Std. Deviation
Deployment of ICT in movement of items ensures that items are tracked to avoid loss in transit.	16.4	12.2	22.3	36.9	12.2	4.17	0.89
Deployment of ICT assists in identifying skills gap for training of staff to minimize cost.	16.8	15.3	25.4	31.4	11.1	4.21	0.86
ICT deployment ensures that expiry date of products is identified and necessary action is taken to avoid loss	20.2	23.3	21.3	24.4	10.8	3.86	1.06
ICT deployment assist in identifying areas which require extra knowledge thus promotes research and development	32.1	15.3	21.6	20.2	10.8	3.93	0.96
ICT deployment minimizes the risk of stock outs and overstocking of items.	29.6	17.8	17.8	22.3	12.5	3.76	0.95

From the finding, most of the respondents agreed that; E-Tendering application promotes information access to potential bidders (M=4.17,SD=1.07); E-payment application enables suppliers to receive payments in real time (M=4.03, SD=1.13); E-Ordering application ensures accuracy of information during ordering (M=3.91, SD=1.08); E-evaluation ensures that all bids are given same consideration since evaluation criteria is applied uniformly (M=3.89, SD=93) and E-awarding application enhances transparency and allows customers to access wide range of market information (M=4.06, SD=1.09).

On ICT Deployment in Production Scheduling the respondent agreed that; The ICT promotes a more accurate material planning for production activities (M=3.77, SD=0.88); ICT ensures that Ensures that quality of products is monitored and controlled (M=3.83, SD=0.94), ICT Ensures that production errors are minimized(M=4.12, SD=1.00), It promotes smooth flow of information from production floor to raw material storage and forward flow of material to the production floor (M=4.11, SD=0.76) and ICT ensures that over-production and under-production is mitigated (M=4.12, SD=1.00).

Further majority of the respondents agreed that ICT Deployment in business to business Collaborations; helps in tracking inventory movement as shown by a mean of 4.17, helps to create a transparent supply chain (M=3.86, SD=1.13), creates a visible demand pattern (M=3.97, SD=0.91), ICT promotes resource sharing (M=3.86, SD=1.12), Promotes relationships which enables resource pooling (M=3.86, SD=1.12) and ICT helps in providing better customer service as shown by a mean of 4.14.

On ICT Deployment in Risk Management, majority of the respondents agreed that the ICT Deployment in Risk Management; helps monitoring operations and strategic processes as shown by a mean of 3.79, Ensures safety of goods on transit as shown by a mean of 4.17, Advises on training of staff (M=4.21, SD=0.86), Ensures that expiry date is managed (M=3.86, SD=1.06), Promotes research and development (M=3.93, SD=0.96) and ICT helps in access to new markets was shown by a mean of 3.76.

4.4 ICT Adoption Challenges

The study sought to establish the challenges faced energy sector parastatals in Kenya. The respondents were asked to rate the statement in table 4.9 using a scale of 1-5, where 5= strongly agree; 4=Agree; 3=Neutral; 2= Disagree; 1=strongly Disagree. The average mean and standard deviations are shown in Table 4.9.

Table 4. 8: ICT Adoption Challenges

Challenges	Strongly Disagree (%)	Disagree (%)	Neutral (%)	Agree (%)	Strongly Agree (%)	Mean	Std. deviation
Implementation of ICT faces resistance to change by staff that is not ready to adapt to a new way of doing things.	19.5	6.3	22.3	24.7	27.2	4.24	0.95
Implementation of ICT encounter lacks support from the top management who consider the associated changes with unnecessary cost	25.2	5.2	11.8	23.7	34.1	4.00	0.96
Low quality of training to staff contribute to low appetite to adoption of ICT	19.2	9.4	12.2	20.2	39	3.86	0.79
The high cost of initial investment of ICT infrastructure negatively affect deployment of ICT in my parastatal	34.1	6.3	13.2	17.1	29.3	3.76	0.74
Poor management of transfer of operations from manual to ICT platform contributes to low success rate of ICT adoption	23	7	13.9	20.2	35.9	4.31	0.66
Poor ICT infrastructure access e.g. internet connectivity inhibits effective implementation of ICT systems	14.3	15.7	13.9	20.2	35.9	4.28	0.79

From the finding majority of the respondents agreed with the above challenges that ICT adoption challenges; are caused by inability of staff to adapt to change (M=4.24, SD=0.95), are caused by lacks support from the top management (M=4.00, SD=0.96) and are promoted by the limited quality of training to staff (M=3.86, SD=0.79). Further the respondents agreed that high cost of initial investment of ICT infrastructure is a challenge (M=3.76, SD=0.74), challenges are contributed by poor management of transfer of operations from manual to ICT platform (M=4.31, SD=0.66) and challenges are contributed by poor ICT infrastructure access (M=4.28, SD=0.79). This is in line with (Mathews, 2007) who posits that in most businesses in the developing countries adopting and developing ICT is being limited by shortage of professional IT workforce.

