EFFECT OF INFORMATION AND COMMUNICATION TECHNOLOGY ON PROCUREMENT PERFORMANCE OF ENERGY SECTOR STATE CORPORATIONS IN KENYA

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Effect of Information and Communication Technology on Procurement Performance in Energy Sector State Corporations in Kenya

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DECLARATION

This theses is my original work and has not been presented for a degree in any other University.

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To Frank and our Children - Zawadi, Amani and Baraka

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LIST OF ABBREVIATIONS/ACRONYMS

EACC	Ethics and Anti-Corruption Commission
EPRA	Energy and Petroleum Regulatory Authority
ERC	Energy Regulatory Commission
ERP	Enterprise Resource Planning
GDC	Geothermal Development Company
GDP	Gross Domestic Product
ICT	Information Communication Technology
IFMIS	Integrated Financial Management Information System
IIS	Integrated Information Systems
IT	Information Technology
KENGEN	Kenya Electricity Generating Company Limited
KETRACO	Kenya Electricity Transmission Company Limited
KPC	Kenya Pipeline Company Limited
KPLC	Kenya Power and Lighting Company Ltd
MoE	Ministry of Energy
PPAD	Public procurement and disposal act
PPOA	Public Procurement Oversight Authority

REA	Rural Electrification Authority
RoK	Republic of Kenya
SCM	Supply Chain Management
TAM	Technology Acceptance Model
TOE	Technology-Organization-Environment Theory
TPB	Theory of Planned Behavior
TRA	Theory of Reasoned Action
UK	United Kingdom
UNOPS	United Nations Office of Proposals Services

OPERATIONAL DEFINITION OF TERMS

Application software This refers to computer programme that allow users to perform specific tasks. Use of application software in procurement processes enhances the efficiency and transparency of the process (Caldwell, Roehrich & Davies, 2009).

Communication Technology This refers to technologies that are used to communicate information which includes emails, telephone, mobile devices, video conferencing among other communication media (Dewett & Jones, 2005).

Electronic Procurement Technical Support staff This refers to specialized skill personnel who provide assistance to procurement users of the ICT products and services with the aim of helping them resolve specific problems with the technology (Resta, 2002).

Enterprise Resource Planning (ERP) This refers to solutions that are integrated to the business processes and firms functions (Al - Mashari et al., 2003).

E-Procurement This refers to the internet-based system used to carry out individual or all stages of procurement process, including search, sourcing, negotiation, ordering, receipt and post-purchase review (Croom & Brandon, 2005).

Information and Communication technology (ICT) This refers to any technology used to support information gathering, processing, distribution and use' (Beckinsale & Ram, 2006).

Information Technology	This refers to technologies that are used to capture, process, store and retrieve data (Sarosa & Zowghi, 2003).
Procurement performance	Process through which the efficiency, effectiveness, transparency and quality of products is quantified. It measures how well a firm's procurement function achieves set goals and objectives (Sabiiti, Muhumuza & Basheka, 2011).
Procurement	This refers to the process of acquiring goods, works and services, covering both acquisitions from third parties and from in-house providers. The process spans the whole life cycle from identification of needs, through to the end of the useful life of an asset (Lysons & Farrington, 2012).
Public Procurement	Public procurement is concerned with how public sector organizations spend tax payers' money on goods and services (Hall, 2009).
Purchasing	This is the process of ordering and receiving goods and services. It is a subset of the wider procurement process (Cavinato, 2004).
Quality	The quality of a product (article or service) is it's the ability to satisfy the needs and expectation of customers (Kotler & Keller, 2009).
State Corporation	This is the nationalized corporation which is publicly owned by the state or government. It's a legal entity created by the government to undertake commercial

	activities with a view to develop and indigenize its economy. In Kenya, such organizations are controlled by the state corporations act chapter 446 of the laws of Kenya (Rok, 2009).
Technology policy	Technology policy concerns the "public means for nurturing those capabilities and optimizing their applications in the service of national goals and interests". They are designed to guide organizational and individual behaviour and decision-making (Branscomb, 1997).
Tendering	It’s a procurement procedure whereby potential suppliers are invited to make a firm and unequivocal offer of the price (McGeorge & Adams, 2003).
Transparency	Transparency in public procurement refers to the access to key procurement information by Civil Society, Media and other Stakeholders (UNDP, 2010).

ABSTRACT

Nowadays, there is increasing emphasis on ICT utilization in procurement for enhancing transactional activities with the aim of gaining operational efficiency. With the use of ICT, these activities have been simplified and speeded up greatly. ICT has been embraced by various governments to improve the quality of public service, increase access to information by the public and energize more participation in civic affairs. The general objective of this study was to examine the effect of ICT on procurement performance in the energy sector state corporations in Kenya. The study intended to determine the effects of communication technology, application soft-wares, information technology, electronic procurement policy and electronic procurement technical support staff on procurement performance in the energy sector state corporations in Kenya. The study adopted an exploratory approach using descriptive survey design and correlational design. The target population comprised 360 procurement staff and 25 electronic procurement technical support staff from 9 Energy Sector state corporations in Kenya. The sample size consisted of 211 respondents who included procurement and electronic procurement technical support staff. Simple random sampling technique was used to select the procurement staff whereas census sampling technique was used to select the electronic procurement technical support staff. Questionnaire was the key instrument of data collection used. A pilot study was undertaken to pretest the questionnaires for reliability using cronbach alpha. The study generated both qualitative and quantitative data which were collected using likert scales. Qualitative data were analysed using content analysis while quantitative data was analysed with the help of Statistical Package for Social Sciences (SPSS) version 21. This helped in generating both descriptive and inferential statistics. Quantitative data were presented in tables, charts and graphs. Out of the 211 employees that were targeted in various energy sector state corporations, 189 responses were received as valid resulting in a response rate of 89.6%. Normality test was done for dependent variable in order to aid subsequent analysis. Factor analysis was also done to reduce the data to meaningful size. Correlation analysis was used to test the direction of relationship between the independent variables and dependent variable. Multiple regression was used to test whether communication technology, application software, information technology, electronic procurement policy and electronic technical support staff have any effect on procurement performance. The study findings indicated that communication technology, application softwares, information technology, electronic procurement policy and electronic procurement technical support staff contribute positively to procurement performance. It was therefore concluded that there is a positive significant relationship between ICT and procurement performance. The findings of the study indicate that ICT is a significant area that organisations should consider in their bid to improve procurement performance. The study recommends regular training of ICT technical support staff, alignment of electronic procurement policies with current procurement practices, implementation of Contract management software and spend analysis software.

CHAPTER ONE

INTRODUCTION

1.1 Background of the Study

The global, regional and local perspective of ICT and procurement performance has been presented in this chapter together with a brief introduction of the energy sector in Kenya. There is interest among governments across the world in the use of ICT for the purpose of promoting better service delivery (Ndou, 2004), greater transparency and improved accountability (Bertot et al., 2010; Kim et al., 2009). Over the last few years, the internet has evolved from being a scientific network only, to a platform that is enabling a new generation of business (Jeyaraj, Rottman & Laicity, 2006). Procurement systems and business to business (B2B) electronic markets are perceived as a new procurement channel enabled by the internet and new technologies of the World Wide Web (Dai & Kaufmann, 2000). The World-Wide network has become a source of information, goods and services thus making adoption of these technologies of great significance to the success of many organizations. Organizations can improve their responsiveness and flexibility and consequently their competitiveness by using ICT (Huang & Lin, 2010; Verissimo, 2009; Bailey & Francis, 2008; Gunasekaran & Ngai, 2004).

Governments of both developed and developing countries have embraced ICT to improve the quality of public service, increase access of information by the public and to energize more participation in civic affairs. Most developed countries have realized the importance of the ICT application in procurement practices as a way of revamping service delivery and guaranteeing effective supply chain performance. Kabaj (2010) contends that an efficient public procurement system is vital to the advancement of African countries economies and is a concrete expression of their national commitment to making the best possible use of public resources. A report by the United Nations Conference on Trade and Development (UNCTD) (2008) pointed out that successful utilization of ICT in the procurement process in firms resulted in approximately 30% savings and curtailment of transaction costs by up to 25%. Use of ICT in procurement processes allows more efficient integration of supply chains and provides better organization and tracking of transaction records for easier data

acquisition (Ogot, 2009). With online transaction, procurement processes can be authorized online resulting in instant order fulfillment; where the required item often arrives in real time (Lewis & Roehrich, 2009).

Ordinary procurement processes include receiving quotes, prequalification of suppliers, issuing tenders, negotiation with suppliers, award of contracts, receipt of supplies and evaluation of tenders which are all linked by information (lysons & Farrington, 2012). Procurement literature has emphasized the potential contribution of ICT in lowering transaction costs and commodity prices, promotion of shorter product- development cycles in addition to enhancing integration in procurement (Mishra et al., 2007; Zsidisin & Ellram, 2001; Croom, 2000). ICT application on procurement processes has simplified and speeded up the activities to a great deal. Nowadays, there is increasing emphasis on the use of ICT to substitute or enhance transactional activities to gain operating efficiencies (Essig & Arnold, 2007).

1.1.1 Global Perspective of effect of ICT on Procurement performance

Public procurement in developing countries is said to account for up to 25 percent of their GDP. In the Middle East and Africa in general, central government purchases range from 9 to 13 percent (Weeks & Namusonge, 2016). According to a study on procurement digitization and supply chain performance in China, e-procurement systems facilitate information flow between the enterprise and its suppliers (Chang, Tsai & Hsu, 2013). Information sharing improves relationships among enterprises. In China, studies have revealed that ICT infrastructure is a prerequisite for successful ICT application in schools. The study concluded that construction of multimedia classrooms could remarkably raise the utilization rates of ICT in schools. For the benefits of ICT to be realized, students should be trained on how to use the new technologies (Chun, Chin-Chung & Wu, 2015).

According to a study by Fuchs et al. (2018) on the role of IT in automotive supply chains, IT functional capabilities have the greatest impact on internal process excellence which in turn enhances supplier performance which may result in improved supply chain performance. The study examined the relationship between IT capabilities, supply chain capabilities and supplier performance. Data were collected

from 343 automotive suppliers in Europe. The study found that frequent and adequate information sharing also contributes significantly to supplier performance.

Arvanitis and Loukis (2020) in the case of European countries (Germany, Spain, France, Italy, UK, and Poland) investigated the effects on the ICT-enabled product/service and process innovation of ICT inputs; of three different types of ICT infra-structures (both internal functions support and external environment transaction oriented ones: use of standard ICT applications for supporting firm's internal administration and production functions, as well as use of e-sales and e-procurement for supporting firm's transactions with customers and suppliers); and finally of the awareness of the relevance of new ICTs. The study found a statistically significant negative relationship between ICT-enabled product innovation and crisis vulnerability, as measured by the extent of the reduction of ICT investment during the crisis (pro-cyclical behavior), but only for new products or services that contain ICT components and are therefore directly affected by crisis-related decreasing product demand.

Electronic procurement in UK Public sector was found to reduce maverick spending, increase supply availability, improved communication and negotiation practices. How internal users are provided with support in using the new technology has significant effect on maverick buying. Reduction in the total cost of acquiring goods and services was realized due to decreased costs of processing purchase requisitions which resulted from improvements made on the procurement system (Croom & Brandon-Jones, 2007). Other studies on ICT adoption in the UK concluded that acquisition of skills through training resulted in rapid adoption of ICT (Hwang, Yen & Cheng, 2004).

1.1.2 Regional Perspective of effect of ICT on Procurement performance

In Nigeria, Awara et al. (2018) revealed that information Technology tools have a positive performance on online retailers in Calabar Metropolis. They concluded that the sole aim of the integration and collaborations of the supply chain is to effectively and efficiently satisfy customers' demands and needs, as well as add value to the supply chain activities which would enhance their performance. Online retailers now develop strategies that allow effective use of information systems in order to improve their supply chain activities such as sourcing, procurement, conversion, and logistics

management activities, coordination and collaboration with channel partners (suppliers, intermediaries, third-party service providers, and customers).

In Uganda, a study carried out by Kakwezi and Nyeko (2010) argued that the procurement departments of public entities in Uganda are faced with the problem of not having reliable information about the procurement procedure, its inputs, outputs, resource consumption and results, and are therefore unable to determine their efficiency and effectiveness. The study concluded that, use of ICT in these public entities can provide the decision-makers with unbiased and objective information relating to the procurement functions performance.

In Tanzania, use of electronic procurement is faced by challenges in the following areas; policy and legislative framework, institutional structures, procurement processes, ICTs and people (Sijaona, 2010). Other studies, Suleiman (2015) indicate that although Tanzania recognizes the benefits it can reap from implementing electronic procurement, it lacks the necessary legal frameworks, technical infrastructure and procedures to fully implement electronic procurement. It was noted by Suleiman that use of e-procurement has resulted in improvement of the performance of firms in Tanzania.

A few studies on ICT adoption in Rwanda exist. Ruzindana and Kalaskar (2016) in their study on adoption of electronic procurement and its influence on procurement performance on Selected Telecommunication Companies in Rwanda, found that to improve adoption level at employee's level, the organizations in Ruanda must work on factors related to perceived risks associated with internet connectivity. Ensuring that the staffs are properly trained on the new technologies and that they understand and comply with the security requirements such as proper use of passwords will enhance the staff confidence in ICT use. That is, the factors related to perceived use and perceived ease of use have a positive effect on behavioral intention towards adoption of e-procurement system.

1.1.3 Local Perspective of effect of ICT on Procurement performance

The government of Kenya recognizes that use of ICT in enhancing service delivery is critical. According to the E-government Strategy Paper 2004, one of the medium term

objectives which were supposed to be implemented by June 2007 was the ICT adoption in procurement (GoK, 2010). Further, PPOA Interim Report (2009) outlined plans to introduce ICT adoption in procurement process in all Kenya's public entities. The government through the Ministry of Finance has also initiated an e- procurement project whose aim is to have e-procurement system implemented in a few selected ministries before full roll out to other government departments (Rok, 2014).

A number of private organizations in Kenya have successfully adopted the use of e-procurement technology. Gitahi (2011) cited the example of Nation Media Group which through their digital platform commonly known as N-Soko has enabled their clients to purchase products online. A study by Mwangi and Mburu (2015) on effect of ICT on procurement performance in star rated hotels in Kenya indicated that ICT usage dramatically led to the transformation of service delivery. Evidence has accumulated to suggest that there is a slow uptake of the technology despite the benefits that ICT adoption in procurement offers (Segal & Taylor, 2001).

In Kenya, the factors associated with slow adoption include limited legislation, poor infrastructure, lack of awareness and top management support, integration with internal systems or solutions, lack of technical standards, lack of suppliers' cooperation and costs associated with adapting web-enabled purchasing system (Malela, 2010). A study by Mutunga, Nyanamba and Okibo (2013) on the effect of e-procurement at the Kisii level 5 hospital, indicated that some of the challenges faced included inadequate funding, organizational inability to handle change and poor training of employees on how to use the system.

Kirui and Mukulu (2019) in their study on the role of e-procurement on the performance of Safari Com PLC, revealed that data transmission and system management led better channel relationship, decision making, and information sharing. The study recommended that Safaricom PLC should share information intensively but selectively, develop supplier technical capabilities and accept supplier complaints as an opportunity to improve on their procurement processes.

A study by Orwenjo and Aila (2018) concluded that e-procurement processes in Kenya power are effective and efficient. ICT in Kenya power has enhanced transparency, traceability of all transactions, value for money, competition through

improved accessibility, reduced procurement costs and transactions costs. The study identifies stake holder involvement in change management as one of the key contributors of success in use of ICT in Kenya power and recommends that Kenya power can be used as a role model in the implementation and use of e-procurement systems.

1.1.4 Energy Sector in Kenya

Energy sector is one of the infrastructural enablers of the three "pillars" of Vision 2030 in Kenya (RoK, 2007). The energy sector comprises of three main sub-sectors namely; the electricity subsector, petroleum subsector and Renewable energy sub-sector. Following adoption of the Sessional Paper No 4 on Energy in 2004 and the enactment of the Energy Act No. 12 of 2006, the energy sector has been restructured over the years to include more players. The policy and overall guidance of the energy sector is a responsibility for the Ministry of Energy (MoE) whereas the Energy and Petroleum Regulatory Authority (EPRA) which is a successor to the Energy Regulatory Commission (ERC) oversees all regulatory functions including coordination of the development of indicative energy planning, tariff setting and oversight, monitoring and enforcement of sector regulations.

The Energy Sector has nine (9) State Corporations or Parastatals namely Rural Electrification Authority (REA); Geothermal Development Company (GDC); Kenya Power and Lighting Company Limited (KPLC); Kenya Electricity Generating Company (KENGEN); Kenya Electricity Transmission Company (KETRACO); Kenya Nuclear Electricity Board (KNEB); National Oil Corporation (NOCK); Kenya Petroleum Refineries Ltd (KPC); and Kenya Pipe Line Ltd (KPRL) (MoE, 2015).

Procurement accounts for the biggest expenditure in the energy sector. About 45% of Kenya national Ministries Departments and Agencies budget for the year 2014/15 was used to directly procure works, goods and services (Ochieng & Muele, 2014; RoK, 2015). According to the office of national statistics in UK, Energy sector contributes 3.3% of GDP, 18.1% of total investments and directly creates approximately 6.2% of industrial employment thus making the energy sector a major contributor to the economy. Data from *OECD National Accounts Statistics* indicate that in 2011, on average, general government procurement spending represented 29% of total general

government expenditures or 13% of GDP (OECD, 2013). In Kenya, although statistics are not available, the sessional paper on vision 2030 puts Energy as an infrastructural enabler of the three "pillars" of Vision 2030 (Rok, 2007). At any rate, there is need to examine the effect of ICT on the procurement performance in the energy sector of which this forms a key objective of this study.

The procurement process in the energy sector is regulated by the energy policy in Kenya with a mission to facilitate provision of sustainable, clean, secure, reliable and reasonably priced energy services at the minimal cost while conserving the environment at the same time. This policy is vital for the country as it steers to attain 2008 vision 2030. The energy Act no. 12 of 2006 and sessional paper no. 4 of 2004 realigned the energy sector to improve the sectors' performance; the energy act and the sessional paper were established to change the energy sector and increase power accessibility across the country. This policy has allowed for increased private participation in the expansion of the sector while attaining better energy services' delivery at the same time (Mutangili, 2021).

In energy sector, there is a shift of economic power coupled with increasing access to lethal and ICT technologies. Most of the energy companies in Kenya have now adopted the electronic procurement practices such as the e-Business, e-procurement and e-supply chain philosophy in order to sustain themselves. For instance, the Kenya Power one of the state corporation in Kenya that has implemented and adopted e-procurement systems, the Rural Electrification and Renewable Energy Corporation, Geothermal Development Company, Kenya Electricity Transmission Company, Kenya Generation Company, and Nuclear Power and Energy Agency (Kenya National Energy Policy, 2019; Mutangili, 2021).

Improving procurement performance therefore, leads to great savings in addition to better service delivery (Maurice, 2014). The procurement functions in the energy sector have been ineffective and inefficient characterized by massive corruption (Cherop, 2016). Kiage (2013) also showed that factors such as contract management, planning, resource allocation and staff competency all had a contribution to the procurement performance. In the energy sector state corporations, the public procurement and disposal act 2015 (PPDA, 2015) governs procurement. This was act which replaced the PPAD 2005.

Kenya's energy sector faces various challenges such as the high cost of energy. This is one of the biggest bottlenecks to economic activity in the country (KIPPRA, 2005). Other challenges include over-dependence on hydropower with its vulnerability to variations in hydrology and climate, high cost of rural electrification projects, outdated refinery and pipeline system, inadequate storage infrastructure for strategic reserves of the petroleum products, volatility of international crude oil prices and weak legal and regulatory framework for energy resources exploration, exploitation and development (RoK, 2015). Statistics indicate that the cost of electricity in Kenya is considered to be four times higher as compared to that of South Africa and three times that of China (KIPPRA, 2005). Other challenges include relatively high petroleum prices compared to other East African countries, frequent electricity interruptions and failures, among others.

1.2 Statement of the Problem

The adoption of ICT has been presumed to enhance the efficiency of procurement process, reduce total cost of acquisition, enhance customer-supplier relationships, promote better service delivery, increase transparency and accountability, improve records management, reduce errors and purchasing outside of standard procurement processes thus increasing the effectiveness and efficiency of organizations (Bertot et al., 2010; Mutunga, Nyanamba & Okibo, 2013; Mutangili, 2014; Rok, 2015). The procurement performance in the local scenes of Kenya has been ineffective. This is evidenced by the numerous issues such as poor record keeping, high costs, delays, corruption, political interference and lack of transparency in these processes (Amaeba et al., 2015; RoK, 2013).

A report presented by EACC (2015) showed that more than 50% of the government officials who had corruption issues related to procurement were from the energy sector. Cherop (2016) further advances that unethical behaviors in the energy sector procurement department have been revealed. Due to these challenges, poor quality goods are procured, tender awards made to unsuccessful bidders, value for money not obtained and huge amounts of resources which could be used to improve the economy and consequently the lives of Kenyans go to waste. This shows that there are indeed loop-holes in the energy sector's procurement departments which need to be addressed appropriately.

In terms of literature, there are numerous studies (Lu, Tsai & Wu, 2015; Mwangi & Mburu, 2015; Abass & Okibo, 2014; Mutunga, Nyanamba & Okibo, 2013; Chang, Tsai & Hsu, 2013; Nchunge, Sakwa & Mwangi, 2013; Croom & Brandon-Jones, 2007) which have been done on the impact that ICT has on procurement. For instance, the study by Abass and Okibo (2014) show that ineffective processes of procurement within the public sector hinder implementation of strategies as per vision 2030 thus making the realization of the energy sector's contribution to the economy unachievable. Additionally, the study by Chimwani, Iravo and Tirimba (2014) attributes the poor performance of procurement to non-adoption of ICT. Studies indicate that ICT has been adopted in the energy sector state corporations (Mwangi & Kariuki, 2018; Orwenjo & Aila, 2018)). However several studies (Nchunge, Sakwa & Mwangi, 2013; Lu, Tsai & Wu, 2015) which attribute inefficiency in Procurement to lack of adoption of ICT fail to explain how adoption of ICT aids the procurement performance.

Moreover, these studies have had their own limitations relating to geographical coverage, methodology and scope. These studies have not been able to explore the influence of communication technology, application software's, information technology, electronic procurement policy and electronic procurement technical support staff in the procurement performance in the energy sector state corporations in Kenya. Hence, this study was prompted to examine the effect of ICT on procurement performance of the energy sector state corporations in Kenya.

1.3 Research Objectives

1.3.1 General Research Objective

The general objective of this study was to determine the effect of ICT on procurement performance of the energy sector state corporations in Kenya.

1.3.2 Specific Objectives

This study was guided by the following specific objectives:

(i) To determine the effect of communication technology on procurement performance of energy sector state corporations in Kenya.

(ii) To assess the effect of application soft-ware on procurement performance of energy sector state corporations in Kenya.
(iii) To evaluate the effect of information technology on procurement performance of energy sector state corporations in Kenya.
(iv) To determine the effect of electronic procurement policy on procurement performance of energy sector state corporations in Kenya.
(v) To establish the effect of electronic procurement technical support staff on procurement performance of energy sector state corporations in Kenya.

1.4 Research Hypotheses

To empirically meet the study objectives, this study was guided by the following hypothetical statements:

H_{a1}: Communication technology has a significant effect on procurement performance of energy sector state corporations in Kenya.

H_{a2}: Application soft-ware have a significant effect on procurement performance of energy sector state corporations in Kenya.

H_{a3}: Information technology has a significant effect on procurement performance of energy sector state corporations in Kenya.

H_{a4}: Electronic procurement policy has a significant effect on procurement performance of energy sector state corporations in Kenya.

H_{a5}: Electronic procurement technical support staff have a significant effect on procurement performance of energy sector state corporations in Kenya.

1.5 Justification of the Study

According to GoK (2014), adoption of ICT in procurement practices has resulted in a remarkable achievement since the government ministries reported a 42.7% plummet in their procurement operating cost amounting to Ksh 629 million down from Ksh 1.64 billion in the previous year. Despite this remarkable achievement, slow ICT adoption in the procurement practices of public organizations raises concerns. It is

only those companies that are able to adapt ICT and adopt new ideas/innovations in their procurement practices that can be guaranteed of enhancing service delivery. There was therefore dire need to explore the ICT effects on procurement performance within the energy sector state corporations in Kenya.

1.5.1 Ministry of Energy

The Ministry of Energy will benefit from the findings of this study. By using the analyzed results, the Ministry of Energy policy-makers and other officers will be in a better position to understand the effect of ICT on the procurement performance. As such, they will be able to develop policies that contribute to the development of ICT that will bring out the best results on procurement performance in the ministries.

1.5.2 Energy Sector Organizations

It is also hoped that organizations in the energy sector will gain insights on the effect that ICT has on the performance of the procurement departments. Consequently, they will be able draw adaptive and creative strategies which are consistent with the current economic and competitive environment. Further, these organizations will be able to identify the factors that need to be reviewed to enhance ICT effectiveness in procurement performance.

1.5.3 Procurement Professionals

Procurement professionals will also benefit from this study. The procurement management bodies and personnel will use the study findings in determining the various aspects of ICT that influence positively the procurement performance. They will be able to influence policy implementations that facilitate the need for appropriate infrastructures of improved procurement performance.

1.5.4 Researchers and Scholars

Scholars and students of research in the public procurement sector will benefit from the study. The findings documented will be easily acquired in the university library and it will equip other learners with more knowledge and skills on effects of ICT on procurement performance. The study will further make a contribution to the available

literature on use of ICT in procurement process in the public sector since this study will be part of the studies that will be useful to researchers who want to advance and gain knowledge in this area.

1.6 Scope of the Study

The focus of this study was on the effect of ICT on procurement performance in the energy sector state corporations in Kenya. Nine (9) energy sector corporations in Kenya that were covered in the study included Rural Electrification Authority (REA); Geothermal Development Company (GDC); Kenya Power & Lighting Company Limited (KPLC); Kenya Electricity Generating Company (KENGEN); Kenya Electricity Transmission Company (KETRACO); Kenya Nuclear Electricity Board (KNEB); National Oil Corporation (NOCK); Kenya Petroleum Refineries Ltd (KPC); and Kenya Pipe Line Ltd (KPRL).

The study involved collecting information from a target population of three hundred and eighty five (385) employees (procurement and electronic procurement technical support staff). This study only focused on the following; communication technology, application soft-wares, information technology, electronic procurement policy and electronic procurement technical support staff. The study focused on primary data which were collected using questionnaires for a period of one month.

1.7 Limitations of the Study

The study encountered various limitations that hindered access to more information that the study sought. Due to the nature of procurement processes, the state corporations had policies which considered such information as confidential. To mitigate this, the interviewer approached the procurement department heads in the respective corporations and requested for support in availing the required information. She assured them of confidentiality in handling the information provided and promised that the information would be for academic purposes only. Some respondents were unwilling to complete the questionnaires but this was mitigated by the researcher being patient and constantly reminding them to complete the questionnaires. Since procurement is a wide area, the study was not able to exhaustively cover it.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter reviewed theoretical and empirical literature related to effect of ICT on procurement performance. The following sections were presented in this chapter: theoretical review, conceptual framework and empirical review.

2.2 Theoretical Review

There are many theories and models relating to the subject of the study. According to Gioia and Gooley (2011), a theory is coherent description, explanation and presentation of observed or experienced phenomena. Theoretical review introduces and describes the theory that explains why the research problem under study exists. This chapter consists of an in-depth description of the concepts and the theories underlying this study. The key theories reviewed in this study include; Technology Diffusion Theory, Technology Acceptance Model (TAM), Technology-Organization-Environment Theory (TOE), Disruptive Technological Innovation Theory and Resource Based View.

2.2.1 Technology Diffusion Theory

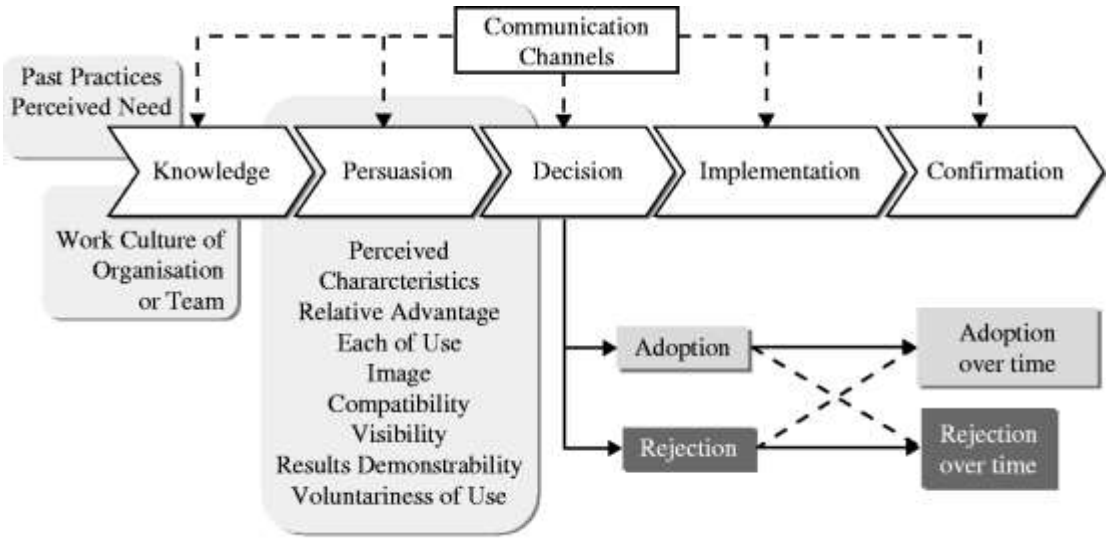
The concept was first formulated in the early 19s by Gabriel Tarde, who tabulated the first S-moulded diffusion bend, followed by Ryan and Gross (1943) who proposed the adoptive categories that were later used in the present hypothesis promoted by Everett Rogers. Rogers (1995), who argues that diffusion is the mechanism by which creativity is transmitted over time to the social system members. In other words, the diffusion of creativity is founded on the premise that the introduction of innovativeness requires the accidental or planned dissemination of new ideas. Rogers describes creativity as a concept, process, or entity considered as new (Rogers, 1995).

There are 5 steps taken in the adoption of innovation, that is the Knowledge, Persuasion, Decision, Implementation and confirmation: The individual finalizes his/her decision to continue using the innovation (Rogers, 1962). As per Rogers,

(1995) dissemination of development is liable to five vital trademarks which incorporate its relative leverage, similarity, multifaceted nature, trialability, and recognizability. This characteristic discusses the perceived value that the innovation will bring to users and is mostly compared to what is currently available (Wani & Ali, 2015).

Therefore, the theory underpins the "what is in for me" for the user in order for them to adopt and use a particular technology. In practice, the study is able to understand the importance of fintech to procurement firms and give perspectives, reasons and extent to which they have or are yet to adopt the technologies. It has been noted that procurement innovation such as e-Procurement is breaking new ground within the public sector of the advanced as well emerging economies by providing the procurement firms with a wealth of supply chain information via the Internet. E-procurement has been on the political agenda in a number of countries (Henriksen & Andersen, 2003).

Although the attributes suggested by the theory include relative advantage, compatibility, complexity, trialability, and observability (Rogers, 1995), only two variables – relative advantage (i.e. degree to which an innovation is perceived as being better than the idea it supersedes) and compatibility (of an innovation with existing practices and values) have been consistently found to be positively related and only variable – complexity (i.e. degree to which an innovation is perceived as relatively difficult to understand and use) has been consistently found to be negatively related to adoption of innovation (Tornatzky & Klein, 1982; Vaidya, 2005).



Source: Rogers (2003)

Figure 2.1: Rogers' Diffusion of Innovation Theory

This theory also supports the variable application soft-wares since compatibility of application soft-wares used by partner organizations results in enhanced supplier collaboration and reduced costs in procurement processes (Zhu et al., 2006). This theory, therefore, is relevant to this study as it informs the study to seek to enhance their innovative strategies in consideration of the advancements in technology for the betterment of the procurement firms' performance. The procurement firms are encouraged to be proactive in the uptake of innovative strategies especially towards financial technological innovations in public financial management. According to some studies, Hsu et al. (2006), use of e-business application software in an organization can be explained by Technology diffusion. Procurement performance can be improved by operating a paperless system (Lysons & Farrington, 2012).

2.2.2 Technology Acceptance Model (TAM)

The Technology Acceptance Model (TAM) was developed and validated by Davis (1993) to explain the mechanisms that influence and shape users' acceptance and/or adoption and use of new technological infrastructure. TAM is an intention-based model developed specifically for explaining and/or predicting user acceptance of computer technology. According to TAM, there are two specific factors that are fundamental determinants of users' attitude toward using new technology and its systems. These include perceived usefulness and perceived ease of use relatively to

new information system design features. TAM also proposes that external factors affect intention and actual use through mediated effects on perceived usefulness and perceived ease of use. The term usefulness refers to the degree to which one considers that utilizing a system will improve their performance whereas the ease of use refers to the degree to which a user believes that the benefits of utilizing the system are more compared to the efforts required for using it.

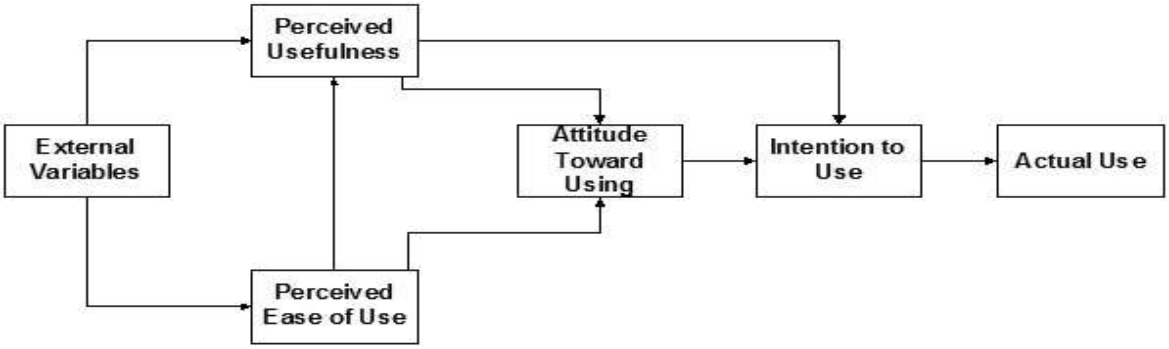


Figure 2.2: Technology Acceptance Model (TAM), Source: Davis et al., (1989)

This theory supports the variable information technology since users perceive that use of information technology enhances procurement performance by eliminating delays, improving supplier relationship and reducing transactional costs. Use of computers, internet and other communication technologies in public organizations has enhanced their performance by providing better communication, access to information, knowledge and promoting innovation and efficiency (Dewett & Jones, 2001). This theory therefore, has been used to link the use of information technology by energy sector state corporations in Kenya towards procurement performance. By use of such applications as websites, procurement databases digital applications to schedule trips, control and monitor the supply chains and time, the energy sector state corporations in Kenya are seen to have taken over the digital era and bridge the gap of security issues, assurance of travel times and destinations among others.

2.2.3 Technology-Organization-Environment Theory (TOE)

According to Tornatzky and Fleischer (1990), there are generic set of factors which predict the likeliness of IT to be adopted and used. As pointed out by the TOE theory, ICT use and adoption is influenced by various factors which include the technology development (Kauffman & Walden, 2001), organizational conditions, business and

organizational reconfiguration (Chatterjee, Grewal, & Sambamurthy, 2002), and industry environment (Chatterjee, Grewal, & Sambamurthy, 2002). With regards to the technological perspective, adoption is based on various technologies within and outside the organization as well as perceived advantages, compatibility, complexity, experimentation and visibility.

In terms of organizational context, various aspects of the business are put into consideration. These include the business scope, management support, culture, managerial structure, human resource quality and the size of the firm related issues such as internal slack resources and specialization (Jeyaraj, Rottman, & Lacity, 2006; Sabherwal, Jeyaraj & Chowa, 2006). On the other hand, the environmental context revolves around the operational factors of an organization. These include competition, readiness of trading partners, socio-cultural issues, government support and the technology support infrastructures (Scupola, 2009).

