INFLUENCE OF INFORMATION AND COMMUNICATION TECHNOLOGY APPLICATION ON MANAGEMENT OF ROAD PROJECTS IN KENYA: A CASE OF NATIONAL HIGHWAY AUTHORITY

BY:

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DECLARATION

This research project is my original work and has not been presented for any award in any other university.

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L50/79825/2015

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

Signed …….....……

Date…….....……

DR. MERCY MUGAMBI

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DEDICATION

I dedicate this project to my parents Albert and Loise Theuri as well as siblings Patricia and Zachary for their sacrifice and support that they gave me to ensure that I complete this research project. Their care, support, concern, enthusiasm, and love motivated me to attain this goal.

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LIST OF ABBREVIATIONS AND ACRONYMS

ERS	Employment Creation Strategy
GST	General System Theory
ICT	Information and Communication Technology
KeNHA	Kenya National Highways Authority
KURA	Kenya Urban Roads Authority
MDGs	Millennium Development Goals
NACOSTI	National Commission for Science, Technology and Innovation
RACECA	Roads and Civil Engineering Contractors Association
SCM	Supply Chain Management
UK	United Kingdom

ABSTRACT

The number of public road construction projects has been increasing in Kenya from one period to another. However, completion of projects within the cost budget allocated is always a challenge. Due to inadequacy of financial resources that exist in Kenya, cost overrun posts a major challenge in the completion of construction projects in Kenya. The purpose of undertaking this research study was to investigate on the influence of information and communication technology application on management of road projects in Kenya. The specific objectives of the study were to assess how electronic communication, electronic records management, supply chain integration and electronic procurement management application on the management of road projects in Kenya. A descriptive explanatory research design was adopted. The population of study included all staff in the headquarters of KeNHA. There are114 staff working in the headquarters of KeNHA. The sample size was determined by the Slovin's Formula. Stratified random sampling was adopted in the selection of 88 staff who represented the sample size. Both primary and secondary data were used. Interview guides were used to obtain information from the key informants. Primary data in this study was obtained by administering questionnaires; the questionnaire comprised of unstructured and structured questions. Secondary data was obtained from KENHA reports for the last five years. A pilot test was carried out as a means of determining the validity and reliability of the research instrument. A document analysis guide was used to collect information such as estimated cost (Ksh), completion cost (Ksh), estimated time (months) and completion time (months). Questionnaires were used as the primary tools for collection of data. Quantitative data was obtained and analysis was done by use of descriptive and inferential statistics .This was achieved by using a statistical package for social sciences (SPSS version 20). Descriptive statistics refers to percentages, frequency distribution, standard deviation and means. The data obtained was presented by use of graphs tables. Furthermore; correlation analysis was adopted in establishing the relationship which existed between the dependent variables and the independent variable. The study found that electronic communication has a significant influence on the management of road projects in KeNHA (β_1=0.676, p-value=0.000). Also, the study established that electronic records management has an insignificant influence on the management of road projects in KENHA (β_2=0.040, p-value=0.830). Further, the study established that supply chain integration has a significant influence on the management of road projects in KeNHA (β_3=0.212, p-value=0.000). In addition, the study revealed that electronic procurement has a significant influence on the management of road projects in in KeNHA (β_4=0.431, p-value 0.000). The study concluded that electronic communication has the most significant influence on the management of road projects, followed by electronic procurement, supply chain integration and electronic records management. The study recommends that KeNHA should develop strategies to improve on stability of network which can be done by establishment .of other communication tools. The study also recommends that KeNHA should develop strategies on public procurement record keeping so as improve on electronic records management.

CHAPTER ONE: INTRODUCTION

1.1 Background to the study

Economic growth and development in any country can be measured in terms of physical infrastructural development such as roads, bridges and buildings. Poor construction of road project is related to performance difficulties. There are various factors behind the occurrence of such problems in construction projects (Adzroe & Ingirige, 2014). The problems experienced in the performance of the road construction industry in developing countries can be grouped into three classes namely: problems related to shortages in the infrastructure industry (mainly deals with the supply and demand of resources), problems due to consultants and clients and lastly problems arising as a result of incompetence of the contractor (Gaith, Khalim & Amiruddin, 2012). So as to attain the goals of employment and wealth creation, poverty alleviation and economic growth, there is need of implementation of a well-functioning and good road network (Ndiang'ui, Ombui & Kagiri, 2015). Hence, the Ministry of Roads of Kenya plays a crucial role so as to attain the following goals; attainment of "Millennium Development Goals (MDGs), Kenya vision 2030" goals, Kenya's Economic Recovery Strategy for Employment and wealth Creation Strategy (ERS) through providing the necessary infrastructural equipment needed by the public for rehabilitating, maintaining, managing and developing of road construction industries in the Kenya (KeNHA, 2015).

Infrastructure is given the first chance in ensuring that the major road projects found in the economic pillar are formulated and implemented. Kahura (2013) reported that there was need to improve on roads as it was the main type of transport in the country. Roads were used to carry about 80% of passengers and cargoes within the country. This was in accordance to the Ministry of Roads Service Charter (2008). The allocation of the cost budget in respect to road projects has increased in the recent times by the government. This has happened as a result of realization that roads are significant to socio-economic development of any nation. Even though efforts are being made in aa way to improve on road projects, Kenya is still faced by challenges such as delays in completion of road projects, demolitions that are experienced in businesses houses, abortive works and cost overruns, (Kinuthia & Were, 2015).

The construction of road projects is made up of a mixture of very dynamic processes which seldom go in hand with the type of implementation plan adopted. According to Wilkinson (2013), the road construction industry is always complex in its nature since it comprises of a broad number of players including contractors, shareholders, consultants, stakeholders, regulators and clients. In addition, Gaith *et al.* (2012) posit that 30% of road construction is made up of rework, 40% to 60% is made up of labor that is used in potential efficiency and the rest is mainly made of materials that are wasted. A project is said to be implemented successfully if it comes to existence on time scheduled, within the cost budget, attains all the basic goals that it was meant for, its accepted by the user and it meets the purpose for which it was intended for. The significance of information and communication technology in road construction projects cannot be overstated. Information technology usage has become a non-negotiable aspect of construction industry (Adzroe & Ingirige, 2014). Information communication technology provides new opportunities to innovative construction companies so as to enhance the process of communication, collaboration and exchange of information. In addition, IT evolution in project management has led to a shift from implementing projects which depend on analysis approach and intuition to sophisticated integrated project management systems (Nyandika & Ngugi, 2014). The main components of information and communication technology in the road construction industry are electronic communication, electronics record management, supply chain integration and electronic procurement management.

There is need for good communication in all the project lifecycle stages so as to ensure the success of the project; it is the main factor that brings together all the factors which affect project implementation (El-Saboni, Aouad & Sabounim, 2009). In most cases, the road construction projects are faced with a problem of inefficient communication as a result of many reasons such as large versatility of the top management in the project lifecycle, and also the adversary relations which may exist among the parties in the construction project. Use of electronic communication in the recent times has become increasingly effective in ensuring there is an efficient and effective project communication (Raulea & Raulea, 2014). Moreover, electronics records management is commonly used to leverage efficiencies, manage projects, shorten delivery cycles, reduce costs, increase productivity, better utilization of resources, capture necessary information to manage projects, comply with

regulatory requirements and defend against claims. Despite the benefits of ICT, the road construction industry is still viewed by many as lagging behind in terms of deployment of technology as compared to other industries (Duranti, 2011). The method by which information on construction is recorded, generated and stored in the current period has resulted to various problems on the side of the construction-based personnel. This is mainly due to the construction-based processes being biased towards the type of communication that is used traditionally including paper documents.

Though at a slow pace, the road construction industry has been adopting supply chain integration to improve efficiency and supply chain performance. The attributes of an integrated construction supply chain includes; it being coordinated at the center and the relationship among the firms being nurtured for the period that a project has been undertaken (Xiangjun & Weimei, 2016). The supply chains are driven towards transaction costs minimization; transfer and enhancement of expertise among the parties in the construction project (Lam & Chang, 2012). In addition, E-Procurement is gaining popularity in business practice and a variety of benefits have encouraged its adoption, such as reducing costs and increasing efficiency. E-procurement systems also contribute to minimization of transaction costs through automation of processes, exchanging of information technology with human labor. Also, e-Procurement enhances breakdown of the functional silos towards the horizontal processes which lead to an increase in integration (Gyampoh-Vidogah, Moreton & Proverbs, 2012).

In The United Kingdom, Adzroe and Ingirige (2014) identified that the performance of UK construction industry was highly affected by inadequacy of integration in the industry. They suggested that the adoption of ICT systems was necessary to speed up communications within the construction industry as a way of improving on performance. This existed in a large number of strategic international and national initiatives that were meant to address on adoption of ICT in road construction industry, including the Department of Trade and Industry, which recommended many changes that are required in the construction industry.