4.5 Regression Analysis

A regression analysis was applied to identify the effects of information communication technology adoption and supply chain performance in parastatals of the energy sector in Kenya. The study used the following equation.

$Y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \beta_4 x_4 + \varepsilon;$

Where Y= Supply Chain Performance, β_0=the constant of regression, β_1, β_2, β_3 and β_4 = are the regression coefficients

x_1= Procurement, x_2= Production Scheduling, x_3= Collaborations, x_4= Risk Management and ε = error term.

Table 4. 9: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.904[a]	.817	.786	.02339

a. Predictors: (Constant), Risk Management, Collaborations, Procurement, Production Scheduling

The four independent variables that were studied explain 81.7% of the information communication technology adoption effect on the SCP as represented by R Squared (Coefficient of determinant). This therefore means that other factors not studied in this research contribute 18.3% in influencing SCP. The results of this study concur with Davis (1989) who found that ICT in Risk Management play a significant role in SCP.

Table 4. 10 ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	.059	4	.015	26.755	.000[b]
	Residual	.013	24	.001		
	Total	.072	28			

a. Dependent Variable: Supply Chain Performance

b. Predictors: Risk Management, Collaborations, Procurement, Production Scheduling

The study used ANOVA to establish the significance of the regression model from which an f-significance value of p less than 0.05 was established ($p=0.000<0.05$). The model is statistically significant in predicting how ICT in; Procurement, Production Scheduling,

Collaborations and Risk Management affect SCP. This therefore means that the regression model has a confidence level of above 95% it is reliable. Using the F-test statistic, the sample F value had a value of 26.755 with a critical f value at $\alpha = 0.05$, 5 degrees of freedom for the numerator and 23 degrees of freedom for the denominator; this implies that the regression model is statistically significant since 26.755 >4.75. According to (Beamon, 2009) this is model can be used for estimating purposes.

Table 4. 11: Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	Procurement	.311	.092	.368	3.384	.002
	Production Scheduling	.298	.096	.350	3.120	.005
	Collaborations	.140	.056	.292	2.518	.019
	Risk Management	.124	.056	.231	2.225	.036

a. Dependent Variable: Supply Chain Performance

The established regression equation was

$$Y = 0.311X_1 + 0.298X_2 + 0.140X_3 + 0.124X_4$$

Therefore, holding all the independent variable (Procurement, Production Scheduling, Collaborations and Risk Management) constant, other factors influencing supply chain performance will be 0.499. The findings also shows that taking all other independent variables at zero, a unit raise in information communication technology adoption in procurement will lead to a 0.311 raise in the scores of the SCP. A unit raise in

information communication technology adoption in Production Scheduling will lead to a 0.298raise in SCP. On the other hand, a unit raise in information communication technology adoption in business to business Collaborations will lead to a 0.140raise in SCP and unit raise in information communication technology adoption in Risk Management will lead to a 0.124 raise in the SCP. This infers that information communication technology adoption in procurement influences the Supply Chain Performance most followed by Production Scheduling, Collaborations and Risk Management.

The study also established a significant relationship between the Supply Chain Performance and Procurement Production Scheduling, Risk Management and Collaborations. The regression coefficients were tested for significance at alfa=0.05. Significance occurs at p-values less than 0.05. From the above results, all the predictors are good for the supply chain performance. These findings were consistent with that of Waller (2009) who found out that Supply Chain Performance is dependent on ICT adoption on business to business collaboration.

4.6 Discussion of the Findings

The study established that the information communication technology deployment in procurement has a great effect on supply chain performance in parastatals of the energy sector in Kenya. The study established that E-Tendering application promotes information access to potential bidders and E-payment application enables suppliers to

receive payments in real time. Further the study established that E-Ordering application ensures accuracy of information during ordering and E-evaluation ensures that all bids are given same consideration since evaluation criteria is applied uniformly. It was also established that E-awarding application enhances transparency and allows customers to access wide range of market information. These findings were in line with (Barnes, 2009) who found that procurement is meant to facilitate sourcing of items and business procurement strive to implement e-procurement systems. Further the prediction by regression model indicated that taking all other independent variables at zero, a unit raise in information communication technology adoption in procurement lead to a raise in the scores of the Supply Chain Performance. The study also established a strong positive correlation coefficient between information communication technology adoption in procurement and Supply Chain Performance, as shown by correlation factor of 0.725.