It may be noted that the TOE framework underscores Rogers' (1995) three groups of adoption predictors- leader characteristics relating to change. These include the internal characteristics (centralization, complexity, formalization, interconnectedness, organizational slack and size), and external characteristics (system's openness). The major snag of TOE is that some of the constructs in the adoption predictors are assumed to apply more to large organizations, where clients are sure of continuity and less complaints, than to SMEs. However, integrating TOE with other models such as TAM, with each adoption predictor offering larger number of constructs than the original provides richer theoretical lenses to the understanding of adoption behaviour.

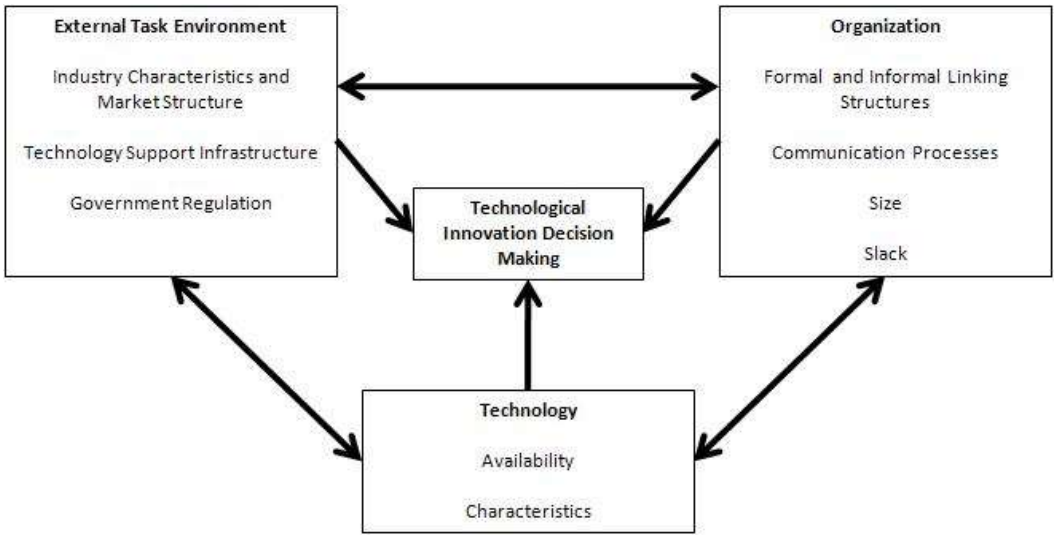


Figure 2.3: Technology-Organization-Environment Theory, Source: DePietro, Wiarda and Fleischer, (1990)

This theory supports the variable communication technology because for the communication technologies to have an effect on procurement performance, they must be easy to use and compatible with other technologies existing in and outside the organization. The organization must have the necessary resources to continue using these technologies. The theory takes into account the need for the energy sector state corporations in Kenya to adopt and utilize communication innovation and channels. These technologies come in handy to help the energy sector state corporations in Kenya achieve competitive advantage and gain external support e.g., by use of the e-procurement services in making procurement decisions and making contact with suppliers and consumers.

2.2.4 Public interest Theory

Public Interest theory is an economic theory first developed by Arthur Cecil Pigou (1932) which holds that regulation is supplied in response to the demand of the public for the correction of insufficient or inequitable market practices. Regulation is assumed to benefit society as a whole rather than particular vested interest (Den Hertog, 2012). The theory holds that regulation is considered to represent the interest of society in which it operates rather than the private interest of the regulator (Richard, 1974).

This theory assumes that economic markets are very fragile and they have a tendency to operate insufficiently and in favor of the individuals concerned while ignoring the importance of society as a whole. Therefore, to direct and monitor the economic markets, government intervention is required. For example, governments regulate banks to make them work in the interest of the society (Pigou & Aslanbeigui, 2017).

Therefore, the regulation of firms or other economic actors contributes to the promotion of the public interest. This public interest can further be described as the best possible allocation of scarce resources for individual and collective goods and services in society. In western economies, the allocation of scarce resources is to a significant extent coordinated by the market mechanism. In theory, it can even be demonstrated that, under certain circumstances, the allocation of resources by means of the market mechanism is optimal (Becker, 2016). Existence of the relevant procurement policies which govern the use of the internet and email results in continued use of ICT on procurement processes leading to achievement of procurement excellence in an organization (Oliveira & Martins, 2010). Implementation of well-formulated policies which controls access to information and ensures confidentiality, enhances the use of ICT in procurement processes resulting in better performance.

The theory advocates that conceptually, ICT regulations/policy are intended to increase the social welfare in the procurement sector. Thus, in support of the current objectives, this theory is relevant linking the variable electronic procurement policy to the procurement performance in energy sector state corporations in Kenya. This is because of the development and implementation of ICT policy is relevant in attempt to protect the general welfare of the energy sector state corporations towards their procurement performance. However, if the relevant electronic procurement policies are not in existence, then the positive effects may not be realized.

2.2.5 Resource Based View Theory

The Resource Based View Theory focuses on a firm's resources and capabilities as determinants of competitive advantage and performance. This theory was introduced by Wernerfelt (1984) whose study concluded that the competitive advantage of a firm is based on its resources and its ability to exploit them. It further explains that these

resources are embedded in the organisations business processes (Ray et al., 2004). Assets and strengths such as information or organizational processes are some of the firms resources which if strategically managed would result in competitive advantage (Barney, 1991).

The assets can be both tangible (physical) and intangible such as intellectual property, brand reputation. The theory assumes that these resources are heterogeneous (they differ from one company to another e.g. skills and capabilities) and immobile (they do not move from company to company at least in the short run). Based on this theory, the effective and efficient use of a firm's internal resources can lead to sustainable competitive advantage (Kraaijenbrink, Spender, & Groen, 2010). When ICT is embedded in specific organizational processes such as procurement, benefits such as cost savings, elimination of paper and delays can be achieved. Processing transactions online through the use of ICT can lead to increased transparency but also exposes the organization to competitive threats (Loh & Venkatraman, 1992). Further, the synergistic benefits achieved through an integrated system provide the sources of sustained competitive advantage for a firm (Bharadwaj, 2000).

This theory supports the variable electronic procurement technical support staff since they can have unique skills and capabilities which if effectively and efficiently used can lead to outstanding improvement in procurement performance. The unique skills and capabilities of these staff can be a source of competitive advantage. The importance of the synergistic effect of the existence of the other variables can also not be ignored. Proper management of electronic procurement technical support staff alone, may not improve the procurement performance in an organization, it may need to be combined with the other factors such as information technology, proper electronic procurement policies among other factors. Likewise, ICT alone may not lead to the required improvement in procurement, it may require other distinctive capabilities of an organization.

2.3 Conceptual Framework

Conceptual framework is a research tool intended to assist a researcher to develop awareness and understanding of the situation under scrutiny and to communicate it (Smyth, 2004). When clearly articulated, a conceptual framework has potential

usefulness as a tool to assist a researcher to make meaning of subsequent findings. The dependent variable conceptualized in this study is procurement performance whereas the independent variables include communication technology, application soft-wares, information technology, electronic procurement policy and electronic procurement technical support staff (See Figure 2.4).

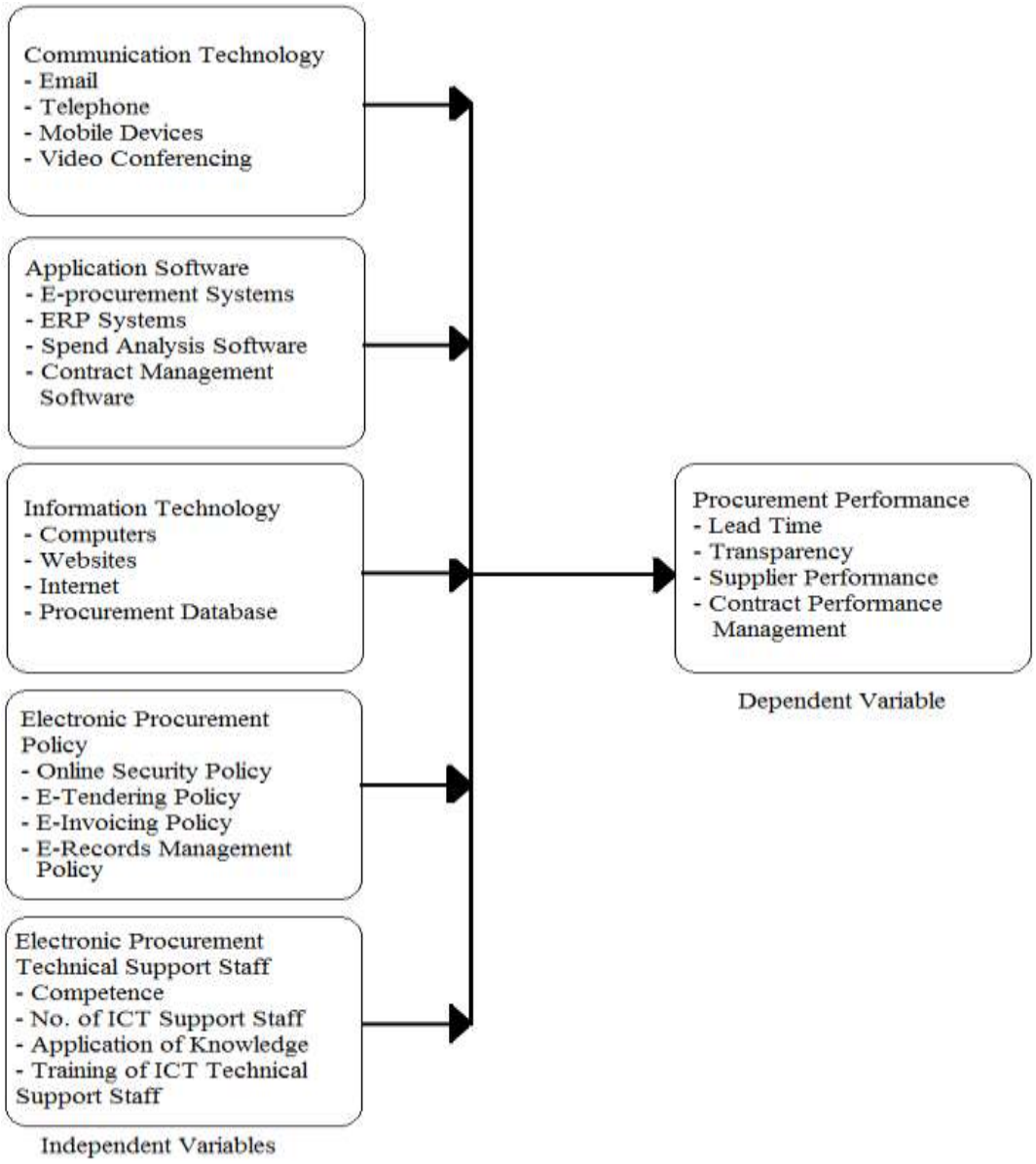


Figure 2.4: Conceptual Framework

2.3.1 Communication Technology

Communication technologies facilitate the processing and flow of information as well as the technologies used in the actual processing that goes on to produce a product or

to provide a service to customers (Owuor, 2004). Studies indicate that evidence of communication technology in an organization can be measured by availability of communication technologies components, integration of the components and intensity of usage (Sirilak, Islam & Khang, 2010; Sigala, 2003).

Emails involve sending electronic messages from one computer user to another user via the network. Since the email method is cheap, fast, convenient and has a permanent record, it can improve procurement performance. Mohammadi, Sahrakar and Yazdani (2012) used email as one of the supply chain communication tools in their study on the investigating the effects of information technology on the capabilities and performance of supply chain of dairy companies in Fars province. Instead of calling each and every supplier, a message can be typed and emailed to all suppliers at the same time.

The telephone is a device that transforms a persons' voice into an electronic signal that is transmitted via cables and other communication channels to another telephone which reproduces the sound to the recipient user. The telephone is used to talk directly to someone who is located in a different place. It allows fast, personal and easy to use two way real-time communication with customers. Calipinar and soysal (2012) used emails and telephones as some of the e-procurement technological tools used to improve the health sector in Turkey. The telephone helps in communicating with suppliers, place orders and receive price proposals

Mobile devices are portable computing devices that are small enough to hold and operate such as Ipads, Smartphones, and Tablets among others. They use wireless network for communication. Use of these devices can result in flexibility and convenience in performing procurement processes. It results in buyer empowerment and increased access to data. According to Vulkan (2008), mobile devices have affected private businesses and state corporations positively. Video conferencing is a communication technology that allows suppliers and customers in separate locations to talk while seeing each other. Video conferencing is live visual connection between two people located in different places for purposes of communication.

The effect of communication technology on procurement performance was measured by assessing the existence and use of email, telephones, mobile devices and video

conferencing in state corporations. The study examined whether every employee in procurement has an email account and whether quotations are sent and received via email. This is because use of email both enhances communication and speeds up the procurement processes. Use of telephones was measured by establishing whether the organizations use the telephone to contact suppliers who are not delivering the agreed level of service and whether the telephone number is a mandatory requirement during supplier registration. Frequent communication with suppliers enhances buyer-supplier relationships. Mobile devices such as phones and tablets to communicate procurement information or approve documents were also examined since the use of such gadgets eliminates delays in the process. The study will also establish whether the procurement functions use video conferences to hold meetings with their suppliers, whether these video conferences have improved communication and whether they have reduced travelling costs.

2.3.2 Application Software

The last decade has seen a stark change not only in the way software solutions are delivered to public and private sector organizations alike, but also how such solutions are procured. Today, buyers can choose from a wide range of software procurement options ranging from traditional up-front payments through to per user, per month models (Belisari, Binci & Appolloni, 2020).

All over the world, most government business operations are highly dependent upon Information and Communications Technology (ICT) for which software represents a significant component. Procurement soft-wares can be standalones or they can reside in ERP systems such as oracle and SAP. Stand-alone soft-wares include e-procurement soft-wares, spend analysis, e-invoicing, contract management, e-sourcing, supplier management and information soft-wares etc. In response to increasing array of procurement choices, government agencies have been quick to formulate strategies and policies to address each emerging trend (Roztocki et al., 2019).

The procurement process has had many loopholes in the recent past due to the long and tiresome processes and lots of paperwork. The chipping in of ICT application in the procurement process has reduced this through the adoption of online methods of

carrying out the procurement process. The use of new software technologies in evaluating and making price comparisons has made this process efficient and at the same time will ensure transparency and accountability as well as reduction in errors and omissions (Caldwell, Roehrich & Davies, 2009). Lui (2010) pointed that use of electronic procurement system (e-procurement) software allows purchasers to access supplier's catalogs via the internet, as well as accepting electronic invoices. The purchasers select their materials, indicate the accounts to be charged for the purchase, and create a purchase order in the accounting system. All procurement related activity is completed in the electronic system, reducing paperwork and increasing efficiency.

According to Gunasekaran and Ngai (2008), e-procurement works in such way that buyer software enables user to automate transactions and focus mostly on buying organizations activities such as order placement, catalogue management, payment, reporting and so on. E-procurement has been given many definitions. Confusion exists in defining the term e-procurement (Vaidya, Yu, Soar & Turner, 2003). According to Croom and Brandon-Jones (2007), E-procurement refers to the use of internet, integrated with ICT to accomplish individual or all stages of procurement process including searching, sourcing, negotiating, ordering, receiving and post-purchase reviewing. Other scholars define it as the process of utilizing web-based technologies to support the identification, evaluation, negotiation and configuration of optimal groupings of trading partners into a supply chain network, which can respond to change market demands with greater efficiency. This definition is in line with Sain, Owen and Hill (2004) who define it as the electronic integration and management of all procurement activities, including purchase request, authorization, ordering, delivery and payment between a purchaser and a supplier.

As noted by Quinnox (2012), e-procurement is a very comprehensive phenomenon which includes making strategic initiatives and it can be used in reorganizing the entire purchasing process. E-procurement system which has been correctly implemented has the potential of creating a link between the companies and the business processes directly with suppliers. Moreover, through the links one is able to manage all the interactions. E-procurement application requires good and supportive soft and hard technological infrastructure across the country for it to be effectively applied (Kalakota et al., 2006).

The growth of internet has nevertheless brought serious challenges to business due data hacking, internet fraud, Cyber vandalism, and virus and malware attacks (Huber et al., 2004). Beth et al. (2003) pointed that lack of employee competency on application and use of software adoption on procurement processes where he affirms that ERP systems perfectly provide the procurement management and the management itself with the opportunity to produce steadfast, consistent, and timely information necessary for attainment of organizational goals. The authors recommended that procurement staff must be competent enough to use the applications of software that offers the organization management skills to manage their activities for example, distribution chain and value addition in a company.

According to Quinnox (2012), a unified approach to software procurement ensures a level playing field for industry, but would provide a clear and simple means by which agencies can achieve the objectives of current software procurement policies, both for traditional and emerging "as-a-Service" solution options. When considered from the end-user organization perspective, it is estimated that the average large enterprise will spend 27% of their software budget on custom software development; that is software languages, application servers, application architecture or testing issues. This compares to an average of 35% spent on packaged application software, and 37% spent on platform and infrastructure software. Due to the emergence of cloud computing as an ICT sourcing and delivery model for enabling convenient, on-demand network access to a shared pool of configurable computing resources (including software), there is a need to move to a more inclusive investment principle.

Spend analysis enables visibility provides the necessary foundation for procurement organizations seeking to make better, more informed sourcing decisions. One of the benefits of using spend analysis is savings which are obtained through identifying opportunities to aggregate spend and negotiate superior contracts, identifying and reducing non-compliant or "maverick" spend, and improving procurement operations and supplier performance (Aberdeen, 2007).

Contract management includes all the activities that a buyer performs during the contract period as he ensures that all parties fulfill their contractual obligation (Bailey, 2008). According to Elsey (2007), contract life cycle management can be defined as the process of systematically and efficiently managing the contract creation, execution

and analysis of maximizing operational and financial performance and minimizing risks. Contract management software results in the following benefits; provides a common source of truth that can be relied on, less time spent searching for information related to the contract, an audit trail that addresses risk and compliance with less efforts, shortens contract life cycle and eliminates bottlenecks. ERP is the soft-ware that integrates areas such as planning, purchasing, inventory, sales, marketing, finance and human resources in an organization (Singh, 2020). The study will establish the effect of ERP software on procurement performance by establishing whether the use of ERP has increased process integration and improved decision-making in the energy sector organizations.

2.3.3 Information Technology

This study conceptualizes that Information Technology (IT) has a certain level of influence on the procurement performance. Collection, processing, storage and retrieval of accurate, reliable and timely information is critical in procurement. The various aspects of IT which have been conceptualized by the study include computers, internet, website and remote access to servers among many others. Jansen (2015) indicated that the various aspects of information technology provide the communication path and services between users, processes, applications, services and external networks.

With the emergence of the personal computer, optical fiber networks, the explosion of the Internet and the World Wide Web, the cost and availability of information resources allow easy linkages and eliminate information related time delays in any supply chain network. Wireless Networking technologies connect multiple computers, systems and devices together without requiring wires or cables: a wireless local area network or WLAN comes under Wi-Fi. Wireless network increases integration and convenience resulting in increased mobility (Darrell et al., 2017). This means that users can be able to work away from their normal working environment. Since no wires are required to link new users, such technology enables the organization to sudden increase in number of users using the existing equipment as is common with web-based procurement transactions. ICT development has enabled procurement processes to be done electronically through a web-based interface. In this case a procuring organization sets up a web site. The web site allows participants to submit

sealed bid tendering. The supplier can bid for a single item or multiple items (lots) within a specified time through electronic interface (Rachinger et al., 2019).

Procurement involves managing large volumes of data. A large collection of procurement data in a computer, organized so that it can be expended, updated and retrieved rapidly for various uses is referred to a procurement database. Examples of procurement data bases include the supplier data base, contracts database, spend database among others. Procurement databases also improve quality and consistency of information and reduce the time spent in managing the data thus improving procurement performance in an organization.

2.3.4 Electronic Procurement Policy

Organisations that use ICT in their procurement processes need to come up with electronic procurement policies that cover different procedures and risks associated with electronic procurement. The policy should guide on electronic management of records to enable effective sharing of information and also the period within which records can be archived since these records are important tools for accountability. Online security should be ensured through confidentiality of information. User identification and validation through password is necessary, in addition to access controls and data integrity. The policy should also guide on the content of the invoice, how to ensure that the invoice represents genuine supply and maintaining of audit trails. Other important policies include the ones governing the exchange of data between systems (Jangra, Raka & Nandanwar, 2020).

Electronic procurement policies can enable or hinder on organization from reaping the benefits of ICT application. A properly designed and implemented electronic procurement policy plays a pivotal role in providing a guiding framework for the implementation of efficient procurement practices. Some of key benefits that accrue from electronic procurement polices include: value for money, protection and enhancement of the environment, more efficient use of resources, greater social inclusion, air and ethical trade, support for innovation, better risk management, lower whole-life costs improved supplier relationships, a diverse and flexible supply chain and a competitive edge (Talluri, 2008). Efficient technology policies in procurement practices are critical for good public financial management and effective budget

implementation (Zuzana, 2012). According to World Bank (2013), there is need for transparency to enhance openness and clarity on procurement policy and its delivery.

Policies such as liberalization of trade and telecoms have a positive impact on e-commerce since they make ICT and Internet access more affordable to firms and consumers (Gibbs, Kraemer & Dedrick, 2006). Absence of a national ICT policy can hinder the desired ICT growth. Previous studies indicate that countries adopting new technology must have appropriate government policies and regulations to enhance transactional integrity in online markets (Zhu & Kraemer, 2005; Dewan & Kraemer, 2000; Oxley & Yeung, 2001). Such policies include issues such as intellectual property, consumer protection laws, dispute resolution law and compliance. Electronic procurement in the public sector can be seen as a policy tool to support the delivery of public procurement policy, improving transparency and efficiency (Carayannis & Popescu, 2005; Croom & Brandon-Jones, 2005).

Governments and other regulatory agencies can influence ICT use if they outline the requirements for use, provide the legal protection and incentives for use. Achieving transparency and competitiveness is key in public sector procurement. Governments have come up with laws and regulations on public procurement in order to enhance competitiveness and transparency in the procurement processes. For example, the US Federal Acquisition rules requires that contracting officers should promote and provide for full open competition in soliciting offers and awarding Government contracts (Cave & Frinking, 2007). Similar concerns about qualitative attributes of the goods a firm wishes to buy can be founded in corporate procurement. Similarly, according to United Nations Office of Proposals Services (UNOPS), the procurement policy states that while cost-effectiveness is always paramount, UNOPS never compromises the quality of items it procures. All goods undergo vigorous sample inspections and the technical/ quality approval before contracts are awarded and UNOPS requires pre-shipment inspections by the manufacturer. These are carried out by certified independent agencies.

In Kenya, lack of a clear legal framework has in the past led to inefficiencies in the procurement process. Since the late 90s, reforms have been made continuously to improve procurement process in the public sector. As a result, improvements have been realized in the regulation of public procurement process. This has been possible

through various acts such as the repealed Public Procurement and Disposal Act (2005), The repealed Public Procurement and Disposal Regulations (2006) and the Suppliers Practitioners Management Act (2007). The regulations have created several autonomous bodies that also form part of the developments of the public procurement system in Kenya over the years. Part of the developments in the government procurement system has been the adoption of the Integrated Financial Management Information System (IFMIS) since the year 2005 as its sole accounting and resource management system. The government uses IFMIS for several initiatives including Electronic Payment System, e-Government Receipt Accounting System, State Public Procurement Portal and Integrated Human Resource Management system among others.

2.3.5 Electronic Procurement Technical Support Staff

Electronic procurement technical support staff includes the network administrators, developers, designers and generic users with access to any ICT appliance or service. Hamada (2012) did a study on influence and challenges of information communication technology on supply chain management, a case of general motor's east Africa. She found that a lack of ICT support among management was one of the factors influencing the use and success of information communication technology on procurement process. According to the Digital Opportunity Task Force (DOT FORCE, 2002), human resources development through systematic training and education is critical if countries have to reap digital dividends.

Hwang (2004), in a study of the relationship between the diffusion of ICTs and changes in skills in the UK within business organizations, found that education and training were important in adjusting skill changes to the rapid expansion of ICTs. Hwang emphasizes the importance of developing both "hard" ICT capital (i.e. ICT equipment and software), and "soft" humans related ICT capital as well if an organization is to successfully implement and use ICT. Bartle and Korosec (2001) have suggested that the use of information technology in procurement is uneven across and within states, and that the degree of use is sometimes hampered by transitions in personnel, support, or training.

There is a need to continuously improve the knowledge of both electronic procurement technical support staff and non-technical staff. This is because the ICT domain changes rapidly leading to emergency of new technologies. These staff is able to innovatively come up with ways of using the newly improved knowledge in organisational processes and consequently improve the performance. Sufficient training on new technologies also leads to better cooperation between the technical staff and ICT users leading to development of better processes and products.

Firms must make a series of linked strategic decisions and moves related to Information Technology (IT) resources so as to blend them with organizational processes and knowledge resources (Barua et al., 2004). Savill-Smith (2005) states that in order for a specific device to be used optimally, certain technical and organizational conditions must be fulfilled. Firms in the Asia-Pacific region have been slow to adopt ICT due to poor telecommunications infrastructure, limited ICT literacy, the high cost of ICT equipment, and incomplete government regulations for e-commerce (Vadim, 2007).

The number of ICT support staff should be adequate to enable them to offer support for numerous ICT users and also attend to other duties such as maintenance and development of existing information systems, operation and administration of other information systems. Studies show that ICT support staff experience high workloads which lead to stress and exhaustion (Shih et al., 2011). The organization should therefore have sufficient available resources to meet its requirements (Wagner & Ettrich-Schmitt, 2009).

2.3.6 Procurement Performance

Procurement as a supply chain function has developed considerably over time; at the outset it was wholly a clerical function until Porter (1980) impelled firms to think of procurement as a strategic function rather than an administrative one in his five forces model where he proved supplier and buyer power as two vital forces for competitive advantage. Today, procurement is considered as a strategic value adding activity instead of a purely cost oriented transactional function. Procurement activities are not only operational but they also include risk management, competitive intelligence,

continuous improvement and technological innovations. Management of the procurement function has become critical in organisations (Basheka, 2008).

Procurement performance can be defined as the process through which the efficiency, effectiveness, transparency and quality of products is quantified. It measures how well a firm's procurement function achieves set goals and objectives (Sabiiti, Muhumuza & Basheka, 2011). Other scholars define procurement performance as the ability of procurement function in the organization to achieve its mission through sound management and strong governance (Mahapatro, 2010).

Procurement excellence which entails aligning procurement objectives with corporate objectives, supplier development and collaboration, leveraging of supply markets smartly, risk management is increasingly becoming an important factor in delivering efficient operations within successful companies. However, looking deeper, adequate measurement is a big issue. Arthur (2009) observed that procurement departments tend to be self-critical in regard to the current inconsistency in their measurement criteria. Performance measurement is viewed as a warning, diagnosis and control system that is used to keep track of the economy and check efficiency and effectiveness of the current organizational processes (Teelken & Smeenk, 2003). For procurement performance measurement system to be regarded as a useful management process, it should act as a mechanism that enables assessment to be made, provides useful information and detects problems, allows judgment against certain predetermined criteria to be performed and more importantly, the systems should be reviewed and updated as an ongoing process.

Use of ICT can improve procurement performance by reengineering existing work processes so that there are fewer breakdowns, bottlenecks, and redundancies on the job (Bajjaly, 1999). Real-time flow of information in the procurement process results in enhanced customer service, lower costs, and improved supplier relationships (Presutti, 2008; Davila, Gupta & Palmer, 2003). However, there is little history of extensive e-procurement use in the public sector. As would be expected, the academic literature covering public sector e-procurement is very limited (Harink & Van Rooijen, 2002).

According to OECD (2013), procurement performance can be based on efficiency of the public procurement cycle, openness and transparency of the public procurement cycle, professionalism of the public procurement workforce and contract performance management. Procurement performance can be determined by examining aspects such as delivery, flexibility, quality and cost (Shalle et al., (2014). Namukasa (2017) indicated procurement performance in terms of compliance with guide lines, minimization of waste, transparency, audit trail and ease to trace payments.

Procurement lead-time consists of the bid preparation time, award and ordering time as well as goods receipt and payment time (Harland et al., 2007). According to Silver et al. (2008), lead-time which he defines as the period between order place and inventory receipt can lead to improved service delivery. Improved Supplier performance indicates improved procurement performance (Dey et al., 2015). According to Ideet and Wankoike (2014), increased information sharing through use of ICT improves the shipment performance of suppliers.

The dependent variable was measured by determining the effect of ICT on the following procurement performance indicators: lead-time, transparency, contract management performance and supplier performance. Procurement lead-time consists of the bid preparation time, award and ordering time as well as goods receipt and payment time (Harland et al., 2007). According to Silver et al. (2008), lead-time which he defines as the period between order place and inventory receipt can lead to improved service delivery. Improved Supplier performance indicates improved procurement performance (Dey et al., 2015). Supplier performance will be measured based on the timely delivery, service levels, conformance to specifications and flexibility in responding to unexpected changes in demand. According to Ideet and Wankoike (2014), increased information sharing through use of ICT improves the shipment performance of suppliers.

Transparency in procurement involves advance publication of procurement plans; advertisement of tender notices; bidder participation in tender opening process; publishing procurement opportunities; publishing clear and comprehensive bidding documents and publication of contract awards and prices paid among others. Transparency enhances competitiveness in public procurement thus improving procurement performance (Ohashi, 2009). According to Sabiiti et al. (2011),

procurement performance can be defined as the process of quantifying efficiency, effectiveness, transparency and acquisition of quality goods and services.

Bailey (2008) defines contract management as the activities that a buyer performs during a contract period in an attempt to ensure that all parties in the contract fulfill their contractual obligations. Improved contract management performance results in improved procurement performance (kiage, 2013). Contract management includes managing contract creation (negotiation of the contract terms and conditions), managing contract execution and analysis (ensuring compliance, agreeing or managing any amendments that may be required during the execution period).

2.4 Empirical Review

There are a couple of empirical studies which have been able to identify a number of drivers and benefits of ICT adoption and map the progress of its usage across the private and public sectors. Developments in ICT Technological Infrastructure have drastically influenced the competitive business environment as proved by the emergence and strengthening of the global economy, and the transformation of industrial economies to knowledge-and-information-based service economies (Laudon & Laudon, 2001). This has in turn encouraged most organizations to use computer-based information systems in order to remain competitive.

2.4.1 Communication Technology

Studies indicate that various forms of communication Technologies have been used to automate and streamline the procurement process, improve efficiency and transparency, thereby reducing the cost of operation within and between business parties (De Boer, Harink & Heijboer, 2002). Humphrey et al. (2013) revealed that conducting e-commerce is mostly meant to enable firms identify trading partners that they could contact on-line with a view to doing business. The follow-up to an initial contract generally takes place through other channels such as e- mail, hyperlink, the telephone, fax or the post.

According to a study by Mohammadi et al. (2012), use of communication tools results in improved information exchange, coordination, activity integration and information

analysis. The study maintains that improved capabilities result in improved supply chain performance. This study investigated the effect of information technology on the capabilities and performance of supply chain of daily companies in Fars province in Iran. The study concluded that ICT is capable of improving supply chain capabilities in the manufacturing sector.

Calipinar and soysal (2012) advances the importance of using emails in procurement of drugs in hospitals. They argued that use of emails saves time since one email can be sent to all suppliers at once and that since it's a written record, it easier to track. But the telephone offered a better bargaining tool although discussions with the various suppliers were not simultaneous. This study involved evaluation of e-procurement application levels and both benefits and barriers for implementing this technology in procurement activities in three private hospitals' pharmacies in Ankara, Turkey. The study concluded that use of e-procurement technologies such as emails and telephones can ensure significant time and money savings with little financial investment. The study used semi structured interviews and non-participant observations to collect the data.

Through the use of various communication technologies, transactions can be standardized and all bids for products and services can be tracked easily, allowing business owners to use such knowledge to obtain better pricing. Due to faster exchange of information and delivery of goods and services, electronic procurement also promotes shorter product- development cycles. One way to estimate the value of a system is to quantify the improvements in the performance in some electronic terms. However, measuring and quantifying the impact on the immediate measures will provide more precise estimate of the value of the system (Kauffman & Kriebel, 2008; Mukhopadhyay, 2008), but require more detailed data at process level. The objective of electronic business strategy in procurement area is to provide purchasing managers with better control over their companies' purchasing habits and relationships with suppliers.

Communication technologies signify the technological standpoint of an information system (IS) and comprise computing, telecommunications and automation activities. Integrated information systems (IS) have taken centre stage in changing organizations. Today, communication technologies are found in several organizational

operations e.g. production, marketing, communication, logistics, besides having greatly influenced present living. It is now not easy to visualize life without computers, the internet, e-mail, e-business, e-learning, mobile phones and much more. Modern enterprises largely depend on ICT for gathering and distribution of data and information. Other firms and individuals as well are using ICT to transfer money from one party to another. According to Kitur (2006), several organizations including banks, insurance companies, and service companies have adopted communication technologies and consider it as a key success factor in the production and delivery of goods and services in those industries.

ICT Infrastructure facilitates information flows and coordination of activities across functional units, geographic regions, and value network partners (Barua et al., 2004). It may be noted that organizations that aim to become part of an extended, integrated supply chain require an effective IT infrastructure that enables effective information flows and streamlined logistics. The most effective of these IT aspects are those that are able to get the mix of information requirements, physical logistics and collaboration right, providing shared benefits to a majority of partner organizations (Bovel & Martha, 2009). Access to the physical network and high bandwidth capabilities will clearly affect the take-up and implementation of e-commerce activities (Al-Somali, Gholami & Clegg, 2015).

2.4.2 Application Soft-wares

Investments in procurement technologies account for the greatest percentage (53 percent) of business investment in enterprise applications software (Moozakis, 2001). In organizations which have adopted electronic procurement, application soft-wares such as e-Tendering, e-RFQ, e-Auctions, e-Catalogues and e-Invoicing are commonly used. The developers of these soft-wares include Ariba, Oracle and SAP among other key players in the e-Procurement market. Due to the procurement process being similar in the public sector organizations, straightforward technologies can be used to automate standard processes (NePP, 2005). Submarian and Shaw (2004) define e-procurement systems as a Web based client/ server application used to replace the manual procurement process.

Findings of a study carried out by Wanjiru and Abdalla (2015) on the effect of information communication technology on procurement process in Total Kenya identified ICT applications that were in use in the organization and concluded that adoption of ICT software applications was not exclusively a matter of resources but on the contrary operational compatibility was also critical. The study was based on a population of 300 employees in Total Kenya which is a multinational company. The study also revealed that the impact of ICT adoption resulted in time reductions and process quality improvements.

According to a study carried on the effect of E-procurement application soft-wares (e-sourcing, e-tendering, e-archiving) on organization performance, use of these applications increases organization performance by increasing information sharing and reducing time taken to perform the various procurement processes (Munubi et al., 2017). The study used a sample of 124 employees randomly selected from 4 major supermarkets (Naivas, Uchumi, Tuskys, Nakumatt) in Nairobi County. The study used two stage sampling techniques to select the sample. The study concluded that the use of e-procurement applications software in supermarkets positively affected their performance. Other studies such as that by Kioko and Mwangangi (2017) on the influence of e-procurement on the performance of Kenyan parastatals have concluded that there is an improvement in performance of parastatals. This is due to the use of application software such as e-sourcing, e-informing, e-payment and e-tendering. This study did not show how this improvement in performance has come about.

Studies on software applications such as ERP & CRM show that software integration leads to high connectivity and consequently facilitating management of cross functional processes in procurement (Rai, Bush, & Tiwana 2002; Rai, Ruppel & Lewis 2002). There is need for integration since working closely with business partners improves informational flows and consequently organizational performance. ERP softwares enable sharing of information between suppliers and customers (Chen & Popvich, 2003).

Muriithi, Waiganjo and Chepngetich (2016) on e-procurement system performance in the energy sector in Kenya revealed that although the integration of buyer-supplier was crucial to the performance of e-procurement system, the organization did not share information with its suppliers openly and completely. Suppliers were also not

promptly and adequately updated with the e-procurement system changes. The e-procurement system was consequently not able to result in the desired buyer-supplier integration. However, it was evident that a significant relationship existed between e-procurement systems and buyer-supplier integration.

In the UK public sector, various studies have been conducted on the impact of E-Procurement (Croom & Brandon-Jones, 2007). This study investigated deployment of E-Procurement across 9 UK Public sector organisations in a period of 18 months. The study concluded that E-Procurement results in reduced costs, increased availability of supply and consequently better prices due to greater leverage in negotiation. Further, it reduces the total cost of goods and services and has a potential to improve compliance. According to the study, the reputation of the procurement function and the general disposition of an organization towards e-procurement is strongly influenced by users' perceptions of internal service.