In Canada, Pellerina et al. (2013) indicate that the performance of the projects is significantly linked to the usage of information technology; the more the use of information and

communication technology the better the performance of projects. In New Zealand, Wilkinson (2013) argues that the construction industry in New Zealand has been left behind in the way they use integrated project management software in the management of construction projects effectively. In addition, Bardhan, Krishnan and Lin (2007) found that the adoption of information technology in construction projects led to an improvement in project coordination, improved communication and information exchange, which subsequently led to a reduction in project cost and completion on time. In Nigeria, Gaith, Khalim and Amiruddin (2012) found that the adoption of information technology led to an improvement in project performance.

In Kenya, Kinuthia and Were (2015) found that Companies that fully understand and leverage the project management software have a higher propensity of achieving project success. Additionally, the study established that many projects fail due to failure to adopt the necessary project management software in the management of the schedule, labor, project activities and budget. Similarly, Ndiang'ui, Ombui and Kagiri (2015) indicate that project technology, database management, communication and software management influence road construction projects completion in Kenya Urban Roads Authority (KURA).

1.1.1 Kenya National Highways Authority

Kenya National Highways Authority (KeNHA) is a sovereign agency of roads, which has the duties of rehabilitation, maintenance, development and management of trunk roads internationally and linking different centers which have international importance and also crossing the international boundaries or ending at international ports (Class A), national trunk roads which link the important centers (Class B) and the roads which link provincially the important centers among the higher-class roads (Class C) (KeNHA, 2015).

Its main responsibilities are to upgrade, maintain, construct and rehabilitate roads of Class A, Class B and Class C roads, implementation of policies on roads in regard to national roads, ensuring that there is adherence to the guidelines and rules on axle load control which are described in the traffic act and any other regulations under the traffic act, ensuring that there are quality roads works which align with the standards as they may be explained by the minister, collate and collect all the type data that is related to the usage of national roads

as may be necessary for efficient forward planning under this act (KeNHA, 2015). With regard to Thika-Superhighway, this institution was mandated with the responsibility of improving the project and the maintenance of the road. Over years, after successful completion, vandalism has been estimated to cost the government on an average amount of 50 million shillings in the past one and a quarter year due to the massive damage of furniture for the roads along the Thika Super-highway (Kenya Roads Board, 2013).

1.2 Statement of the problem

Infrastructural development of road networks in Kenya is a sector that has been put under emphasis by the government due to it being the key incentive to spur economic growth. A large share of the national budget resource allocations goes to it. During the 2013/2014 fiscal year, 7.7% of the National budget allocation was allocated to the Ministry of transport and Infrastructure. Contracting for paved road construction has increased in great measure making construction industry an easily noticeable development (RoK, 2014). This is intended to spur growth by creating efficiency, convenience and cost effectiveness in the transportation of both goods and services in the Kenyan economy.

According to Kenya Roads Board (2014) report, almost 30% of funds that are directed to the ministry of roads annually go to Kenya National Highways Authority. Most of the construction projects end up experiencing cost overruns and hence exceeding the contract amount that was planned for initially. In Kenya, public roads construction projects have been increasing from one period to another. Completion of the project within the stipulated time remains to be a problem. Kenya is faced with a problem of cost overruns as a result of inadequate financial resources within the country. Statistics obtained from the Republic of Kenya report indicates that KeNHA is faced with problems of cost overruns in the implementation of its road projects. For example, during the construction of the Thika Super Highway, there was an increase in cost to 34.45 billion from 26.44 billion. Furthermore, there was a change in the completion deadline to July 2013 from July 2011 of the Thika super highway project (Roads and Civil Engineering Contractors Association, 2013). In addition, the system of sewerage located along Lot1-RD 0530 of the Thika superhighway project also changed after the completion of the superhighway. Data from Republic of Kenya

report indicate that due to overruns in cost, there is stagnation in the economic development and also the realization of vision 2030 (republic of Kenya, 2014).

Bardhan, Krishnan and Lin (2007), found out that the adoption of information and communication technology in the construction industry improves effectiveness and efficiency, which in turn lead to an improvement in delivery within time scheduled and the cost of the project. Even though, there is adoption of information and communication technology at KeNHA, road projects are still experiencing cost and time overruns. This study therefore sought to investigate the influence of information and communication technology application on management of road projects in Kenya National Highway Authority.

1.3 Purpose of the study

The purpose of the study was to investigate on the influence of information and communication technology application on management of road projects in Kenya.

1.4 Objectives of the study

The study aimed at achieving the following objectives:

i. To assess how electronic communication influence management of road projects in Kenya.
ii. To determine the influence of electronic records application on the management of road projects in Kenya.
iii. To determine the influence of supply chain integration on the management of road projects in Kenya.
iv. To determine the influence of electronic procurement on the management of road projects in Kenya.

1.5 Research questions

The following research questions guided the researcher;

i. How does electronic communication influence the management of road projects in Kenya?

ii. How does electronic records application influence the management of road projects in Kenya?
iii. How does supply chain integration influence the management of road projects in Kenya?
iv. How does electronic procurement influence the management of road projects in Kenya?

1.6 Significance of the study

Almost 30% of the funds allocated to the roads ministry annually go to Kenya National Highways Authority. This is a clear indication that the performance of road projects in Kenya is crucial to the national economy. Therefore, to the policy makers and the national government of Kenya, the study provided them with information on influence of information and communication technology on the performance of road projects. The information obtained may be used as a base upon which regulations on information and communication technology in road construction projects can be revised. This information can also be used to formulate more policies in relation information and communication technology in road construction projects in Kenya.

Management of Kenya National Highway Authority may benefit from the study as it provides information on how the use of information and communication technology in project management influence road projects performance. The findings of this study can also be used in formulating strategies that improve on the adoption of information and communication technology in road projects in terms of improving communication, records management, supply chain integration and procurement management.

Academicians benefit from this study as the study provides information that may be used in literature review. In addition, the study provides more information to the body of knowledge on the influence of information and communication technology adoption in project management on the performance of road projects. The study also forms a basis on which further research studies can be carried out on the influence of information and

communication technology adoption in project management on the performance of road projects.

1.7 Delimitation of the study

This study involved four uses of information and communication technology in project management, namely; electronic communication, electronic records management, supply chain integration and electronic procurement management. This study was conducted in Kenya National Highways Authority headquarters in Nairobi. The population of the study was all the professional staff in the headquarters in Nairobi.

1.8 Limitations of the study

The research study was conducted in Kenya National Highways Authority which hinders the generalization of the findings to different government institutions in Kenya. In the head office, the management of the organization felt as if they are being investigated and hence they were reluctant to grant permission for collection of data. However, the researcher presented a data collection authorization letter from the University and National Commission for Science, Technology and Innovation. In addition, the management were given an assurance that data obtained was used for research purposes only.

1.9 Basic Assumptions of the study

This study assumed that the target population can read, understand and also be able to answer and write the questions in the survey tool. In addition, the study assumed that all participants would be co-operative and provide reliable, accurate and honest responses to the best of their ability. Further, the study assumed that the staff working in the headquarters of KeNHA would be ready to give true and correct information willingly during collection of data and that permission would be granted to the researcher by the authorities for collection of data.

1.10 Definitions of Significant Terms

Electronic communication: involves transferring of signals, intelligence, data, writing, signs images or sounds, through electronic devices.

Electronic procurement management: use of a company's intranet or internet in the procurement of services and goods that are used in the running of a business.

Electronic records management: This includes a group of activities which are needed in control of distribution, creation, maintenance, disposition and use of recorded information that is stored for purposes of evidence of the business transactions and activities electronically.

Performance of road projects: This is the completion of road construction projects in time scheduled, cost budget and also attaining objectives set.

Management of road projects: These are interlocking functions and activities involving organizing, planning, controlling and directing resources in the construction and maintenance of road projects.

Supply chain integration: refers to an group of suppliers and customers working together through use of management techniques so as to optimize on the performance collectively in creation, distribution, and support of the end product.

1.11 Organization of the Study

This study is organized into five chapters. The first chapter entails of the introduction which highlights the background of the study, problem statement, purpose, objectives, research questions, significance, delimitation, limitations, assumptions of the study and definition of significant terms.

Chapter two presents a literature review of the study. The subsections of this chapter include an introduction, review of studies on study variables, theoretical framework, conceptual framework, gaps in literature reviewed and summary of the literature.

Chapter three includes a research methodology that was adopted and focused on the research design, target population, data collection instrument, sample size and sampling procedures, sample size, pilot test of the research instruments, procedures of data collection, techniques of data analysis, ethical consideration, and operationalization of variables.

Chapter presents data analysis, presentation, interpretation and discussion of the findings. The chapter begins with a section on response rate followed by general information of the respondents, descriptive statistics as per the objectives of the study and inferential statistics that included correlation and regression analysis. The last section of this chapter is the discussion of the findings which was done as per the objectives of the study. Chapter five presents the summary of the research findings; it indicates the conclusions drawn from these findings, offers recommendations, and suggestions for further studies. The summary of the findings, conclusions and recommendations were done as per the objectives of the study.

CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction

This chapter contains related literature review as per the objective of the study: influence of information and communication technology application in terms of electronic communication, electronic records management, supply chain integration and electronic procurement on management of road projects in Kenya. This is then followed by a theoretical framework, explanation of relationships of variables in the conceptual framework, gaps in literature reviewed and summary of literature.