Further the study revealed that ICT deployment in product scheduling promotes; accurate material planning for production activities (M=3.77, SD=0.88), reduction in time wastage and smooth flow of information from production floor to raw material storage and forward flow of material to the production floor (M=4.11, SD=0.76). This finding concurs with that of (Giffler, 2012) that production schedule identifies where resources may conflict, ensures timely order of necessary, ensures that deliveries are made on time and identify the time necessary for maintenance to prevent delays. The study also revealed that ICT deployment in product scheduling ensures that; quality management is

effective in production process and over-production and under-production is mitigated (M=4.12, SD=1.00). According to (Graves, 2011) computer based scheduling using computers assists manufacturers to reduce the time spent on deliveries, act quickly on clients' orders, and come up with manageable schedules hence it has a positive relationship with supply chain performance. This finding concur with this study that there exists a strong positive correlation between Supply Chain Performance and information communication technology adoption in Production Scheduling. The regression model also predicted a unit increase in information communication technology adoption in Production Scheduling lead to 0.356 increase in the scores of the Supply Chain Performance.

The study established that ICT Deployment in business to business Collaborations helps in; tracking inventory movement and creating a transparent supply chain. It also promotes resource sharing and creates a visible demand pattern. This study is line with (Bryson, 2011) that any supply chain management effort must include working with others. The study further established a strong positive correlation between Supply Chain Performance and information communication technology adoption in business to business Collaborations. Prediction from regression indicated that a unit increase in ICT adoption in business to business Collaborations lead to increase in Supply Chain Performance.

On deployment of ICT in Risk Management, the study established that ICT helps in monitoring operations and strategic processes as well as accessing new markets. It also

ensures that goods on transit are safe (M=4.17, SD=.89) and expiry date are managed. ICT also Promotes research and development. These findings conform to that of (Williams, 2013) that developing an effective supply chain risk management calls for expertise in a number of areas. Further the study revealed that a unit increase in ICT adoption in Risk Management lead to a 0.140 increase in the Supply Chain Performance in parastatals of the energy sector in Kenya. The study also revealed a strong correlation between ICT adoption in Risk Management and Supply Chain Performance in parastatals of energy sector in Kenya.

Finally the study established that ICT adoption challenges are caused by; inability of staff to adapt to change (M=4.24, SD=0.95), lacks support from the top management (M=4.00, SD=0.96) and the limited quality of training to staff (M=3.86, SD=0.79). Further the study noted that high cost of initial investment of ICT infrastructure is also a challenge. Finally the study noted that ICT adoption challenges are contributed by poor management of transfer of operations from manual to ICT platform and also poor ICT infrastructure. This conforms to findings by (Mathews, 2007) view that lack of competent and globally renowned IT professionals is extremely obstructing IT adoption and expansion in most businesses in developing countries.

CHAPTER FIVE

SUMMARY OF FINDINGS CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

This chapter presents the summary of the study findings, conclusions and recommendations. The chapter is structured into the following sub-headings:

5.2 Summary of findings

The study investigated the effect of ICT adoption and supply chain performance of the energy sector parastatals in Kenya, the study revealed that information communication technology deployment in procurement has a great effect on supply chain performance in parastatals of the energy sector in Kenya. It further established that E-Tendering application increase competitiveness in bidding, E-payment application improves supply relationship and E-Ordering application increases efficiency of product delivery. E-awarding application is found to increase efficiency and transparency in awarding of tenders and E-business application promotes flow of information which enhances sourcing. The study also established that an increase in ICT adoption level in procurement lead to a corresponding increase in the scores of the Supply Chain Performance. It also established a strong positive relationship between information communication technology adoption in procurement and Supply Chain Performance.

Further, ICT deployment in product scheduling promotes; accurate material planning for production activities, reduction in time wastage and smooth flow of information from production floor to raw material storage and forward flow of material to the production floor. Also ICT deployment in product scheduling ensures that; quality management is effective in production process and over-production and under-production is mitigated. Further it is noted that a unit increase in ICT adoption in Production Scheduling leads to an increase in the scores of the Supply Chain Performance. A strong relationship between Supply Chain Performance and Production Scheduling was established.

ICT Deployment in business to business Collaborations has helped in; tracking inventory movement and creating a transparent supply chain, also it promotes resource sharing and creates a visible demand pattern. The study further has established a strong relationship between Supply Chain Performance and ICT adoption in business to business Collaborations. A unit increase in ICT adoption in business to business Collaborations leads to increase in Supply Chain Performance.