According to Dai and Kauffman (2001), EDI systems continue to enable firms to achieve more efficient and timely data and information management and to improve supply chain management, but still many companies do not use EDI due to the relatively high costs of implementing and running such systems. EDI tends to enhance the ease of transacting business and due to advanced security measures involved, security and confidentiality of information is guaranteed.

According to Mose, Njihia and Magutu (2013), private and public sector organizations have been utilizing information technology (IT) systems to streamline and automate their purchasing and other processes over the past years. Most governments are adopting ERP. ERPs are large-scale computer software and hardware systems. They try to integrate all data and processes of an organization into a unified system. This is housed in a centralized database which is accessed through a secure network. ERPs have capabilities for handling enterprise wide business processes ranging from functions such as manufacturing, logistics, distribution, inventory, shipping, invoicing and accounting. According to Chaffey (2009), there have been many attempts to automate the process of procurement for the buyer using electronic procurement systems (EPS), workflow systems and links with suppliers through electronic data interchange (EDI). Further, not all the technology is in place

yet to enable the Government to take full advantage of internet commerce (PPOA, 2009).

According to e-government strategy paper (2004), e-procurement was one of the medium term objectives which was to be implemented by June 2007, but the process has been very slow and findings show that most of the procurement processes in public sector are still manual with the internet only being used for e-mails and web browsing (PPOA, 2013). Despite the benefits of e-procurement as recognized by managers such as better coordination with suppliers, quicker transaction times, higher flexibility, better supplier integration, and lower costs, it is clear that adaption of ICT in procurement is still very low (Gunasekaran & Ngai, 2008). This slowed ICT adoption in the procurement departments in the public sector. As such, concerns were raised pertaining to the challenges facing the adoption of e-procurement in Kenya. If a country is weak in one or some of these infrastructures, then e-Procurement activities are destined to fail.

2.4.3 Information Technology

With regard to information technology, a study conducted on the effect of web-based e-procurement solutions on performance concluded that use of web-based solutions results in enhanced relationships between buyers and sellers which lead to improved performance.

Technological resources have been consistently identified as an important factor for successful information systems adoption. Information technologies have changed and redefined the way organizations and government corporations operate web-based technologies facilitate information and knowledge exchange and in addition they enable new and more efficient ways of work execution by integrating information, documents and employees. For example, intranets can be used to distribute and share individual experience and innovation throughout the organization (Bhatt et al., 2005), and also with other organizations (Kleis et al., 2012). Web technologies, have a great potential to enable significant innovations in firms' business processes, products and services, leading to considerable business performance improvements (Bresnahan & Trajtenberg, 1995).

The study by Chang, Yao-Chuan and Che-Hao (2013) on the e-procurement and supply chain performance points out three key processes of e-procurement which contribute to supply chain performance. These processes include partner relationships, information sharing and supply chain integration. The study further revealed that supply chain integration affects the supply chain performance to a greater extent as compared to the other two processes. The study was carried out by interviewing 4 practicing Managers and also collecting empirical data on 108 Taiwaness enterprises.

ICT is used to find, explore, analyze, exchange and present information responsibly without discrimination. According to Rusek (2006), the digitalization of information and data, as well as the opportunities offered by the Internet, provides the basis for rationalization and improved efficiency in administrative processes for private sector procurement companies. The digitalization of the administrative and procurement functions of public sector companies provides a number of advantages, for example, the opportunity to establish new and more efficient work processes and to communicate and co- operate in new ways. Traditional paper-based work processes in procurement can be made more efficient, changed or rendered superfluous when data and data-communication become electronic. Via this path, resources can be transferred from administration to service (Barsemoi, Mwangagi & Asienyo, 2014).

A study was carried out by Ordanini and Rubera (2008) on the role of the use of internet resources in procurement. The study used a sample of 93 firms in the textile and clothing industry in Italy. The study showed that although the use of the internet may have positive effects on purchasing costs resulting from reduced transaction costs and this may not be so for direct procurement of materials. It was also noted that, for direct procurement, organisations may prefer a close relationship with a few suppliers instead of increasing the number of suppliers which would expose the organization to stiff competition. Every organization must choose between the efficiency that is achieved through a large supply base and the monitoring and coordination involved in the management of many suppliers.

According to Nchunge et al. (2013), in their study on assessment of ICT Infrastructure on ICT adoption in education institutions, low connectivity speed and lack of internet access, were some of the factors that were resulted in schools producing graduates with inadequate ICT skills. This study focused on secondary schools in Kiambu

County in Kenya. Poor network infrastructure may also hinder organisations from reaping the benefits of using ICT in procurement processes.

New information technologies are adopted by organizations so as to improve the efficiency and effectiveness of various work processes. Unfortunately, many technology-based products and services never reach their full potential, and some are simply rejected (Burton-Jones & Hubona, 2006). Failed investments in technology may not only cause financial losses, but also lead to dissatisfaction among employees. Hence, explaining and predicting user adoption of new technology is important. New technology adoption by service employees is affected by various factors. Some of them include; technology readiness, technology integration and interoperability with the existing IT systems and the IT security applications.

Research by Parasuraman and Colby (2015) revealed that technology readiness (TR) is a key factor in the adoption of innovative products and services. TR refers to the propensity to adopt and embrace technology in home life or work. It reflects a set of beliefs about technology and is not an indicator of competence. TR is highly predictive of the speed of technology adoption and level of technological use in consumer households and organizations. TR is multifaceted, with some factors being contributors and some factors behind inhibitors.

Other researchers indicate that organisations are slowly moving towards cloud applications in order to reduce costs and wait time of some of the ICT infrastructures such as hardware, improve flexibility and increase reliability. Organisations can build private clouds or engage external cloud service providers. For organisations to be able to connect to cloud service, they must have network devices that provide the necessary performance, flexibility, reliability and Security (Bhoir & Patil, 2014).

2.4.4 Electronic Procurement Policy

Over the past decade, adoption of ICT in procurement processes has basically risen at the same rate as the increase in the number of suppliers and products in procurement. Studies show that a few factors continue to seize back user adoption; these include inadequate accounts of spending categories within the system coupled with unpredictable purchase requirements, bureaucratic procedures, lack of policies to

drive adoption, and distorted supply bases (Raymond, 2008). According to a study by Aberdeen Group (2005) on best practice in electronic procurement, more than half of respondents reported that failure to receive budget/policy support was a challenge that delayed or muted the benefits of ICT. However, best practice firms have been working on user adoption for years and many procurement managers at these ventures have become top "sellers" of the ICT enabled procurement systems.

According to Al-somali, Gholami and Clegg (2015), access to personal computers and effective telecommunication systems at a reasonable cost may not be sufficient for organisations to reap benefits of ICT; consumers must have reasonable confidence in the integrity of online transactions and a supporting legal environment. This study was carried out through a survey on 202 manufacturing and service companies in Saudi Arabia. These findings are in line with previous researches which suggest that countries adopting new technologies must formulate appropriate policies and regulations to enhance transaction integrity in online markets (Zhu & Kraemer, 2005).

A study by Maina (2008) revealed that designing and implementation of procurement policies including technology policies as per the procurement legal framework could help organizations to implement effective and efficient procurement practices. A study by Maiyo (2009) noted that there were increased levels of irregularities in undertaking procurement practices in most organization and this questioned the nature of procurement policies employed by organization. Victor (2012) noted that procurement expenditure could be minimized through implementation of effective procurement policies and practices which include proper use of technology or e-procurement.

Tanzi (2009) noted that application of technology policies and lack of top management support are key impediments towards implementation of effective procurement process in many government institutions in East Africa. Arthur (2009) noted that many procurement managers in Kenyan State corporations' lacks competitive knowledge and skills on how to formulate and embrace effective procurement policies including technology application regulations set in many public institutions in Kenya.

Despite lack of a legislative framework, some significant changes have been realized in the information and communications technology (ICT) sector in Kenya since the turn of the millennium. A notable achievement is the country's ICT policy document, which was approved by the cabinet in February 2006 (Republic of Kenya, 2006). Research by the Aberdeen Group (2001) cited user adoption as an essential factor in successful e-procurement deployment. To achieve close communication, e-procurement information systems need to be decentralized so that the process is improved by the closeness of the concerned stakeholders.

Nchunge, Sakwa and Mwangi (2013) in their assessment of the ICT Infrastructure on ICT Adoption in Education Institutions in Secondary Schools in Kiambu County in Kenya, found a positive association between the pace of ICT adoption and high infrastructure costs, pace of ICT adoption and inadequate internet connectivity, pace of ICT adoption and absence of clear guidelines. This leads to low usage of ICT and consequently causing delay of actual technology integration in schools.

2.4.5 Electronic Procurement Technical Support Staff

According to Armstrong (2000), the staff support on ICT is a formal and systematic modification of behavior which is achieved through training and experience. Training within an organization helps to increase value of the human resource which is considered to be a key resource. Staff support involves investing in people for the best utilization of their natural abilities. The purpose of support staff includes developing skills and competency as well as improving performance and increase growth in the organization. When the support staff is effective, learning cost is minimized and improves overall performance (output, quality, speed and productivity). In addition, effectiveness of the support staff also helps to improve the operational flexibility and commitment of the employees.

Mutula and Brakel (2007) studied ICT skills readiness in Botswana concluded that there is a serious skills gap for ICT support staff especially certified developers of the application soft-wares in the developing countries. Using a qualitative design, data was collected from focus group discussions consisting of key stake holders from the ICT sector. The study further revealed that the level of ICT usage was high since ICT was their tool of work. Department of Enterprise, Trade and Employment (Ireland)

(2005) in Ireland revealed that Low levels of ICT usage was found to have resulted in failure of Europe to catch up with productivity growth rates of the USA. Studies show that high levels of ICT usage lead to increased productivity in organisations.

A study done by Arvanitis, Loukis and Vasiliki (2013) on the effect of soft capital on innovation performance ICT Personnel showed that ICT Training and Users have a positive impact of both process and product innovation. Further, the total effect of these three types of soft capital on innovation performance was found to be stronger than that of hard ICT capital. This study used data collected through a survey based on a structured questionnaire administered to 271 Greek firms. The study suggests that organisations should consider both soft and hard capital in order to optimize ICT related investment.

Comparing the present ICT supported procurement, traditional procurement was paper-based and conversation-based (Bartezzaghi & Ronchi, 2003). Currently, this has changed to some extent and procurement has become a strategic function: procurement personnel look for suppliers that fit within a company's overall plan and strategy. If the ICT adoption in procurement system does not have the full support of the top management team, there is every reason for it to fail. It is important to make sure that the top management has given full support for the adoption of e-procurement. Considerable attention and support should be provided by senior management to ensure that the procurement reform has been well understood in the agency.

Top management support, firm's size, skills and knowledge and organization policy are considered to be factors that influence firms' willingness to adopt of E-procurement. Jeyaraj et al. (2009) found that top management support to be one of the best predictors of organizational adoption of IS innovations. Top management can stimulate change by communicating and reinforcing values through an articulated vision for the organization. Top management support is critical for creating a supportive climate for the adoption of new technologies.

According to Chatterjee (2006), top managers nowadays continuously emphasize adoption of Internet applications; they often advise employees to be sensitive to competitors' initiatives with regard to e-business; top managers insist that their

employees must bring more of their business practices online in order to meet customers' future needs; they are willing to try to provide the necessary resources for implementing e-business practices; they often advise employees to keep track of the latest developments in Internet technology and Internet related business practices, and incorporating e-business practices in company. The emphasis of top managers on e-business would facilitate performance gains from e-business adoption. Procurement Managers and internal stakeholders can easily drive user adoption and system compliance through significant change management efforts and ongoing education of those utilizing ICT for various functions. This is because of the interactions made by suppliers and businesses who they supply to and those that manufacture or supply to them.

2.4.6 Procurement Performance

Improvement in procurement functions in any organization can lower the costs incurred in the identification and subsequent selection of the best suppliers, increase the value of purchases in terms of their price-quality relationship and lower transaction costs associated with greater process efficiency. Studies on Procurement show that improvements in Procurement processes can highly improve organization performance (Barry, 2004).

Studies on the impact of e-procurement systems on supply chain performance show that e-procurement systems can facilitate information flow and activity coordination thus enhancing integration (Chang et. al., 2013). The study interviewed practicing managers from 108 Taiwanese enterprises. The study analysed the following aspects of e-procurement namely e-design, e-sourcing, e-negotiation and e-evaluation. It was further revealed that the use of electronic procurement systems results in reduced cost of procurement process.

Other researches indicate that use of ICT in procurement can help re-engineer existing work processes so that there are fewer breakdowns, bottlenecks, and redundancies on the job (Bajjaly, 1999). Real-time flow of information in the procurement process results in enhanced customer service, lower costs, and improved supplier relationships (Presutti, 2003; Roberts & Mackay, 1998; Davila, Gupta & Palmer, 2003). However, there is little history of extensive e-procurement use in the public sector.

Studies indicate that use of ICT may result in reduced lead-times rather than cost reductions (Wanjiru & Abdalla, 2014). The study was aimed at determining the effects of ICT adoption in procurement processes. The study used a population of 300 employees from Total Kenya. Findings of the study indicate that ICT applications influence procurement processes. Other studies show that ICT influences contract management in public procurement (Kibogo & Mwangangi, 2014). The study examined the factors affecting contract management in public procurement Sector in Kenya. The study used a descriptive research design with a design a targeting a population of 220 staff from Kenya Literature Bureau. Its findings showed that information technology influences contract management together with management styles, relationship management, and employee competence.

A study by Hwang and Min (2013) on the impact of ERP on supplier capabilities and performance concluded that use of ERP facilitates information sharing, process improvement and product innovation. The study involved examining a large scale survey of Korean manufacturers and their suppliers. This is in line with a study carried out by Wiengarten et al. (2013) which investigated e-business applications on supply chain collaboration in the German automotive industry. In this study, a web-based survey was carried out collect data within the German automotive industry. The study concluded that electronic business applications have a direct and positive impact on supply chain collaboration which consequently improves supply chain performance.

According to Roos and Roos (1997), the performance of the organization is linked to the performance of Procurement. This is supported by a study carried out by Munubi, Kinanga and Ondiba (2017) on major supermarkets in Nairobi County which was aimed at determining the effects of e-procurement on organizational performance. This study involved 26 major hyper markets and supermarkets in Nairobi County. The study concluded that e-procurement improves organization performance. Since ICT increases organization performance therefore, measuring procurement performance is critical. A performance measurement system that allows benchmarking across government would increase sophistication of the measures used by modelling the government's efforts with the private sector (Evennet & Bernard, 1999). The importance of proper management of procurement process is highlighted by the fact

that it accounts for substantial portion of firm's resources and time (Naief, 2002). In such a highly competitive environment, it is necessary for every firm to maintain an efficient and effective procurement to cut administration cost and to keep abreast with the market conditions of procuring material and services at the right price, quality and time.

According to Mwangi and Kariuki (2018), for the energy sector state corporations to realize the envisioned benefits of implementing ICT, they need to enhance data migration, user involvement, training and integration of various systems. This study was carried out in the energy sector state corporations and it was aimed at establishing the effect of ICT on supply chain performance. The study concluded that use of ICT in the energy sector state corporations was hindered by inadequate data migration, poor ICT infrastructure, user resistance, lack of top management support, inadequate training and high initial capital outlay.

Studies on challenges facing public procurement performance in Kenya indicate that public procurement performance in Kenya can be improved through review of existing legislations to encourage extensive use of technology in the management of the procurement process (Amaeba et al., 2013). Regardless of the recognition of value of ICT in procurement practices, it is clear from the study by Gunasekaran and Ngai (2008) that the adoption of ICT in procurement is still very low. Likewise, despite government initiative for public organization to adopt e-procurement, the process has been slowly adopted among many public organizations. E-procurement is a practice if adopted can lead to efficiency, transparency, reduction in costs among public organizations in Kenya. Its slowed adoption raises questions as to what challenges face its adoption in public sector. Even given the potential benefits of ICT in procurement process, many organizations especially within the developing economies have not effectively embraced the practice.

The United Nations Economic and Social Council defined transparency as the unfettered access to timely and reliable information on decisions and performance. Transparency in procurement involves publishing procurement policies; advance publication of procurement plans; advertisement of tender notices; disclosure of evaluation criteria in solicitation documents; publication of contract awards and prices paid; establishing appropriate and timely complaint/ protest/dispute mechanisms;

implementing financial and conflict of interest disclosure requirements for public procurement officials; and publishing supplier sanction lists.

2.5 Critique of Literature Relevant to the Study

Over the past decade, both private and public sector organizations have been utilizing Information Technology (IT) to streamline and automate their procurement and other processes (Koorn et al., 2001). With the emergence of Information and Communication Technology (ICT), companies have been forced to shift their operation from the traditional style to e-Business, e-Procurement and e-Supply Chain philosophy in order to sustain themselves (Lee et al., 2007). Existing literature on ICT in procurement has emphasized that cost improvements that may be achieved as a result of transactional and process efficiencies resulting from use of ICT. These efficiencies are gained in three ways; Greater opportunity for lower prices from suppliers; reduced work content in the total 'requisition to payment' process; and significant reductions in the time taken to complete the procurement process (Min & Galle, 2003; Croom, 2000; Zsidisin & Ellram, 2001).

Wanjiru and Abdalla (2015) sought the effect of information communication technology on procurement process in Total Kenya identified ICT applications that were in use in the organization and concluded that adoption of ICT software applications was not exclusively a matter of resources but on the contrary operational compatibility was also critical. However, the study failed to provide generalizations to energy sector state corporations in Kenya but focused on the case of Total Kenya.

According to a study carried on the effect of E-procurement application soft-wares e-sourcing, e-tendering, e-archiving) on organization performance, use of these applications increases organization performance by increasing information sharing and reducing time taken to perform the various procurement processes (Munubi et al., 2017). However, the study failed to provide generalizations to energy sector state corporations in Kenya but focused on the case of 4 major supermarkets (Naivas, Uchumi, Tuskys, Nakumatt) in Nairobi County. Kioko and Mwangangi (2017) on the influence of e-procurement on the performance of Kenyan parastatals have concluded that there is an improvement in performance of parastatals. However, the study failed

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Croom and Brandon-Jones (2007) investigated deployment of E-Procurement across 9 UK Public sector organisations in a period of 18 months. However, the study failed to provide generalizations to energy sector state corporations in Kenya but focused on the case of UK Public sector organisations.

The study by Chang, Yao-Chuan and Che-Hao (2013) on the e-procurement and supply chain performance points out three key processes of e-procurement which contribute to supply chain performance. However, the study failed to provide generalizations to energy sector state corporations in Kenya but focused on the case of Taiwaness enterprises. A study was carried out by Ordanini and Rubera (2008) on the role of the use of internet resources in procurement. However, the study failed to provide generalizations to energy sector state corporations in Kenya but focused on the case of firms in the textile and clothing industry in Italy. The study by Al-somali, Gholami and Clegg (2015) was carried out through a survey on 202 manufacturing and service companies in Saudi Arabia. However, the study failed to provide generalizations to energy sector state corporations in Kenya but focused on the case of Saudi Arabia.

Nchunge, Sakwa and Mwangi (2013) in their assessment of the ICT Infrastructure on ICT Adoption in Education Institutions in Secondary Schools in Kiambu County in Kenya, found a positive association between the pace of ICT adoption and high infrastructure costs, pace of ICT adoption and inadequate internet connectivity, pace of ICT adoption and absence of clear guidelines. However, the study failed to provide generalizations to energy sector state corporations in Kenya but focused on the case of Secondary Schools in Kiambu County in Kenya. Arvanitis, Loukis and Vasiliki (2013) on the effect of soft capital on innovation performance ICT Personnel showed that ICT Training and Users have a positive impact of both process and product innovation. However, the study failed to provide generalizations to energy sector state corporations in Kenya but focused on the case of Greek firms. Kibogo and Mwangangi (2014) examined the factors affecting contract management in public procurement Sector in Kenya. However, the study failed to provide generalizations to

energy sector state corporations in Kenya but focused on the case of Kenya Literature Bureau.

2.6 Research Gaps

Globalization and liberalization have facilitated intensive business competition which in turn has increased the need for adoption of new technologies to increase the efficiency in service delivery. Despite the proliferation of computer based-application in the public sector, the implementation of the same has remained a significant issue especially in public institutions. ICT components even where available particularly in government institutions is underutilized and does not meet its full potential or fails to be used at all. This can be attributable to many challenges in adopting ICTs, most important of which, is the challenge of leadership, financial limitations, teaching capability, content development, lack of technical support and the concern that ICT literacy among staff is very low especially to those that are working in critical departments (Yang, 2003).

Indeed, for ICT integration programs to be effective and sustainable, administrators themselves must be competent in the use of the technology, and they must have a broader understanding of the technical, administrative, financial, and social dimensions of ICT infrastructure use in procurement process. Despite having little or no training in ICT, management and senior supervisors in procurement department find themselves in a situation that requires them to understand and address some of these challenges. Failure to meet the challenges means that many organizations would not be able to effectively use ICT infrastructure in their procurement process, leading to further widening knowledge gap and deepening existing economic and social inequalities between those who have access to and control of technology, and those who do not (Mingaine, 2013).

In general, studies have shown that there is a general positive relationship between ICT and procurement performance. However, not much research has been done on how ICT affects procurement performance. It is important to establish the relation-ship between communication technology, electronic procurement soft-wares, information technology, electronic procurement policy and electronic procurement technical support staff on procurement performance. This study therefore seeks to

establish the relationship between ICT and procurement performance in the energy sector state corporations in Kenya.

From the literature review, it is evident that there are no studies showing the effect of ICT on procurement performance in the energy sector state corporations in Kenya. Further to this, there are no studies which show the following relationships: relationships between communication technology, application soft-wares, information technology, electronic procurement policy, electronic procurement technical support staff and procurement performance; relationship between electronic procurement technical support staff and procurement performance and application soft-wares and procurement performance. Whereas other studies on electronic procurement have used exploratory research designs, this study used descriptive and correlation designs. It is against this background that the study sought to find out effect of ICT on procurement performance in energy sector state corporations in Kenya.

2.7 Summary of Literature Reviewed

This chapter reviewed the relevant literature on the effect of communication technology, application soft-wares, information technology, electronic procurement policy and electronic procurement technical support staff on procurement performance. The literature revealed that although application of these ICT aspects on the procurement processes is expected to result in huge benefits for the organisations, through improved procurement performance adoption of these components has been quite challenging. Consequently, the rate of adoption has been slow. Literature on challenges faced by organisations recommends how these challenges could be resolved since there is no doubt that the benefits of ICT are real. Literature on how ICT elements affect procurement performance is limited.

The importance of the role of communication technology in procurement performance is supported in literature. Procurement processes are all about exchange of goods and information. Communication technology enhances information flow in procurement processes by increasing the speed of information exchange and eliminating paperwork in the processes and thus reducing the costs and eliminating the errors resulting from repetitive data entry. Thus enhancing the communication by automating the process should have a positive effect on the procurement performance.

Information technology enhances integration of the procurement processes by providing communication paths between suppliers and customers. Critical in IT is the existence of compatible networking resources between the parties. With the introduction of wireless networks and secure remote access to servers, workers can perform their tasks from the comfort of their homes or any other location away from the office. Consequently, procurement tasks cam be completed speedily at any time and from any location.

Electronic procurement policy, electronic procurement technical support staff and applications soft-wares are infrastructures that have been adopted in procurement processes in order to enhance performance. Although a few studies have been done on the effect of E-procurement systems in procurement, there is limited literature on the effect of ICT on procurement performance. The significance of the effect of each of these ICT elements on procurement performance in the energy sector organisations in Kenya is not known.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This chapter describes how the research was carried out. It sets out various stages and phases that were followed in completing the study. It starts by explaining the research design that was adopted; according to Sekaran (2010), a central part of research is to develop an efficient research strategy. In this chapter, the research design, the study population, the type of data to be collected, sampling frame, sample size determination and sampling techniques, data collection instrument, data collection procedure, pilot test, validity and reliability of the instrument and the data analysis and presentation are discussed. Lastly, the analytic techniques that were used to test the hypotheses are also presented.

3.2 Research Design and Reseaerch Philosophy

3.2.1 Research Design

Research design is a roadmap of how one goes about answering the research questions (Bryman & Bell, 2007). Sekaran (2010) stated that a good research design has a clearly defined purpose and there is consistency between the research questions and the proposed research method. The study adopted a descriptive survey design and correlational design. The descriptive survey is a method of collecting information by interviewing or administering a questionnaire to a sample of individuals (Orodho, 2003). A correlation design determines whether two variables are correlated.

Creswell (2003) stated that the descriptive method of research is to gather information about the present existing condition. The design also has enough provision for protection of bias and maximized reliability (Kothari, 2008). The emphasis was on describing rather than on judging or interpreting. The descriptive approach is quick and practical in terms of the financial aspect. Moreover, this method allows a flexible approach, thus, when important new issues and questions arise during the duration of the study, further investigation may be conducted.

3.2.2 Research Philosophy

Research philosophy relates to the foundation of knowledge upon which important assumptions and predispositions of a study are based. It can be defined as the development of knowledge and the nature of that knowledge (Saunders et al., 2009). A research philosophy is a belief about the way in which data about a phenomenon should be gathered, analyzed and used. In social sciences, there are two main research philosophies, namely; positivism (scientific) and phenomenology (interpretivism) which may also be viewed in terms of two perspectives, namely; quantitative and qualitative approaches (Coopers & Schindler, 2011).

The philosophical foundation of this study was positivism where scientific processes were followed in hypothesizing fundamental laws then deducing the observations so as to determine the truth or falsify the said hypotheses. Further, according to Beardwell and Claydon (2007), positivism underpins many organizational activities such as psychometric testing for selection models. Positivist philosophy premises that knowledge is based on facts and that no abstractions or subjective status of individuals are considered. Positivism thus derives a quantitative perspective which holds that there is an objective reality that can be expressed numerically, with explanatory and predictive power (Furrer, Thomas & Goussevkaia, 2008). Under this paradigm, knowledge is valid only if it is based on values of reason and facts, gathered through direct observations and experience, measured empirically using quantitative methods and statistical analysis. Under this paradigm, theoretical models can be developed that are generalized to explain cause and effects relationships (Saunders, Lewis & Thornhill, 2007). Consequently, problem solving under this approach follows a pattern of formulating hypotheses in which assumptions of social reality are made and hypotheses tested often using quantitative techniques.

3.3 Target Population

Sekaran (2010) describes the population as the total collection of elements about which inferences are made and refers to all possible cases which are of interest to the study. It can also be referred to as the total population. Target population as described by Borg and Gall (2009) is a universal set of study of all members of real or hypothetical set of people, events or objects to which an investigator intends to

generalize the results. The target population of this study was obtained from 9 organizations in the energy sector. These organizations included Kenya Power and Lighting Company Limited (KPLC), Kenya Electricity Generation Company Limited (KENGEN), Nuclear electricity board (KNEB), National Oil Corporation of Kenya (NOCK), Energy Regulatory Commission (ERC), Geothermal Development Company Limited (GDC), Rural Electrification Authority (REA), Kenya Pipeline Company Limited (KPC) and Kenya Electricity Transmission Company Limited (KETRACO).

The target population comprised the procurement staff and electronic procurement technical support staff from the nine organizations. There are 360 procurement staff and 25 electronic procurement technical support staff and consequently the study population was categorized into 2 as shown on table 3.1. In total, the study population consisted of three hundred and eighty five (N=385). The unit of analysis was the energy sector state corporations while the unit of observation was the staff.

3.4 Sampling frame

The sampling frame describes the list of all population units from which the sample was selected (Cooper & Schindler, 2011). It is a physical representation of the target population and comprises all the units that are potential members of a sample (Kothari, 2008). In this study, the sampling frame was the list of employees in procurement department and electronic procurement technical support section as listed in the HR data bases of the 9 energy sector organizations totaling to 360 employees from Procurement and 25 electronic procurement technical support staff as shown in table 3.1. These lists were obtained from the Human resources Managers of these state corporations.

Table 3.1: A Summary of the Target Population

Organization	Procurement Staff	Electronic Procurement Technical Support Staff
Kenya Power & Lighting Company Limited (KPLC)	85	6
Kenya Electricity Generation Company Limited (KENGEN)	42	4
Kenya Electricity Transmission Company Limited (KETRACO)	32	3
Kenya Pipeline Company Limited (KPC)	28	2
Rural Electrification Authority (REA)	53	2
Geothermal Development Company Limited (GDC)	36	2
Energy Regulatory Commission (ERC)	18	2
National Oil Corporation of Kenya (NOCK)	53	2
Kenya Nuclear Electricity Board (KNEB)	13	2
Total	**360**	**25**

Source; HR data bases

3.5 Sample Size and Sampling Techniques

A sample is a subset of the population. It is a carefully chosen subgroup that is representative of the whole population with the relevant characteristics. The purpose of sampling is to gain some understanding about some features or attributes of the whole population based on the characteristics of the sample (Sekeran, 2008). Moreover, Paton (2002) indicates that the sample size depends on what one wants to know, the purpose of the inquiry, what is at stake, what was useful, what will be credible and what can be done with available time and resources. The table of determining sample size of a known population by Krejcie and Morgan (1970) was used to determine the sample size of the procurement officers as illustrated on Appendix iv. On the other hand, the population of the electronic procurement technical support staff being small, all of them were selected to participate in the study. As such, the sample size for this study comprised 186 procurement staff and 25 electronic procurement technical support staff totaling to 211 employees as shown on

table 3.2 (n=211). The sample size was proportionately distributed among the 9 energy sector organizations so as to make the data representative.

Stratified, simple random and census sampling techniques were used to select the sample size. With regard to stratified sample technique, the respondents were first categorized according to their different departments. The two main departments in the context of this study were the electronic procurement technical support staff and those in the procurement department. Johnson and Christensen (2010) argue that stratified sampling technique produces estimates of overall population parameters with greater accuracy.

Once this was done, simple random sampling technique was applied to select the exact sample size of the procurement staff. The names of the procurement staff were written on pieces of paper and placed in a tin. The names were then mixed up thoroughly. Once finished, the names were picked from the tin one at time randomly. This was done until the required number of respondents was achieved. The procedure was repeated for all the other energy sector organizations. This process gave an equal opportunity for all the targeted respondents to be selected to participate in the study.

As indicated by Kothari (2006), simple random sampling gives each and every item in the population an equal chance of inclusion in the sample, consequently reducing bias and increasing levels of representation. On the other hand, census sampling technique was used to select the electronic procurement technical support staff. This was because their population was very small and hence all of them were involved in the study.

Table 3.2: Summary of the Sample Size

	Procurement Staff			Electronic Procurement Technical Support Staff		Total
	Population	**Sample**	**%**	**Sample**	**%**	
Kenya Power & Lighting Company Limited (KPLC)	85	44	24	6	24	
Kenya Electricity Generation Company Limited (KENGEN)	42	22	12	4	16	
Kenya Electricity Transmission Company Limited (KETRACO)	32	17	9	3	12	
Kenya Pipeline Company Limited (KPC)	28	14	8	2	8	
Rural Electrification Authority (REA)	53	27	15	2	8	
Geothermal Development Company Limited (GDC)	36	19	10	2	8	
Energy Regulatory Commission (ERC)	18	9	4	2	8	
National Oil Corporation of Kenya (NOCK)	53	27	15	2	8	
Kenya Nuclear Electricity Board (KNEB)	13	7	3	2	8	
Total	360	186	100	25	100	211

3.6 Data Collection Instrument

According to Mugenda and Mugenda (2003), data collection method refers to the instruments which a study needs to collect the necessary information which can include questionnaires, interviews, schedules and available records. Creswell (2003) defines data collection as a means by which information is obtained from the selected subjects of an investigation. Two types of data that can be used in a study include primary and secondary data (Kothari, 2008). The study used primary data collected through the use of questionnaires which were given to the respondents from each organisation.

The study used questionnaires which were structured to include both closed, open-ended and matrix questions to allow variety. Questionnaires avoid the embarrassment

of direct questioning and hence enhance the validity of the responses (Babbie, 2004). The questionnaire was divided into various sections to obtain information covering various aspects of the study. Measures were adopted from previous studies and organized according to research questions and specific objectives. Matrix questions were also utilized so as to present the respondent with a range of questions against which they were expected to respond based on a likert scale. These types of scales are used to measure perceptions, attitudes, values and behaviour (Cooper & Schinder, 2011). The Likert scale also provides a format that results in equal-interval data which allow use of various statistics to be used in testing the research variables (Kiess & Bloomquist, 2009). These types of questions are popular with the respondents and researchers as they are easy to fill in, economical and provide easy comparability. The first section of the questionnaire captured the background information of the respondents whereas the other sections captured the research objectives.

3.7 Data collection procedure

The study used the drop and pick method of administering the questionnaires. The data was collected with the help of one research assistant who assisted in distributing the questionnaires to the targeted respondents face to face. The research assistants were trained so that they could clearly understand the research instrument, purpose of the study and ethics of research. Upon completion, the researcher collected the filled questionnaires ready for analysis.

3.8 Pilot Testing

The study used a pilot study to test the validity and reliability of its data collection instrument. Cooper & Schindler (2011) indicated that a pilot test is conducted to detect weaknesses in design and instrumentation and to provide proxy data for selection of a probability sample. According to Babbie (2004), a pilot study is conducted when a questionnaire is given to just a few people with an intention of pre-testing the questions. Pilot test is an activity that assists the researcher in determining if there are flaws, limitations, or other weaknesses within the interview design and allows him or her to make necessary revisions prior to the implementation of the study (Kvale, 2007).

The pilot testing was conducted using questionnaires circulated to 21 respondents from two organizations namely KENGEN and KPLC which were conveniently sampled since they were geographically close to the researcher. The pilot group was selected through random sampling so as to ensure that the results were representative. The rule of thumb is that 10% of the sample should constitute the pilot test (Cooper & Schilder, 2011). Since the pilot test constituted 21 respondents who represent 10% of the sample, it was within the recommended percentage.

3.8.1 Reliability of Instruments

Reliability is the consistency of a set of measurement items while validity indicates that the instrument is testing what it should (Cronbach, 1951). It is important to remember that reliability is not measured, it is estimated. Reliability does not, however, imply validity because while a scale may be measuring something consistently, it may not necessarily be what it is supposed to be measuring. The researcher used the most common internal consistency measure known as Cronbach's alpha (α). It indicates the extent to which a set of test items can be treated as measuring a single latent variable (Cronbach, 1951). A construct composite reliability co-efficient (Cronbach alpha) of 0.6 or above, for all the constructs, was considered to be adequate for this study. The acceptable reliability coefficient is 0.6 and above (Rousson, Gasser & Seifer, 2002). Cronbach Alpha was used to test the reliability of the research instrument.

3.8.2 Validity of Instruments

Validity is used to check whether questionnaire is measuring what it purports to measure (Bryman & Cramer, 1997). Validity is the strength of our conclusions, inferences or propositions. More formally, Patton (2002) defined it as the best available approximation to the truth or falsity of a given inference, proposition or conclusion. One of the main reasons for conducting the pilot study was to ascertain the validity of the questionnaire. The study used content validity method to determine the validity of the questionnaires. Content validity refers to the degree to which the instrument fully assesses or measures the construct of interest (Wallen & Fraenkel, 2001). This method uses a panel of experts (Raters) who are familiar with the construct to examine the items in the questionnaire and decide what each particular

item is supposed to measure (cozby, 2001). Content validity draws an inference from test scores to a large domain of items similar to those on the test. Content validity is concerned with sample-population representativeness. Gillham (2008) stated that the knowledge and skills covered by the test items should be representative to the larger domain of knowledge and skills.

The study tested validity of the constructs by distributing questionnaires to 4 experts who made their judgment based on their expertise. These questionnaires were then collected and analyzed using the content validity formula. The average content validity index was then obtained. Content validity which was above 0.78 or higher was accepted (Shi, Mo et al., 2012) while content validity of above 0.9 was considered to be excellent (Shi et al., 2012).

3.9 Data Analysis and Presentation

The study generated both qualitative and quantitative data. Quantitative data was cleaned, arranged, coded and checked for completeness before entering it into Statistical Packages for Social Scientists (SPSS Version 23.0). Requisite analysis which included the use of factor analysis, reliability analysis, tests for normality and tests for multicollinearity were performed. According to Bryman and Bell (2007), these packages have considerable data handling capabilities and scores of statistical data analysis procedures that can handle any size of data. Qualitative data was analyzed using content analysis. Responses with common themes or patterns were grouped together into coherent categories. Quantitative data was presented in tables, charts and graphs.