2.2 Electronic Communication and Management of Road Projects

Project communication refers to exchange of information which is intended to bring about an understanding among the stakeholders of the project. Stakeholders refers to a group of people who have the ability to be affected with the implementation of the project such as the customers, regulatory agencies, local communities, project sponsor and project team among others. Even though, most scholars have echoed that communication is important in the construction projects, project failures are still as a result of poor communication (Jameson, 2013). Raulea and Raulea (2014) indicate that ineffectiveness in communication is a major contributor to project failures as it contributes to 95% of most project failures. According to Turkulainen, Aaltonen and Lohikoski (2015), effective communication is among the major factors which account for the success of a project. The quality of flows in communication determines the effectiveness that is required in project construction. The quality of flows in communication via the life cycle of project can be termed as the degree to which the required information arrives the intended user of the information within an appropriate time.

There is need for good communication in all project lifecycle stages so as to ensure the success of the project; it is the main factor which brings together all the factors which affect project implementation (Hart, Vroman & Stulz, 2015). In most cases, the road construction projects are faced with a problem of efficient communication as a result of many reasons such as the large versatility of the top management in the project lifecycle, and also the adversary relations which may exist among the parties in the construction project. Use of

electronic communication in the recent times has become increasingly effective in ensuring that there is an efficient and effective project communication

According to Turkulainen *et al.* (2015), electronic communication is among the central elements that are required in the integration of project management. A project manager must select appropriate information communication technology equipment which will assist him in the coordination of activities of the team concerned with implementation. Technology adopted must be able to coordinate and monitor all the activities that are ongoing within the project in the team. One such technology that can be used to coordinate communication is the use of the internet. Jameson (2013) emphasized on the same idea. He stated integration of the back office and other systems of the project were of necessity. Also, there was need for every member in the project team to have accessibility to the internet without considering their specific locations. With the availability of the internet, project manager and the implementation team can easily access information about the progress of the project.

The internet can be supported by the establishment of other communication tools. These tools include the adoption of video conferencing, use of mobile phones to communicate and emails. Team members obtain information on the progress of a project from the project manager (El-Saboni, Aouad & Sabounim, 2009). Jameson (2013) supported the use of other communication tools by insisting that through emails, professionals can send drawings to their team members. In such an instance, project manager is required to keep trail and track on the documents that are being transferred by the professionals. The tracking then makes it easy for the manager to come up with corrective measures for the project in case of any need.

In the United Arab Emirates, El-Saboni, Aouad and Sabounim (2009) conducted a study on challenges facing the success of a construction project. There were seven main journals that were chosen to review the previous work done on project success in the field of construction. This study identified challenges that were related with electronic communication systems implementation as one of the factor facing the success of a construction project. A number of findings indicated the electronic media as an option to paper based communication, but there was an extra cost that was considered for need of IT and also more Human Resources for data entry in various kinds of management's organizations. In Romania, Raulea and

Raulea (2014) conducted a study on the effect of electronic communication technology and teamwork. This study reviewed other studies carried out on electronic communication technology in projects. The study found that virtual teams in road construction projects used information and communication technology to share information, communicate, coordinate and collaborate their efforts.

Rimmington, Dickens and Pasquire (2015) conducted a study on the effect of information and communication technology in construction projects industry. This study reviewed the necessary secondary data which provided a theoretical position on the work and determined what type primary data should be collected. Questionnaires were adopted in the collection of primary data. The study found out that an intranet in the organization was the most preferable communication alternative for the parties concerned in the research sample and this was as a result of the work being undertaken. Communication technology which use pictorial messages need to be developed rather than those that use texts only. The distance in geographical location among the parties also supports the adoption of electronic that has a long circulation than the one which has a direct approach communication. Due to easiness in the sending of text messages, a sender may use a scatter-gun approach.

2.3 Electronic Records and Management of Road Projects

The fast pace and complexity of the contemporary large-scale construction activity affects heavily the process of record management. The records on construction project need to be current and quickly retrievable (Xiangjun & Weimei, 2016). In most cases, there is occurrence of obstacles that are unexpected in the completion and continuation of the construction projects. Management of record affect the cost and the time scheduled for the project. In the recent past, road construction companies have been changing from paper records management system to electronic records management systems (RMS) so as to improve on the speed of record retrieval and also storage of vast quantities with various records formats (Craig & Sommerville, 2007).

Despite the benefits of ICT, the road construction industry is still viewed by many as lagging behind in terms of deployment of technology as compared to other industries (Duranti, 2011). The method by which information on construction is recorded, generated and stored in

the current period has resulted to various problems on the side of the construction-based personnel. This is mainly due to the construction-based processes being biased towards the type of communication that is used traditionally including paper documents. For purposes of sharing the information, there is need for knowledge in the construction-based records to be included in the memory of the project. Traditional paper based systems do not provide flexibility required in the construction environment today. In its simpler form, management of records in the construction industry includes storage, retrieval and creation. Most of the records are less accessible, retrievable and reliable as compared to the past (Nycyk, 2008).

Although, the management process of IT records in the construction industry depends on the broad information that is provided, information that is provided in a good environment where there are adequate management practices of records should be appropriate, accurate and clear as decisions made on a daily basis are based on accurate information recorded. Currently, in any business environment, records relating to a specific matter may be found in various forms such as on paper, e-mail and part of it may be found on a database. There is need for establishment of the relationship that exists in the different forms of records and be able to create a group of related records and formatted records. Xiangjun and Weimei (2016) found that records management was meaningless and also out of context and in future users will understand the dossier related to the subject.

The importance and scale of management of records is a crucial facet of management of information as demonstrated by the fact that almost more than 90 percent of documentations of a company exists in paper .Veal (2011) indicated that the electronic methods are taking over the hard copy distribution creation . Due to most paper based records in the construction projects having more future use, the records require to be maintained and organized so as to avoid claims situation and conflicts.

Resistance to use technologies of such in RMS practices has led to performance of projects being poor in specific areas like quality, time and cost. Resistance to technological change in construction projects is related to work divisions existing in professions like between the constructor and designer (Nycyk, 2008). Some project professionals resist keeping their records systems in order as they view it as a function relating the support staff and the

administrative. Furthermore, the project staff see records management as being a less significant activity for them to invest their time in hence they spent most of their time on other activities (Lam & Chang, 2012).

Craig and Sommerville's (2006) conducted a research in theUnited Kingdom road construction projects; they established that due to inadequate flows of information, poor archiving methods and the retrieval of information led to the poor performance of the projects. Easy accessibility to records is followed by problems such as when the issues occurring on the site. .

Mampe and Kalusopa (2012) carried out a study on records management and project management in the Ministry of Health in Botswana. A case study approach was adopted. The case study approach was adopted together with qualitative and quantitative data collection methods. Data was obtained through the use of interviews, documentary review, questionnaires and observations. The findings revealed that the practices applied on management of records were not well entrenched hence leading to undermining of service delivery and project performance. It was evidenced by records management policy, manual procedures based on RMU service standards and lack of awareness from the Botswana National Archives; security problems and measures of preservation involving missing files, torn folders and folios; delay in the access to and records usage; missing of an elaborate electronic management programme of records and the lower level of training and skills in management of records. As a result, the study recommended the adoption of information technology in records management.

Coetzer (2012) conducted a study on the management of records at the University of Zululand. Survey research was adopted. Questionnaires were used to obtain primary data. The study established that besides the Integrated Tertiary Software (ITS) that is an Enterprise Management System, there was no other formal management system of records that was identified Zululand University which deals with either electronic records or paper-based including emails. Further, there was also no policy which was made specifically for management of records. The study recommended that increase in the usage of information technology in management of records was needed.

Lusuli and Rotich (2014) conducted a study on the problems influencing public procurement records management practice in public entities in the National Treasury. Descriptive research design was adopted. The population in the study was 80 staff members working in National Treasury. The study established that there was poor public procurement record keeping systems which led to inefficient of accountability and corrupt practices. The study also found that due to inadequate adoption of the modern technology in records storage, it has led to records loss whenever they are in demand. The study recommended need for use of new information technology in management of records implemented.

2.4 Supply Chain Integration and Management of Road Projects

The number of construction organizations in the construction industry has increased lately indicating a realization of the need of Supply Chain Management (SCM) (Akintoye et al., 2012). The construction industry has indicated to be slow in employment of SCM concept as compared to the manufacturing and retail sectors. According to Ofori (2011) use of SCM philosophy can lead to resolving of various problems which are mainly associated with traditional practices that are mainly in the construction industry. The problems that are resolved arise mainly as a result of prevalence of lose and win arrangements; any difficulties that are encountered in the construction processes, insufficient exchange of knowledge and information; increase in price as a result of competition that result from purchases from many suppliers; presence of an environment that is full of dishonest, frustration and fear (Khalfan, Khan & Maqsood, 2015).