Study revealed that ICT helps in monitoring operations and strategic processes as well as accessing new markets. It also ensures goods on transit are safe and expiry date are well managed. A unit increase in ICT adoption in Risk Management is found to result to an increase in the Supply Chain Performance in parastatals in the Kenya's energy sector. Strong relationship between ICT adoption in Risk Management and Supply Chain Performance in these parastatals is also established.

Finally the study has established that ICT adoption challenges are caused by; inability of staff to adapt to change, lacks support from the top management and the limited quality of training to staff. Further ICT adoption challenges are contributed by poor management of transfer of operations from manual to ICT platform, poor ICT infrastructure and high cost of initial investment of ICT infrastructure.

5.3 Conclusion

The study concluded that best-value procurement ICT deployment in procurement has a great effect on supply chain performance of in parastatals of the energy sector in Kenya. E-Tendering, application E-payment application, E-Ordering application, E-awarding application and E-business application has improved the supply chain performance in the parastatals in the Kenya's energy sector. There is a strong positive relationship between information communication technology adoption in procurement and Supply Chain Performance.

Further the study concludes that product scheduling promotes; accurate material planning for production activities, reduction in time wastage and smooth flow of information from production floor to raw material storage and forward flow of material to the production floor. It also ensures that; quality management is effective in production process and over-production and under-production is mitigated. Further the study concludes that a unit increase in ICT adoption in Production Scheduling leads to an increase in the scores

of the Supply Chain Performance and strong relationship between Supply Chain Performance and Production Scheduling exist.

The study also concludes that ICT in business to business Collaborations helps in tracking inventory movement and creating a transparent supply chain and also it promotes resource sharing and creates a visible demand pattern. There is a strong relationship between Supply Chain Performance and ICT adoption in business to business Collaborations.

The study finally concludes that ICT helps in monitoring operations and strategic processes as well as accessing new markets. It also ensures safety of goods on transit and it manages expiry. A unit increase in ICT adoption in Risk Management increase in the Supply Chain Performance in parastatals of the Kenya's energy sector. There exists a strong correlation between ICT adoption in Risk Management and Supply Chain performance of in the parastatals.

5.4 Recommendations

From the study findings it was concluded that information communication technology deployment in procurement has a great effect on supply chain Performance of in parastatals in the energy sector, therefore study recommends that ICT deployment in procurement should be highly observed in Kenya's energy sector parastatals.

The study finds strong support for the argument that ICT deployment in product scheduling has a positive effect on organizational performance, therefore the study

recommends that the deployment of ICT in product scheduling policies should be well outlined to enhance transparency.

Since the study found that ICT adoption challenges are caused by; inability of staff to adapt to change, lacks support from the top management and the limited quality of training to staff. The study recommends more training to the staffs and also top management to be responsible and support ICT adoption.

Lastly since the study has established a strong relationship between ICT adoption and supply chain Performance of parastatals in the Kenya's energy sector. The management should now focus ICT adoption and budget more funds for ICT adoption.

5.5 Limitations of the Study

The study findings were applicable to parastatals in the Kenya's energy sector only. The findings can therefore not be generalized to all organizations in the world without considering the private energy sector. Inadequate time and finances were not enough to exhaust the study of all the effects of information communication technology adoption and supply chain performance of parastatals in the Kenya's energy sector.

5.6 Recommendation for Further Research

A similar study could be replicated to a larger sample including more people from each county to enable comparisons of results and establish more variables of ICT adoption that may affect the Supply Chain Performance among parastatals of the energy sector in

Kenya. A study could be done also to establish the challenges faced by private entities of the energy sector in Kenya. More extension of the study could be done to establish the other underlying variables affecting supply chain performance of parastatals in Kenya's energy sector.

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APPENDIX I: QUESTIONNAIRE

SECTION A: DEMOGRAPHIC INFORMATION

1. Gender

   Male [ ] Female [ ]

2. Position/Designation of the respondent

   ICT Manager [ ] Supply Chain Manager [ ]

   ICT support staff [ ] Procurement Officer [ ]

3. Please indicate the highest level of education attained? (Tick as applicable)

   Certificate [ ]

   College Diploma [ ]

   Undergraduate [ ]

   Master [ ]

   Others (specify) ……...