Preliminary analysis which involved factor analysis, reliability analysis, tests for normality and tests for multicollinearity were carried out before descriptive and inferential analysis. The study used factor analysis which involved for reduction and summarization of data. To determine whether the data was suitable for factor analysis, the study used Kaiser-Meyer-Olkin (KMO) tests and Bartletts test of sphericity. All variables with the KMO above 0.50 and Barlets test of sphericity significance level of p less than 0.05 were useful for factor analysis. The data were then tested for reliability using Cronbachs alpha to determine whether the data gathered on each variable had a significant relationship with the determinants of procurement

performance. Variables whose reliability measures were found to be between 0.6 and 0.9 were recommended for further analysis since it was concluded that they had a significant relationship with the determinants of procurement performance and therefore reliable/acceptable.

Additional preliminary test carried out on the data included normality tests and multicollinearity tests. The test for normality of the independent and dependent variables were done using Box-and-whisker plot, Quantile-quantile plot and Kolmogorov-Smirnov tests. These tests were used to determine if the data was normally distributed. This is because the study was using multiple regression model and so the condition of normality had to be satisfied (Lapan et al., 2012). Multicollinearity test was used to test whether there was a high correlation between the independent variables leading to unreliable and unstable estimates of regression coefficients. All variance inflation factors (VIF) of less than 10 were acceptable. The data were checked for heteroscedasticity using normal P plots and scatter diagrams and there was no evidence of heteroscedasticity. Heteroscedasticity means the previous error terms are influencing other error terms and this violates the statistical assumption that the error terms have a constant variance.

The data was then analyzed using descriptive and inferential statistics before coming up with an overall model for the relationship. Descriptive statistics involved the use of absolute and relative (percentages) frequencies, measures of central tendency and dispersion (mean and standard deviation respectively). Descriptive analysis forms the basis for statistical tests such as correlation and regression, in addition to measures of central tendency and variability (Mugenda & Mugenda, 2008; Bryman & Bell, 2007). Inferential statistics involved the use of correlation, regression and ANOVA tests to establish the nature and magnitude of the relationships between the variables and to test the hypothesized relationships. The research hypothesis was tested at 95% level of confidence in order to provide conclusions.

The study used both the univariate and the multiple linear regression model to establish the significance of the independent variables on the dependent variable. Pearson's product moment correlation (r) was derived to show the nature and strength of this linear relationship. Coefficient of determination (R^2) was used to measure the amount of variation in the dependent variable explained by the independent variable.

The significance level used in this study was 5%. The findings of the study were presented using tables since they can be used to show frequencies and percentages. An empirical model was used to test the statistical significance of the relationship between the variables.

This study applied the following 5 univariate regression models:

Procurement Performance = f (Communication Technology + random error)

$$Y = \beta_0 + \beta_1 X_1 + e \quad \text{.....Equation (i)}$$

Procurement Performance = f (Application Software + random error)

$$Y = \beta_0 + \beta_2 X_2 + e \quad \text{.....Equation (ii)}$$

Procurement Performance = f (Information Technology + random error)

$$Y = \beta_0 + \beta_3 X_3 + e \quad \text{.....Equation (iii)}$$

Procurement Performance = f (Electronic Procurement Policy + random error)

$$Y = \beta_0 + \beta_4 X_4 + e \quad \text{.....Equation (iv)}$$

Procurement Performance = f (Electronic Procurement Technical Support Staff + random error)

$$Y = \beta_0 + \beta_5 X_5 + e \quad \text{.....Equation (v)}$$

The study was also guided by multiple linear regression model shown below.

$$Y = \beta o + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \varepsilon \quad \text{.....Equation (vi)}$$

Where;

$\beta_1 - \beta_5$ = Slopes coefficients representing the effect of the associated independent variables over the dependent variables over the dependent variable.

Y= Procurement Performance (Dependent variable)

X_1= Communication Technology (Independent variable)

X_2= Application Software (Independent variable)

X_3= Information Technology (Independent variable)

X_4= Electronic Procurement Policy (Independent variable)

X_5= Electronic Procurement Technical Support Staff (Independent variable)

βo = Constant of Regression

ε = Error term

CHAPTER FOUR

FINDINGS AND DISCUSSION

4.1 Introduction

This chapter describes the processes, techniques and procedures applied to analyze, present, and interpret data collected using the questionnaires. The chapter explains quantitative data analysis, cross tabulation tables, percentages and mean scores. The chapter consists of response rate, pilot study results, respondents' background information, requisite analysis, descriptive analysis, inferential analysis and overall model.

4.2 Response Rate

Simple random sampling was used to select a sample of 55% of the population from each stratum translating to a total of 211 questionnaires being administered to the various energy sector organizations. 189 questionnaires were returned. Twenty-two questionnaires were not returned from these the following organizations namely; Kenya Power & Lighting Company Ltd, Kenya Electricity Generating Company Ltd, Geothermal Development Company Ltd, Energy Regulatory Commission, Rural Electrification Authority, Kenya Pipeline Company Ltd, and National Oil Corporation of Kenya 7,4,2,2,5,1,1 respectively.

Therefore, the response rate is computed as: 189/211 x 100 = 89.6%. The response was considered appropriate according to Sekaran (2010) who argues that any response above 70% is classified as very good. The high response rate of 89.6% facilitated gathering sufficient data that could be generalized to determine the effect of ICT on Procurement performance in the Energy Sector State Corporations in Kenya. This was in line with Orodho (2009) that a response rate above 50% contributes towards gathering of sufficient data that could be generalized to represent the opinions of respondents about the study problem in the target population.

Table 4.1: Response rate

Organisation	Questionaires administered	Questionaires Returned	Response rate
Kenya Power & Lighting Company Limited (KPLC)	50	43	86%
Kenya Electricity Generation Company Limited (KENGEN)	26	22	84%
Kenya Electricity Transmission Company Limited (KETRACO)	20	20	100%
Kenya Pipeline Company Limited (KPC)	16	15	93%
Rural Electrification Authority (REA)	29	24	82%
Geothermal Development Company Limited (GDC)	21	19	90%
Energy Regulatory Commission (ERC)	11	9	81%
National Oil Corporation of Kenya (NOCK)	29	28	96%
Kenya Nuclear Electricity Board (KNEB)	9	9	100%
TOTAL	211	189	89.6%

4.3 Pilot Study Results

Pilot study may be viewed as an approach to improving the validity of a research (Zikmund et al., 2010). Pilot studies are considered important because they help in refining questions and reducing the risk that the actual study may be flawed. In this study, a pilot test was carried out to examine the validity and reliability of the data collection instruments.

4.3.1 Validity test

The study used a panel of supply chain experts from different fields and electronic technical support staff to evaluate the items in the questionnaire and determine whether they would establish the effect of information and communication technology on procurement performance in energy sector state corporations. The questionnaires were distributed to the 4 experts who read, made their judgment based on their

expertise and made recommendations on the relevance of the various items in the questionnaire. The responses were analysed based on context validity index which was calculated using the content formula (*Content Validity Index = (No. of judges declaring item valid)/ (Total No. of items)* by Amin (2005). This analysis was in line with previous studies (Lefort & Urzua, 2008; Cull, Demirguc-Kunt, & Morduch, 2007). Table 4.2 shows a summary of the validity analysis test results with an average validity index score of 0.9320175439 which implies that the instrument was valid based on the findings by (Amin, 2005).

Table 4.2: Content Validity Index

Rater	Total Items	Valid items	Fraction
1	114	103	0.9035087719
2	114	107	0.9385964912
3	114	109	0.9561403509
4	114	106	0.9298245614
Average			0.9320175439

4.3.2 Reliability test

In the pilot test, twenty-one respondents were selected from the companies that are KPLC and KENGEN to participate in the study. The respondents were able to finish and return the questionnaires. Table 4.3 shows a summary of the reliability analysis according to the various variables that are under investigation.

Table 4.3: Reliability Analysis

Variable	No. of cases(N)	Cronbach's Alpha	No. of items
Communication Technologies	20	.865	20
Application Software	20	.927	18
Information Technology	20	.912	19
Electronic Procurement Policy	20	.936	19
Electronic Procurement Technical Support Staff	20	.963	16
Procurement Performance	20	.960	23

As shown in the table, the items under the communication technologies (α=.865), application software (α=.927), information technology (α=.912), electronic procurement policy (α=.936), electronic procurement technical support staff (α=.963) and procurement performance (.960) were reliable. According to an observation made by George and Mallery (2003), if the value obtained falls within the accepted levels (0.6-0.9), the questionnaires is held reliable and thus accepted. From the reliability testing, it is evident that the values obtained were above these levels and hence, it was concluded that questionnaire was reliable.

4.4 Respondents Background Information

4.4.1 Energy Sector Organizations Response

The study focused on Energy sector state corporations and findings in Table 4.4 show that the sample of this study was representative since the respondents were from the major energy sector organizations, namely; Kenya Power & Lighting Company Limited (22.2%), Kenya Electricity Generating Company Limited (11.6%), Kenya Electricity Transmission Company Limited (10.6%), Kenya Pipeline Company Limited (7.9%), Rural Electrification Authority (13.2%), Geothermal Development Company Limited (10.1%), National Oil Corporation of Kenya (14.8%), Kenya Nuclear Electricity Board 4.8%), Energy Regulatory Commission (4.8%). This was a good distribution as it was based on 9 of the main organizations in the Energy Sector

in Kenya which made the sample more representative and eased the generalizability of the research findings.

Table 4.4: Energy Sector Organizations Response

Energy Sector Organizations	Percentage of Respondents
Kenya Power & Lighting Company Ltd (KPLC)	22.2
Kenya Electricity Transmission Company Ltd (KETRACO)	10.6
Kenya Pipeline Company Limited(KPC)	7.9
Rural Electrification Authority(REA)	13.2
Geothermal Development Company Ltd(GDC)	10.1
Kenya Electricity Generating Company Ltd(KENGEN)	11.6
Energy Regulatory Commission (ERC)	4.8
National Oil Corporation of Kenya (NOCK)	14.8
Kenya Nuclear Electricity Board(KNEB)	4.8
Total	**100.0**

4.4.2 Designation of Respondents

The designation of the respondents was considered in this study and figure 4.1 shows majority of the respondents (88.71%) were from Procurement while (11.29%) of the respondents were Electronic Procurement Technical Support. This clearly shows that the study sampled heavily on procurement and that data were gathered from the respondents with knowledge and skills on procurement management making it a representative sample of the target population for generalization purposes.

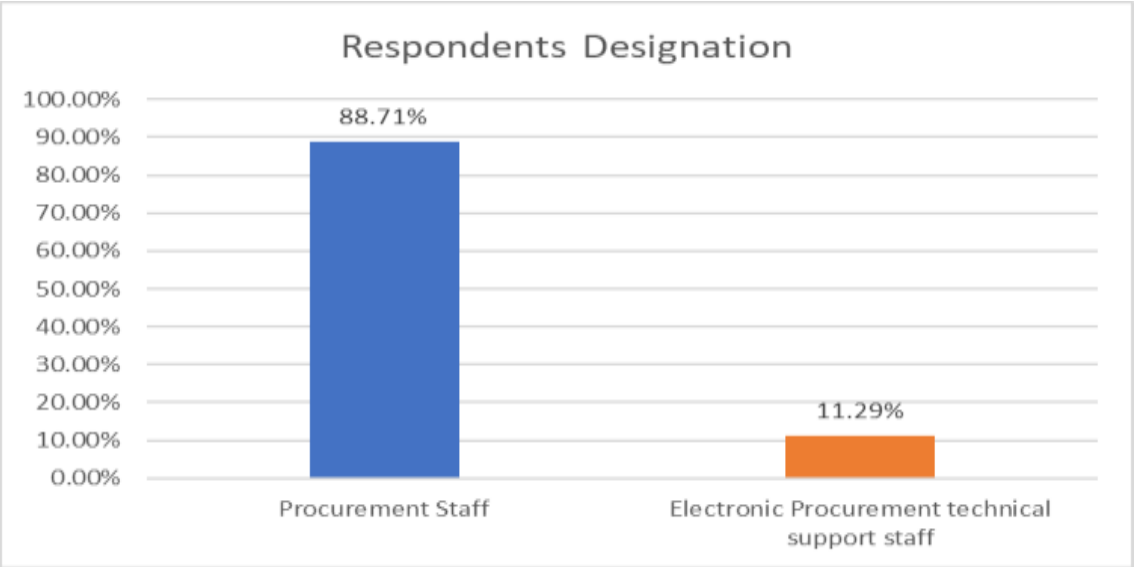

Figure 4.1: Respondents Designation

4.4.3 Respondents' Position in the Department

The respondents were requested to indicate their position in the department and the results on table 4.5 show that the majority (71.4%) were procurement officers while 11.1% were procurement system analysts, 10.6% procurement assistants, 4.2% procurement clerks and 2.1% were procurement managers. This demonstrated that most of the respondents to the study held a high position in the procurement department and their opinions could be relied upon and generalized on the entire population.

Table 4.5: Respondents' Position in the Department

Position in Department	Frequency	Percentage of respondents
Procurement Manager	4	2.1
Procurement Officer	135	71.4
Procurement Assistant	20	10.6
Procurement Clerk	9	4.2
Procurement System analyst	21	11.1
Total	**189**	**100**

4.4.4 Working Experience of Respondents

The working experience of each respondent was sought and the study showed that majority of the respondents (50.79%) had worked between 6-10 years, 43.92% have less than 5years, 4.76% have between 11-15 years and 0.53% had 16 years and above as illustrated in figure 4.2. This means that majority of the respondents and adequate working experience and therefore knowledgeable enough to enable them to provide useful data for this study. Since the sample was obtained from respondents with different years of experience, it was representative.

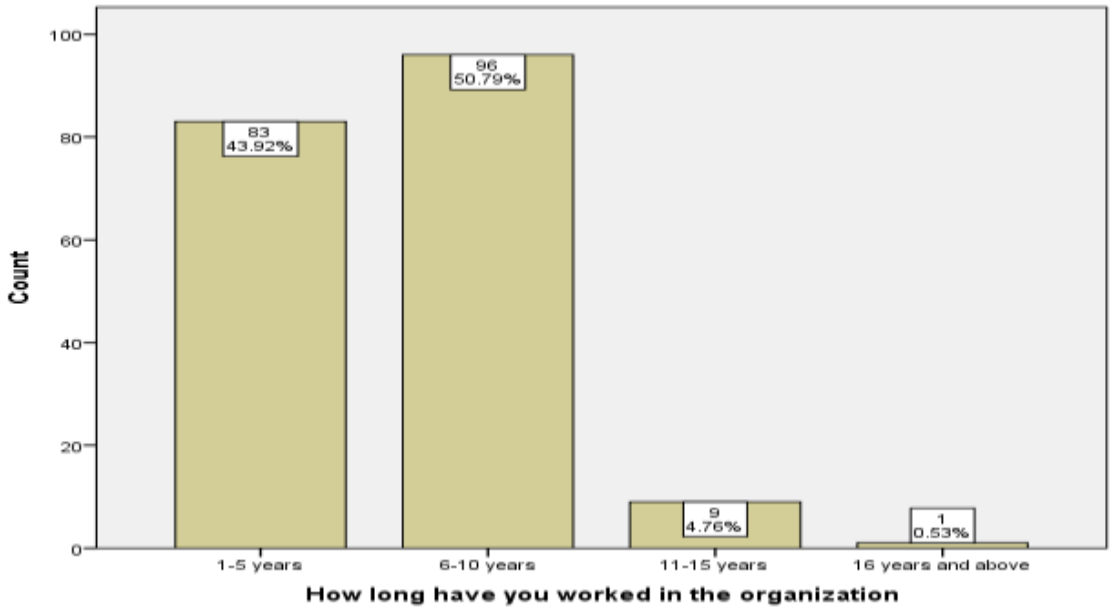

Figure 4.2: Respondents length of service

4.4.5 Level of Education of Respondents

The study also sought to establish the education level of the respondents in order to determine whether the data were from respondents who were highly knowledgeable. From the study findings as indicated in table 4.6, majority (61.9%) were undergraduate, 18.5% post graduate, 18.5% diploma and 1.1% were certificate holders. This indicates that the majority of the respondents were highly educated and their responses were therefore valid for this study.

Table 4.6: Level of Education of Respondents

Level of Education	Percentage of Respondents
Certificate	1.1
Diploma	18.5
Undergraduate	61.9
Post graduate	18.5
Total	**100.0**

4.5 Requisite Analysis

This section covers the preliminary analysis of dependent and independent variables which were done before descriptive and inferential analysis. The requisite analysis included the use of factor analysis, reliability analysis, tests for normality and tests for multicollinearity. The independent variables discussed include communications technology, application software, information technology, electronic procurement policy and electronic procurement technical support staff.

4.5.1 Factor and Reliability Analysis

The study used factor analysis for data reduction and summarization where the underlying dimensions (factors) that explain the correlations among the variables were determined and the original set of correlated variables replaced with uncorrelated ones. Factor analysis groups variables with similar characteristics together (Hare, 1998). Factor analysis operates on the notion that measurable and observable variables can be reduced to fewer latent variables that share a common variance and are observable which is known as reducing dimensionality (Yong & Pearce, 2013). The Component Matrix contains estimates of the correlations between variables and estimated components. Questions with estimated correlations that were less than 0.4 were expunged while those with 0.4 and above were retained.

Kaiser-Meyer-Olkin (KMO) test and Bartlett's test of Sphericity were performed before factor analysis as recommended by Field (2005). Kaiser-Meyer-Olkin (KMO) test was used to indicate the proportion of variance in the indicators/variables that might have been caused by underlying factors. It was used to test how suited the data

were for factor analysis. According to Kaiser (1974), a High KMO values close to 1.0 generally indicated that factor analysis could be useful with the data. If the KMO value was less than 0.50, the results of the factor analysis were considered not to be very useful.

Bartlett's test is used to test the strength of relationships among variables, that is, if the k samples have equal variances (Snedecor & Cochran, 1983). Small significance values (less than 5%) indicated that factor analysis would be useful with the data and such factors were consequently retained for further analysis. Table 4.7 shows the KMO for all the variables is above 0.50 and the Bartletts test of sphericity significance level is at $p<0.05$ which indicates that factor analysis is useful. Consequently, factor analysis was performed on the study.

Table 4.7: KMO and Barlett's Test Results

Variables	Kaiser-Meyer-Olkin (KMO) test of sampling adequacy	Bartlett's test of sphericity Approx. Chi-square	df	Sig.
Communications Technology	0.653	520.688	91	0.000
Applications Software	0.664	233.503	66	0.000
Information Technology	0.542	171.963	66	0.000
Electronic Procurement Policy	0.736	267.912	78	0.000
Electronic Technical Support Staff	0.814	465.016	105	0.000
ICT & Procurement Performance	0.742	716.269	231	0.000

Reliability analysis Results

The data was tested for reliability using Cronbach's alpha to determine whether the data gathered on each variable had a significant relationship with determinants of procurement Performance. The results of Cronbach's alpha were as follows, communications technology (0.710), application software (0.756), information technology (0.709), electronic procurement policy (0.714), electronic procurement

technical support staff (0.787), ICT and Procurement performance (0.801) as shown on table 4.8. Since the reliability measures were found to be between 0.6 and 0.9, as recommended by George and Mallery (2003), it was concluded that the data gathered for each variable had a significant relationship with the determinants of procurement performance and therefore acceptable/reliable.

Table 4.8: Reliability Analysis

Reliability Statistics	Cronbach's Alpha Value	No. of items
Communications Technology	0.710	9
Applications Software	0.756	9
Information Technology	0.709	7
Electronic Procurement Policy	0.714	9
Electronic Technical Support Staff	0.787	12
ICT & Procurement Performance	0.801	17

4.5.1.1 Factor Analysis for Communication Technology

The independent variable had 14 items from the original questionnaire as illustrated in appendix v. Out of the 14 items 5 did not meet the recommended threshold of 0.4 and above. These 5 items were consequently dropped and not considered for further analysis as shown in the results in table 4.9.

Table 4.9: Factor Analysis for Variable Communications Technology

Component Matrix	Component
1) Every employee involved in the procurement process has a Company email account	.691
2) Mobile devices are used to complete procurement tasks from any location	.638
3) Suppliers are able to directly and quickly get answers to their queries using the telephone	.616
4) Telephone is used to quickly contact suppliers who were not delivering the agreed level of service	.613
5) Use of email standardizes communication	.553
6) Email improves tracking of transactions	.535
7) Quotations are sent & received via email	.522
8) All suppliers are required to indicate their telephone contacts during registration	.510
9) Using mobile devices, notifications of approvals and rejections can be received instantly	.377

4.5.1.2 Factor Analysis for Application Software

The variable application software had 12 items in the original questionnaire which were subjected to factor analysis. Out of these items, 3 had an estimated correlations of below 0.4 as shown in appendix v and were expunged from the analysis and the results illustrated on table 4.10.

Table 4.10: Factor Analysis for Application Software

Component Matrix	Component
1) Use of contract management software has reduced paperwork	.660
2) With the use of spend analysis software, maverick purchases have been reduced	.578
3) Use of the contract management software has improved reporting and compliance	.578
4) Contract management software has reduced the time taken to prepare contract documents.	.568
5) By using spend analysis software, analysis of spend and identification of areas for cost savings is attained.	.496
6) By using the ERP, purchase orders are created electronically thus reducing the cost of paper.	.471
7) Processing tenders using the e-procurement software has increased transparency.	.466
8) Use of the ERP system has led to improved decision making since information on procurement is available	.413
9) Use of the ERP software solutions has increased process integration	.405

4.5.1.3 Factor Analysis for Information Technology

The independent variable had 12 items which were subjected to factor analysis as shown in appendix v. Out of these items, 5 items had estimated correlations that were below 0.4 and therefore did not meet the recommended threshold. These items were therefore dropped from the analysis and not considered for further analysis. The result of factor analysis for this variable is as illustrated in table 4.11.

Table 4.11: Factor Analysis for Information Technology

Component Matrix	Component
1) Use of internet leads to quick access of information on sourcing and prices.	.604
2) With the use of the internet there is increased information sharing resulting increased collaboration	.510
3) By using a supplier database buyers are able to identify sources of supply quickly and cost-effectively.	.495
4) The organisations' website contains a guide on how new suppliers can register as suppliers	.477
5) Through the internet purchase orders and invoices are sent electronically increasing efficiency	.470
6) Maintaining a database of procurement transactions enables our organisation to analyse data in a variety of ways	.396
7) Use of computers has eliminated delays & errors in our procurement processes	.389

4.5.1.4 Factor Analysis for Electronic Procurement Policy

Factor analysis was performed on the independent variable electronic procurement policy which had 13 items in its original questionnaire. Out of the 13 items that were subjected to the analysis, 4 items had an estimated correlation of below 0.4 as shown in appendix v. These 4 items were dropped from the analysis resulting in table 4.12. No further analysis was carried out on these items.

Table 4.12: Factor Analysis for Electronic procurement policy

Component Matrix	Component
1) The electronic record policy covers when and how to destroy the electronic records	.669
2) The electronic records policy covers the length of period that records should be retained	.617
3) Extension of tender closing/opening period if the system fails at a critical point during the process is allowed in the electronic tendering policy	.594
4) The aspect of traceability for all submitted tenders e.g. time received, time opened is covered in the electronic tendering policy.	.578
5) The means of demonstrating that the invoice is of a genuine supply is covered in the electronic invoicing policy.	.569
6) To prevent unauthorised data modifications the online security policy specifies user access controls	.543
7) The electronic tendering policy ensures that the tender contents are genuine and that the bidder is the author	.486
8) The electronic records management policy defines how electronic records are generated and stored	.460
9) The online security policy guides that users should be advised to immediately change their passwords on receipt	.404

4.5.1.6 Factor Analysis for Electronic Procurement Technical Support Staff

The independent variable had 15 items in the original questionnaire which were subjected to factor analysis. Out of these items, 3 items had estimated correlations of below 0.4 which was below the recommended threshold as illustrated in appendix v. These 3 items were expunged and not considered for any further analysis as shown in table 4.13.

Table 4.13: Factor analysis for Electronic Technical Support Staff

Component Matrix	Component
1) Technical support staff have the necessary technical knowledge to deliver products and services that support procurement	.625
2) Technical support staff are trained regularly to keep up with changing technology	.608
3) Technical support staff respond promptly when we have ICT related technicalities	.602
4) The technical support staff are able to analyse problems in electronic procurement systems and provide solutions	.597
5) All support staff attend a formal training program that meets their requirements	.583
6) We have a virtual/development system where the support staff can run transactions before running them in the live system	.579
7) The support staff regularly receive & implement feedback from users thus ensuring continued use of the system	.559
8) The organization has an e-learning tool for training ICT	.551
9) Training materials are customized for specific jobs by our support staff and provided to users	.533
10) The technical support staff are able to communicate, understand the needs of our procurement Users	.459
11) Support staff constantly check and maintain the system to ensure confidentiality and data integrity	.453
12) Manual procedures have been blocked to ensure that Staff utilize ICT Knowledge	.416

4.5.1.7 Procurement Performance

The dependent variable had 22 items from the original questionnaire. These items were subjected to factor analysis as illustrated in appendix v and consequently 5 items had estimated correlations of below 0.4. The 5 items were dropped from the analysis as shown in table 4.14.

Table 4.14: Factor Analysis for Procurement Performance

Component Matrix	Component
1) Suppliers deliver goods/services on time	.561
2) Bidders are able to electronically view the tender opening process	.536
3) Suppliers are willing to change goods/services to meet the changing customer needs	.536
4) With the use of ICT Contracts are created using predefined templates thus reducing contract document creation time	.536
5) Annual procurement plans are published on the website	.529
6) Contract award notices are published in the portal/website	.529
7) Key performance indicators for the contracts are tracked electronically	.517
8) The outcome of the tendering process(winning bidder, price, ranking) is available online	.507
9) With the adoption of ICT in procurement department, off contract buying has been reduced	.484
10) Sourcing time has been reduced considerably with the implementation of ICT	.480
11) Clear & comprehensive bidding documents are published in standard form and made available in the website/portal	.469
12) Contract deadlines and notifications are electronically monitored	.461
13) With adoption of ICT in procurement re-entering data from paper documents has gone down consequently reducing errors/time taken to prepare purchase orders/contracts	.460
14) Suppliers have enough flexibility to respond to unexpected demand changes	.449
15) Suppliers offer products that consistently conform to our specifications	.428
16) Circulation of Contracts documents is done electronically thus reducing paperwork	.424
17) Purchase orders/contracts are sent electronically to Suppliers resulting in reduced contract award lead time.	.390

4.5.2 Tests for Normality

4.5.2.1 Box-and-Whisker Plot

The study used the visual method of box-and-whisker plot (boxplot) to assess for normality. The box-and-whisker plot determines whether the data were symmetric or skewed. A symmetric data set show the median roughly in the middle of the box. As shown on figure 4.3 the median is roughly in the middle of the box of the data on procurement performance indicating that normal distribution of the data.

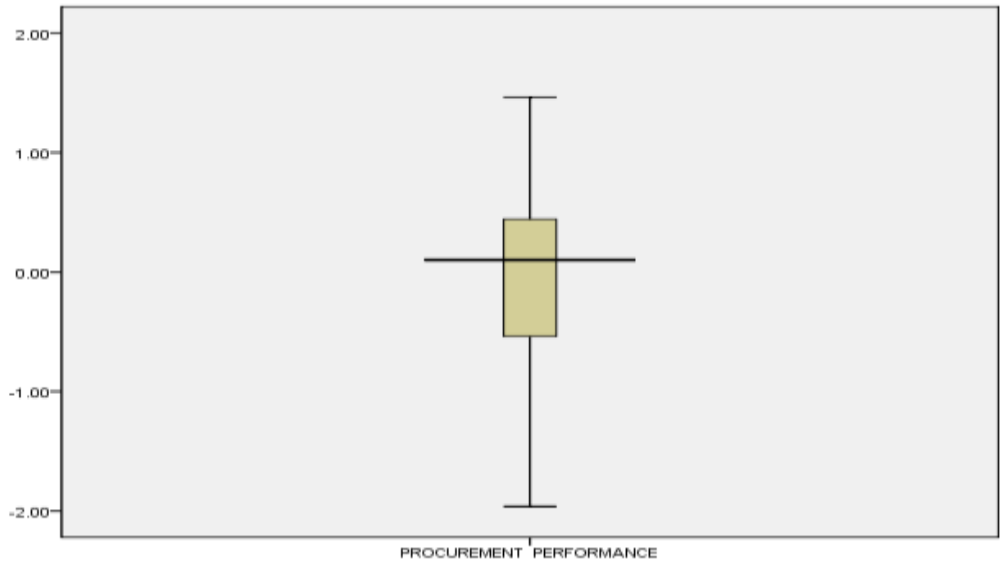

Figure 4.3: Box-and-whisker plot for procurement performance

4.5.2.2 Quantile-Quantile Plot for Procurement Performance

The study used also used the visual method of Quantile-quantile plot to determine if the data for procurement performance were well modelled by a normal distribution. Data were plotted on a quantile-quantile plot and a theoretical quantile line of the data fitted. The results on Figure 4.4 indicate that the observed values are randomly distributed along the diagonal line indicating that the independent variable is normally distributed. For a variable to be normally distributed, most of the points should lie on the theoretical quantile line (Shenoy & Pant, 1994). Where the dependent variable is found not to be normally distributed, normality must be sought before checking whether the dependent variable is affected by the independent variables.

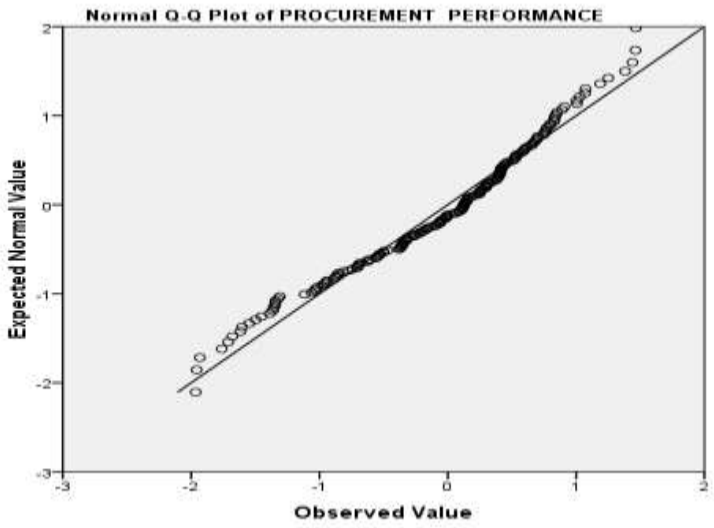

Figure 4.4: Normal Q-Q plot for procurement performance

4.5.2.3 Kolmogorov-Smirnov Test

The study used the one-sample Kolmogorov-smirnov test at 5% level of significance (α) to confirm the distribution of scores. The rule was to reject H0 if p-value was less than α or else fails to reject H0, where data were normal and H1: where data is not normal. The study results in table 4.15 indicate that procurement performance data were normal since the p-value is .091 which is greater than α which had been set to be 0.05. Therefore, we failed to reject the null hypothesis and concluded that procurement performance variable were normal in distribution and hence subsequent analysis could be carried out. Since the study was using multiple linear regression model, the condition of normality must be satisfied (Lapan, *et al.*, 2012).

Table 4.15: One-Sample Kolmogorov-Smirnov Test

		Procurement performance
N		188
Normal Parametersa	Mean	-.0669
	Std. Deviation	.75353
Most Extreme Differences	Absolute	.091
	Positive	.052
	Negative	-.091
Kolmogorov-Smirnov Z		1.242
Asymp. Sig. (2-tailed)		.091

a. *Test distribution is Normal*

4.5.3 Multicollinearity

Multicollinearity occurs when there are high correlations among independent variables leading to unreliable and unstable estimates of regression coefficients. Multicollinearity is shown by the variance inflation factor (VIF) which estimates how much the variance of a coefficient is "inflated" because of linear dependence with independent variables. The square root of the variance inflation factor indicates how much larger the standard error is, compared with what it would be if that variables were uncorrelated with the other predictor variables in the model. Thus, a VIF of 9.709 indicates that the standard error for the coefficient of that predictor variable is 3 times as large as it would be if that predictor variables were uncorrelated with the other predictor variables. The VIF for the different independent variables was as follows: Communication technology (9.709), Application software (9.009), Information technology (3.424), Electronic procurement policy (7.692) and Electronic procurement technical support staff (7.407) as indicated on table 4.16. According to Myers (1997), VIF greater than 10 is a cause of concern. Since all the independent variables had a VIF of less than 10, it was concluded that there were no significant multicollinearity problems were indicated as to cause concern and therefore all the variables were retained for analysis.

Tolerance refers to the total allowable error within an item. It's a useful tool for diagnosing multicollinearity, which happens when variables are too closely related. Tolerance values less than 0.10 indicate collinearity. Tolerance is used in applied regression analysis to assess levels of multicollinearity. Tolerance measures for how much beta coefficients are affected by the presence of other predictor variables in a model. Smaller values of tolerance denote higher levels of multicollinearity. Since all the variables had a tolerance of greater than 0.1, there were no serious multicollinearity problems.

Table 4.16: Multicollinearity

Variables	**Collinearity statistics**	
	Tolerance	**VIF**
Communication Technology	0.566	1.766
Application Software	0.565	1.771
Information Technology	0.445	2.245
Electronic Procurement Policy	0.431	2.322
Electronic Procurement Technical Support Staff	0.519	1.928

4.5.4 Heteroscedasticity

Heteroscedasticity occurs when the size of the error term differs across values of an independent variable. The assumption of homoscedasticity (meaning "same variance") is central to linear regression models. The study used Breusch-Pagan and White heteroscedasticity tests to check if the residuals of a regression have changing variance. The null hypothesis was: The data (residuals) are homoscedastic VS the alternative hypothesis: The data are heteroscedastic. The decision rule was if p-value < 0.05(level of significance) then null hypothesis was rejected but if the p-value > 0.05(level of significance) then the study failed to reject the null hypothesis. The results on table 4.17 indicate that the p-value was 0.1777 which was greater than 0.05, the null hypothesis was not rejected meaning that the data are homoscedastic and regression analysis can therefore be carried out.

Table 4.17: Heteroscedasticity

Breusch -pagan test statistic	Degrees of freedom	P-value
7.6319	5	0.1777

4.6 Descriptive Analysis

4.6.1 Communication Technology

Communication technology consists of the various innovations of communication which are used for exchanging procurement information over long distances such as email, telephones, mobile devices and video conferencing. Since procurement involves a lot of information exchange, use of these communication technologies is expected to enhance communication and consequently improve procurement performance.

To identify the most commonly used communication technology in procurement processes, respondents were asked to indicate the most common communication technologies used in the procurement processes in their organisations and results presented in appendix vi. Email was ranked as the most common technology used in their organizations, while mobile devices were ranked second and telephone was the third. Video conferencing was found to be the least used communication technology. Email was the most common communication technology because in procurement a lot of emphasis is made on written records. The respondents did not specify any other communication technology commonly used in their procurement processes. This is in line with the study by Calipinar and soysal (2012) which concluded that emails were a more preferred communication tool in comparison to telephones. This implies that effective emailing systems will improve procurement performance in an organization.

The study sought to establish how the respondents rated the effectiveness of communication technologies on the performance of Procurement department. Majority of the respondents (78.3%) indicated that communication technologies were very effective on the performance of procurement department, twenty-one point two per cent (21.2%) indicated that communication technologies were effective on the

performance of procurement while 0.5 per cent were not sure whether communication technologies were effective on procurement performance as shown in appendix vi. This indicates that majority of the respondents indicated that Communication Technologies have achieved their objective of improving procurement performance in the Energy Sector State Corporations in Kenya.

Regarding the use of email, respondents were asked to indicate whether every employee involved in the procurement process had an email account, majority (97.4%) strongly agreed that every employee involved in the procurement process had an email account, 2.1% agreed that every employee involved in the procurement process had an email account, 0 were neutral, 0.5 disagreed that every employee involved in the procurement process had an email account, and none strongly disagreed that every employee involved in the procurement process had an email account as shown in table 4.18. The mean was 5 with a standard deviation of 0 indicating that almost everyone strongly agreed that every employee had an email account. This means that the energy sector state corporations recognize the importance of email accounts as a key means of communication in procurement. The results are in agreement with studies carried out by Mohammadi et al. (2012) which used email as one of the communication tools in their study on effect of ICT o supply chain performance of dairy companies. Possession of an email account by every employee in procurement had a positive impact on procurement performance in the energy sector organisations.