Proverbs and Holt (2010) advocated for the usage of the philosophy of SCM as way of effectively reducing the total costs of construction. They advocated for the early involvement of the suppliers and subcontractors in a similar way as the early involvement of contractors in the procurement process. In their perspective, this could lead to opportunities to the concerned parties in offering their services that could lead to potential savings on cost and can be an obstacle in improvement of the communication that is two way between the collaborative partners. Dainty *et al.* (2011) on the other hand stresses on facilitation of the relationships between firms, attaining benefits that are mutual, and building trust between the main components of supply chain. According McDermott and Khalfan (2006), there is need

of introduction of changes in the framework of management so as to increase on the process of implementing supply chain management at the level of operations so as to eliminate the deep-rooted barriers that exists in the adversarial culture and traditional relationships

On the other hand, Tan (2009) is responsible for the identification of the key drivers that are necessary in the integration of supply chain. Tan noted the following as the drivers necessary in the integration of supply chain communication; trust among the parties involved, change in the organizational culture knowledge sharing and information, evaluation of development of supplier and also sharing of goals that are common of waste management and increase in efficiency. Dainty *et al*. (2011) identified ways that are needed to make the supply chain integration to be effective. The ways included ensuring fair payments; trust between parties; educating the construction workforce; early involvement with projects and many others (Malik & McDermott, 2006).

Barratt (2014) advocates a 'collaborative culture' that is needed in enhancement of culture integration and improvement of collaboration among the partners in the supply chain that are within the construction industry. In their perspective, culture is involves a number of items which are collaborative namely: internal and external trust; information exchanges in the supply chain, mutual gain and pain, quality and transparency in the flow of information, understanding and communication, process alignment and the effectiveness of cross-functional activities; joint processes of decision making; using measures in the assessment of supply chain performance, resources commitment in the early stages of the development of the project, inter- and intra- organizational support, demonstration of a business case for collaboration, corporate focus on the SCM, and a notion that technology is basis of collaboration. Through aggregating demand and supply it leads to enhancement of integration and collaboration in the industry and at the end resulting to collaboration of the construction firms (Proverbs & Holt, 2010).

Kocoglu et al. (2011) conducted a study on the role of integration of supply chain on sharing of information and performance of supply chain. Data was obtained from 158 manufacturing firms Marmara Region in Turkey. The findings indicated that the function of supply chain integration is important in sharing of information process because it reinforces coordination,

collaboration and connectedness, among the members in a supply chain. The results also indicated that supply chain integration provides information which is real time to the customers necessary for determination of effectiveness management in management of stock.

Moshkdanian, Shahid and Molahosseini (2013) carried out a study ion the effect of integration of supply chain and Bahman group performance. The study adopted a descriptive research design and questionnaires were used to gather data. Obtaining data from Bahman group staff and managers of logistics, customer services, and IT, the study found that integration of information influence positively integration of logistic thus improving performance. The study demonstrated that relationship between suppliers which are long term improves performance indirectly via logistic integration and information.

In Kenya, Njagi and Ogutu (2014) conducted a study on the significance of integration of supply chain on performance supply chain among the Kenyan State Corporations. A descriptive survey design was used with a total of 15 corporations being surveyed in the study. The study demonstrated that state corporations had attained an average that was above the level of integration in the external integration of suppliers and in the internal integration of operations,. The findings also indicated that integration of supply chain is one means of efficient ways of competition, and implementing of a supply chain integration have a significant effect on competitive advantage of the firm and supply chain performance. The integration of supply chain has revealed to be a key success factor for a company's performance and supply chain.

2.5 Electronic Procurement and Management of Road Projects

A number of government institutions all over the world have responded by adopting electronic procurement. E-procurement involves the adoption of a social media like intranet in the process of purchase and sale of services and goods (Caniato, Longoni & Moretto, 2012). E-procurement is mainly thought of addressing three major concerns in manual procurement practices:, collusion in the bidding process, corruption and inadequate accessibility to bid information. E-procurement increases the number of bidders through reducing the costs of collecting information concerning a tendering process, hence leading to an increase in the number of firms which can bid. Similarly, e-procurement leads to reduction

in the collusions among the bidders through provision of information on tenders to various firms that are outside a local cartel, hence allowing the non-cartel firms to take part and dissolving the local bidding cartels. E-procurement potentially reduces corruption through reduction of the degree with which the government officials withhold information selectively and refusal to collect bids from unfavored bidders. Furthermore, through ensuring that there is accessibility by the public to procurement data, it facilitates the possibility of public and oversight transparency (Briggs, 2007).

On the other hand, it is agreed that in settings of low levels of income, whereby information technology is low and also other areas of state capacity remain low, e-procurement can worsen the areas. Potential contractors that are in the system may never learn about new cartels and tenders, and those officials who are strong may continue to adopt strong-arm tactics to avoid entry of new contractors. If most small firms are limited to internet accessibility then need for electronic bids could actually impact competition (Briggs, 2006).

Lewis-Faupel *et al*. (2014) posited that e-procurement leads to lowering of prices that are paid by the government and also established that e-procurement is concerned with improvements in quality. In India, they revealed that an independent measure of construction quality, e-procurement leads to improvement of the average quality of roads, and in Indonesia, e-procurement leads to reduction in the delays that are experienced in the completion of public projects. Data on bidding indicates that a core channel of influence is selection of areas where e-procurement is involved a broader distribution of winners, bidding winners in most cases are from not from the region where bidding take place.

In the Unites States, Quesada et al. (2010) conducted a study on effect of e-procurement on performance and procurement practices. This study postulated a structure of relationships among e-procurement technology (EPT) usage, procurement practices, and procurement performance. The structure was validated and tested by use of 368 specialists in procurement found in USA. The results indicated that use of EPT affect the perceptions of managers positively of both procurement performance and the procurement practices.

In the United Kingdom, Smart (2010) conducted a study on eProcurement and its impact on supply management. Explanatory research design was adopted. The results indicated that

tools of e-procurement were adopted as a way of to implementing and extending the strategy in relation to supply base. Moreover, it was established that techniques in the segments that were defined were developing, as purchase firms adopt tools of e-procurement so as to lower numbers of supplier and to reduce their numbers competitive markets with high prices.

In Kenya, Matunga and Okibo (2013) found out that Kisii Level 5 hospital used e-quotations, e-sourcing and e-tendering as the major e-procurement applications and also that the major challenges faced when e-market provider is used is the problem of inability of the organization to deal with changes in management, inadequate employee training on the way the system is used and inadequate funding. In Elgeyo-Marakwet County, Barngetuny and Kimutai (2015) found that lack of an E-Procurement system in the has made it impossible for the county to achieve the best deal of the supply contract and thus little is done in terms of giving the right information. Payments are delayed when it comes to service delivery and thus the county is slow in delivering as a result of timelessness in supply. Furthermore, the county has failed to pay suppliers effectively as a result of late invoices and delays in approving the supply of services and goods needed by county government.

2.6 Theoretical framework

A theory refers to a set of accepted facts, assumptions or propositions, that attempts to provide a rational and plausible explanation of cause and effect relationships, among a set of elements of an observed phenomenon. This study was anchored on three theories, namely: Theory of Reasoned Action (TRA), Technology acceptance model (TAM) and Unified Theory of Acceptance and Use of Technology (UTAUT).

2.6.1 Theory of Reasoned Action (TRA)

Ajzen and Fishbein developed the TRA in 1980, a versatile behavioral theory and model (Ajzen and Fishbein, 1980). This model is the basis for attitude-behavior relationships studies. The TRA model reveal that beliefs affect social norms and attitudes which as a result try to shape the behavioral intention that guides or dictates the behaviour of an individual. Intention refers to the cognitive presentation of an individual's readiness to use certain behaviour, it is considered as being the immediate antecedent of the behavior.

TRA includes two core constructs of intention: first, the attitude in relation to behavior (ATB) and lastly the subjective norm (SN) that is related to behavior. It points out that individuals first think first think of the outcome of a specific behaviour before getting involved in or not. The theory sees an intention of a particular individual in performing a specific act as being the determinant of an action, and on the other hand attitude is based on a person's beliefs and how he evaluates the outcome of behaviour.

TRA is a generally accepted intention theory which has been adopted largely in the prediction and explanation of behavior across major domains and also virtual human behavior (Ajzen and Fishbein, 1980) and many modern technology adoption models have their roots pegged on TRA. The researcher considered this as a significant improvement from the previous models studied in terms of specifics and relationship between these specifics. Compared to the previous models, it would be much easier to domesticate this model to use of information and communication technology application. The constructs Behavioral Intention and Actual Use were carried on to later models and the researcher retained them as well. However, this model did not exhaust constructs considered relevant for information and communication technology application. For example, the environmental factors mentioned in the SCT model earlier were dropped, yet the researcher considered them critical in this study. At the same time, moderating variables were missing. At this stage, the researcher extracted Subjective Norm, Behavioral Intention and Actual Usage as the key most useful constructs from this model.

The theory is significant to the study as it was used to explain how information and communication technology application influence management of road projects in Kenya .The theory explains on how attitude toward behavior and norms associated with that behavior determine the application of information and communication technology of road projects in Kenya. In the management of road projects in Kenya the application of information and communication technology in the organization depends on the attitudes and behaviour of the management which improves on the road projects.