4. Indicate your period of service in this Company

   Below 5 years [ ] 5 to 10 years [ ]

   10 to 15 years [ ] above 15 years [ ]

5. How long has this Company been in existence?*(Tick where appropriate)*

   Below 5 years [ ]

   5 – 15 years [ ]

   15– 25 years [ ]

   Above 25 Years [ ]

Section B: Effects of Adoption of ICT

6. Indicate your level of agreement with the following statements relating to deployment of ICT in supply chain. Key Use a scale of 1-5, where (1= strongly disagree, 2= disagree, 3= moderately agree, 4= Agree and 5= strongly Agree)

Deployment of ICT in Procurement in my parastatal	**1**	**2**	**3**	**4**	**5**
E-Tendering application promotes information access to potential bidders.					
E-payment application enables suppliers to receive payments in real time.					
E-Ordering application ensures accuracy of information during ordering.					
E-evaluation ensures that all bids are given same consideration since evaluation criteria is applied uniformly.					
E-awarding application enhances transparency.					
E-business application allows customers to access wide range of market information					

7. To what extent do you agree with the following statements on production scheduling? Use a scale of 1-5, where (1= strongly disagree, 2= disagree, 3= moderately agree, 4= Agree and 5= strongly Agree)

Adoption of ICT in Production Scheduling in my parastatal	**1**	**2**	**3**	**4**	**5**
Enables a more accurate material planning for production activities.					

Ensures that quality of products is monitored and controlled					
Ensures that production errors are minimized.					
Promotes smooth flow of information from production floor to raw material storage and forward flow of material to the production.					
Ensures that over-production and under-production is mitigated by mapping material requirement to production planning to product storage.					

8. To what extent do you agree with the following statements on collaborations? Use a scale of 1-5, where (1= strongly disagree, 2= disagree, 3= moderately agree, 4= Agree and 5= strongly Agree)

Deployment of ICT in business to business Collaborations in my parastatal.	**1**	**2**	**3**	**4**	**5**
Helps in tracking inventory movement from the supplier to the store.					
Helps to create a transparent supply chain					
Creates a visible demand pattern					
Promotes information sharing					
Promotes business to business relationships through resource pooling					

9. To what extent do you agree with the following statements on Risk management? Use a scale of 1-5, where (1= strongly disagree, 2= disagree, 3= moderately agree, 4= Agree and 5= strongly Agree)

ICT Deployment in Risk Management in my parastatal	**1**	**2**	**3**	**4**	**5**
ICT helps monitoring operations and strategic processes					
Deployment of ICT in movement of items ensures that items are tracked to avoid loss in transit.					
Deployment of ICT assist in identifying skills gap for training of staff to minimize cost.					
ICT deployment ensures that expiry date of products is identified and necessary action is taken to avoid loss.					
ICT deployment assist in identifying areas which require extra knowledge thus promotes research and development					
ICT deployment minimizes the risk of stock outs and overstocking of items.					

10. To what extent do you agree with the following statements on ICT adoption in supply chain? Use a scale of 1-5, where (1= strongly disagree, 2= disagree, 3= moderately agree, 4= Agree and 5= strongly Agree)

ICT adoption in supply chain in my parastatal	**1**	**2**	**3**	**4**	**5**
Deployment of ICT facilitates efficient procurement of items					
Implementation of ICT systems in inventory management curtails overstocking and shortages.					
ICT adoption in supply chain creates a transparent, visible demand pattern in the entire supply chain					
ICT adoption in supply chain enhances decision making between supplier and my entity through sharing of information					
Deployment of ICT in transportation of goods ensures that the most economical routes are used to make deliveries.					

11. To what extent do you agree with the following statements on ICT adoption challenges? Use a scale of 1-5, where (1= strongly disagree, 2= disagree, 3= moderately agree, 4= Agree and 5= strongly Agree)

The following challenges are associated with adoption of ICT in my parastatal	**1**	**2**	**3**	**4**	**5**
Implementation of ICT faces resistance to change by staff that is not ready to adapt to a new way of doing things.					
Implementation of ICT encounter lacks support from the top management who consider the associated changes with unnecessary cost					
Low quality of training to staff contribute to low appetite to adoption of ICT					
The high cost of initial investment of ICT infrastructure negatively affect deployment of ICT in my parastatal					
Poor management of transfer of operations from manual to ICT platform contributes to low success rate of ICT adoption					
Poor ICT infrastructure access e.g. internet connectivity inhibits effective implementation of ICT systems					
Adoption of ICT is negatively affected by lack of affordable connectivity and bandwidth					

THANK YOU FOR YOUR TIME

APPENDIX II: LIST OF PARASTATALS IN THE KENYA'S ENERGY SECTOR

1. Rural Electrification Authority
2. Kenya Petroleum Refineries Limited
3. Kenya Electricity Generating Company Limited
4. Kenya Power Company
5. National Oil Corporation of Kenya
6. Kenya Pipeline Company
7. Kenya Electricity Transmission Company Limited
8. Energy Regulatory Commission
9. Geothermal Development.