Further, the respondents were asked whether in their organization email was used to send and receive quotations. Majority of the respondents (78.2%) agreed that their organization uses email to receive and send quotations, 18.6 per cent strongly agreed that in their organization email is used to send and receive quotations, 1.1 per cent were neutral, 1.6 per cent disagreed that emails were used to send and receive quotations while 0.5 per cent strongly disagreed that emails are used to send and receive quotations in their organisation. The mean was 4 with a standard deviation of 1 indicating that most of the respondents agreed. Most energy sector state corporations have digitized the process of sending and receiving quotations. Digitization of this process is expected to have an effect on the performance of procurement in the energy sector organisations.

Respondents were asked whether the use of email standardizes communication in their organisations. Majority of the respondents (55.6%) agreed that use of email standardizes communication in their organizations, 40.2 per cent strongly agreed that email standardizes communication in their organization, 3.2 per cent were neutral, 1.1 per cent disagreed and none strongly disagreed as show in table 4.18. The mean was 4 with a standard deviation of 1 implying that most of the respondents agreed that use of email standardizes communication. Since majority of the respondents agreed that use of email standardized communication, use of emails has an effect on the performance of procurement in energy sector organisations.

On whether the use of email improved tracking of transactions, majority of the respondents (63%) strongly agreed that use of emails improved tracking of procurement transactions, 32.3 per cent agreed that use of email improved tracking of procurement transactions, 4.2 per cent were neutral, 0.5 per cent disagreed that use of email improved tracking of procurement transactions while none strongly disagreed that use of emails improved tracking of procurement transactions. The mean was 5 with a standard deviation of 1 indicating that majority of the respondents agreed. Email improves tracking of transactions in procurement consequently affecting procurement performance.

Respondents were asked to indicate whether they use the telephone to quickly contact suppliers who were not delivering the agreed level of service. The results indicate that the majority (57.1%) of the respondents strongly agreed that they use the telephone to quickly contact suppliers who were not delivering the agreed level of service, 40.7 per cent agreed that they use the telephone to quickly contact suppliers who were not delivering the agreed level of service, 1.1 per cent were neutral, 1.1 per cent disagreed and none strongly disagreed that they use the telephone to quickly contact suppliers who were not delivering the agreed level of service. The mean was 5 with a standard deviation of 1 which means that most of the respondents agreed that telephone is used to quickly contact suppliers who were not delivering the agreed level of service. Use of the telephone therefore can lead to improved supplier performance.

Respondents were further asked to indicate whether suppliers were able to directly and quickly get answers to their queries using the telephone. Majority of the respondents (50.8%) strongly agreed that suppliers use the telephone to directly and

quickly get responses to their queries using the phone, 44.4 per cent agreed that suppliers use the telephone to directly and quickly get responses to their queries using the phone, 3.7% were neutral, 0.5 per cent disagreed while 0.5 per cent strongly disagreed that suppliers use the telephone to directly and quickly get responses to their queries using the phone. The mean was 5 with a standard deviation of 1 which means that majority of the respondents agreed that suppliers use the telephone to directly and quickly get responses to their queries.

Respondents were further asked to indicate whether suppliers were required to indicate their telephone contacts during registration. The findings presented on table 4.18 show that 59.3% which is the majority of the respondents indicated that provision of telephone contacts was one of the requirements during supplier registration, 36.5 per cent agreed that suppliers use the telephone to directly and quickly get responses to their queries using the phone, 3.7 per cent were neutral, 0.5 per cent disagreed while none strongly disagreed that suppliers use the telephone to directly and quickly get responses to their queries using the phone. The mean was 5 with a standard deviation of 1 which means that most of the respondents agreed that suppliers were required to indicate their telephone contacts during registration. This indicates that use of the telephone has an impact on procurement performance in energy sector organisations.

On mobile devices, respondents were asked whether by using mobile devices in their organisations their organization procurement tasks could be completed anywhere at any time. Majority of the respondents (50.3%) strongly agreed that by using mobile devices in their organisations their organization procurement tasks could be completed anywhere at any time, 42.9%, 3.7%, 3.2% of the respondents respectively agreed, were neutral and disagreed that their procurement tasks could be completed anywhere at any time using mobile devices. The mean was 4 with a standard deviation of 1, indicating that majority of the respondents agreed that their procurement tasks could be completed anywhere at any time using mobile devices. Ability to complete procurement tasks anywhere at any time is likely to result in reduced lead-times thus affecting procurement performance.

They were further asked whether notifications of procurement approvals and rejections were received instantly via mobile devices. The results indicate that

majority of the respondents (51.9%), strongly agreed that notifications of procurement approvals and rejections were received instantly via mobile devices, as illustrated on table 4.17, 37 per cent agreed that notifications of procurement approvals and rejections were received instantly via mobile devices, 7.9 per cent were neutral, 3.2 per cent disagreed that notifications of procurement approvals and rejections were received instantly via mobile devices and none of the respondents strongly disagreed that notifications of procurement approvals and rejections were received instantly via mobile devices. The results indicate that the mean was 4 with a standard deviation of 1 which means that most of the respondents agreed that notifications of procurement approvals and rejections. This indicates that use of mobile devices has an effect on procurement performance.

The study sought to find to what extent Communication Technologies have affected procurement performance in their organization. The majority of the respondents (85.7%) indicated that communication technology had affected procurement performance to a great extent as indicated in appendix IV. 11.6%, 0.5%, 1.6% indicated that communication technologies have affected procurement performance to some extent, not at all and not sure respectively. Procurement process is largely characterized by exchange of information and consequently use of Communication technologies will result in improved procurement performance. This is in line with studies by other scholars which concluded information sharing improved procurement performance (Ali *et al.,* 2017). Communication technologies should therefore be one of the areas that every organization that is seeking to improve its performance should focus on. This concurs with an observation made by Humphrey et al., (2013) where it was revealed that conducting e-commerce is mostly meant for enabling a firm to identify trading partners that they could contact on-line with a view to doing business. In addition, Bovel and Martha (2009) have also indicated that the most effective of the IT aspects are those that are able to get the mix of information requirements, physical logistics and collaboration right, providing shared benefits to a majority of partner organizations.

The findings of this study show that the use of communication technologies seems to be improving the speed of procurement communication within the organizations hence increasing procurement efficiency. Moreover, the management is able to have

full control of the procurement process. In line with these findings, various researchers have been able to show that various forms of communication technologies (IT) have been used to automate and streamline the procurement process, improve efficiency and transparency, thereby reducing the cost of operation within and between business parties. Moreover, Croom and Johnston (2003) observed that the objective of electronic business strategy in procurement area is to provide purchasing managers with better control over their companies' purchasing habits and relationships with suppliers.

Table 4.18: Communication Technologies

Statement (N= 189)	SD(1)	D(2)	N(3)	A(4)	SA(5)	Mean	Median	Mode	Std Deviation
1)Every employee in procurement has a Company email account	.0%	.5%	0%	2.1%	97.4%	5	5	5	0
2) Quotations are sent & received via email	.5%	1.6%	1.1%	78.2%	18.6%	4	4	4	1
3)Use of email standardizes communication	.0%	1.1%	3.2%	55.6%	40.2%	4	4	4	1
4)Email improves tracking of transactions	.0%	.5%	4.2%	32.3%	63.0%	5	5	5	1
5)Telephone is used to quickly contact suppliers who were not delivering the agreed level of service	.0%	1.1%	1.1%	40.7%	57.1%	5	5	5	1
6)Suppliers use the telephone to directly and quickly get answers to their queries	.5%	.5%	3.7%	44.4%	50.8%	4	5	5	1
7)Suppliers are required to indicate their telephone contacts during registration	.0%	.5%	3.7%	36.5%	59.3%	5	5	5	1
8)Mobile devices are used to complete procurement tasks from any location	.0%	3.2%	3.7%	42.9%	50.3%	4	5	5	1
9)Using mobile devices, notifications of approvals and rejections can be received instantly	.0%	3.2%	7.9%	37.0%	51.9%	4	5	5	1

Key: SD=Strongly Disagree, D= Disagree, N=Neutral, A= Agree, SA=Strongly Agree, Std deviation = Standard deviation

4.6.2 Application Software

The purpose of application soft-wares is to enable the end user to perform tasks such as creating documents, running businesses and designing graphics. To assess the effect of application software on procurement performance, the study rated the effect of procurement soft-wares on procurement performance. These soft-wares included; e-procurement systems, ERP systems, spend analysis software and contract management Software. Use of procurement application soft-wares makes the procurement process more efficient and transparency in addition to improving accountability (Caldwell, Roehrich & Davies, 2009).

Respondents were asked to indicate the soft-wares that are used in procurement departments in their origination. The results in appendix vi show that 95.2% of the respondents indicated that they use e-procurement systems, while 3.7% indicated that they use ERP, 0.5% indicated that they use contract management software and 0% indicated that they use the spend analysis software. Most energy sector state corporations are using e-procurement systems. This is because all state corporations were instructed to implement e-procurement systems in 2014 in an attempt to increase transparency and competiveness in government procurement (Rok, 2014). Use of e-procurement systems is expected to improve procurement performance in these state corporations.

Respondents were asked to indicate the effectiveness of procurement application soft-wares on the performance of procurement department in their organizations. Majority of the respondents that is 88.9% indicated that they were very effective as shown in appendix vi while 9% indicated that it was effective and 2.1% indicated that they were not sure. This means that the soft-wares that are in use in these energy sector state corporations are effective and should therefore have an impact on procurement performance.

Regarding e-procurement software and its effect on transparency, 95.8 per cent of the respondents indicated that they strongly agreed that processing tenders using the e-procurement software has increased transparency, 3.7 per cent agreed that processing tenders using the e-procurement software has increased transparency, 0 per cent were neutral, 0.5 per cent indicated that processing tenders using the e-procurement

software has increased transparency and none strongly disagreed that processing tenders using the e-procurement software has increased transparency as shown on table 4.18. The results indicate that the mean was 5 with a standard deviation of 0 which means that most of the respondents indicated that processing tenders using the e-procurement software has increased transparency.

On ERP systems, respondents were asked whether the use of ERP application software solutions has increased process integration in the organization. The results show that most of the respondents 48.7% strongly agreed that use of ERP Software solutions has increased process integration in the organization, 40.2 per cent agreed that use of ERP software solutions has increased process integration in the organization, 10.1 percent were neutral, 1.1 per cent disagreed that use of ERP software solutions has increased process integration in the organization and none strongly disagreed. The results indicate that the mean was 4 with a standard deviation of 1 which means that majority of the respondents agreed that use of ERP application software solutions has increased process integration in their organization. ERP Soft-wares integrate all functions of an organization into a single software that is able to serve the specific needs of different functions. This integration may at times include suppliers leading to improved supplier performance.

Respondents were further asked whether they whether the use of ERP has led to improved decision-making since procurement information was available. The results in table 4.19 indicate that 51.3% agreed that use of ERP has led to improved decision making since procurement information was available, 42.9% strongly agreed that use of ERP has led to improved decision-making since procurement information was available, 5.3%, 0.5% and 0%, were neutral, disagreed and strongly disagreed that use of ERP has led to improved decision-making since procurement information was available respectively. The results indicate that the mean was 4 with a standard deviation of 1 which means that majority of the respondents agreed that use of ERP has led to improved decision-making since procurement information was available. Improved decision making is expected to lead to better performance of procurement.

Asked whether use of ERP has led to automatic creation of purchase orders leading to reduction in paper cost, majority (48.1%) agreed that use of ERP has led to automatic creation of purchase orders leading to reduction in paper cost, 45.5% strongly agreed

that use of ERP has led to automatic creation of purchase orders leading to reduction in paper cost, 6.3% were neutral while none disagreed or strongly disagreed that use of ERP has led to automatic creation of purchase orders leading to reduction in paper cost as shown in table 4.19. The results indicate that the mean was 4 with a standard deviation of 1 which means that majority of the respondents agreed that by using ERP soft-wares, purchase orders are created automatically thus reducing the cost of paper. Use of ERP soft-wares has a positive effect on procurement performance.

On spend analysis software, most of the respondents(54%) strongly agreed that the use of spend analysis software enables the organization to analyse spend and identify areas of cost savings, 38.6 per cent agreed that the use of spend analysis software enables the organization to analyse spend and identify areas of cost savings, 7.4 per cent were neutral and none disagreed or strongly disagreed that that the use of Spend analysis software enables the organization to analyse spend and identify areas of cost savings. The results indicate that the mean was 4 with a standard deviation of 1 which means that majority of the respondents agreed that use of the spend analysis software enables the organization to analyse spend and identify areas of cost savings.

Further, respondents were asked to indicate whether with the use of spend analysis software, maverick purchases have been reduced. Majority of the respondents (54%) strongly agreed that with the use of spend analysis software maverick purchases have been reduced as illustrated in table 4.19, 38.6% agreed that with the use of spend analysis software maverick purchases have been reduced while 7.4%, 0% and 0% were neutral, disagreed and strongly disagreed that with the use of Spend analysis software maverick purchases have been reduced respectively. The results indicate that the mean was 4 with a standard deviation of 1 which means that most of the respondents agreed. The organization is able to ensure that all procurement are based on the set contracts thus improving procurement performance. In support, Aberdeen (2007) explained that the benefit of using spend analysis is savings which are obtained through identifying opportunities to aggregate spend and negotiate superior contracts, identifying and reducing non-compliant or “maverick” spend, and improving procurement operations and supplier performance.

On contract management, respondents were asked whether the use of contract management software improved reporting and compliance in their organization. Most of the respondents, that is 51.3 % agreed that use of this software had improved reporting and compliance in their organization, 38.1% of the respondents strongly agreed that use of contract management software improved reporting and compliance while 9.5% were neutral and 1.1% disagreed that use of contract management software improved reporting and compliance in their organization while none strongly disagreed that use of contract management software improved reporting and compliance in their organization. The results indicate that the mean was 4 with a standard deviation of 1 which means that majority of the respondents agreed that use of contract management software improved reporting and compliance in their organization.

On whether contract management software reduced paper work, majority of the respondents (56.1%) agreed that contract management software reduced paperwork, while 36.5 % agreed that contract management software reduced paperwork. 6.9% were neutral and 0.5% disagreed that contract management software reduced paperwork while none strongly disagreed that contract management software reduced paperwork. The results indicate that the mean was 4 with a standard deviation of 1 which shows that most of the respondents agreed that use of contract management software reduced paper work in their organization.

The study further found that, majority of the respondents(52.7%) strongly agreed that contract management software had reduced the time taken to prepare contract documents in their organisations, 41.5 per cent agreed that contract management software had reduced the time taken to prepare contract documents in their organisations, while 5.3% of the respondents were neutral and 0.5 % disagreed that contract management software had reduced the time taken to prepare contract documents in their organisations while none strongly disagreed that contract management software had no effect on procurement performance. The results indicate that the mean was 4 with a standard deviation of 1 indicating that most respondents agreed that use of contract management software had reduced the time taken to prepare contract documents in their organization. Contract management software has a positive effect of procurement performance in energy sector organisations.

The findings show that there are various application soft-wares that are being utilized in the procurement process. Each of the software has its own contributions to the efficiency of the procurement process. In this line, Caldwell, Roehrich and Davies (2009) explained that the use of new software technologies in evaluating and making price comparisons has made this process efficient and at the same time will ensure transparency and accountability as well as reduction in errors and omissions. In addition, Gunasekaran and Ngai (2008) also pointed out that e-procurement works in such a way that buyer software enables users to automate transactions and focus mostly on buying organizations activities such as order placement, catalogue management, payment, reporting and so on.

The findings of various other studies have been able to relate with the findings made in this study. For instance, the study by Wanjiru and Abdalla (2015) carried out on the effect of information communication technology on procurement process in Total Kenya. The study showed that adoption of ICT software applications is not exclusively a matter of resources but on the contrary operational compatibility was also critical. In addition, Munubi *et al*. (2017) in their study established that use of e-procurement application soft-wares (e-sourcing, e-tendering, e-archiving) increases organization performance by increasing information sharing and reducing time taken to perform the various procurement processes.

Also concurring with the findings of this study is Mose, Njihia and Magutu (2013) who indicated that the private and public sector organizations have been utilizing information technology (IT) systems to streamline and automate their purchasing and other processes over the past years. Most governments are adopting ERP. ERPs are large-scale computer software and hardware systems that attempt to integrate all data and processes of an organization into a unified system housed in a centralized database which is accessed through a secure network.

Table 4.19: Application Software

Statement (N= 189)	SD(1)	D(2)	N(3)	A(4)	SA(5)	Mean	Median	Mode	Std.Dev
1)Processing tenders using the E- Procurement software has increased transparency	.0%	0.5%	0%	3.7%	95.8%	5	5	5	0
2) Use of the ERP software solutions has increased process integration.	.0%	1.1%	10.1%	40.2%	48.7%	4	4	5	1
3)Use of the ERP system has led to improved decision making since information on procurement is available	.0%	.5%	5.3%	51.3%	42.9%	4	4	4	1
4) By using the ERP, purchase orders are created electronically thus reducing the cost of paper.	.0%	.0%	6.3%	48.1%	45.5%	4	4	4	1
5) By using a spend analysis software, analysis of spend & identification of areas of cost savings is attained.	.0%	.0%	7.4%	38.6%	54.0%	4	5	5	1
6)With the use of spend analysis software, maverick purchases have been reduced	.0%	1.1%	9.0%	65.6%	24.3%	4	4	4	1
7)Use of the contract management software has improved reporting and compliance	.0%	1.1%	9.5%	51.3%	38.1%	4	4	4	1
8)Use of contract management software has reduced paperwork	.0%	.5%	6.9%	36.5%	56.1%	4	5	5	1
9) Contract management software has reduced the time taken to prepare contract documents.	.0%	.5%	5.3%	41.5%	52.7%	4	5	5	1

Key: SD=Strongly Disagree, D= Disagree, N=Neutral, A= Agree, SA=Strongly Disagree Std. Dev = Standard Deviation

The respondents were also asked to indicate some of other effects of ICT application Software on the procurement in their organization. One of the respondents indicated that: Our *organization has reaped benefits such as reduced lead-times and better collaboration with our service providers.* Another respondent indicated that: *E-*

Procurement has essentially helped us in robotizing inside acquisition cycles, for example, buy request following, and provider assessment, bringing about expanded functional effectiveness. Moreover, they have decreased exchange time and speeded up downstream cycles. Another responded also indicated that: These softwares have reduced errors in our procurement processes and increased operational efficiency.

These assertions corroborate those of another respondent who claimed that: *To us, an electronic procurement system aids in the standardization of workflows and the reduction of process deviations. Some of the advantages of going online include routing transactions through the proper channel and obtaining the appropriate level of approval, using existing suppliers and referring to current contracts, and avoiding off-contract purchases.*

4.6.3 Information Technology

Information technologies are innovations that facilitate the collection, processing, storage and retrieval of accurate, reliable and timely information in the procurement process. According to Jansen (2015), various aspects of information technology provide the communication path and services between users, processes, applications, services and external networks. The study covered the following aspects of information technology: Computers, websites, internet and procurement database. With proper management of procurement information, organisations are able to improve procurement performance.

Given computers, web technology, internet and procurement database, respondents were asked to indicate the most common information technologies used in their organization. Majority of the respondents (98.3%) indicated that the most common information communication technology used in their organization was the internet, 0.6% indicated that computers were the most common communication technology used, 1.1% indicated that the most common communication technology was the web technology as shown on appendix vi. In line with this, a study conducted by Jau -Jeng et al., (2008) on the effect of web based e-procurement solutions on performance concluded that use of web based solutions results in enhanced relationships between buyers and sellers which lead to improved performance.

On Computers, 51.9 per cent of the respondents, that is the majority, strongly agreed that the use of computers has eliminated delays and errors in the procurement processes, 43.4 per cent agreed that the use of computers has eliminated delays and errors in the procurement processes while 4.2 per cent were neutral, 0.5 per cent disagreed that the use of computers has eliminated delays and errors in the procurement processes and none strongly disagreed that the use of computers has eliminated delays and errors in the procurement processes. As shown in table 4.20, the mean was 4 with a standard deviation of 1 indicating that most respondents agreed that use of computers has eliminated delays and errors in the procurement processes. Elimination of delays and errors procurement processes results in improved procurement performance.

The study sought to find out whether guides on registration of new suppliers were put in the organizations websites. Results indicate that 53.4% of the respondents strongly agreed that guides on registration of new suppliers were put in the organizations websites, 41.3% agreed that guides on registration of new suppliers were put in the organizations websites, 4.8%, 0.5% and 0% were neutral, disagreed and strongly disagreed that guides on registration of new suppliers were put in the organizations websites respectively. The results indicate that the mean was 4 with a standard deviation of 1 indicating that most respondents agreed that their website has a guide on how new suppliers can register with the organization. Maintaining supplier registration guide in the website enables many suppliers to access this information widening the organizations sourcing base leading to improved procurement performance.

On the internet, respondents were asked to indicate whether the use of the internet enables them to quickly access information on sourcing and prices. The results shown on table 4:20 indicate that most of the respondents (48.1%) strongly agreed use of the internet enables them to quickly access information on sourcing and prices, 46 per cent of the respondents agreed that use of the internet enables them to quickly access information on sourcing and prices, 4.8 per cent were neutral while 1.1 per cent disagreed that use of the internet enables them to quickly access information on sourcing and prices and none of the respondents strongly disagreed that use of the internet enables them to quickly access information on sourcing and prices. The

results indicate that the mean was 4 with a standard deviation of 1 indicating that most respondents agreed that use of the internet enables them to quickly access information on sourcing and prices. Faster access to information and sourcing is likely to lead to reduced lead-times thus affecting procurement performance. On the other hand, a study carried out by Ordanini and Rubera (2008) on the role of the use of internet resources in procurement established that although the use of the internet may have positive effects on purchasing costs resulting from reduced transaction costs and this may not be so for direct procurement of materials.

Respondents were further asked to indicate whether use of the internet increased information sharing resulting in increased collaboration. Majority of the respondents (50.3%) agreed that use of the internet increased information sharing and consequently collaboration, 45 per cent of the respondents strongly agreed that use of the internet increased information sharing resulting in increased collaboration, 0.5 per cent of the respondents disagreed that use of the internet increased information sharing and collaboration, 4.2 per cent were neutral and none of the respondents strongly disagreed that use of the internet increased information sharing resulting in increased collaboration. The results indicate that the mean was 4 with a standard deviation of 1 indicating that most respondents agreed that use of the internet increased information sharing resulting in increased collaboration.

On the whether the internet was used to send purchase orders and invoices electronically, respondents responded as shown on table 4.20. Majority of the respondents (48.7%) strongly agreed that internet was used to send purchase orders and invoices electronically, 47.6 per cent agreed that internet was used to send purchase orders and invoices electronically while 3.2, 0.5,0 per cent were neutral, disagreed and strongly disagreed that internet was used to send purchase orders and invoices electronically respectively. The results indicate that the mean was 4 with a standard deviation of 1 indicating that most respondents agreed that internet was used to send purchase orders and invoices electronically. Sending purchase orders and invoices electronically by internet will have an impact on procurement performance.

On the procurement database, respondents were asked to indicate whether maintaining a procurement database for their procurement transactions enabled them to analyse data in a variety of ways. Fifty point eight per cent of the respondents

strongly agreed that maintaining a procurement database for transactions enabled them to analyse data in a variety of ways, 44.4% of the respondents agreed that maintaining a database for their transactions enabled them to analyse data in a variety of ways, 3.2 per cent were neutral, 1.1% disagreed that maintaining a procurement database for their procurement transactions enabled them to analyse data in a variety of ways while 0.5 strongly disagreed that maintaining a procurement database for their procurement transactions enabled them to analyse data in a variety of ways as illustrated on table 4.20. In adding to these findings, Bhoir and Patil (2014) points out that Organisations can build private clouds or engage external cloud service providers. For organisations to be able to connect to cloud service, they must have network devices that provide the necessary performance, flexibility, reliability and Security. These cloud services can play an important role in storing the procurement database and thus making it easier to be accessed from any given location at any given time with ease.

Respondents were further asked whether their organization had a supplier database that enabled buyers to identify sources of supply quickly and cost effectively. Majority of the respondents (53.6%) strongly agreed that their organizations had a supplier database that enabled them to identify sources of supply quickly while 42.5% of the respondents agreed that their organization had a supplier database that enabled buyers to identify sources of supply quickly and cost effectively. Three point three per cent, 0%, 0.6% were neutral, disagreed and strongly disagreed that their organization had a supplier database that enabled them to identify sources of supply quickly. The results indicate that the mean was 4 with a standard deviation of 1 indicating that most of the respondents agreed that that their organizations had a supplier database that enabled them to identify sources of supply quickly. Existence of a supplier database has an effect on procurement performance. In line with this finding, Lui (2010) pointed out that the use of electronic procurement system (e-procurement) software allows purchasers to access supplier’s catalogs via the Internet, as well as accepting electronic invoices.

Table 4.20: Information Technology

Statement (N= 189)	SD (1)	D (2)	N (3)	A (4)	SA (5)	Mean	Median	Mode	Std. Dev
1) Use of computers has eliminated delays & errors in our procurement processes	.0%	.5%	4.2%	43.4%	51.9%	4	5	5	1
2) The organisations' website has a guide on how new suppliers can register as suppliers	.0%	.5%	4.8%	41.3%	53.4%	4	5	5	1
3) Use of the internet leads to quick access of information on sourcing and prices.	.0%	1.1%	4.8%	46.0%	48.1%	4	4	5	1
4) With the use of the internet there is increased information sharing resulting increased collaboration	.0%	.5%	4.2%	50.3%	45.0%	4	4	4	1
5) The internet has enabled us to send purchase orders and invoices electronically increasing efficiency	.0%	.5%	3.2%	47.6%	48.7%	4	4	5	1
6) Maintaining a database of our procurement transactions enables us to analyses data in a variety of ways	.5%	1.1%	3.2%	44.4%	50.8%	4	5	5	1
7) By using a supplier database buyers are able to identify sources of supply quickly and cost-effectively.	.6%	.0%	3.3%	42.5%	53.6%	4	5	5	1

Key: SD=Strongly Disagree, D= Disagree, N=Neutral, A= Agree, SA=Strongly, Disagree, Std Deviation= Standard Deviation

4.6.4 Electronic Procurement Policy

Electronic procurement policies provide a guide on the use of ICT in procurement processes in the organisation. As it has been indicated by Zuzana (2012), efficient

technology policies in procurement practices are critical for good public financial management and effective budget implementation. World Bank (2013) report indicates that there is need for transparency to enhance openness and clarity on procurement policy and its delivery. As such, this study was set to cover the following aspects of electronic procurement policies: online security policy, electronic invoicing policy, electronic tendering policy and electronic records policy.

Respondents were asked to indicate the electronic procurement policies that have been put in place in their organizations given electronic tendering policy, electronic invoicing policy, electronic records management policy and online security policy. Results in appendix vi show that majority of the respondents (97.2 %) indicated that electronic tendering policy had been put in place in their organization, 2.3 per cent indicated that electronic invoicing policy had been put in place in their organization while 0.6 per cent indicated that electronic records management policy had been put in place in their organization. None of the respondents indicated that on line security policy had been put in place in their organization. In addition respondents did not specify other electronic procurement policies that had been put in place in their organisations.

Regarding online security, respondents were asked to indicate whether their online security policy guides that users should immediately change their passwords on receipt. The results in table 4.20 indicate that most of the respondents (83.1%) agreed that their online security policy guides that users should immediately change their passwords on receipt, 15.9% of the respondents strongly agreed that their online security policy did not guide that users should immediately change their passwords on receipt, none disagreed of strongly disagreed that their online security policy did not guide that users should immediately change their passwords on receipt and 1.1 per cent of the respondents were of a neutral opinion. The results indicate that the mean was 4 with a standard deviation of 0 indicating that majority of the respondents agreed that their online security policy did not guide that users should immediately change their passwords on receipt. This finding confirms a previous observation made by Al-somali, Gholami and Clegg (2015) who pointed out that the access to personal computers and effective telecommunication systems at a reasonable cost may not be

sufficient for organisations to reap benefits of ICT; consumers must have reasonable confidence in the integrity of online transactions and a supporting legal environment.

Further, majority of the respondents (55.3%) strongly agreed that they have an online security policy on user access controls that prevents unauthorized data modifications, 40.4%, agreed that they have an on line security policy on user access controls that prevents unauthorized data modifications while 3.7%, 0.5%, 0% were neutral, disagreed and strongly disagreed that they had an online security policy on user access controls that prevents unauthorized data modifications respectively. The results in table 4.21 indicate that the mean was 5 with a standard deviation of 1 indicating that majority of the respondents agreed that they had an online security policy on user access controls that prevents unauthorized data modifications.

On electronic invoicing policy, respondents were asked to indicate whether their invoicing policy covers the means of demonstrating that the invoice was of genuine supply. Majority of the respondents (55.6%) strongly agreed that their electronic invoicing policy covered the means of demonstrating that the invoice was of genuine supply, 40.2 per cent strongly agreed that their electronic invoicing policy covered the means of demonstrating that the invoice was of genuine supply, none disagreed or strongly disagreed that their electronic invoicing policy did not cover the means of demonstrating that the invoice was of genuine supply while 4.2 per cent indicated that they were neutral. The results indicate that the mean was 4 with a standard deviation of 1 indicating that majority of the respondents agreed that their electronic invoicing policy covered the means of demonstrating that the invoice was of genuine supply.

On the electronic tendering policy, respondents were asked whether their electronic tendering policy that ensured that the tender contents are genuine and that the bidder is the author. Fifty one point nine, who were the majority agreed that their electronic tendering policy ensured that the tender contents are genuine and that the bidder is the author, 43.4 per cent strongly agreed that their electronic tendering policy ensured that the tender contents are genuine and that the bidder is the author while 0.5 per cent disagreed that their electronic tendering policy did not ensure that their tender contents were genuine and that the bidder is the author, 4.2 per cent were neutral and none strongly disagreed that their electronic tendering policy ensured that the tender contents are genuine and that the bidder is the author. The results indicate that the

mean was 4 with a standard deviation of 1 indicating that majority of the respondents agreed that their electronic tendering policy did not ensure that their tender contents were genuine and that the bidder is the author.

Analyzed results in table 4.21 on electronic tendering policy indicate that majority of the respondents (56.1%) strongly agreed that their electronic tendering policy covered traceability for all submitted tenders regarding time received and time opened, 41.1% agreed that their electronic tendering policy covered traceability for all submitted tenders regarding time received and time opened, 0.5 per cent of the respondents disagreed that their electronic tendering policy did not cover traceability for all submitted tenders while 2.1 per cent were neutral and none strongly disagreed that their electronic tendering policy covered traceability for all submitted tenders regarding time received and time opened. The results indicate that the mean was 5 with a standard deviation of 1 indicating that majority of the respondents agreed that their electronic tendering policy covered traceability for all submitted tenders regarding time received and time opened.

Further, 49.2 per cent, that is the majority of the respondents agreed that their electronic tendering policy allows for extension of tender closing/opening period if the system fails at a critical point during the tendering process, 4.6.6 per cent strongly agreed that 2.1 percent disagreed that their electronic tendering policy allows for extension of tender closing/opening period if the system fails at a critical point during the tendering process, 1.6 per cent disagreed that their electronic tendering policy allows for extension of tender closing/opening period if the system fails at a critical point during the tendering process while 2.1 per cent were neutral and 0.5 per cent strongly disagreed that their electronic tendering policy allows for extension of tender closing/opening period if the system fails at a critical point during the tendering process. The results indicate that the mean was 4 with a standard deviation of 1 indicating that majority of the respondents agreed that their electronic tendering policy allows for extension of tender closing/opening period if the system fails at a critical point during the tendering process.

On electronic records policy, respondents were asked to indicate whether their electronic records management policy defined how electronic records could be generated and stored. Majority of the respondents (55%) strongly agreed that their

organisation had put in place an electronic records policy that defined how electronic records were generated and stored, 40.7% agreed that their organisation had put in place an electronic records policy that defined how electronic records were generated and stored, none disagreed or strongly disagreed that their organisation had put in place an electronic records policy that defined how electronic records were generated and stored while 4.2 per cent were neutral. The results indicate that the mean was 5 with a standard deviation of 1 indicating that majority of the respondents agreed that their organisation had put in place an electronic records policy that defined how electronic records were generated and stored.

Further, respondents were asked to indicate whether their electronic records policy covers when and how records are destroyed. Sixty six point five percent of the respondents strongly agreed that electronic records policy covered when and how to destroy electronic records, 29.3 per cent agreed that their electronic records policy covers when and how records are destroyed while 4.2 per cent were neutral and none indicated that they did not have an electronic records policy that covered when and how to destroy electronic records. The results indicate that the mean was 5 with a standard deviation of 1 indicating that majority of the respondents agreed that their electronic records policy covers when and how records are destroyed.

As it has been presented in the findings, there are various procurement policies which have been put in place in the energy sector. Each of these policies has different roles that they play so as to enhance the security and openness of the procurement transactions. According to Gibbs, Kraemer and Dedrick (2006), policies such as liberalization of trade and telecoms have a positive impact on e-commerce since they make ICT and Internet access more affordable to firms and consumers. From the findings, some of the policies that have been put in place for the procurement purposes as pointed out by the respondents include online security policy, electronic tendering policy, electronic records management policy and electronic records policy. According to Hasan (2003), the absence of a national ICT policy can hinder the desired ICT growth. Victor (2012) noted that procurement expenditure could be minimized through implementation of effective procurement practices which include proper use of technology or e-procurement. In supporting the role played by electronic procurement policies, various researchers such as Carayannis and Popescu

(2005); Croom and Brandon-Jones (2005) have observed that electronic procurement in the public sector can be seen as a policy tool to support the delivery of public procurement policy, improving transparency and efficiency.

Table 4.21: Electronic Procurement Policy

Statement (N= 189)	SD (1)	D (2)	N (3)	A (4)	SA (5)	Mean	Median	Mode	Std. Dev
1)Our online security policy guides that users should be advised to immediately change their passwords on receipt	.0%	.0%	1.1%	83.1%	15.9%	4	4	4	0
2)We have an online security policy on user access controls preventing unauthorized data modifications	.0%	.5%	3.7%	40.4%	55.3%	5	5	5	1
3) The means of demonstrating that the invoice is of a genuine supply is covered in the electronic invoicing policy.	.0%	.0%	4.2%	55.6%	40.2%	4	4	4	1
4) The electronic tendering policy that covers that ensures that the tender contents are genuine and that the bidder is the author	.0%	.5%	4.2%	51.9%	43.4%	4	4	4	1
5) The aspect of traceability for all submitted tenders e.g. time received, time opened is covered in the electronic tendering policy	.0%	.5%	2.1%	41.3%	56.1%	5	5	5	1
6) Extension of tender closing/opening period if the system fails at a critical point during the process is allowed in the electronic tendering policy	.5%	1.6%	2.1%	49.2%	46.6%	4	4	4	1
7)The electronic records management policy that defines how electronic records are generated and stored	.0%	.0%	4.2%	40.7%	55.0%	5	5	5	1
8)The electronic records policy covers when and how to destroy the records	.5%	1.1%	2.7%	29.3%	66.5%	5	5	5	1

Key: SD=Strongly Disagree, D= Disagree, N=Neutral, A= Agree, SA=Strongly, Disagree
Agg. = Aggregate percentage, Std deviation= Standard Deviation

4.6.5 Electronic Procurement Technical Support

The electronic procurement technical support staff include all the ICT staff who offer technical support for the procurement systems. The study covered the following aspects of the electronic technical support staff: competence, number, knowledge application and Training. The results of the study are shown in table 4.22.

On competence, respondents were asked to indicate whether their electronic procurement technical support staff had the necessary technical knowledge to deliver products and services that support procurement. Majority of the respondents (84%) strongly agreed that their technical support staff had the necessary technical knowledge to deliver product and services that support procurement, 14.9 per cent agreed that their technical support staff had the necessary technical knowledge to deliver product and services that support procurement, 0.5 per cent indicated that their technical support staff did not have the necessary technical knowledge to deliver product and services that support procurement, 0.5 per cent were neutral while none strongly disagreed that their electronic procurement technical support staff had the necessary technical knowledge to deliver products and services that support procurement. The results indicate that the mean was 5 with a standard deviation of 0 indicating that majority of the respondents agreed that their technical support staff had the necessary technical knowledge to deliver product and services that support procurement.