2.6.2 Technology acceptance model (TAM) Theory

Davies advanced the Theory of Reasoned Action (Davies, 1986) to Technology Acceptance Model (TAM) from. TAM was based on two main beliefs including perceived ease in the usage and attitudes of the user, behaviors and perceived usefulness. The intentional behaviour is determined by the perceived usefulness and attitude. On the other hand, user of the attitude is based on the perception of its usage (PU) and perception of easiness in usage (PEOU).

TAM focuses on the perception of its easiness in the usage and how its perceived in terms of its usefulness as compared to TRA that depends on the attitude. Thus, TAM determines the main determinants of an individual use of technology and hence it has been used and it can be adopted to either predict or explain the behaviors of an individual throughout the user groups and end users computing technologies (Davis, 1989).

The aim of the model is to give the reasons on the factors of acceptance of computer that are able of determining behaviors of an individual throughout the user groups and end users computing technologies, and also being theoretically justified and parsimonious and. On the contrary, due to its incorporation of findings which have accumulated over a number of decades of research in IS, it thus may be suitable for computer Information Systems modelling (Davis, 1989). TAM has since been a powerful, parsimonious and robust model in the prediction of acceptance by the user. Davis validated and advanced measures that were better in in giving explanations and predictions on use that mainly had a focus on two theoretical constructs: perceived easiness in the use and the perception on the usage, this were theorized as the main determinants of use of the system (Davis, 1989).

Apart from the theoretical values, good measures for explaining and predicting would lead to a greater practical value, on both the vendors that are after assessment of demand of the user for the new ideas in design, and also managers of information systems that are found in the user organizations that are after evaluating the offerings of the vendor. TAM theorized on the issue that perceived easiness in the usage and perceived usefulness were the mediators of influence of variables which were external such as development process and system characteristics on intention to use. Perceived usefulness can also be affected by perceived

easiness in the usage since if other variables are the same, the system becomes easier and alspo it becomes more useful (Venkatesh and Davies, 2000).

This model was found to be more parsimonious as compared to DTPB by the researcher, hence making it suitable to be adopted in the study on information and communication technology application .The theory is simpler but so much comprehensive. Also, major constructs such as Trialability, Subjective Norm and the environmental factors are not included. Furthermore, TAM in its application does not consider the moderating variables. Hence making it more comprehensive.

Technology Acceptance Model was appropriate for the study on the influence of information and communication technology application on management of road projects in Kenya because the theory acts as a predictor of using information system' to acquire information literacy skills. In the case of perceived easiness in usage and perceived usefulness of information system it determines the extent of its application on the management of road projects in Kenya. It indicates that perception of easiness of usage (PEOU) and the perceived usefulness are the determinants of an individual's behaviour. On the other hand, perception of easiness of usage (PEOU) and the perceived usefulness determines attitude and perceived ease of use (PEOU) and it is due to these factors that determines the use of information and communication technology application which enhances improvement on the management of road projects in Kenya.

2.6.3 Unified Theory of Acceptance and Use of Technology (UTAUT)

This theory was advanced by Venkatesh and other researchers in "User acceptance of information technology: In response to the unified view". The the theory focuses on explaining the intentions of the user in the application of subsequent usage behavior and the information system (Venkatesh, et al., 2003). Lin and Anol (2008) and also Wang and Wang (2010) were the ones who proposed the theory. Wang and Wang (2010) extended on the UTAUT theory in the study their study on 343 target population in Taiwan to find out the differences in gender on mobile Internet acceptance. They advanced three constructs perceived value, palm-sized computer self-efficacy and perceived playfulness to UTAUT and decided to choose the intentional behaviour as the dependent variable. Lin and Anol (2008)

posited UTAUT model, involving the effect of online social support and network information technology use.

The UTAUT was based on four key determinants on usage and intention, and also four main moderators of core relationships. The UTAUT posited four main constructs which has a key function in determining behavior usage and user acceptance: Facilitating conditions, Performance expectance, Social influence and Effort expectancy. The main moderators of the theory were age, experience, voluntariness and gender. The UTAUT gives a more improved way of how the behavior and intention evolve (Venkatesh, et al., 2003). In addition, it the main relationships that make the model have been moderated.

Intentional behaviour involves the intention of a person to work out on a certain action that forecast on the behavior of an individual (Dunnebeil et al., 2012). Apart from this, behavioral intentions are the subjective probability of conducting behavior and also effect of a particular usage behavior. Hence, intentions indicate factors that are motivational which affect the behavior and are also indicate the willingness of people to try. Performance expectancy refers to the degree to which users gain advantage in the use of a technology while conducting activities (Venkatesh et al. 2012). Effort expectancy is the degree to which a technology is easy to use. Social influence is apperception of an individual that it is good to adopt the technology and is always different from those of other people. The UTAUT2 added four more constructs: hedonic motivation, facilitating conditions, and habit and price value.

Facilitating Conditions involves perceiving that technical and organizational infrastructure exist so as to support technology (Venkatesh et al. 2003). Hedonic Motivation refers to the pleasure of adopting technology. Price Value refers to the trade-off between cost paid by adopting a particular technology and benefits received. Habit involves the extent of execution of behaviors automatically by an individual. Venkatesh et al. (2012) posited that habit indirectly and directly affect behaviour of adoption of technology. It was discovered that increase in experience of use result to habitual use of technology.

This theory was adopted in this study to explain the effect of utilization of information technology on the performance of road projects. This is measured in terms of effectiveness of the system, improvement in the work performance of the system, improvement in the work

productivity of the system, chances of gaining better control and transferable skills of work. Effort Expectancy refers to an individual's attitude and perception that the use of an IT system will be a free of effort (Dunnebeil et al., 2012). This is measurable in terms of easy of clarification of data, accessibility to data, smoothness in the interactions with the system, the ability of identifying the relevant data, and overall presentation of the system and outline. Social Influence is an individual's perception of the degree to which important other people approve or disapprove of the target behavior (Heselmans et al., 2012). This is measured by the organizational encouragement; pressure exerted by the organization for change; management of communication and involvement of people in process change; demo experience beforehand; and availability of an "open door" policy which allows for discussion of aspects related to change. Facilitating Conditions includes the availability of information systems, computers and other related equipment. Also, if adopting an information and communication technology will be very costly, and a company cannot afford then this would act as a hindrance to adoption.

2.7 Conceptual framework

Conceptual framework refers to a structure of rules, assumptions and principles which holds together ideas concerning a specific concept. The study is conceptualized based on the variables adopted in the study which are diagrammatically represented to indicate the relationship existing between them through an illustration of the influence of the dependent variables and the independent variables in order to provide coherence. Independent Variables include; electronic communication, electronic records management, supply chain integration and electronic procurement management. The intervening variables will be top management support and resources allocation. Moderating variables will be age, gender, voluntariness and experience.

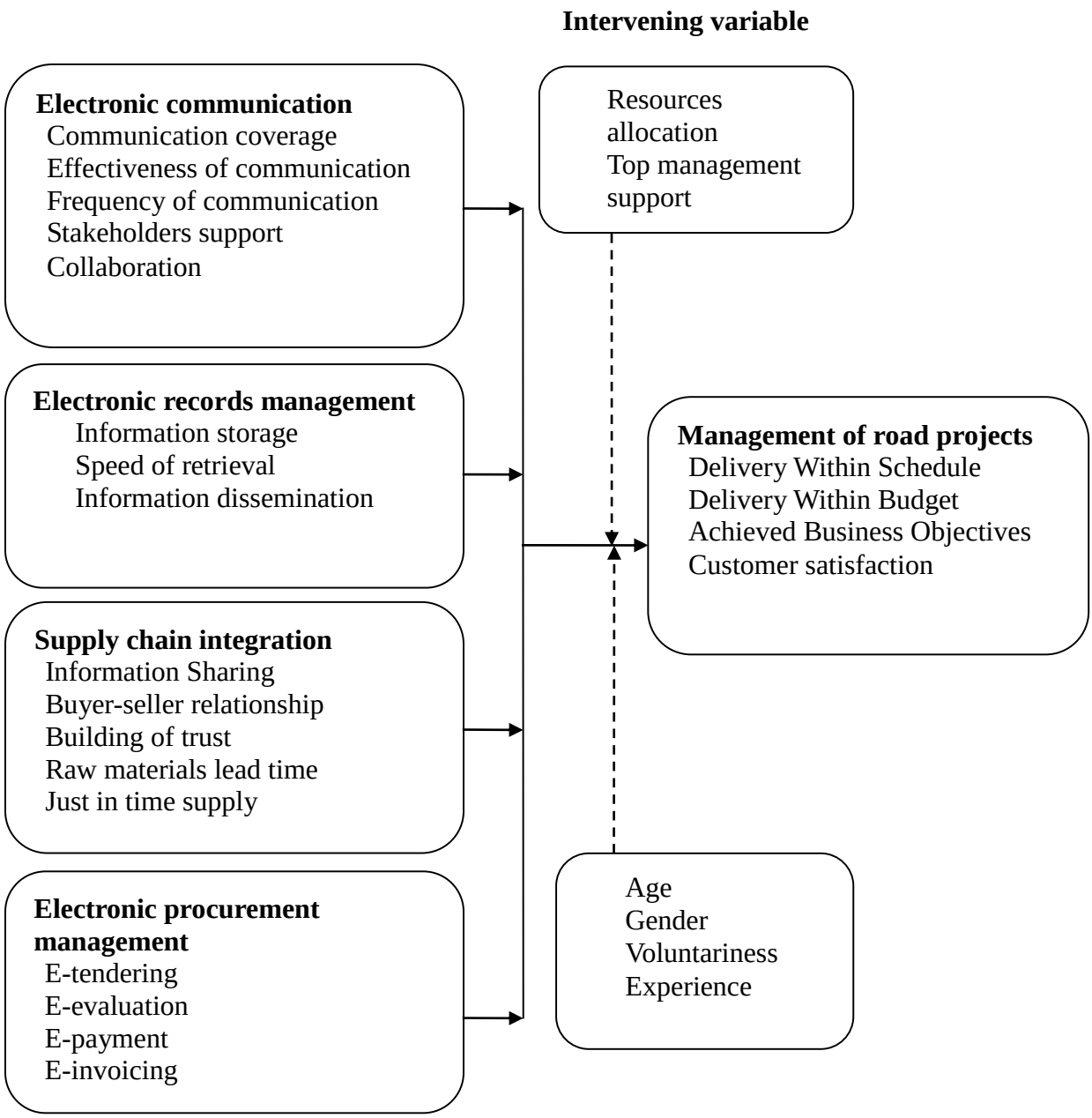

Figure 2. 1: Conceptual Framework

Communication is crucial for project success and it has been echoed by scholars, although up-to-date communication still stands as a major cause of failure of many projects (Jameson, 2013). Electronic communication enhances effectiveness and efficient project communication in the management of road projects as it is a main element in the integrative project management. Managers of integrative projects use communication tools like video conferencing equipment, emails, mobile phone communication and the internet to help him in coordination of the activities of the implementation team and monitoring all the ongoing project activities in the team. Electronic records also assist in having access to records quickly. Electronic records improve the management of projects, due to quick retrieval of of information whenever necessary. Use software like the e-records improves on easy access and safety of storing records. The use of the Supply chain integration effectively reduces the overall project management cost. The role played by supply chain integration in the process of road projects management through sharing information as it reinforces coordination, collaboration and connectedness among supply chain members. Electronic procurement involves the adoption of electronic media like the internet, for all or some of the process of acquisition of services and goods (Caniato, Longoni & Moretto, 2012). It significantly mitigates the level of corruption through reduction of the degree to which the officials of the government withhold information or refusal to obtain bids from the non-favored bidders found in the road projects. In addition, through making sure that all procurement data is accessible by the public, e-procurement increases the chances of public oversight and transparency (Briggs, 2007). E-quotations, e-sourcing and E-tendering are the major types of e-procurement applications that assist in road project management as they provide a faster means of service delivery. Payments also are made faster through the process of e-procurement by use of e-payments.

2.8 Gaps in Literature Reviewed

Various studies in relation to the adoption of ICT in various types of projects have been carried out both globally and locally. However, these studies have been limited to specific countries, sectors and have focused on different independent and dependent variables. In Australia, Hossein et al. (2012) carried out a study on ways for implementation of ICT technologies in the road construction industry. The study found that ICTs technologies have a

great impact on reducing the prevailing rampant issues in the construction projects and methods to utilize them have been implemented on various projects. In Nigeria, Ikediashi and Ogwueleka (2016) carried out a study to assess the adoption of ICT systems and its effect on performance of construction projects in the Nigerian construction industry. Due to differences in legal frameworks and macroeconomic factors, the results of the studies carried out in different countries cannot be concluded to Kenya.

In addition, many studies have been carried out on electronic communication. For instance, Raulea and Raulea (2014) conducted a study on the impact of electronic communication technology on teamwork in Romania. However, the study did not specifically show the influence of electronic communication on project performance. In relation to electronics records management, Mampe and Kalusopa (2012) carried out a study on records management and project management in the Ministry of Health in Botswana. Although the study outlined the importance of electronic communication, the findings of the study cannot be generalized to Kenya. In regard to supply chain integration, Moshkdanian, Shahid and Molahosseini (2013) carried out a study on the effect of supply chain integration on Bahman group performance. However, the dependent variable was organizational performance which is different from the performance of road projects. Regarding, electronic procurement management, Quesada et al. (2010) conducted a study on the effect of e-procurement on procurement practices and performance in the United States. Due to the study being conducted in a developed country, the findings of this study cannot be concluded to Kenya, which is a developing country.

In Kenya, Gituthu (2015) carried out a study on the influence of information communication technology applications on the performance of architects in construction projects in public sector. The dependent variable was performance of architects in construction projects, which is different from performance of road projects. Olembo (2012) conducted a study on the determinants of successful technological innovation implementation in road construction projects in Kenya. However, the study did not look at how the technological innovations influence performance of projects. Therefore this study, sought to fill the existing knowledge gap through investigating the influence of information and communication technology adoption on the performance of road projects in Kenya.

Table 2. 1:Summary of the Research Gaps

Variable	Author	Purpose of the study	Key Findings	Knowledge gap
Electronic communication	El-Saboni, Aouad & Sabounim (2009).	To determine the role played by electronic communication systems in the successful implementation of road construction projects situated in the United Arab Emirates	The study found that electronic communication through media influence the successful implementation of the road construction projects situated in the United Arab Emirates.	However the findings cannot be generalized to management of road projects in Kenya as they were carried out in the UAE.
	Rimmington, Dickens. & Pasquire (2015).	Effect of adoption of Information and Communication Technology on road construction projects in the New York	The study established that an intranet organization was the preferred communication for most parties.	However the findings cannot be generalized to management of road projects in to Kenya as they were carried out in New York.
	Turkulainen, Aaltonen & Lohikoski, (2015).	Managing Project Stakeholder Communication in Turkey.	The study found electronic communication is one of the central elements of integrative project management	However the findings cannot be generalized to management of road projects in to Kenya as they were conducted in Turkey.

Electronic Records	Craig & Sommerville (2007).	Effect of management of records and processing of information on construction sites in the United Kingdom construction projects.	The study established that inadequate information currency, poor archiving, information flows and retrieval of information contribute to the poor management of projects.	However the findings cannot be generalized to management of road projects in Kenya as they were carried out in the United Kingdom
	Mampe & Kalusopa (2012).	Management of records and delivery of service: A case of Department of Corporate Services in the Ministry of Health in Botswana.	The study findings revealed that the practices on records management were not well entrenched hence undermined service delivery and the performance of projects.	However the findings cannot be generalized to management of road projects in Kenya as they were conducted in Botswana.
	Lusuli & Rotich (2014).	Challenges influencing the management of procurement of records in public corporations in Kenya: A case of National Treasury of Kenya.	The study revealed that public procurement practices were poor in terms of keeping records in the systems which resulted into practices that were corrupt practices and also less accountability.	However the findings cannot be generalized to management of road projects in Kenya as they were focused on the National Treasury in Kenya.

Supply Chain Integration	Njagi & Ogutu (2014).	Effect of supply chain collaboration and integration on supply chain performance among the Kenyan State Corporations.	The study established that state corporations had attained an acceptable level of integration in external integration with suppliers and also internal integration of operations.	However the findings cannot be generalized to management of road projects in Kenya as it was conducted in state corporations in Kenya.
	Kocoglu *et al.* (2011).	Role of integration of supply chain on information sharing: Enhancing the performance of supply chain in Turkey.	The study found that the role of supply chain integration in the process of sharing information has led to reinforcement of coordination, collaboration and connectedness among members in supply chain.	However the findings cannot be generalized to management of road projects in Kenya as they were conducted in Turkey.
	Moshkdanian, Shahid & Molahosseini (2013).	The effect of integration of supply chain on the performance of Bahman group in India.	The study suggests that integration of information positively affect the logistic of integration and through this factor there is improvement in performance.	However the findings cannot be generalized to management of road projects in Kenya as the study was conducted in Bahman group in India.

Electronic Procurement	Quesada *et al*, (2010).	The effect of e-procurement on performance and procurement practices in the Unites States.	The study findings suggest that the use of EPT positively affect the management's attitudes and perceptions on procurement practices and performance.	However the findings cannot be generalized to management of road projects in Kenya as the study was conducted in US.
	Smart (2010)	Effect of e-procurement on supply chain management in the United Kingdom.	The results revealed that e-procurement tools were the ones adopted in the extension and implementation of the given strategy in response to the supply base	However the findings cannot be generalized to management of road projects in Kenya as the study was conducted in in UK.
	Matunga & Okibo (2013)	Role of e-Procurement practices on the effectiveness of procurementservices in Public Hospitals: A Case of Kisii Level 5 Hospital.	The study established that Kisii Level 5 hospital used e-quotations, e-sourcing and e-tendering, as the majore-procurement applications	However the findings cannot be generalized to management of road projects in Kenya as the study was conducted in the health sector.

2.9 Summary of Literature Review

This chapter reviewed past studies on influence of information and communication technology adoption on project performance. The literature review indicated that that utilization of electronic communication improves the effectiveness of communication and quality of the communication flows. This helps in the coordination of activities in all the process of road construction projects. In addition, virtual teams in road construction projects use information and communication technology to collaborate, share information communicate and coordinate their efforts.