Respondents were further asked whether their technical staff were able to analyze problems in electronic procurement systems and provide solutions. Forty eight point seven per cent who were the majority agreed that their technical support staff were able to analyse system problems and provide solutions, 46.6 per cent agreed that their technical support staff were able to analyse system problems and provide solutions while 3.7 per cent, 1.1 per cent and zero percent were neutral, disagreed and strongly disagreed respectively, that the technical support staff are able to analyse system problems and provide solutions. The results indicate that the mean was 4 with a standard deviation of 1 indicating that majority of the respondents agreed that their

technical staff were able to analyse problems in electronic procurement systems and provide solutions.

The study also sought to find out whether electronic procurement technical support staff were able to communicate and understand the needs of the Procurement system users. The results shown in table 4.22 indicate that 57.1 per cent of the users strongly agreed that their electronic procurement technical support staff were able to understand and communicated the needs of procurement system users, 38.6 per cent agreed while 0.5 percent disagreed that their electronic procurement technical support staff were able to understand and communicate the needs of the procurement users and 3.7% of the respondents were neutral and none strongly disagreed that technical support staff were able to communicate and understand the needs of the procurement system users. The results indicate that the mean was 5 with a standard deviation of 1 indicating that majority of the respondents agreed that their electronic procurement technical support staff were able to understand and communicate the needs of the procurement users.

Regarding use of ICT knowledge, respondents were asked whether they had a virtual/development system where the support staff could run transactions before transporting them to the live system. Majority of the respondents (47.6%) agreed that they had a virtual system where the technical support staff would run transactions before transporting them to the live system, 47.1% strongly agreed that they had a virtual system where the technical support staff would run transactions before transporting them to the live system, 1.1 per cent disagreed that they had a virtual system where technical support staff would run transactions before transporting the transactions to the live system ,4.2 per cent of the users were neutral and none strongly disagreed that they had a virtual system where technical support staff would run transactions before transporting the transactions to the live system. The results indicate that the mean was 4 with a standard deviation of 1 indicating that majority of the respondents agreed that they had a virtual system where Technical support staff would run transactions before transporting the transactions to the live system.

Further, 54 per cent, that is the majority of the respondents agreed that their technical support staff regularly received and implemented feedback from users thus ensuring continued use of the system, 40.2% agreed that their technical support staff regularly received and implemented feedback from users thus ensuring continued use of the system, one point one per cent disagreed that technical support staff regularly received and implemented feedback from users, 4.8 per cent took a neutral position on the issue while none strongly disagreed that their technical support staff regularly received and implemented feedback from users thus ensuring continued use of the system. The results indicate that the mean was 4 with a standard deviation of 1 indicating that majority of the respondents agreed that their technical support staff regularly received and implemented feedback from users thus ensuring continued use of the system.

Further, the study sought to find out whether the support staff regularly checked and maintained the system to ensure confidentiality and data integrity. Majority of the respondents (49.7%) strongly agreed that support staff regularly checked and maintained the system to ensure confidentiality and data integrity, 46 % of the respondents agreed that support staff regularly checked and maintained the system to ensure confidentiality and data integrity, 3.7% were neutral while 0.5% and 0% disagreed, strongly disagreed that support staff regularly checked and maintained the system to ensure confidentiality and data integrity respectively. The results indicate that the mean was 4 with a standard deviation of 1 indicating that majority of the respondents agreed that support staff regularly checked and maintained the system to ensure confidentiality and data integrity respectively.

The study also asked respondents to indicate whether manual procedures had been stopped to ensure that staff utilizes ICT knowledge. Majority of the respondents (50.8%) strongly agreed that manual procedures had been stopped to ensure that staff utilize ICT knowledge, 41.3% of the respondents agreed that had been stopped to ensure that staff utilize ICT knowledge, none of the respondents strongly disagreed while 1.6% and 6.3% strongly disagreed and were neutral that had been stopped to ensure that staff utilize ICT knowledge respectively. The results indicate that the mean was 4 with a standard deviation of 1 indicating that majority of the respondents

agreed that manual procedures had been stopped to ensure that staff utilize ICT knowledge respectively.

On Training, respondents were asked to indicate whether ICT technical support staff were trained regularly to enable them to keep up with the changing technology. Majority of the respondents (56.6%) strongly agreed that ICT Technical support staff were trained regularly, 39.2% of the respondents agreed that ICT Technical support staff were trained regularly, 1.1 per cent disagreed that ICT Technical support staff were trained regularly, 3.2 per cent were neutral while none strongly disagreed that ICT technical support staff were trained regularly. The study results indicate that the mean was 5 with a standard deviation of 1 indicating that majority of the respondents agreed that ICT technical support staff were trained regularly.

The study also sought to find out whether the organization had an e-learning tool for training ICT. Majority of the respondents that is 50.3 per cent, strongly agreed that their organization had an e-learning tool for ICT, 46 per cent of the respondents agreed that their organization had an e-learning tool for ICT, 2.6 per cent were neutral, 0.5 per cent disagreed that their organization had an e-learning tool for ICT while 0.5 per cent strongly disagreed that their organization had an e-learning tool for ICT. The study results indicate that the mean was 5 with a standard deviation of 1 indicating that majority of the respondents agreed that that their organization had an e-learning tool for ICT.

Respondents were further asked whether the electronic technical support staff promptly responded when procurement staff were experiencing ICT related technicalities. Most of the respondents(49.2%) strongly agreed that the electronic technical support staff responded promptly when procurement staff were experiencing ICT related technicalities, 46.6% agreed that the electronic technical support staff responded promptly when procurement staff were experiencing ICT related technicalities while 2.6%, 1.6% and 0% were neutral, disagreed and strongly disagreed that the electronic technical support staff responded promptly when procurement staff were experiencing ICT related technicalities. The results indicate that the mean was 4 with a standard deviation of 1 indicating that majority of the

respondents agreed that their electronic procurement technical support staff responded promptly when procurement staff were experiencing ICT related technicalities.

Based on the findings, the knowledge and skills among the ICT staff are critical to its integration within the procurement department. This is in line with Hwang (2004) in his study on the relationship between the diffusion of ICTs and changes in skills in the UK within business organizations whereby he established that education and training were important in adjusting skill changes to the rapid expansion of ICTs. In addition, a study carried out by Mutula and Brakel (2007) on the ICT skills readiness in Botswana concluded that there is a serious skills gap for ICT support staff especially certified developers of the application soft-wares in the developing countries. Moreover, the Digital Opportunity Task Force (DOT FORCE, 2002) reported that human resources development through systematic training and education is critical if countries have to reap digital dividends. As such, in the context of the study, the readiness of the support staff plays an integral role in helping the energy organizations to gain more in utilizing the ICT in the procurement process.

The results corroborate with Hamada (2012) findings which stated that lack of ICT technical support among management was one of the factors influencing the use and success of information communication technology on procurement process. Further, Arvanitis, Loukis and Vasiliki (2013) states that training of ICT Personnel and Users have a positive impact of both process and product innovation. Further, soft capital was found to have a stronger effect on innovation performance than hard ICT capital.

According to Bartle and Korosec (2001), the degree of use of ICT in the procurement is sometimes hampered by transitions in personnel, support, or training. In addition, Attewell and Savill-Smith (2005) states that in order for a specific device to be used optimally, certain technical and organizational conditions must be fulfilled. This confirms the findings of this study whereby a majority of the respondents indicated

that their ICT support staffs were receiving training so as to enhance their skills and knowledge and be able to provide adequate support in the organization in the utilization of the ICT for procurement purposes.

Table 4.22: Electronic Procurement Technical Support Staff

Statement (N= 189)	SD (1)	D (2)	N (3)	A (4)	SA (5)	Mean	Median	Mode	Std. Dev
1)Our technical support staff have the necessary technical knowledge to deliver products & services that support procurement	.0%	.5%	.5%	14.9%	84.0%	5	5	5	0
2)The technical support staff are able to analyse problems in electronic procurement systems and provide solutions	.0%	1.1%	3.7%	48.7%	46.6%	4	4	4	1
3)The technical support staff are able to communicate, understand the needs of our procurement Users	.0%	.5%	3.7%	38.6%	57.1%	5	5	5	1
4)Our technical support staff respond promptly when we have ICT related technicalities	.0%	1.6%	2.6%	49.2%	46.6%	4	4	4	1
5)We have a virtual/development system where the support staff can run transactions before running them in the live system	.0%	1.1%	4.2%	47.6%	47.1%	4	4	4	1
6)The support staff regularly receive & implement feedback from users thus ensuring continued use of the system	.0%	1.1%	4.8%	40.2%	54.0%	4	5	5	1
7)Support staff constantly check and maintain the system to ensure confidentiality and data integrity	.0%	.5%	3.7%	46.0%	49.7%	4	4	5	1
8)Manual procedures have been blocked to ensure that Staff utilize ICT Knowledge	.0%	1.6%	6.3%	41.3%	50.8%	4	5	5	1
9)Our organization has an e-learning tool for training ICT	.5%	.5%	2.6%	46.0%	50.3%	4	5	5	1
10)Our support staff are trained regularly to keep up with changing technology	.0%	1.1%	3.2%	39.2%	56.6%	5	5	5	1
11)Training materials are customized for specific jobs by our support staff and provided to users	.0%	1.1%	3.7%	36.5%	58.7%	5	5	5	1

Key: SD=Strongly Disagree, D= Disagree, N=Neutral, A= Agree, SA=Strongly, Disagree, Std deviation= Standard Deviation

The respondents were also required to indicate some of the challenges affecting the electronic procurement technical support staff in facilitating smooth procurement processes in their organizations. The most common theme was that despite years of process innovations and elegant technological solutions, an adaptable, flexible procurement process remains elusive. Perhaps it's the people who are impeding progress. It is widely assumed that, rather than considering the procurement to be a 50/50 mix of infrastructure and information systems technology, any supply chain is a 45/45/10 mix of human behavior, systems technology, and asset infrastructural facilities.

One of the respondents recorded the following: *Procurement staff must be competent enough to use the applications softwares. At some point when we are doing recruitment process, some of the recruits who turn up are not that experienced but full of potential in the related field, young and appreciative of the current era of digital transformation. We therefore, have to prepare for the talent gap and intensify our training and development programs in the IT department. A*nother respondent asserted the following: *There is a good chance that some leaders or employees are unaware of various procurement laws. According to this viewpoint, procurement professionals tend to adhere to regulations with which they are familiar. As a result, understanding procurement laws is regarded as one method of ensuring that all parties are in compliance. Some policies are complicated for public institutions, resulting in procurement professionals having insufficient knowledge of what is required to fully comply with the policies. As a result, we are forced to provide appropriate training programs for employees in order for them to be aware of various procurement provisions.*

4.6.6 Procurement Performance

The study covered the following aspects of procurement performance: reduced lead-times, increases transparency, supplier performance and contract management performance. Use of ICT in Procurement is expected to reduce procurement lead-times, increase transparency, improve supplier performance and improve contract performance. The findings of the study are illustrated on table 4.22.

On reduced lead-times, respondents were asked to indicate whether with the adoption of ICT in procurement sourcing time had been reduced. Majority of the respondents, that is, 82.5 per cent agreed that adoption of ICT had reduced sourcing time, 16.9 per cent of the respondents strongly agreed that with the adoption of ICT in procurement sourcing time had been reduced, none were neutral while 0.5 per cent disagreed and 0% percent strongly disagreed that adoption of ICT in procurement sourcing time. The results indicate that the mean was 4 with a standard deviation of 1 indicating that majority of the respondents agreed that with the adoption of ICT in Procurement Sourcing time had been reduced.

Respondents were further asked to indicate whether use of ICT had reduced the time taken to prepare purchase orders and contracts since re-entering of data from paper documents had gone down. Majority of the respondents (82.5%) strongly agreed that use of ICT had reduced the time taken to prepare purchase orders and contracts, 16.9% of the respondents agreed while 0%, 0.5% and 0% were neutral, disagreed, strongly disagreed that the use of ICT had reduced the time taken to prepare purchase orders and contracts respectively. The results indicate that the mean was 4 with a standard deviation of 0 indicating that majority of the respondents agreed use of ICT had reduced the time taken to prepare purchase orders and contracts since re-entering of data from paper documents had gone down. With the use of ICT, data is captured once and referenced by many users therefore savings on time since other subsequent users don't need to enter the data.

The study sort to find out whether by sending purchase orders and contracts electronically to suppliers the lead-time had been reduced considerably. Most of the respondents, that is, 52.9 per cent agreed that by sending purchase orders and contractors electronically to suppliers the lead-time had been reduced considerably, 44.4 per cent strongly agreed that by sending purchase orders and contractors electronically to suppliers the lead-time had been reduced considerably, 2.6 per cent were neutral and none of the respondents disagreed or strongly disagreed that sending purchase orders and contracts electronically to suppliers had considerably reduced the lead time. The results indicate that the mean was 5 with a standard deviation of 1 indicating that majority of the respondents agreed that sending

purchase orders and contracts electronically to suppliers had considerably reduced the lead time.

On transparency, respondents were asked whether annual procurement plans are published on the website. Majority of the respondents, that is 55% agreed that annual procurement plans are published on the website, 41.3% of the respondents strongly agreed that annual procurement plans are published on the website while 0.5%,3.2%,0% were neutral, disagreed and strongly disagreed that annual procurement plans are published on the website respectively. The results in table 4.23 indicate that the mean was 4 with a standard deviation of 1 indicating that majority of the respondents agreed that annual procurement plans are published on the website.

Respondents were further asked whether bidders were able to electronically view the tender opening process. Majority of the respondents (46.6%) strongly agreed that bidders were able to electronically view the tender opening process, 50.3 per cent indicated that bidders were not able to view the tender opening process electronically while 1.6 per cent indicated that they neither agreed nor disagreed that bidders were able to electronically view the tender opening process. None of the respondents strongly disagreed that annual procurement plans are published on the website. The results indicate that the mean was 4 with a standard deviation of 1 indicating that majority of the respondents agreed that bidders were able to electronically view the tender opening process.

The study also sought to find out whether clear and comprehensive bidding documents are published in standard form and made available in the website/portal. As shown on table 4.23, 54 per cent strongly agreed that clear and comprehensive bidding documents are published in standard form and made available in the website/portal, 40.2 per cent agreed that clear and comprehensive bidding documents and made available in the website/portal and 5.3 per cent were neutral on the this issue. Zero point five percent disagreed and none strongly disagreed that clear and comprehensive bidding documents are published in standard form and made available in the website/portal. The results indicate that the mean was 4 with a

standard deviation of 1 indicating that majority of the respondent's agreed that clear and comprehensive bidding documents are published in standard form and made available in the website/portal.

Most of the respondents (51.9%) strongly agreed that price ranking and winning bidder were made available online. Forty one point three per cent agreed that price ranking and winning bidder were made available online while four point eight were neutral and 1.6 disagreed while 0.5 strongly disagreed that price ranking and winning bidder were made available online. Table 4:23 further indicates that 47.6 per cent of the respondents strongly agreed that their organization publishes contract award notices on the website/portal, 45.5%, 4.2%, 2.1%,and 0.5% agreed, were neutral, disagreed, strongly disagreed that price ranking and winning bidder were made available online. The results indicate that the mean was 4 with a standard deviation of 1 indicating that majority of the respondents agreed that price ranking and winning bidder were made available online.

On supplier performance, respondents were asked whether with the use of ICT their suppliers were delivering goods on time. Majority of the respondents (60.6%) strongly agreed that with the use of ICT their suppliers were delivering goods on time, 36.2% agreed that their suppliers were delivering goods on time, 0.5 per cent of the respondents disagreed that their suppliers were not delivering goods on time while 2.7 per cent were neutral and none strongly disagreed that with the use of ICT their suppliers were delivering goods on time as indicated on table 4.23. The results indicate that the mean was 5 with a standard deviation of 1 indicating that majority of the respondents agreed that with the adoption of ICT their suppliers were delivering goods on time.

The study also sought to find out whether the suppliers were supplying products that consistently conform to the specifications given. Most of the respondents (69.3%) agreed that suppliers were supplying products that consistently conform to the specifications given, 25.4% strongly agreed suppliers were supplying products that consistently conform to the specifications given, 0.5 per cent disagreed that their suppliers were not supplying products that consistently confirmed to the

specifications, 4.8 per cent were neutral and none strongly disagreed that their suppliers were not supplying products that consistently confirmed to the specifications. The results indicate that the mean was 4 with a standard deviation of 1 indicating that majority of the respondents agreed that their suppliers were not supplying products that consistently confirmed to the specifications.

Asked whether suppliers were willing to change goods/services to meet the changing customer needs, majority of the respondents, 55 per cent of the respondents agreed that their suppliers were willing to change goods/services to meet the changing customer needs. 39.2 per cent strongly agreed that their suppliers were willing to change goods/services to meet the changing customer needs, while 0.5 per cent disagreed that suppliers were willing to change goods/services that did not meet changing customer needs while 5.3 per cent, 0% were neutral and strongly disagreed that suppliers were willing to change goods/services that did not meet changing customer needs respectively. The results in table 4.23 indicate that the mean was 4 with a standard deviation of 1 indicating that majority of the respondents agreed that suppliers were willing to change goods/services that did not meet changing customer needs.

Respondents were asked to indicate whether their suppliers had enough flexibility to respond to unexpected demand changes. Ninety four point two per cent of the respondents indicated that their suppliers had enough flexibility to respond to unexpected demand changes, 0.5 per cent indicated that their suppliers had enough flexibility to respond to unexpected demand changes while 2.6 per cent were neutral. The results indicate that the mean was 4 with a standard deviation of 1 indicating that majority of the respondents agreed that their suppliers had enough flexibility to respond to unexpected demand changes.

On contract performance, the study sought to find out whether with the use of electronic predefined templates contract creation time was reduced. Majority of the respondents (48.7%) agreed that with the use of electronic predefined templates contract creation time was reduced, 44.4% strongly agreed that with the use of electronic predefined templates contract creation time was reduced, 1.1 per cent of

the respondents disagreed that with the use of predefined electronic templates contract creation time had been reduced while 5.8 per cent were neutral and none strongly disagreed as shown on table 4.23. The results indicate that the mean was 4 with a standard deviation of 1 indicating that majority of the respondents agreed that with the use of electronic predefined templates contract creation time was reduced.

The results in table 4.23 shows that most of the respondents, that is 49.2 per cent strongly agreed that contract deadlines and notifications were electronically monitored, 47.6 percent agreed that that contract deadlines and notifications were electronically monitored, 0 per cent of the respondents disagreed that contract deadlines and notifications were not electronically monitored while 3.2 per cent were neutral on this aspect and none strongly disagreed that contract deadlines and notifications were not electronically monitored. The results indicate that the mean was 4 with a standard deviation of 1 indicating that majority of the respondents agreed that contract deadlines and notifications were electronically monitored.

Respondents were further asked whether circulation of the contract documents was done electronically and consequently reducing paperwork. The results show that, 50.8 per cent strongly agreed that circulation of contract documents was done electronically, 43.9 per cent agreed that contract documents were circulated electronically, 4.8 per cent were neutral, 5 per cent disagreed that circulation of contract documents was done electronically while none strongly disagreed that circulation of contract documents was done electronically. The results indicate that the mean was 4 with a standard deviation of 1 indicating that majority of the respondents agreed that circulation of contract documents was done electronically.

The results in table 4.23 further indicate that with the adoption of ICT in procurement department off-contract buying had been reduced. Majority of the respondents (60.3%) strongly agreed that with the adoption of ICT in procurement department off-contract buying had been reduced, 33.9% agreed that with the adoption of ICT in procurement department off-contract buying had been reduced, 4.8%, 0.5%,0.5% percent of the respondents indicated that with the adoption of ICT in procurement department off-contract buying had reduced respectively. The results

indicate that the mean was 5 with a standard deviation of 1 indicating that majority of the respondents agreed that circulation of contract documents was done electronically.

Respondents were further asked whether key performance indicators for contracts were tracked electronically. Most of the respondents 49.7% strongly agreed that key performance indicators for contracts were tracked electronically, 45% agreed that key performance indicators for contracts were tracked electronically, 5.3% were neutral while none disagreed or strongly disagreed that key performance indicators for contracts were tracked electronically. The results indicate that the mean was 4 with a standard deviation of 1 indicating that majority of the respondents agreed that key performance indicators for contracts were tracked electronically.

In a summary, the findings in this section show that the procurement performance has improved to some extent through the adoption of ICT. Some of the areas that have improved include transparency, reduced lead times, increased efficiency. This concurs with a number of studies. For instance, Gordon (2009) indicated that introduction of ICT is expected to enhance the status and influence of the procurement function within organizations. Moreover, the study by Munubi, Kinanga and Ondiba (2017) concluded that e-procurement improves organization performance whereas in supporting the findings of this study, Wiengarten et al. (2013) established that electronic business applications have a direct and positive impact on supply chain collaboration which consequently improves supply chain performance. The findings also support the study by Kiage (2013) which indicates that improved contract management performance has a positive effect of procurement performance.

Table 4.23: Procurement Performance

Statement (N= 189)	SD (1)	D (2)	N (3)	A (4)	SA (5)	Mean	Median	Mode	Std. Dev
1)Sourcing time has been reduced considerably with the implementation of ICT	.0%	.5%	3.2%	59.3%	37.0%	4	4	4	1
2)Adoption of ICT has reduced re-entering data from paper documents consequently reducing errors/time taken to prepare purchase orders/contracts	.0%	.5%	.0%	82.5%	16.9%	4	4	4	0
3) Purchase orders/contracts are sent electronically to Suppliers resulting in reduced contract award lead time.	.0%	.0%	2.6%	44.4%	52.9%	5	5	5	1
4)Annual procurement plans are published on the website	.0%	3.2%	.5%	55.0%	41.3%	4	4	4	1
5)Bidders are able to electronically view the tender opening process	.0%	1.6%	1.6%	50.3%	46.6%	4	4	4	1
6)Clear & comprehensive bidding documents are published in standard form and made available in the website/portal	.0%	.5%	5.3%	40.2%	54.0%	4	5	5	1
7)The outcome of the tendering process(winning bidder, price, ranking) is available online	.5%	1.6%	4.8%	41.3%	51.9%	4	5	5	1
8)Our organisation publishes contract award notices in the portal/website	.5%	2.1%	4.2%	45.5%	47.6%	4	4	5	1
9)Our suppliers deliver goods/services on time	.0%	.5%	2.7%	36.2%	60.6%	5	5	5	1
10)Our suppliers offer products that consistently conform to our specifications	.0%	.5%	4.8%	69.3%	25.4%	4	4	4	1
11)Our suppliers are willing to change goods/services to meet the changing customer needs	.0%	.5%	5.3%	55.0%	39.2%	4	4	4	1
12)Our suppliers have enough flexibility to respond to unexpected demand changes	.5%	.0%	2.6%	43.4%	53.4%	4	5	5	1
13)With the use of ICT Contracts are created using predefined templates thus reducing contract document creation time	.0%	1.1%	5.8%	48.7%	44.4%	4	4	4	1
14)Contract deadlines and notifications are electronically monitored	.0%	.0%	3.2%	47.6%	49.2%	4	4	5	1
15)Key performance indicators for the contracts are tracked electronically	.0%	.0%	5.3%	45.0%	49.7%	4	4	5	
16)Circulation of Contracts documents is done electronically thus reducing paperwork	.0%	.5%	4.8%	43.9%	50.8%	4	5	5	1
17)With the adoption of ICT in procurement department, off contract buying has been reduced	.5%	.5%	4.8%	33.9%	60.3%	5	5	5	1

Key: SD=Strongly Disagree, D= Disagree, N=Neutral, A= Agree, SA=Strongly, Disagree Std. Dev= Standard Deviation

The respondents were also asked to indicate the measures that can be put in place to improve the effectiveness of ICT in the procurement performance in your organization. These are some of the responses:

Respondent 19: *Between program development, evaluating suppliers and tenders, and making the best deals, working in procurement requires exceptional analytical skills. Having a comprehensive view of the entire process helps to keep investments on track. Most modern contract management platforms include extensive analytics.*

Respondent 36: *One of the quickest ways to increase efficiency in the procurement process is to digitize mechanisms. Moving contracts and documents to the Cloud is critical for accelerating processes and becoming a forward-thinking organization. Having a computer-controlled contract product lifecycle system in place will aid in contract creation, real-time negotiations, faster signatures, and automated compliance reminders.*

In line with the above, **respondent 55** indicated the following: *RFID innovation, which is utilized in a wide scope of uses, helps with stock control and item level monitoring. Each item added to the stock is labeled with an interesting distinguishing code that the RFID framework consequently tracks.*

4.7 Inferential Analysis

Inferential uses statistical tests to determine the existence and the strength of the relationship between the independent and the dependent variable. Inferential statistics are used to make inferences about the larger population based on the sample. These statistics actually determine how one variable compares to another (Joppe, 2000). The study used correlation and regression statistical tests. Before performing inferential statistics, the distribution of the data was determined.

4.7.1 Correlation Analysis

Correlation analysis tests the direction and relationship between variables. Correlation tests look for an association between variables. The study used scatter plots to illustrate the degree of correlation between the variables.

4.7.1.1 Scatter Plot between Communication Technology and Procurement Performance

The scatter plot on figure 4.5 shows that there is a positive correlation or relationship between procurement performance and communication technology because the pattern of dots slopes from lower left to upper right. This means that when communication technology increases, procurement performance increases. Since the scatter plots lie close together, it means that there is a strong correlation between communication technology and procurement performance. The results indicate that communication technology is a significant positive predictor of procurement performance and therefore energy sector state corporations should ensure that they enhance communication technology. This is in line with the study by Calipinar and soysal (2012) which concluded that emails were a more preferred communication tool in comparison to telephones. This implies that effective emailing systems will improve procurement performance in an organization.

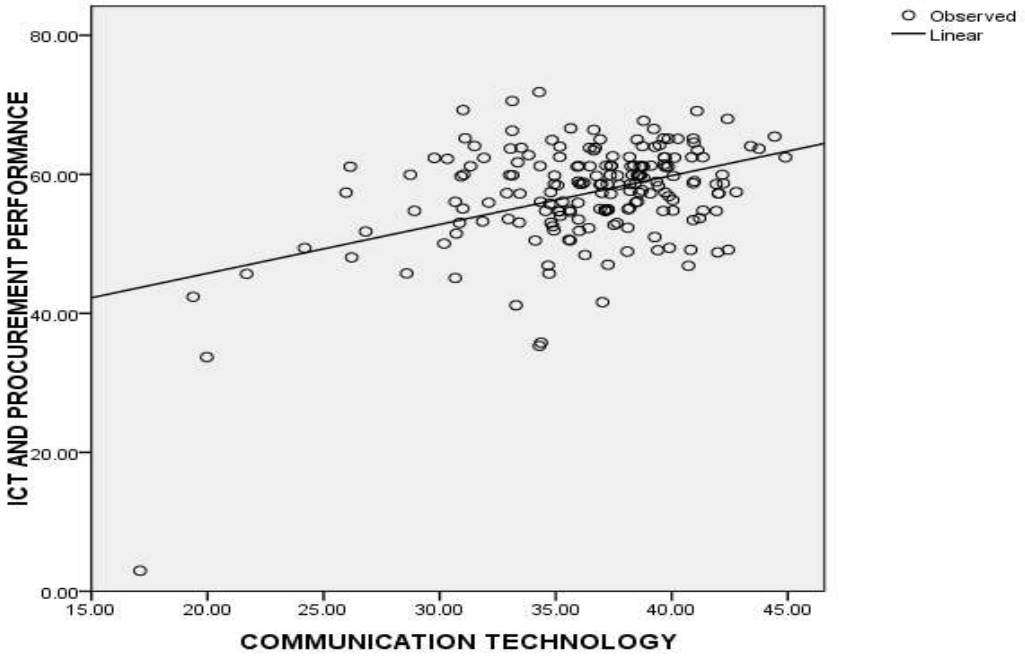

Figure 4.5: Correlation results on Communication technology

4.7.1.2 Correlation Co-efficient Analysis between Communication Technology and Procurement Performance

To assess the strength of the relationship between communication technology and procurement performance, the study used correlation coefficient (r) which tests the degree to which changes to the value of one variable predict changes to the value of another. It measures the direction and strength of a linear relationship between two variables on a scatter plot. A correlation coefficient of +1 indicates perfect positive correlation while a correlation coefficient of -1 indicates perfect negative correlation. A coefficient correction of 0 indicates no correlation between the variables.

Table 4.24 shows that communication technology has a coefficient correlation of 0.423 which indicates that it has a positive effect of procurement performance. The results in table 4.24 also show that the p-value is 0.000 which meets the threshold of p less than 0.05 and therefore communication technology has a significant positive effect on procurement performance. Consequently we reject the null hypothesis that there is no difference between the means and conclude that a significant difference does exist. This is in line with the study by Calipinar and soysal (2012) which concluded that emails were a more preferred communication tool in comparison to telephones. This implies that effective emailing systems will improve procurement performance in an organization.

Table 4.24: Correlation coefficient analysis on communication Technology

		Procurement performance	**Communication Technology**
Procurement performance	Pearson Correlation	1	.423
	Sig. (2-tailed)		.000
	N	189	189
Communication Technology	Pearson Correlation	.423	1
	Sig. (2-tailed)	.000	
	N	189	189

**Correlation is significant at the 0.01 level (2-tailed)

4.7.1.3 Scatter Plot between Application Software and Procurement Performance

Application software and procurement performance have a positive correlation as illustrated on scatter plot in figure 4.6 which has a pattern of dots sloping from lower left to upper right. Since the scatter plots lie close together, it can be concluded that there is a strong correlation between application software and procurement performance. The results indicate that application software is a significant positive predictor of procurement performance. The findings of various other studies have been able to relate with the findings made in this study. For instance, the study by Wanjiru and Abdalla (2015) carried out on the effect of information communication technology on procurement process in Total Kenya. The study showed that adoption of ICT software applications is not exclusively a matter of resources but on the contrary operational compatibility was also critical. In addition, Munubi *et al*., (2017) in their study established that use of e-procurement application soft-wares (e-sourcing, e-tendering, e-archiving) increases organization performance by increasing information sharing and reducing time taken to perform the various procurement processes.

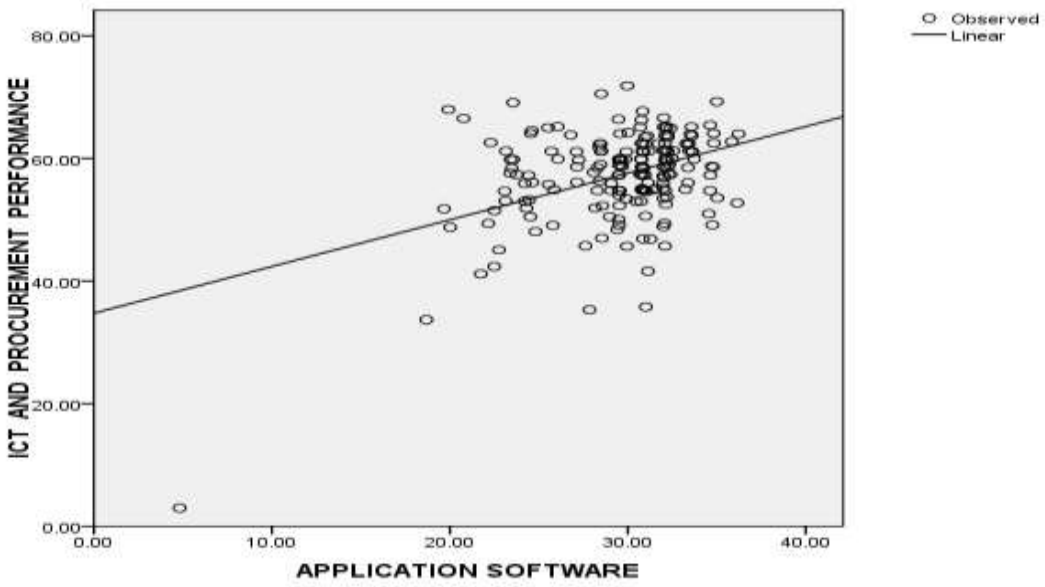

Figure 4.6: Correlation results on procurement application software

4.7.1.4 Correlation Co-efficient Analysis between Application Software and Procurement Performance

To gauge the strength of the relationship between application software and procurement performance, the study used correlation coefficient (r). The results in table 4.25 indicate that application software has a significant positive effect on procurement performance since it has a correlation coefficient of 0.412 which is positive and less than one with 189 respondents. Since the p-value is 0.000 which meets the threshold of p less than 0.05, the relationship is significant. Consequently, we reject the null hypothesis that there is no difference between the means and conclude that a significant difference does exist. Also concurring with the findings of this study is Mose, Njihia and Magutu (2013) who indicated that the private and public sector organizations have been utilizing information technology (IT) systems to streamline and automate their purchasing and other processes over the past years. Most governments are adopting ERP. ERPs are large-scale computer software and hardware systems that attempt to integrate all data and processes of an organization into a unified system housed in a centralized database which is accessed through a secure network.

Table 4.25: Correlation coefficient analysis on application software

		Procurement performance	**Application software**
Procurement performance	Pearson	1	.412
	Correlation Sig. (2-tailed)		.000
Application software	Pearson	.412	1
	Correlation Sig. (2-tailed)	.000	
	N	189	189
**Correlation is significant at the 0.01 level (2-tailed)			

4.7.1.5 Scatter Plot between Information Technology and Procurement Performance

The scatter plot in figure 4.7 shows that there is a positive correlation or relationship between information technology and procurement performance based on the pattern of dots which slopes from lower left to upper right. This means that when information technology increases, procurement performance increases. Since the scatter plots lie close together, it means that there is a strong correlation between information technology and procurement performance. The results indicate that information technology is a significant positive predictor of procurement performance and therefore energy sector state corporations should ensure that they enhance information technology. On the other hand, a study carried out by Ordanini and Rubera (2008) on the role of the use of internet resources in procurement established that although the use of the internet may have positive effects on purchasing costs resulting from reduced transaction costs and this may not be so for direct procurement of materials. In adding to these findings, Bhoir and Patil (2014) points out that Organisations can build private clouds or engage external cloud service providers. For organisations to be able to connect to cloud service, they must have network devices that provide the necessary performance, flexibility, reliability and Security. These cloud services can play an important role in storing the procurement database and thus making it easier to be accessed from any given location at any given time with ease.

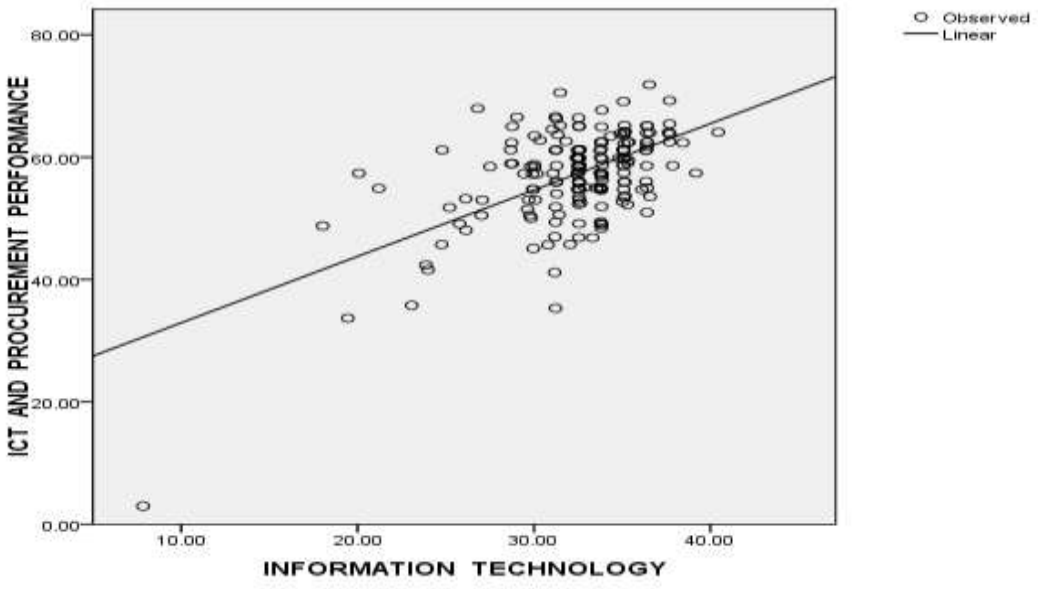

Figure 4.7: Correlation results on Information technology

4.7.1.6 Correlation Co-efficient Analysis between Information Technology and Procurement Performance

The study used correlation coefficient (r) to assess the direction and strength of the linear relationship between information technology and procurement performance. Table 4.26 shows that information technology has a coefficient correlation of 0.574 with 189 respondents which indicates that it has a positive effect of procurement performance. The results in table 4.25 also show that the p-value is 0.000 which meets the threshold of p less than 0.05 and therefore information technology has a significant positive effect on procurement performance. Consequently, we reject the null hypothesis that there is no difference between the means and conclude that a significant difference does exist. In line with this finding, Lui (2010) pointed out that the use of electronic procurement system (e-procurement) software allows purchasers to access supplier's catalogs via the Internet, as well as accepting electronic invoices.