In addition, the literature above indicates that records management is a key factor influencing project performance and hence construction records require being current, quickly retrievable and accurate. Traditional paper based systems are resistant to change and they do not give the flexibility that is required in the construction environment which exists currently. . Electronic communication was found to increase efficiency and effectiveness of information storage, retrieval and usage.

The literature also indicates that the adoption of supply chain integration leads to an improvement exchange of information and knowledge between various stakeholders in a project. However, it is highly affected by the prevalence of environment of dishonesty, frustration and fear. The literature above shows that supply chain integration is of necessity in the process of sharing information because it reinforces coordination, collaboration and connectedness among the members in a supply chain. In addition, integration of the supply chain provides information that is real time information from and to the customers which is used in the determination of stock management effectiveness.

Lastly, the literature indicates that the adoption of E-Procurement leads to an increase in accessibility to information on bids, reduction of collusion in the bidders, and also reduces the corruption level. The most commonly used forms or E-Procurement include e-tendering, e-invoicing and e-payment. E-procurement leads to reduction of collusion in the bidders through provision of information concerning the tenders that are available to firms located outside the cartel, hence allowing firms that are non-cartel to take part and also reducing the local bidding cartels. Further, it mitigates the corruption level through reduction of the degree by which

officials of the government withhold information selectively or they refuse to take some bids that belong to the non-favored bidders.

CHAPTER THREE: RESEARCH METHODOLOGY

3.1 Introduction

This chapter gives the methodology that was used in response to the research questions in this study. It includes the research design, sample size and sampling technique, target population, pilot study, research instruments, the data collection procedure, data analysis techniques, ethical considerations and operational definition of terms.

3.2 Research design

Research design is the blue print that increases the smooth flow of different research operations, hence making research to be more efficient and thus resulting to information that is maximum and less expenditure in terms of effort, money and time Kothari (2004). A descriptive explanatory research design was adopted. Descriptive research refers to collecting data that describes occurrences, tabulates, organizes, describes and depicts data. Studies that are descriptive portray the variables by answering what, how and who questions (Creswell, 2006). Explanatory research reveals that, the research in question is intended to explain rather than describing the event under study. Descriptive explanatory studies are designed to test whether one event causes another. Further, correlational analysis was adopted to determine the relationship between the dependent variable and independent variables and .Correlational analysis is good for analysis of relationships and description of the existing situation (Greener, 2008).

3.3 Target Population

Kothari (2004) explained that a population refers to the whole group of items under study in a given field of research and always have similar characteristics. In this study, target population will be all staff working in the headquarters of KeNHA. According to KeNHA (2015), there is 114 staff working in the headquarters of KeNHA. Thus, the target population of this study was 114 staff. Table 3.1 presents the target population of the study.

Table 3. 1: Target Population

Department	Target Population
Design & Construction	12
Planning & Environment	8
Finance	11
Maintenance	14
Quality Assuarance	11
Procurement	11
Legal and Regulatory Affairs	8
Enterprise & Risk Management	12
Human Resource Management & Development	6
Internal Audit	12
ICT	9
Total	**114**

Source: KeNHA (2015)

3.4 Sample Size and Sampling Techniques

Sample size refers to the selected population for research to represent the population as a whole and a sampling technique describes the procedure and method of sample selection.

3.4.1 Sample size

Sample size needs to represent the whole population, hence it should be large (Kothari, 2004). Further, the selected sample size require to give sufficient information concerning the entire population and it should also be easy to analyse (Creswell, 2006). Slovin's Formula was adopted in this study to determine the sample size. The formula is adopted in the calculation of sample size (n) when the size of the population (N) and an error of margin (e). The formula is a random sampling technique that is used in the estimation of the sampling size. This formula was chosen because it considers the size of the population.

$$n = \frac{N}{1 + NE^2}$$

Where by:

n = number of samples

N = target population

E = margin of error (0.05)

$$n = \frac{114}{1 + (114 * 0.05^2)}$$

$$n = 88$$

Table 3. 2: Sample Size

Department	Target Population	Sample Size	Percent
Design & Construction	12	9	10.53
Planning & Environment	8	6	7.02
Finance	11	8	9.65
Maintenance	14	11	12.28
Quality Assurance	11	8	9.65
Procurement	11	8	9.65
Legal and Regulatory Affairs	8	6	7.02
Enterprise & Risk Management	12	9	10.53
Human Resource Management & Development	6	5	5.26
Internal Audit	12	9	10.53
ICT	9	7	7.89
Total	**114**	**88**	**100.00**

Source: KeNHA (2015)

3.4.2 Sampling Techniques

Stratified random sampling was adopted in selection of 88 staff from the target population. Stratified random sampling gives estimate of the total population parameters involving a higher precision and also ensures that a more representative sample is obtained from a population that has similar attributes (Greener, 2008). Stratification is done so as to decrease the standard error through providing control on variance. This study used proportionate stratification so as to ensure the sample size of every stratum is proportional to the size of population of the stratum. This implied that every stratum has an equal sampling fraction.

3.5 Research Instruments

Secondary and primary data were adopted. Secondary data which was used was obtained from KENHA reports for the last five years. A document analysis guide was used to collect information such as estimated cost (Ksh), completion cost (Ksh), estimated time (months) and completion time (months). Questionnaires were used as the primary tools for collecting data. The adoption of questionnaires in the study resulted in various pros, including ability to be delivered to the entire group of respondents and also they were economical in usage as they save on time and money. The questionnaires in the study consisted of open and closed ended questions. Structured questions in the questionnaire will be adopted in the study as a way of conserving money and time. The unstructured questions allow the respondents to express their behavior and feelings towards the research questions. For the structured questions, a Five-point Likert Scale was adopted and involved the following: (1) strongly disagree (2) disagree (3) Neutral (4) agree (5) strongly agree. Responses with strongly agreed responses had a score of 5 due to positive responses that are direct and the ones with strongly disagree got a score of 1 due to negative responses. An, interview guide was used enable an in-depth collection of data from the senior managers. These were considered as key informants for the study because they are the decision makers in the organization.

3.6 Pilot Study

Pilot testing refers to the process by which the research instruments are given to some respondents in the population study that are not part of the sample selected in order to test for reliability and validity of the research instruments. The pilot test was conducted in Kenya Urban Roads Authority (KURA) as it deals with roads the same as KeNHA. This was done with 10% of the sample size (8 staff). A 10% sample of the target population is good for the study of the whole population (Hertzog, 2008). The respondents in the pilot group were selected using simple random sampling. The findings of the pilot test were used to revise the research instrument by removing any ambiguous question and rectifying typographical errors.

3.6.1 Validity of the Research Instrument

Validity is defined as the degree to which the test measures what they are required to perform. The researcher obtained content validity of the research instrument by obtaining opinions from people with expertise like the supervisor in the field of study. This assisted in the improvement of the content validity of the collected data. Also, content validity increased the needed modification and revision on the research instrument hence improving on validity (Bryman & Cramer, 2012).

3.6.2 Reliability of the Research Instrument

In psychometrics and statistics, reliability refers to the necessary consistency in any measure. Measures are said to be having reliability that is high when it gives same outcomes under similar circumstance (Bhattacherjee, 2012). Data reliability which is a measure of internal consistency and average correlation will be measured by use of Cronbach's alpha that lies between 0 and 1. Internal consistency refers to how close items are as a group and is measured by the Cronbach's alpha. It is seen as a measure of scale reliability. If the alpha coefficient values are higher, it implies that consistency exists among the items in the group in measuring the concept of interest. Greener (2008) posited that if the Cronbach's alpha is above 0.7, it is seen as being acceptable and when the Cronbach's alpha is below 0.7 it is seen as being questionable.

Table 3. 3: Cronbach Alpha

Construct	Cronbach reliability alpha	No of items
Electronic communication	0.731	4
Electronic records management	0.723	5
Supply chain integration	0.733	4
Electronic procurement	0.756	6
Management of road projects	0.725	3

From the findings, electronic communication had a Cronbach alpha of 0.731, electronic records management had a Cronbach alpha of 0.723, supply chain integration had a Cronbach alpha of 0.733 electronic procurement had a Cronbach alpha of 0.756 and management of road projects

had a Cronbach alpha of 0.725. This clearly shows that the research instrument was reliable and hence no amendments were needed.

3.7 Data Collection Procedure

Before data collection, the researcher asked for clearance by the department of extra mural studies upon successful proposal defense. After clearance by the department of extra mural studies, the researcher thereafter sought for a research permit from the National Commission for Science, Technology and Innovation through application. A letter of transmittal of data collection instruments was written by the researcher to individual respondents. The researcher paid a visit to KeNHA so as to book appointments on the right time to fill the questionnaires and meet with the respondents. Questionnaires were administered by help of two assistants of research, who were trained on the study objectives and creation of a rapport with the respondents. The questionnaires were administered to the respondents by hand delivery and also emails will be used in delivery as they increase the response rate. As a way of monitoring the process of filling the questionnaires, there were daily follow ups.