Table 4.26: Correlation coefficient analysis on information technology

		Procurement performance	Information technology
Procurement performance	Pearson	1	.574
	Correlation Sig. (2-tailed)		.000
	N	189	189
Information Technology	Pearson	.574	1
	Correlation Sig. (2-tailed)	.000	
	N	189	189

**Correlation is significant at the 0.01 level (2-tailed)

4.7.1.7 Scatter Plot between Electronic Procurement Policy and Procurement Performance

As shown on the scatter plot in figure 4.8, there is a positive correlation or relationship between electronic procurement policy and procurement performance because the pattern of dots slopes from lower left to upper right. Consequently, as electronic procurement policy increases, procurement performance increases. Since the scatter plots lie close together, it means that there is a strong correlation between electronic procurement policy and procurement performance. The results indicate that electronic procurement policy is a significant positive predictor of procurement performance. As it has been indicated by Zuzana (2012), efficient technology policies in procurement practices are critical for good public financial management and effective budget implementation. World Bank (2013) report indicates that there is need for transparency to enhance openness and clarity on procurement policy and its delivery.

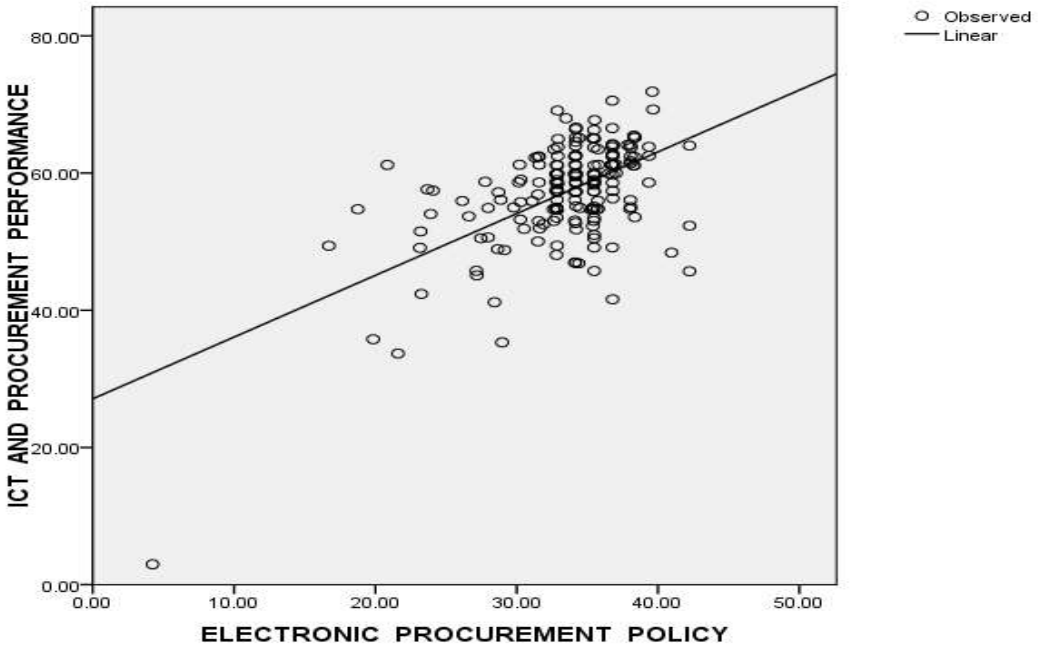

Figure 4.8: Correlation results on electronic procurement policy

4.7.1.8 Correlation Co-efficient Analysis between Electronic Procurement Policy and Procurement Performance

To assess the direction and strength of the relationship between electronic procurement performance and procurement performance, the study used correlation coefficient (r). The results in table 4.27 indicate that there is a positive effect electronic procurement policy on procurement performance with a correlation coefficient of 0.568 with 189 respondents. The results also show that electronic procurement performance has a significant positive effect on procurement performance since the p-value is 0.000 which meets the threshold of p less than 0.05. Consequently, we reject the null hypothesis that there is no difference between the means and conclude that a significant difference does exist. According to Gibbs, Kraemer and Dedrick (2006), policies such as liberalization of trade and telecoms have a positive impact on e-commerce since they make ICT and Internet access more affordable to firms and consumers. Victor (2012) noted that procurement expenditure could be minimized through implementation of effective procurement practices which include proper use of technology or e-procurement. In supporting the role played by electronic procurement policies, various researchers such as Carayannis

and Popescu (2005); Croom and Brandon-Jones (2005) have observed that electronic procurement in the public sector can be seen as a policy tool to support the delivery of public procurement policy, improving transparency and efficiency.

Table 4.27: Correlation coefficient analysis on electronic Procurement policy

		Procurement performance	**Electronic procurement policy**
Procurement performance	Pearson Correlation	1	.568
	Sig. (2-tailed)		.000
	N	189	189
Electronic procurement policy	Pearson Correlation	.568	1
	Sig. (2-tailed)	.000	
	N	189	189

**Correlation is significant at the 0.01 level (2-tailed)

4.7.1.9 Scatter Plot between Electronic Procurement Technical Support Staff and Procurement Performance

To determine the effect of electronic technical support staff on procurement performance correlation analysis was used. The scatter plot in figure 4.9 shows that there is a positive correlation or relationship between electronic procurement technical support staff and procurement performance. Since the scatter plots lie close together, it means that there is a strong correlation between electronic procurement technical support staff and procurement performance. The results indicate that electronic technical support staff are a significant positive predictor of procurement performance and therefore energy sector state corporations should ensure that they enhance communication technology. The results corroborate with Hamada (2012) findings which stated that lack of ICT technical support among management was one of the factors influencing the use and success of information communication technology on procurement process. Further, Arvanitis, Loukis and Vasiliki (2013) states that training of ICT Personnel and Users have a positive impact of both

process and product innovation. Further, soft capital was found to have a stronger effect on innovation performance than hard ICT capital.

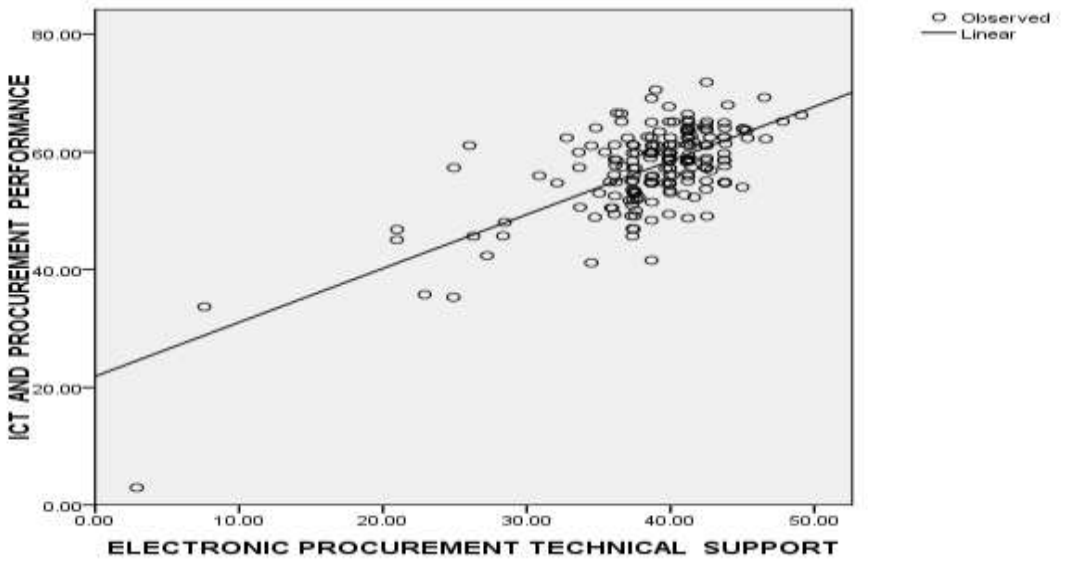

Figure 4.9: Correlation results on electronic procurement technical support

4.7.1.10 Correlation Co-efficient Analysis between Electronic Procurement Technical Support Staff and Procurement Performance

The results in table 4.28 indicate that electronic procurement technical support staff have a positive effect on procurement performance which is represented by correlation coefficient of 0.689 with 189 respondents. Further, the results show that electronic procurement technical support staff have a significant positive effect on procurement performance since the p-value is 0.000 which meets the threshold of p less than 0.05. We therefore reject the null hypothesis that there is no difference between the means and conclude that a significant difference exists. According to Bartle and Korosec (2001), the degree of use of ICT in the procurement is sometimes hampered by transitions in personnel, support, or training. In addition, Attewell and Savill-Smith (2005) states that in order for a specific device to be used optimally, certain technical and organizational conditions must be fulfilled.

Table 4.28: Correlation coefficient analysis on electronic procurement technical support staff

			Procurement performance	Electronic procurement technical support staff
Procurement performance	Pearson Correlation	Sig. (2-tailed)	1	.689
				.000
	N		189	189
Electronic procurement technical support staff	Pearson Correlation	Sig. (2-tailed)	.687	1
			.000	
	N		189	189

**Correlation is significant at the 0.01 level (2-tailed)

4.7.2 Regression Analysis

The study used regression analysis to establish statistical significance of the relationship between the independent variables, namely; communication technology, application software, information technology, electronic procurement policy, electronic procurement technical support staff and the dependent variable procurement performance. Regression analysis is a statistical process of estimating the relationship between variables (Marshall & Rossman, 2006). Regression analysis assess if change in one variable predicts change in another variable. Regression analysis produces a regression equation where the coefficients represent the relationship between each independent variable and the dependent variable.

4.7.2.1 Regression Analysis for Construct Communication Technology

Table 4.29 represents the regression model summary for communication technology with the coefficient of determination R^2 =0.179 and R of 0.423 at 0.05 significant level. This model confirms that there exists a strong positive relationship between communication technology and procurement performance since R^2 which is referred

to as coefficient of determination is 0.179. This indicates that communication technology explains 17.9% of the variations in procurement performance while 82.1% is explained by other variables not included in this model.

Appendix vii shows the coefficient of the variable in the regression analysis. The results show a constant of 31.697 which means that even when there is no communication technology, procurement performance is still positive at 31.697 indicating that there are other drivers of procurement performance including application software and electronic procurement policy among others. Communication technology was highly statistically significant in affecting procurement performance. The resulting regression model was given by Y= 31.697 + 0.703 * X1 where Y= procurement performance, 31.697= Constant and X1=communication technology. The fitted model implies that a unit change in communication technology will increase procurement performance by the rate of 0.703 holding all other factors constant. This verified the fact that communication technology affects procurement performance in the energy sector state corporations.

Table 4.29: Model summary for Construct Communication Technology

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.423[a]	.179	.174	6.82392

a. Predictors: (Constant), Communication Technology

4.7.2.2 Regression Analysis for Construct Application Software

The model summary for the variable application software shows that the coefficient of determination $R^2 = 0.170$ as indicated on table 4.30. This confirms that there exists a strong positive relationship between application software and procurement performance since R^2 which is referred to as coefficient of determination is 0.170. This indicates that application software explains 17% of the variations in procurement performance while 83% is explained by other variables not included in this model.

The results for the regression test show the coefficient variable as illustrated on appendix vii. The constant of 34.762 indicates that even when there is no application software procurement performance is still positive at 34.762 indicating that there are other drivers of procurement performance including communication technology and electronic procurement policy among others. Application software was highly statistically significant in affecting procurement performance. This is in line with the study by Calipinar and soysal (2012) which concluded that emails were a more preferred communication tool in comparison to telephones. This implies that effective emailing systems will improve procurement performance in an organization.

The resulting regression model was given by Y= 34.762 + 0.762 * X2 where Y= Procurement performance, 34.762=Constant and X2=Application software. The fitted model implies that a unit change in communication technology will increase procurement performance by the rate of 0.762 holding all other factors constant. This verified the fact that application software affects procurement performance in the energy sector state corporations.

Table 4.30: Model summary for Construct Application Software

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.412[a]	.170	.165	6.86264

a. Predictors: (Constant), Application software

4.7.2.3 Regression Analysis for Construct Information Technology

Table 4.31 represents the regression model summary for information technology with the coefficient of determination R^2 =0.330. This model confirms that there exists a strong positive relationship between information technology and procurement performance since R^2 which is referred to as coefficient of determination is 0.330. This indicates that information technology explains 33% of the variations in

procurement performance while 67% is explained by other variables not included in this model.

Appendix vii shows the coefficient of the variable in the regression analysis. The results show a constant of 22.079 which means that even when there is no information technology, procurement performance is still positive at 22.079 indicating that there are other drivers of procurement performance including application software and electronic procurement policy among others. Application software was highly statistically significant in affecting procurement performance. In addition, Munubi *et al*., (2017) in their study established that use of e-procurement application soft-wares (e-sourcing, e-tendering, e-archiving) increases organization performance by increasing information sharing and reducing time taken to perform the various procurement processes.

The resulting regression model was given by Y= 22.079 + 1.085* X3 where Y= Procurement performance, 22.079=Constant and X3= Information Technology. The fitted model implies that a unit change in information technology will increase procurement performance by the rate of 1.085 holding all other factors constant. This verified the fact that information technology affects procurement performance in the energy sector state corporations.

Table 4.31: Model summary for Construct Information Technology

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.574[a]	.330	.326	6.16445

a. Predictors: (Constant), Information Technology

4.7.2.4 Regression Analysis for Electronic Procurement Policy

The model summary for the regression analysis in table 4.32 confirms that there exists a strong positive relationship between electronic procurement policy and procurement performance since R^2 which is referred to as coefficient of

determination is 0.322. This indicates that electronic procurement policy explains 32.2% of the variations in procurement performance while 67.8% is explained by other variables not included in this model.

Appendix vii shows the coefficient of the variable in the regression test. The results show a constant of 27.091 which means that even when there is no electronic procurement policy, procurement performance is still positive at 27.091 indicating that there are other drivers of procurement performance including application software and communication technology among others. Electronic procurement policy was highly statistically significant in affecting Procurement performance. In adding to these findings, Bhoir and Patil (2014) points out that Organisations can build private clouds or engage external cloud service providers. For organisations to be able to connect to cloud service, they must have network devices that provide the necessary performance, flexibility, reliability and Security. As it has been indicated by Zuzana (2012), efficient technology policies in procurement practices are critical for good public financial management and effective budget implementation. World Bank (2013) report indicates that there is need for transparency to enhance openness and clarity on procurement policy and its delivery.

The resulting regression model was given by Y= 27.091 + 0.900 * X4 where Y= Procurement performance, 27.091=Constant and X4= electronic procurement policy. The fitted model implies that a unit change in electronic procurement policy will increase procurement performance by the rate of 0.900 holding all other factors constant. This verified the fact that electronic procurement policy affects procurement performance in the energy sector state corporations.

Table 4.32: Model summary for Construct Electronic Procurement Policy

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.568[a]	.322	.319	6.19965

a. Predictors: (Constant), Electronic Procurement policy

4.7.2.5 Regression Analysis for Construct Electronic Procurement Technical Support Staff

Table 4.33 represents the regression model summary for the variable electronic procurement technical support staff with the coefficient of determination R^2 =0.472. This model confirms that there exists a strong positive relationship between electronic procurement technical support staff and procurement performance since R^2 which is referred to as coefficient of determination is 0.472. This indicates that application electronic procurement technical support staff explains 47.2% of the variations in procurement performance while 52.8% is explained by other variables not included in this model.

The results for the regression analysis shows the coefficient variable as illustrated on appendix vii. The constant of 21.887 indicates that even when there is no electronic procurement technical support staff performance is still positive at 21.887 indicating that there are other drivers of procurement performance including communication technology and electronic procurement policy among others. Electronic procurement technical support staff were highly statistically significant in affecting procurement performance. The results corroborate with Hamada (2012) findings which stated that lack of ICT technical support among management was one of the factors influencing the use and success of information communication technology on procurement process. Further, Arvanitis, Loukis and Vasiliki (2013) states that training of ICT Personnel and Users have a positive impact of both process and product innovation. Further, soft capital was found to have a stronger effect on innovation performance than hard ICT capital

The resulting regression model was given by Y= 21.887 + 0.916 * X5 where Y= procurement performance, 21.887=Constant and X5= electronic procurement technical support staff. The fitted model implies that a unit change in electronic procurement technical support staff will increase procurement performance by the rate of 0.916 holding all other factors constant. This verified the fact that electronic procurement technical support staff affects procurement performance in the energy sector state corporations.

Table 4.33: Model summary for Construct Electronic Procurement Technical Support Staff

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.687[a]	.472	.469	5.47108

a. Predictors: (Constant), Electronic Procurement technical support staff

4.7.3 ANOVA Test

The study used analysis of variance ANOVA to test whether there is a statistically significant difference in the mean's that is if population means are equal. ANOVA can determine whether the means of three or more groups are different. ANOVA uses F-tests to statistically test the equality of means thus determining whether the relationship is statistically significant.

4.7.3.1 ANOVA Test for Construct Communication Technology

As shown on table 4.34, the F-statistic which is simply a ratio of two variances is 40.733 while df which is the degree of freedom is indicated as 1. The linear model fits the data well since the p value is 0.000 which is less than 5%. This implies that there is a significant linear relationship between communication technology and procurement performance.

Table 4.34: ANOVA for Communication Technology

		Sum of Squares	df	Mean Square	F	Sig.
	Regression	1896.786	1	1896.786	40.733	.000[a]
	Residual	8707.813	187	46.566		
	Total	10604.599	188			

a. Predictors: (Constant), Communication Technology

b. Dependent Variable: Procurement performance

4.7.3.2 ANOVA Test for Construct Application Software

The study used the F- test to establish whether the relationship between application software and procurement performance was statistically significant. As shown on table 4.35, the F-statistic which is simply a ratio of two variances is 38.171 while df which is the degrees of freedom is indicated as 1. The linear model fits the data well since the p value is 0.000 which is less than 5%. In conclusion, there is a significant linear relationship between application software and procurement performance.

Table 4.35: ANOVA for Application Software

	Sum of Squares	df	Mean Square	F	Sig.
Regression	1797.691	1	1797.691	38.171	.000[a]
Residual	8806.908	187	47.096		
Total	10604.599	188			

a. Predictors: (Constant), Application software

b. Dependent Variable: Procurement performance

4.7.3.3 ANOVA Test for Construct Information Technology

The study results on table 4.36 show that the F-statistic is 92.065 while df which is the degrees of freedom is indicated as 1. The linear model fits the data well since the p value is 0.000 which is less that 5%. Consequently, the linear relationship between information technology and procurement performance is statistically significant.

Table 4.36: ANOVA for information Technology

		Sum of Squares	df	Mean Square	F	Sig.
	Regression	3498.513	1	3498.513	92.065	.000[a]
	Residual	7106.086	187	38.000		
	Total	10604.599	188			

a. Predictors: (Constant), Information Technology

b. Dependent Variable: Procurement performance

4.7.3.4 ANOVA Test for Construct Electronic Procurement Policy

Table 4.37 shows that the linear relationship between electronic procurement policy and procurement performance is statistically significant since, the F-statistic which is simply a ratio of two variances is 88.906 while df which is the degrees of freedom is indicated as 1. The linear model fits the data well since the p value is 0.000 which is less than 5%.

Table 4.37: ANOVA for Electronic Procurement Policy

		Sum of Squares	df	Mean Square	F	Sig.
	Regression	3417.140	1	3417.140	88.906	.000[a]
	Residual	7187.459	187	38.436		
	Total	10604.599	188			

a. Predictors: (Constant), Electronic Procurement Policy

b. Dependent Variable: Procurement Performance

4.7.3.5 ANOVA Test for Construct Electronic Procurement Technical Support Staff

As shown in table 4.38, the F-statistic which is simply a ratio of two variances is 167.281 while df which is the degrees of freedom is indicated as 1. The linear model fits the data well since the p value is 0.000 which is less than 5%. This results

indicate that the linear relationship between electronic technical support staff and procurement performance is statistically significant.

Table 4.38: ANOVA for Electronic Procurement Technical Support Staff

		Sum of Squares	df	Mean Square	F	Sig.
	Regression	5007.172	1	5007.172	167.281	.000[a]
	Residual	5597.427	187	29.933		
	Total	10604.599	188			

a. Predictors: (Constant), Electronic Procurement technical support

b. Dependent Variable: Procurement performance

4.8 Overall Model

Multiple regression was used to model the relationship between the independent variables, namely; Communication technology (X1), Application software (X2), Information technology (X3), Electronic technical support(X4), Electronic procurement technical support staff (X5) and the dependent variable (Y) which is procurement performance. To determine the combined effect of the independent variables on the dependent variable. The model used for the regression analysis was expressed in the general form as given below:

$$Y = \beta o+\beta_1 X_1+\beta_2 X_2+\beta_3 X_3 +\beta_4 X_4+ \beta_5 X_5 +\varepsilon$$

Where:

Y = Procurement performance (Dependent Variable)

X1 = Communication technology (Independent Variable)

X2 = Application software (Independent Variable)

X3 = Information technology (Independent Variable)

X4= Electronic procurement policy (Independent Variable)

X5= Electronic procurement technical support staff (Independent Variable)

B0 = Constant of Regression (Independent Variable)

έ. = Error Term

The study considered the coefficient of multiple determinations, the standard error of estimate and the regression coefficients as shown on table 4.39. The model shows a high coefficient of multiple determination of 0.993 indicating that 99.3% of the variation on procurement performance in energy sector state corporations can be explained by Communication technology (X1), Application software (X2), Information technology (X3), Electronic technical support(X4) and Electronic procurement technical support staff (X5). The remaining 0.7% of the variation in procurement performance in energy sector state corporations can be explained by other variables outside this model. Since the value is above 75%, then the model can be said to have a good fit.

Table 4.39: Regression model summary

R	R Square[b]	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
.996[a]	.993	.993	4.90548	1.986

The relationship between the combined effect of the variables and procurement performance is significant since the ANOVA table 4.40 indicates that the F statistic is 5197 at 0.05 confidence level. The value of the F statistic is large enough to conclude that Communication technology (X1), Application software (X2), Information technology (X3), Electronic technical support(X4) and Electronic procurement technical support staff (X5) have a major effect on procurement performance in energy sector state corporations. However, the relative effect of each variable was different. The model fits the data well since the p-value is .000.

Table 4.40: ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	625248.066	5	125049.613	5197	.000
	Residual	4427.730	184	24.064		
	Total	629675.796[b]	189			

To determine the effect of each independent variable on the dependent variable, the study used unstandardized and standardized regression coefficients. The unstandardized coefficients of correlation (B) indicate the average change in the independent variable associated with a unit change in the dependent variable statistically controlling for the other independent variables.

Study results show that a unit change in communication technology will change procurement performance by 0.177 holding all other variables constant as shown on table 4.41. This is in line with the study by Calipinar and soysal (2012) which concluded that emails were a more preferred communication tool in comparison to telephones. This implies that effective emailing systems will improve procurement performance in an organization.

A unit change in application software will change procurement performance by 0.191 holding all other variables constant. In addition, Munubi *et al*., (2017) in their study established that use of e-procurement application soft-wares (e-sourcing, e-tendering, e-archiving) increases organization performance by increasing information sharing and reducing time taken to perform the various procurement processes.

A unit change in information technology will change procurement performance by 0.501 holding all other variables constant. In adding to these findings, Bhoir and Patil (2014) points out that Organisations can build private clouds or engage external cloud service providers. For organisations to be able to connect to cloud service, they must have network devices that provide the necessary performance, flexibility, reliability and Security.

Further, a unit change in electronic procurement policy will change procurement performance by 0.409 holding all other variables constant. As it has been indicated by Zuzana (2012), efficient technology policies in procurement practices are critical for good public financial management and effective budget implementation. World Bank (2013) report indicates that there is need for transparency to enhance openness and clarity on procurement policy and its delivery.

A unit change in electronic procurement technical support staff will change procurement performance by 0.610 holding all other variables constant. The results corroborate with Hamada (2012) findings which stated that lack of ICT technical support among management was one of the factors influencing the use and success of information communication technology on procurement process. Further, Arvanitis, Loukis and Vasiliki (2013) states that training of ICT Personnel and Users have a positive impact of both process and product innovation. Further, soft capital was found to have a stronger effect on innovation performance than hard ICT capital

Therefore, the regression equation is

$Y = 1.325 + 0.177X_1 + 0.191X_2 + 0.501X_3 + 0.409\ X_4 + 0.610X_5$.

The study used standardized coefficients of correlation (beta) was used to compare the relative effect of different independent variables upon the dependent variable. Standardized coefficients refer to how many standard deviations a dependent variable will change, per standard deviation increase in the independent variable. The standardized coefficients of correlation (beta) for each variable were as follows: Communication technology (.112), Application software (.147), Information technology (.283), Electronic procurement policy (.239) and Electronic procurement technical support staff (.412) as indicated on table 4.41. This shows that electronic procurement technical support staff have the strongest effect on procurement performance, followed by information technology, electronic procurement policy, application software and communication technology respectively.

The significance of the Beta coefficients was found to be as follows: Communication technology (.038), Application software (.044), Information technology (.000),

Electronic procurement policy (.000) and Electronic procurement technical support staff (.000) as shown on table 4.41. Since B is termed as significant as it is less that 5%, then all the variables were statistically significance.

Table 4.41: Coefficients

	Unstandardized Coefficients		**Standardized Coefficients**			**Collinearity Statistics**	
VARIABLES	**B**	**Std. Error**	**Beta**	**t**	**Sig.**	**Tolerance**	**VIF**
Constant	1.325	.253		5.237	.000		
Communication technology	.177	.085	.112	2.090	.038	.103	9.709
Application software	.191	.094	.147	2.032	.044	.111	9.009
Information technology	.501	.119	.283	4.229	.000	.292	3.424
Electronic procurement policy	.409	.093	.239	4.370	.000	.130	7.692
Electronic procurement technical support	.610	.080	.412	7.618	000	.135	7.407

Linear regression through the origin

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

This chapter presents the summary of major findings, draws conclusions, highlights key recommendations for practice and suggests areas of further research based on the analysed data for this study on the effect of information and communication technology on procurement performance in the energy sector state corporations.

5.2 Summary of the Findings

This section summarizes the major research findings that were made in the analysis. The summary of findings is presented according to the objectives. The main objective of the study was to determine the effect of ICT on procurement performance in the energy sector state corporations in Kenya. The specific objectives of the study were: to determine the effect of communications technology, assess the effect of applications software, evaluate the effect of information technology, determine the effect of electronic procurement policy and establish the effect of electronic procurement technical support staff on procurement performance in energy sector state corporations in Kenya.

The study adopted a descriptive survey design and a correlational design. The unit of observation was 385 employees from 9 energy sector state corporations. The study adopted stratified, simple random and consensus sampling techniques to select the sample size. According to Johnson and Christensen (2010), stratified sampling technique produces estimates of overall population parameters with greater accuracy. Kothari (2006) argues that simple random sampling gives each and every item in the population an equal chance of inclusion in the sample, consequently reducing bias and increasing levels of representation. The sample size of 186 procurement staff out of 360 were selected using the Krejecies Morgan (1970) table of sample size while all the 25 electronic procurement technical support staff were selected to participate

in the study since they were a small number. Qualitative and quantitive analysis was carried out on the data that were collected using a questionnaire.

Preliminary tests for normality and multicollinearity were carried out on the data before inferential analysis. Tests for normality, namely; Box-and-whisker plot, Quantile-Quantile plot and Kolmogorov-Smirnov were carried out on the observed values for the dependent variable to establish whether they were normally distributed. The condition for normality must be satisfied since the data were using multiple regression model for analysis (Lapan et al., 2012). For Box-and whisker plot, the median was roughly in the middle indicating normal distribution. The Quantile-Quantile plot indicated that the observed values were randomly distributed along the diagonal line indicating normal distribution. Normality was further confirmed by the results of the Kolmogrov-Smirnov test and it was concluded that procurement data had a normal distribution. The data for the independent variables were tested for multicollinearity and found have no significant multicollinearity problems.

Multiple regression model was used to test whether communication technology, application soft-wares, information technology, electronic procurement policy and electronic procurement technical support staff have an effect on procurement performance. Coefficients of correlation show that electronic procurement technical support staff have the strongest effect on procurement performance, followed by information technology, then electronic procurement policy with a coefficient correlation, application software and communication technology. Based on the study findings, it can be concluded that electronic procurement technical support staff should be given special attention in order for ICT to have the desired effect on procurement performance. Since all the significance of all the Beta coefficients was found to be less that 5%, then all the variables were statistically significant consequently making them important indicators of procurement performance in energy sector state corporations in Kenya. This confirmed the variables conceptualized in the conceptual model had a positive relationship with procurement performance. The major study findings based on the descriptive and inferential statistical analysis are summarized below.

5.2.1 Communications Technology

The study sought to determine whether communications technology has an effect on procurement performance and to test the hypothesis that communications technology has a significant positive effect on procurement performance in the energy sector state corporations. Kaiser-Meyer-Olkin (KMO) test and Bartlett's test of Sphericity were performed on the data to indicate whether factor analysis could be useful with the data. KMO for communications technology was found to be valid. Factor analysis was carried out and 5 items which had an estimated correlation of below 0.4 were dropped out of 14 items and consequently not considered for further analysis.

The study found that energy sector organisations were using various communication technologies and email was the most commonly used while video conference was the least used. Descriptive analysis results showed that communication technologies were very effective on the performance of procurement department. Majority of the respondents strongly agreed that every employee involved in the procurement process had an email account and that use of emails improved tracking of procurement transactions. The email was also used to send and receive quotations. Use of email standardized communication in procurement resulting in improved procurement performance. The telephone was used to quickly contact suppliers who were not delivering the agreed level of service and suppliers used the telephone to directly and quickly get responses from the state corporations. To facilitate use of the telephone, provision of telephone contacts was one of the requirements during supplier registration. Procurement tasks could be completed anywhere at any time using mobile devices and notifications of procurement approvals and rejections were received instantly via mobile devices.

The majority of the respondents indicated that communication technology had affected procurement performance to a great extent. There is a positive significant linear relationship between communication technology and procurement performance. The results and the findings therefore conclude that communication technology has a significant positive effect on procurement performance in energy sector state corporations in Kenya.

5.2.2 Application Soft-wares

The study sought to assess whether Application soft-wares have an effect on procurement performance and to test the hypothesis that Application soft-wares have a significant positive effect on procurement performance in the energy sector state corporations. Kaiser-Meyer-Olkin (KMO) test and Bartlett's test of Sphericity were performed on the data to indicate whether factor analysis could be useful with the data. KMO for Applications software was found to be 0valid. Factor analysis was carried out and 3 items which had an estimated correlation of below 0.4 were dropped out of 12 items and consequently not considered for further analysis.

Descriptive analysis results showed that the most commonly used Application software was E-procurement software with an overwhelming majority of. This was followed by ERP, then contract management software and finally spend analysis software. Most respondents indicated that procurement application soft-wares were very effective. Majority of the respondents strongly agreed that processing tenders using the e-procurement software has increased transparency, use of ERP software solutions has increased process integration in the organization, use of spend analysis software enables the organization to analyse spend and identify areas of cost savings, contract management software reduced paperwork and contract management software had reduced the time taken to prepare contract documents in their organisations. Respondents agreed that use of ERP has led to improved decision making since procurement information was available, automatic creation of purchase orders leading to reduction in paper cost, use of spend analysis software maverick purchases have been reduced, use of contract management application software had improved reporting and compliance in their organization and that contract management software had reduced the time taken to prepare contract documents in their organisations.

The study results indicated that there is a positive significant linear relationship between applications software and procurement performance. The results and the findings therefore conclude that application soft-wares have a significant positive effect on procurement performance in energy sector state corporations in Kenya.

5.2.3 Information Technology

The study sought to evaluate whether information technology has effect on procurement performance and to test the hypothesis that information technology has a significant positive effect on procurement performance in the energy sector state corporations. Kaiser-Meyer-Olkin (KMO) test and Bartlett's test of Sphericity were performed on the data to indicate whether factor analysis could be useful with the data. KMO for information technology was found to be valid. Factor analysis was carried out and 5 items which had estimated correlations that were below 0.4 were dropped out of 12 items and consequently not considered for further analysis.

The study found that the most common information communication technology used in their organization was the internet, followed by computers and web technologies. Procurement data base was rarely used. Majority of the respondents strongly agreed that the use of computers has eliminated delays and errors in the procurement processes, guides on registration of new suppliers were put in the organizations websites, use of the internet enables them to quickly access information on sourcing, internet was used to send purchase orders and invoices electronically, maintaining a database for their transactions enabled them to analyse data in a variety of ways and that their organization had a supplier database that enabled buyers to identify sources of supply quickly and cost effectively. Majority of respondents also agreed that use of the internet increased information sharing and consequently collaboration.

The study results indicated that there is a positive significant linear relationship between information technology and procurement performance. The results and the findings therefore conclude that Information technology has a significant positive effect on procurement performance in energy sector state corporations in Kenya.

5.2.4 Electronic Procurement Policy

The study sought to determine the effect of electronic procurement policy on procurement performance and to test the hypothesis that electronic procurement policy has a significant positive effect on procurement performance in the energy sector state corporations. Kaiser-Meyer-Olkin (KMO) test and Bartlett's test of

Sphericity were performed on the data to indicate whether factor analysis could be useful with the data. KMO for electronic procurement policy was found to be valid. Factor analysis was carried out and 4 items which had estimated correlations that were below 0.4 were dropped out of 13 items and consequently not considered for further analysis.

Majority of the respondents indicated that electronic tendering policy had been put in place in their organization. Most of the respondents indicated that electronic invoicing policy, electronic records management policy and online security policy had not been put in place in their organisations. Most of the respondents strongly agreed that that they have an online security policy on user access controls that prevents unauthorized data modifications, their electronic tendering policy covered traceability for all submitted tenders regarding time received and time opened, electronic records policy that defined how electronic records were generated and stored and that their electronic records policy covers when and how records are destroyed. Most respondents agreed that they have an online security policy on user access controls that prevents unauthorized data modifications, that their electronic invoicing policy covered the means of demonstrating that the invoice was of genuine supply and that their electronic tendering policy allows for extension of tender closing/opening period if the system fails at a critical point during the tendering process.

The study results indicated that there is a positive significant linear relationship between electronic procurement policy and procurement performance. The results and the findings therefore conclude that Electronic Procurement policy has a significant positive effect on procurement performance in energy sector state corporations in Kenya.

5.2.5 Electronic Procurement Technical Support Staff

The study sought to establish the effect of electronic procurement technical support staff on procurement performance and to test the hypothesis that electronic procurement technical support staff have a significant positive effect on procurement performance in the energy sector state corporations. Kaiser-Meyer-Olkin (KMO) test

and Bartlett's test of Sphericity were performed on the data to indicate whether factor analysis could be useful with the data. KMO for electronic procurement technical support staff was found to be valid. Factor analysis was carried out and 3 items which had estimated correlations that were below 0.4 were dropped out of 15 items and consequently not considered for further analysis.

Descriptive analysis results indicated that majority of the respondents strongly agreed that their technical support staff had the necessary technical knowledge to deliver product and services that support procurement, their electronic procurement technical support staff were able to understand and communicated the needs of procurement system users, they had a virtual system where the technical support staff would run transactions before transporting them to the live system, they had a virtual system where the technical support staff would run transactions before transporting them to the live system, their technical support staff regularly received and implemented feedback from users thus ensuring continued use of the system, support staff regularly checked and maintained the system to ensure confidentiality and data integrity, manual procedures had been stopped to ensure that staff utilizes ICT knowledge, that manual procedures had been stopped to ensure that staff utilize ICT knowledge, ICT Technical support staff were trained regularly, and that their organization had an e-learning tool for ICT. Most of the respondents agreed that the electronic technical support staff responded promptly when procurement staff was experiencing ICT related technicalities, their technical support staff were able to analyse system problems and provide solutions and that they had a virtual system where the technical support staff would run transactions before transporting them to the live system.

The study results indicated that there is a positive significant linear relationship between electronic procurement technical support staff and procurement performance. The results and the findings therefore conclude that electronic procurement technical support staff has a significant positive effect on procurement performance in energy sector state corporations in Kenya.

5.3 Conclusions

Based on the findings, it can be concluded that information and communications technology has a considerable effect on procurement performance in energy sector state corporations in Kenya. This confirms the findings by Mwangi and Mburu (2015) that use of ICT improves procurement performance and should therefore be considered critical for every procurement function. The findings of this research support the findings of previous researchers that use of ICT in Procurement improves procurement through reduced lead-times, increased transparency, improved supplier performance and improved contract performance (Burt et al., 2010; Kim et al., 2009).

It can further be concluded that Communications technology has a critical role in improving the procurement performance at the energy sector state corporations in Kenya. Through the adoption of various communication technologies such as emails and mobile phones, tracking of procurement transactions has improved, communication between the suppliers and buyers is direct and quick, the organization procurement tasks could be completed anywhere at anytime and the notifications of procurement approvals and rejections can be received instantly via mobile devices. This has helped to improve on procurement performance to a greater extent.

With regards to the application software, the key application soft-wares used in the energy sector state corporations are E-procurement systems, ERP and Contract management software. Spend analysis software is used on a limited scale. Use of these soft-wares has played a great role in addressing various issues in the procurement department. Through application software utilization, transparency has increased. ERP Software solutions have increased process integration in the organizations and improved decision-making. Since Procurement information is available, purchase orders are created automatically leading to reduction in paper usage and consequently costs. By using Spend analysis software organizations are able to analyse spend and identify areas of cost savings. In conclusion, the utilization of these software has resulted in cost cutting and facilitated transparency which is

important for accountability and decision making. This has positively affected procurement performance in the energy sector organisations.

The information technology was also found to significantly contribute to Procurement performance. Through the use of ICT, decision making has improved and accountability has also been enhanced. It can also be concluded that the utilization of the internet has made it easier for the organizations to access information that is vital to the performance of procurement department such as guidelines on the registration of new suppliers, sourcing and prices, send purchase orders and invoices electronically and maintaining a procurement database for transactions which has enabled them to analyse data in a variety of ways and thus having a well-informed decision-making process.

The presence of electronic procurement policies in the organizations has helped in improving accountability and security. Through the electronic procurement policies, security measures have been put in place that can help the team monitor the procurement process as well as ensuring that ethical principles are adhered to in the organization. The electronic tendering policy covered traceability for all submitted tenders regarding time received and time opened and also defines how electronic records were generated and stored and when and how to destroy electronic records. In conclusion, existence of these electronic procurement policies has led to better use of ICT leading to improved procurement performance.

Electronic procurement technical support staff was found to have the strongest effect on procurement performance. The electronic technical support staff have the required technical knowledge to deliver products and services that support procurement processes. They were also able to quickly respond to ICT related technicalities. In addition, the technical support staffs were able to understand and communicate the needs of procurement system users and regularly check and maintain the system to ensure confidentiality and data integrity. The staffs require regular training since ICT is very dynamic. Organisations that require to improve their Procurement performance through use of ICT must invest heavily in their technical support staff.

All the variables used in this study were found to significantly affect procurement performance and therefore the null hypotheses were rejected. The study concluded that the relationship between ICT and procurement performance among energy sector state corporations is positive and significant. Organisations should invest on ICT to improve procurement performance. They can invest more on the electronic technical support staff since it has the greatest effect on procurement performance. The model can be used in procurement to enhance performance.

5.4 Recommendations

From the summary of the findings and conclusions, a number of recommendations are provided. First, it is important that the electronic procurement technical staff undergo regular training so as to be in touch with the evolving technologies. They should be well equipped with the right information and knowledge on ICT so as to best improve the services. Moreover, the procurement staff should also receive general knowledge on how they can utilize the information presented through ICT so as to make well-informed decisions on procurement practices in the organization. The trainings can be made through on-job training, seminars, workshops and even attending higher institutions of learning for further certification courses. Organisations should invest on ICT to improve procurement performance. They can invest more on the electronic technical support staff since it has the greatest effect on procurement performance. The model can be used in procurement to enhance performance.

Improvements in the electronic procurement policies should also be done so as to ensure that they are in line with the current requirements in the procurement practices. The state corporations require to come with electronic procurement policies that cover electronic invoicing, electronic records management and on-line security. The electronic procurement policies need to cover current demands especially on the issues of accountability and transparency. The National treasury, which is responsible for public procurement and asset disposal policy formulation should formulate electronic procurement policies that cover online security, e-tendering, e-invoicing and e-records management among others.

Procurement performance can be improved further through the use of communication technologies such as video conferencing. This will cut down travelling costs and reduce lead-time and at the same time improve communication by allowing visual connection between suppliers and buyers who are in different locations. Since mobile devices improve procurement performance, the state corporations should implement bring your own mobile device policy which would save investment costs, increase workplace flexibility and increase employee productivity.

Regarding application soft-wares, energy sector state corporations should consider investing more on spend analysis software since this software will help identify areas of cost savings by providing visibility in the procurement activities. Spend analysis will enhance buyer-supplier relationships, eliminate non-performing suppliers and reduce maverick buying. Use of contract management software should be encouraged so as to ensure improved reporting and compliance.

5.5 Areas for Further Research

This study focused on the five independent variables which included communication technology, application soft-wares, information technology, electronic procurement policy and electronic procurement technical support staff. The coefficient of determination that is R squared, was 0.993 as indicated in the optimal model. This implies that 99.3% of the variation on procurement performance in energy sector state corporations can be explained by the five independent variables. The remaining 0.7% of the variation in procurement performance in energy sector state corporations can be explained by other variables outside this model. Therefore, it is recommended that other factors affecting procurement performance may be examined as well.

This study was done in energy sector state corporations in Kenya and therefore other similar studies can be done in other sectors of the economy such as the other government ministries private sector and Non-Governmental Organizations (NGOs). With the introduction of a moderating variable, the same study could be done to show whether they affect procurement performance in the same way. Further studies can be extrapolated to look into the impact of Electronic procurement technical support since it was found to have the greatest contribution (0.610) towards procurement performance in energy sector state corporations. Likewise, ICT policy presented a significant contribution of 0.409 which implies that there is a need for researchers to seek and prioritize the above two variables for more information and to provide policy, theoretical and practical contributions to future studies.

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APPENDICES

Appendix I: Letter of Introduction

Dear Sir/Madam,

REF: REQUEST TO CARRY OUT DATA COLLECTION.

I am a student of JKUAT CBD campus pursuing a PHD Degree in Supply Chain Management. As a requirement in fulfillment of this degree, am currently carrying out a research in the area of supply chain management. My research topic is '**Effect of ICT on Procurement Performance in the Energy Sector State Corporations in Kenya**'.

You have been chosen as you are well positioned to provide reliable information that will enable the study achieve its objectives. I intend to research the above though the use of questionnaires.

The purpose of this letter is to request you to respond to the attached questionnaire.

Any information given shall be treated as confidential and will be used purely for academic purposes. A final copy of the document shall be availed to you upon request.

Thank you in advance for your time and cooperation.

Jane Ireri Muriuki	**Supervisors**
PhD Student – JKUAT	**Dr. Wario Guyo: PhD**
……	……
	Dr. Julius Kinoti
	Prof. Romanus Odhiambo

Appendix II: Questionnaire for the Respondents

EFFECT OF ICT ON PROCUREMENT PERFORMANCE IN THE ENERGY SECTOR STATE CORPORATIONS IN KENYA

Please read each question carefully and follow the instructions given. Then, kindly answer the questions by ticking (√) in the box that best describes your answer or write your answers in the space provided where applicable. The answers provided are for ***ACADEMIC PURPOSES*** *only and will be treated with utmost confidentiality*.

Section A: Background Information

1. Name of your Organization

a) Kenya Power & Lighting Company Ltd [ ]
b) Kenya Electricity Transmission Company Limited [ ]
c) Kenya Pipeline Company Limited [ ]
d) Rural Electrification Authority [ ]
e) Geothermal Development Company Limited [ ]
f) Kenya Electricity Generating Company Limited [ ]
g) Energy Regulatory Commission [ ]
h) National Oil Corporation of Kenya [ ]
i) Kenya Nuclear Electricity Board [ ]

2. What is your designation?

a) Procurement staff [ ]
b) Electronic Procurement Technical Support Staff [ ]

3. What is your position in the department? _____

4. How long have you worked in the organization?

a) 1-5 years [ ]
b) 6-10years [ ]
c) 11-15 years [ ]
d) 16 years and above [ ]

5. What is your highest level of education?

a) Certificate [ ]
b) Diploma [ ]
c) Undergraduate [ ]
d) Post Graduate [ ]
e) PHD Degree [ ]

Section B: Effect of Communication Technology on Procurement Performance

6. What are the most common communication technologies used in the procurement processes in

your organization?

a) Emails [ ]
b) Telephones [ ]
c) Mobile devices [ ]
d) Video conferencing [ ]
e) Any other specify_____

7. How can you rate the effectiveness of the communication technology on the performance of Procurement department in your organization?

a) Very effective [ ] c) Not Effective [ ]
b) Effective [ ] d) Not sure [ ]

8. Kindly indicate your level of agreement to the following statements regarding Communication technology and procurement process in your organization. Using a scale of 1-5 where 1- strongly disagrees, 2- disagree, 3- neutral, 4- agree and 5- strongly agree, please tick (√) the statement that best describes your response appropriately in the space provided.

Statements	SA	A	N	D	SD
i) Every employee involved in the procurement process has a Company email account	☐	☐	☐	☐	☐
ii) Email is used to send/receive quotations	☐	☐	☐	☐	☐
iii) Use of email standardizes communication	☐	☐	☐	☐	☐
iv) Email improves tracking of transactions	☐	☐	☐	☐	☐
v) Telephone is used to quickly contact suppliers who were not delivering the agreed level of service	☐	☐	☐	☐	☐
vi) Suppliers use the telephone to directly and quickly get answers to their queries	☐	☐	☐	☐	☐
vii) Suppliers are required to indicate their telephone contacts during registration	☐	☐	☐	☐	☐
viii) Mobile devices are used to complete procurement tasks any from any location	☐	☐	☐	☐	☐
ix) Procurement documents are approved timely from anywhere & anytime using mobile devices	☐	☐	☐	☐	☐
x) Notifications of procurement approvals and rejections are received instantly via mobile devices	☐	☐	☐	☐	☐
xi) Video conferencing is used to conduct online procurement meetings with stakeholders	☐	☐	☐	☐	☐
xii) Use of video conference has improved communication	☐	☐	☐	☐	☐
xiii) With the use of video conferencing travelling costs have been reduced	☐	☐	☐	☐	☐
xiv) Video conferencing has speeded up decision making since it is interactive.	☐	☐	☐	☐	☐

9. To what extent has the communication technologies affected the procurement performance in your organization?

a) To a greater extent [ ] c) Not at all [ ]
b) To some extent [ ] d) Not Sure [ ]

Section C: Effect of Procurement Application Softwares on Procurement Performance

10. Which ICT procurement application softwares are used in the procurement processes

in your organization?

a) E-procurement systems [ ] c) ERP [ ]
b) Spend Analysis software [ ] d) Contract Management software [ ]

e) Any other specify_____

11. How can you rate the effectiveness of the ICT Procurement application softwares on the Procurement department performance in your organization?

a) Very effective [ ] c) Not Effective [ ]
b) Effective [ ] d) Not Sure [ ]

12. Indicate your level of agreement to the statements provided regarding the effect of

ICT application software on procurement performance in your organization. Where 1- Strongly disagrees, 2- disagree, 3- neutral, 4- agree and 5- strongly agree.

Statements	SA	A	N	D	SD
i) Processing tenders using the e-procurement software has increased transparency.	☐	☐	☐	☐	☐
ii) E-procurement software has improved information sharing with our suppliers	☐	☐	☐	☐	☐
iii) Use of e-procurement system has reduced reducing transaction time	☐	☐	☐	☐	☐
iv) Use of the ERP software solutions has increased process integration in our organization.	☐	☐	☐	☐	☐
v) Use of the ERP system has led to improved decision since information on procurement is available	☐	☐	☐	☐	☐
vi) By using the ERP, purchase orders are created electronically thus reducing the cost of paper.	☐	☐	☐	☐	☐
vii) By using a spend analysis software, analysis of spend & identification of areas for cost savings is attained.	☐	☐	☐	☐	☐
i) Spend analysis system has resulted in elimination of non- performing suppliers	☐	☐	☐	☐	☐
ii) With the use of spend analysis software, maverick purchases have been reduced	☐	☐	☐	☐	☐
iii) Use of the contract management software has improved reporting and compliance.	☐	☐	☐	☐	☐
iv) Use of contract management software has reduced paperwork	☐	☐	☐	☐	☐
v) Contract management software has reduced the time taken to prepare contract documents.	☐	☐	☐	☐	☐

13. What are the other effects of ICT application Software on the procurement in your organization?

_____

_____

_____

14. To what extent has the utilization of ICT application software affected the procurement department performance in your organization?

a) To a greater extent [ ] c) Not at all [ ]
b) To some extent [ ] d) Not Sure [ ]

Section D: Effect of Information Technology on Procurement performance

15. What are the common information technologies used in the procurement processes in Your organization?

a) Computers [ ] d) web technology [ ]
b) Internet [ ] e) Procurement Database [ ]
c) Any other specify, _____

16. Have you received any training on utilizing the information technology for procurement processes?

a) Yes [ ] b) No [ ]

17. How can you rate the effectiveness of the information technology on the procurement department performance in your organization?

a) Very effective [ ] c) Not Effective [ ]
b) Effective [ ] d) Not Sure [ ]

18. By use of a tick, indicate your level of agreement to the following statements regarding the effect of information technology on the procurement performance in your organization. Where 1- strongly disagrees, 2- disagree, 3- neutral, 4- agree and 5- strongly agree.

Statements	SA	A	N	D	SD
i) Every procurement staff has a Computer which they use for their daily work.	☐	☐	☐	☐	☐
ii) Use of computers in has eliminated delays & errors in our procurement processes	☐	☐	☐	☐	☐
iii) By using Computers large amounts of procurement data is conveniently stored	☐	☐	☐	☐	☐
iv) Placing tenders in the website has increased transparency in the procurement process.	☐	☐	☐	☐	☐
v) Contract awards are put in the website	☐	☐	☐	☐	☐
vi) The organisations' website has a guide on how new suppliers can register	☐	☐	☐	☐	☐
vii) Use of the internet leads to quick access of information on sourcing and prices.	☐	☐	☐	☐	☐
viii) With the use of the internet there is increased information sharing resulting increased collaboration	☐	☐	☐	☐	☐
ix) Through the internet purchase orders and invoices are sent electronically	☐	☐	☐	☐	☐
x) Maintaining a single database of procurement transactions enables our organisation to analyse data in a variety of ways	☐	☐	☐	☐	☐
xi) Through the supplier database buyers are able to identify sources of supply quickly and cost-effectively.	☐	☐	☐	☐	☐
xii) Maintaining one single procurement database which is accessible to our internal customers.	☐	☐	☐	☐	☐

19. To what extent has the use of information technology in your organization affected the performance of the Procurement department?

a) To a greater extent [ ] c) To some extent [ ]
b) Not at all [ ] d) Not sure [ ]

Section E: Effect of Electronic Procurement Policy on Procurement Performance

20. Are you aware of electronic procurement policies put in place to guide the electronic procurement processes?

a) Yes [ ] b) No [ ]

21. Indicate the electronic procurement policies that you are aware of which have been put in place to guide the performance of the procurement department.

a) Online security policy [ ] c) Electronic invoicing policy [ ]
b) Electronic tendering policy [ ] d) Electronic records management policy [ ]

e) Any other specify, _____

22. Indicate your level of agreement to the statement provided regarding the effect of electronic procurement policies on the procurement performance in your organization. Where 1- Strongly disagree, 2- disagree, 3- neutral, 4- agree and 5- strongly agree.

	Statement	SA	A	N	D	SD
i.	We have an online security policy that requires username & password to be sent to users via email enhancing confidentiality	☐	☐	☐	☐	☐
ii.	Our online security policy guides that users should be advised to immediately change their passwords on receipt	☐	☐	☐	☐	☐
iii.	Our online security policy governs password design thus enhancing the strength of the password	☐	☐	☐	☐	☐
iv.	We have an online security policy on user access controls preventing unauthorised data modifications	☐	☐	☐	☐	☐
v.	We have an electronic invoicing policy covers the content of the invoice	☐	☐	☐	☐	☐
vi.	Our electronic invoicing policy covers the means of demonstrating that the invoice is of a genuine supply	☐	☐	☐	☐	☐
vii.	Our electronic invoicing policy covers the means for maintaining an audit trail	☐	☐	☐	☐	☐
viii.	We have an electronic tendering policy that covers that ensures that the tender contents are genuine and that the bidder is the author	☐	☐	☐	☐	☐
ix.	Our electronic tendering policy covers the aspect of traceability for all submitted tenders e.g time received, time opened	☐	☐	☐	☐	☐
x.	Our electronic tendering policy allows for extension of tender closing/opening period if the system fails at a critical point during the process	☐	☐	☐	☐	☐
xi.	We have an electronic records management policy that defines how electronic records are generated and stored	☐	☐	☐	☐	☐
xii.	Our electronic records policy covers the length of period that records should be retained	☐	☐	☐	☐	☐
xiii.	The electronic record policy covers when and how to destroy the records	☐	☐	☐	☐	☐

23. To what extent have the electronic procurement policies affected the effectiveness of ICT in the procurement performance in your organization?

a) To a greater extent [ ]
b) To some extent [ ]
c) Not at all [ ]
d) Not sure [ ]

Section: Effect of Electronic Procurement Technical Support Staff on Procurement performance

24. Indicate your level of agreement to the following statements regarding the effect of Electronic procurement technical support staff and procurement performance in your organization. Where 1- strongly disagree, 2- disagree, 3- neutral, 4- agree and 5- strongly agree.

ELECTRONIC PROCUREMENT TECHNICAL SUPPORT STAFF	**SA**	**A**	**N**	**D**	**SD**
i. Our technical support staff have the necessary technical knowledge to deliver products & services that support procurement	☐	☐	☐	☐	☐
ii. Our technical support staff are able to effectively coordinate their work and respond to electronic procurement incidences	☐	☐	☐	☐	☐
iii. The technical support staff are able to analyse problems in electronic procurement systems and provide solutions	☐	☐	☐	☐	☐
iv. The technical support staff are able to communicate, understand the needs of our procurement Users	☐	☐	☐	☐	☐
v. Our organization has an adequate number of Electronic procurement technical support staff	☐	☐	☐	☐	☐
vi. Our technical support staff respond promptly when we have ICT related technicalities	☐	☐	☐	☐	☐

vii.	Our procurement technical support staff only support procurement Users	☐	☐	☐	☐	☐
viii.	We have a development system where the support staff test transactions before running them in the live system	☐	☐	☐	☐	☐
ix.	The support staff regularly receive & implement feedback from users thus ensuring continued use of the system	☐	☐	☐	☐	☐
x.	Support staff constantly check and maintain controls in the system to ensure confidentiality and data integrity	☐	☐	☐	☐	☐
xi.	Use Manual procurement procedures has been stopped to ensure that Staff utilize ICT Knowledge	☐	☐	☐	☐	☐
xii.	All support staff attend a formal training program that meets their requirements	☐	☐	☐	☐	☐
xiii.	Our organization has an e-learning tool for training ICT	☐	☐	☐	☐	☐
xiv.	Our support staff are trained regularly to keep up with changing electronic procurement technology	☐	☐	☐	☐	☐
xv.	Training materials are customized for specific jobs by our support staff and provided to users	☐	☐	☐	☐	☐

25. What are the challenges affecting the Electronic procurement technical support staff in facilitating smooth procurement processes in your organization?

_____

_____

26. How can you rate the effectiveness of the Electronic procurement technical support staff in integrating ICT in the procurement activities in your organization?

a) Very effective [ ]
b) Effective [ ]
c) Not effective [ ]
d) Not sure [ ]

Section G: ICT and Procurement Performance

27. To what extent has use of ICT affected procurement performance in your organization? Where 1- strongly disagrees, 2- disagree, 3- neutral, 4- agree and 5- strongly agree.

PROCUREMENT PERFORMANCE	**SA**	**A**	**N**	**D**	**SD**
i. ICT use has reduced time taken to communicate identified needs.	☐	☐	☐	☐	☐
ii. With adoption of ICT in procurement re-entering data from paper documents has gone down consequently reducing errors/time taken to prepare purchase orders/contracts	☐	☐	☐	☐	☐
iii. Sourcing time has been reduced considerably with the implementation of ICT	☐	☐	☐	☐	☐
iv. Purchase orders/contracts are sent electronically to Suppliers resulting in reduced contract award lead time.	☐	☐	☐	☐	☐
v. Bids/procurement opportunities are adequately published in the website/portal	☐	☐	☐	☐	☐
vi. Annual procurement plans are published on the website	☐	☐	☐	☐	☐
vii. Bidders are able to electronically view the tender opening process	☐	☐	☐	☐	☐
viii. Clear & comprehensive bidding documents are published in standard form and made available in the website/portal	☐	☐	☐	☐	☐

ix.	The outcome of the tendering process(winning bidder, price, ranking) is available online	☐	☐	☐	☐	☐
x.	Our organisation publishes contract award notices in the portal/website	☐	☐	☐	☐	☐
xi.	Our suppliers deliver goods/services on time	☐	☐	☐	☐	☐
xii.	We have suppliers who exhibit high service levels	☐	☐	☐	☐	☐
xiii.	Our suppliers offer products that consistently conform to our specifications	☐	☐	☐	☐	☐
xiv.	Our suppliers are willing to change goods/services to meet the changing customer needs	☐	☐	☐	☐	☐
xv.	Our suppliers have enough flexibility to respond to unexpected demand changes	☐	☐	☐	☐	☐
xvi.	With the use of ICT Contracts are created using predefined templates thus reducing contract document creation time	☐	☐	☐	☐	☐
xvii.	Contract deadlines and notifications are electronically monitored	☐	☐	☐	☐	☐
xviii.	Key performance indicators for the contracts are tracked electronically	☐	☐	☐	☐	☐
xix.	Circulation of Contracts documents is done electronically thus reducing paperwork	☐	☐	☐	☐	☐
xx.	Improved reporting of contract information resulting in high compliance levels	☐	☐	☐	☐	☐
xxi.	key contract information stored electronically in a single central register leading to quick access and efficient retrieval	☐	☐	☐	☐	☐
xxii.	With the adoption of ICT in procurement department, off contract buying has been reduced	☐	☐	☐	☐	☐

28. How can you rate the effectiveness of procurement department in your organization?

a) Very effective [ ]
b) Effective [ ]

c) Not effective [ ]

d) Not sure [ ]

29. What are the measures that can be put in place to improve the effectiveness of ICT in the procurement performance in your organization?

_____

_____

_____

_____

Thank you for your participation

Appendix III: List of Energy Sector State Corporations

Kenya Power & Lighting Company Limited (KPLC)

Kenya Electricity Generation Company Limited (KenGen)

Kenya Electricity Transmission Company Limited (KETRACO)

Kenya Pipeline Company Limited (KPC)

Rural Electrification Authority (REA)

Geothermal Development Company Limited (GDC)

Energy Regulatory Commission (ERC)

National Oil Corporation of Kenya (NOCK)

Kenya Nuclear Electricity Board (KNEB)

Appendix IV: Table for Determining Sample Size for Known Population

N	S	N	S	N	S	N	S	N	S
10	10	100	80	280	162	800	260	2800	338
15	14	110	86	290	165	850	265	3000	341
20	19	120	92	300	169	900	269	3500	346
25	24	130	97	320	175	950	274	4000	351
30	28	140	103	340	181	1000	278	4500	354
35	32	150	108	360	186	1100	285	5000	357
40	36	160	113	380	191	1200	291	6000	361
45	40	170	118	400	196	1300	297	7000	364
50	44	180	123	420	201	1400	302	8000	367
55	48	190	127	440	205	1500	306	9000	368
60	52	200	132	460	210	1600	310	10000	370
65	56	210	136	480	214	1700	313	15000	375
70	59	220	140	500	217	1800	317	20000	377
75	63	230	144	550	226	1900	320	30000	379
80	66	240	148	600	234	2000	322	40000	380
85	70	250	152	650	242	2200	327	50000	381
90	73	260	155	700	248	2400	331	75000	382
95	76	270	159	750	254	2600	335	1000000	384

Note: N is Population Size; S is Sample Size *Source: Krejcie & Morgan, 1970*

Appendix V: Reliability and Factor Analysis

1. **Component matrix for communication technology**

Component Matrix	**Component**	
Every employee involved in the procurement process has a Company email account	.691	Retained
We use mobile devices to complete procurement tasks any time &from any location	.638	Retained
Our suppliers are able to directly and quickly get answers to their queries using the telephone	.616	Retained
We use the telephone to quickly contact suppliers who were not delivering the agreed level of service	.613	Retained
Use of email standardizes communication	.553	
Email improves tracking of transactions	.535	Retained
We use email to send/receive quotations	.522	Retained
All suppliers are required to indicate their telephone contacts during registration	.510	Retained
Using mobile devices, notifications of approvals and rejections can be received instantly	.377	Retained
With the use of video conferencing travelling costs are reduced	.245	Expunged
Video conferencing speeds up decision making since it is interactive.	.222	Expunged
Procurement documents can be approved timely from anywhere & anytime using mobile devices	.204	Expunged
Videoconferencing is used to conduct online procurement meetings with stakeholders	.120	Expunged
Use of video conference improves communication	.030	Expunged

2. Component matrix for procurement application softwares

Component Matrix[a]		
	Component	
	1	
Use of contract management software has reduced paperwork	.660	Retained
With the use of spend analysis software, maverick purchases have been reduced	.578	Retained
Use of the contract management software has improved reporting and compliance in our organization	.578	Retained
Contract management software has reduced the time taken to prepare contract documents.	.568	Retained
By using a spend analysis software, our organization is able to analyse spend and identify areas of cost savings.	.496	Retained
By using the ERP, purchase orders are created electronically thus reducing the cost of paper.	.471	Retained
Processing tenders using the e-procurement software has increased transparency.	.466	Retained
Use of the ERP system has led to improved decision since information on procurement is available	.413	Retained
Use of the ERP software solutions has increased process integration in our organization.	.405	Retained
Use of e-procurement system has reduced reducing transaction time	.240	Expunged
E-procurement software has improved information sharing with our suppliers	.137	Expunged
Spend analysis system has resulted in elimination of non- performing suppliers	.082	Expunged

3. Component matrix for information technology

Component Matrix	Component	
The internet enables us quickly access information on sourcing and prices.	.604	Retained
With the use of the internet there is increased information sharing resulting increased collaboration	.510	Retained
Our organisation has a supplier database that enables buyers to identify sources of supply quickly and cost-effectively.	.495	Retained

Our website has a guide on how new suppliers can register with our organisation.	.477	Retained
The internet has enabled us to send purchase orders and invoices electronically increasing efficiency	.470	Retained
Maintaining a database of our procurement transactions enables us to analyse data in a variety of ways	.396	Retained
Use of computers has eliminated delays & errors in our procurement processes	.389	Retained
Placing tenders in our website has increased transparency in the procurement process.	.310	Expunged
We maintain one single database which is accessible to our internal customers.	.266	Expunged
Computers enable us to conveniently store large amounts of procurement data	.258	Expunged
Our contract awards are put in the website	.227	Expunged
Every procurement staff has a Computer which they use for their daily work.	.028	Expunged

4. Component matrix for Electronic Procurement Policy

Component Matrix[a]	Component	
The electronic record policy covers when and how to destroy the records	.669	Retained
Our electronic records policy covers the length of period that records should be retained	.617	Retained
Our electronic tendering policy allows for extension of tender closing/opening period if the system fails at a critical point during the process	.594	Retained
Our electronic tendering policy covers the aspect of traceability for all submitted tenders e.g time received, time opened	.578	Retained
Our electronic invoicing policy covers the means of demonstrating that the invoice is of a genuine supply	.569	Retained
We have an online security policy on user access controls preventing unauthorised data modifications	.543	Retained
We have an electronic tendering policy that covers that ensures that the tender contents are genuine and that the bidder is the author	.486	Retained
We have an electronic records management policy that defines how electronic records are generated and stored	.460	Retained
Our online security policy guides that users should be advised to immediately change their passwords on receipt	.404	Retained
Our online security policy governs password design thus enhancing the strength of the password	.125	Expunged
We have an electronic invoicing policy covers the content of the invoice	.098	Expunged
Our electronic invoicing policy covers the means for maintaining an audit trail	.078	Expunged
We have an online security policy that requires username & password to be sent to users via email enhancing confidentiality	.016	Expunged

5. Component matrix for electronic procurement technical support staff

Component Matrix	Component	
Our technical support staff have the necessary technical knowledge to deliver products & services that support procurement	.625	Retained
Our support staff are trained regularly to keep up with changing technology	.608	Retained
Our technical support staff respond promptly when we have ICT related technicalities	.602	Retained
The technical support staff are able to analyse problems in electronic procurement systems and provide solutions	.597	Retained
All support staff attend a formal training program that meets their requirements	.583	Retained
We have a virtual/development system where the support staff can run transactions before running them in the live system	.579	Retained
The support staff regularly receive & implement feedback from users thus ensuring continued use of the system	.559	Retained
Our organization has an e-learning tool for training ICT	.551	Retained
Training materials are customized for specific jobs by our support staff and provided to users	.533	Retained
The technical support staff are able to communicate, understand the needs of our procurement Users	.459	Retained
Support staff constantly check and maintain the system to ensure confidentiality and data integrity	.453	Retained
Manual procedures have been blocked to ensure that Staff utilize ICT Knowledge	.416	Retained
Our technical support staff are able to effectively coordinate their work and respond to electronic procurement incidences	.308	Expunged
Our procurement technical support staff only support procurement Users	.221	Expunged
Our organization has an adequate number of Electronic procurement technical support staff	.104	Expunged

6. Component matrix for ICT and Procurement Performance

Component Matrix	Component	
Our suppliers deliver goods/services on time	.561	Retained
Bidders are able to electronically view the tender opening process	.536	Retained
Our suppliers are willing to change goods/services to meet the changing customer needs	.536	Retained
With the use of ICT Contracts are created using predefined templates thus reducing contract document creation time	.536	Retained
Annual procurement plans are published on the website	.529	Retained
Our organisation publishes contract award notices in the portal/website	.529	Retained
Key performance indicators for the contracts are tracked electronically	.517	Retained
The outcome of the tendering process(winning bidder, price, ranking) is available online	.507	Retained
With the adoption of ICT in procurement department, off contract buying has been reduced	.484	Retained
Sourcing time has been reduced considerably with the implementation of ICT	.480	Retained
Clear & comprehensive bidding documents are published in standard form and made available in the website/portal	.469	Retained
Contract deadlines and notifications are electronically monitored	.461	Retained
With adoption of ICT in procurement re-entering data from paper documents has gone down consequently reducing errors/time taken to prepare purchase orders/contracts	.460	Retained
Our suppliers have enough flexibility to respond to unexpected demand changes	.449	Retained
Our suppliers offer products that consistently conform to our specifications	.428	Retained

Circulation of Contracts documents is done electronically thus reducing paperwork	.424	Retained
Purchase orders/contracts are sent electronically to Suppliers resulting in reduced contract award lead time.	.390	Retained
key contract information stored electronically in a single central register leading to quick access and efficient retrieval	.190	Expunged
We have suppliers who exhibit high service levels	.136	Expunged
Bids/procurement opportunities are adequately published in the website/portal	.130	Expunged
Improved reporting of contract information resulting in high compliance levels	.106	Expunged
ICT use has reduced time taken to communicate identified needs.	.090	Expunged

Appendix VI: Descriptive Statistics for Study Variables

1. Effectiveness Communication Technologies on the performance of Procurement department

	Frequency	Percent	Valid Percent	Cumulative Percent
Very Effective	148	78.3	78.3	78.3
Not Sure	1	.5	.5	100.0
Total	189	100.0	100.0	

2. What are the most common communication technologies used in the procurement processes in your organization?

communication technology	Frequency	Percent	Rank
Email	188	99.5	1
Mobile devices	175	92.6	2
Telephone	89	47.1	3

3. The extent to which Communication Technology has affected Procurement Performance

	Frequency	Percent	Cumulative Percent
To a greater extent	163	85.7	86.2
To some extent	22	11.6	97.9
Not at all	1	.5	98.4
Not Sure	3	1.6	100.0
Total	**189**	**100**	

4. Which ICT application software technologies are used in the procurement processes in your organization?

		Frequency	Percent	Cumulative Percent
	E-procurement systems	180	95.2	95.2
	ERP	7	3.7	98.9
	Contract Management Software	2	.5	99.5
	Total	**189**	**100.0**	

5. **How can you rate the effectiveness of the ICT application soft-wares on the procurement department performance in your organization?**

	Frequency	Percent	Cumulative Percent
Very effective	168	88.9	88.9
Effective	17	9.0	97.9
Not sure	4	.2.1	100.0
Total	**189**	**100.0**	

6.What are the common information technologies used in the procurement processes in your organization?

	Frequency	Percent
Computers	1	.6
Internet	176	98.3
Web technology	2	1.1
Total	179	100.0

7. Indicate the electronic procurement policies that you are aware of which have been put in place to guide the performance of the procurement department.

		Frequency	Percent
	Electronic tendering policy	171	97.2
	Electronic invoicing policy	4	2.3
	Electronic records management policy	1	.6
	Total	189	100.0

Appendix VII: Correlation and Regression Analysis

Coefficients: Communication technology and procurement performance Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	31.697	4.032		7.862	.000
	COMMUNICATION TECHNOLOGY	.703	.110	.423	6.382	.000

a. Dependent Variable: PROCUREMENT PERFORMANCE

1. Coefficients: Application software and procurement performance

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	34.762	3.671		9.469	.000
	APPLICATION SOFTWARE	.762	.123	.412	6.178	.000

a. Dependent Variable: PROCUREMENT PERFORMANCE

2. Coefficients: Information Technology on technology and procurement performance

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	22.079	3.691		5.982	.000
	INFORMATION TECHNOLOGY	1.085	.113	.574	9.595	.000

a. Dependent Variable: PROCUREMENT PERFORMANCE

3. Coefficients: Electronic procurement policy and procurement performance

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	27.091	3.228		8.392	.000
	ELECTRONIC PROCUREMENT POLICY	.900	.095	.568	9.429	.000

a. Dependent Variable: PROCUREMENT PERFORMANCE

b.

4. Coefficients: Electronic procurement technical support staff

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	21.887	2.762		7.925	.000
	ELECTRONIC PROCUREMENT TECHNICAL SUPPORT	.916	.071	.687	12.934	.000

a. Dependent Variable: PROCUREMENT PERFORMANCE

5. Correlation matrix

CORRELATION MATRIX

		Ict and procurement performance	Communication technology	Application software	Information technology	Electronic procurement policy	Electronic procurement technical support
ICT and procurement performance	Pearson Correlation	1	.423**	.412**	.574**	.568**	.687**
	Sig. (2-tailed)		.000	.000	.000	.000	.000
	N	189	189	189	189	189	189
Communication technology	Pearson Correlation	.423**	1	.369**	.399**	.299**	.459**
	Sig. (2-tailed)	.000		.000	.000	.000	.000
	N	189	189	189	189	189	189
Application software	Pearson Correlation	.412**	.369**	1	.587**	.499**	.415**
	Sig. (2-tailed)	.000	.000		.000	.000	.000
	N	189	189	189	189	189	189
Information technology	Pearson Correlation	.574**	.399**	.587**	1	.515**	.485**
	Sig. (2-tailed)	.000	.000	.000		.000	.000
	N	189	189	189	189	189	189
Electronic procurement policy	Pearson Correlation	.568**	.299**	.499**	.515**	1	.475**
	Sig. (2-tailed)	.000	.000	.000	.000		.000
	N	189	189	189	189	189	189
Electronic procurement technical support	Pearson Correlation	.687**	.459**	.415**	.485**	.475**	1
	Sig. (2-tailed)	.000	.000	.000	.000	.000	
	N	189	189	189	189	189	189

**. Correlation is significant at the 0.01 level (2-tailed).