3.8 Data Analysis Techniques

The process of data analysis involves the process by which the collected data is packaged, placed in order, then structuring the main elements in such a manner that the outcome of the collected data can be efficiently and easily communicated. This study used quantitative data analysis. Analysis of quantitative data was done by making use of the statistical package for social sciences (SPSS version 20). A codebook was also prepared preceding the analysis; it was for various quantitative variables depending on the numbering structure of the questionnaires easily. Questionnaires that were used were numbered depending on data collection so as referencing can be easy. Quantitative data was analyzed through descriptive statistics; occurs after confirmation that data entered in the system is correct. Descriptive statistics to be used was such as standard deviation, frequency distribution, percentages and means. Thereafter, data presentation was by adoption of graphs and tables. Creswell, (2008) explained that descriptive statistics assist the researcher to explain the distribution in measurements, reviewing and organizing data.

Furthermore, correlation analysis was adopted in finding out whether there is a relationship between the dependent and independent variables. A 95% confidence level was applied. This showed a 0.05 significance level. This indicated that for any independent variable to have a

significant effect on the dependent variable, the p-value needs to be less than the significance level (0.05).

3.9 Ethical Considerations

In this study, the researcher put ethical issues into consideration so as to prevent loss of plausibility of the study. Plagiarism was avoided through acknowledgement of new ideas that were gotten from other scholars. Furthermore, any other person who was interested in taking part in this study was also required to fill the questionnaires. On the other hand, personnel who were not willing to get involved with the study were not forced to take part in any way. An informed consent was required on those respondents who were to take part in the study voluntarily. Hence, this showed that all the potential research respondents in the study were aware of the necessary procedures that the research study involved. This implied that the respondents were required to give their consent so as to participate in the research study. Moreover, there was adherence to strict confidentiality; there was no information that was provided to a person who was not be authorized. Where there were cases of anonymity of the respondent, the researcher was given assurance to the respondents on the integrity of their confidentiality. Lastly, a letter of data collection was obtained from National Commission for Science, Technology and Innovation by the researcher.

3.10 Operational definition of variables

Table 3.4: Operational Definition of Variables

Variable	Indicators	Measurement scale	Instrument For Collection of data	Analysis of data
Electronic communication	• Communication coverage • Effectiveness of communication • Frequency of	Ordinal	Questionnaire	• Mean • Standard deviation • Correlation Analysis

	communication • Stakeholders support • Collaboration			
Electronic records management	• Information storage • Speed of retrieval • Information security • Information dissemination	Ordinal	Questionnaire	• Mean • Standard deviation • Correlation Analysis
Supply chain integration	• Information Sharing • Buyer-seller relationship • Building of trust • Raw materials lead time • Just in time supply	Ordinal	Questionnaire	• Mean • Standard deviation • Correlation Analysis
Electronic procurement management	• E-tendering • E-evaluation • E-payment • E-invoicing	Ordinal	Questionnaire	• Mean • Standard deviation • Correlation Analysis
Performance of road construction projects	• Delivery Within Schedule • Delivery Within Budget • Achieved Business Objectives • Customer satisfaction	Ordinal	Questionnaire Document analysis guide	• Mean • Standard deviation • Correlation Analysis

CHAPTER FOUR: DATA ANALYSIS, PRESENTATION, INTERPRETATION AND DISCUSSION

4.1 Introduction

This chapter covers data analysis and interpretation of the findings as per the purpose and objectives of the study. The chapter includes the response rate, general information, electronic communication and management of road projects, electronic records management and management of road projects, supply chain integration and management of road projects, electronic procurement and management of road projects and management of road projects

4.2 Response Rate

Questionnaire return is the proportion of the questionnaires returned after they have been issued to the respondents. Out of 88 questionnaires issued, 86 questionnaires were filled and returned, accounting for 97.73% return rate which was deemed adequate for the analysis. A 100% response rate was not achieved as some of the questionnaires had some inconsistent information and some were half way filled and thus could not be used in the study. According to Kothari (2004) a response rate of 50% or more is adequate for analysis, which shows that 97.73% was an acceptable basis for drawing conclusions.

4.3 General Information

The general information of the respondents comprises of their gender, age bracket, duration worked in the organization and highest level of education.

Table 4. 1: General information of the Respondents

	Frequency	Percent
Gender		
Male	39	45.3
Female	47	54.7
Total	86	100.0
Age bracket		
Below 25 years	22	25.6
Between 25 and 35 years	21	24.4
Between 35 and 45 years	25	29.1
Above 45 years	18	20.9
Total	86	100.0
Duration in the organization		
Less than 1 year	12	14.0
Between 1 and 5 years	43	50.0
Between 5 and 10 years	18	20.9
Above 10 years	13	15.1
Total	86	100.0
Highest level of education		
Diploma	13	15.1
Undergraduate Degree	56	65.1
Postgraduate Degree	17	19.8
Total	86	100.0

According to the findings, 55% of the respondents indicated that they were male while 45% indicated that they were female. This shows that most of the staff working in the headquarters of KeNHA were male.

In relation to their age bracket, 29.1% of the respondents indicated that they were aged between 35 and 45 years, 25.6% indicated below 25years, 24.4% indicated between 25 and 35 years and 20.9% indicated above 45 years. This implies that most of the staff working in the headquarters of KeNHA were aged between 35 and 45 years.

According to the findings, 50% indicated that they had been working in their organization for between 1and 5years, 20.9 % indicted for between 5 and 10 years, 15.1% indicated for above 10 years and 14% indicated for less than1 year. This shows that most of the staff working in the headquarters of KeNHA had been working in their organization for between 1and 5years.

In regard to their highest level of education, 65.1% of the respondents indicated that they had undergraduate degree as their highest level of education, 19.8% indicated that they had postgraduate degrees and 15.1% indicated that they had diplomas. This shows that most of the staff working in the headquarters of KeNHA had undergraduate degree as their highest level of education.

4.3.1 Respondents' Departments

The respondents were requested to indicate their departments. The results were as presented in table 4.2.

Table 4. 2: Respondents' Departments

Department	Frequency	Percent
Design & Construction	22	25.6
Finance	9	10.5
Quality Assurance	9	10.5
Internal Audit	5	5.8
Legal and Regulatory Affairs	5	5.8
Human Resource Management & Development	4	4.7
Planning & Environment	4	4.7
Maintenance	4	4.7
Procurement	4	4.7
ICT	8	9.3
Enterprise & Risk Management	12	14.0
Total	**86**	**100.0**

From the findings, 25.6% of the respondents indicated that they were working in the design and construction department, 14% indicated enterprise and risk management, 10.5% indicated finance department and a similar percent indicated quality and assurance department, 9.3% indicated ICT department. Also, 5.8% indicated internal audit department and the same percent indicated the legal and regulatory affairs. Further, the respondents indicated with a similar percent of 4.7% in each of the following departments: procurement, maintenance, planning and

environment, human resource management and development. This implies that most of the staff working in the headquarters of KeNHA work in the design and construction department.

4.4 Electronic Communication and Management of Road Projects

The first objective of this study was to assess how electronic communication influence management of road projects in Kenya.

4.4.1 Aspects of Electronic Communication and Management of Road Projects

The respondents were asked to indicate the extent to which various aspects of electronic communication influence the management of road projects in Kenya. The results were as shown in table 4.3.

Table 4. 3: Aspects of Electronic Communication and Management of Road Projects

	Mean	Std. Deviation
Communication coverage	3.604	0.655
Effectiveness of communication	3.546	0.680
Frequency of communication	3.651	0.569
Stakeholders support	3.651	0.479
Collaboration	3.755	0.529

From the findings, the respondents indicated that collaboration influences the management of road projects in Kenya to a great extent as shown by a mean of 3.755. The respondents also indicated that stakeholders support influences the management of road projects to a great extent as shown by a mean of 3.651 and also indicated with a similar mean that frequency of communication influences the management of road projects. Furthermore, the respondents indicated that communication coverage influences the management of road projects to a great extent as indicated by a mean of 3.604. Lastly the respondents indicated that effectiveness of communication influence the management of road project to a great extent as shown by a mean of 3.546.

4.4.2 Influence of Electronic Communication on the Management of Road Projects

The respondents indicated that electronic communication influences the management of road projects in Kenya through liaising with other departments making work easier and effective in

road projects. The respondents further reported that electronic communication assists in sharing of information in the management of road projects. Furthermore, the respondents indicated that good communication that is provided through electronic communication throughout the phases of the lifecycle of the project is a vital factor in the success of the project as it is the prime factor which connects all of the project success factors together. The respondents indicated that the quality of flows in communication via the life cycle of project determined the effectiveness that was required in project construction and that it assisted in the integration and coordination of activities of project management. The respondents also reported that distance in geographical location among the parties also supported the adoption of electronic communication that has a long circulation than the one which has a direct approach communication. The key informants reported that electronic communication makes communication easier, faster, effective and efficient. The use of WhatsApp and mail, one does not need to be in the office to work or store the data collected in the field.

4.4.3 Challenges Faced in the Implementation of Electronic Communication

The respondents reported that they experienced a challenge of unstable network in the process of implementation of electronic communication. This was due to its low coverage across different regions. Also, they indicated that ineffectiveness in communication due large versatility of the top management in the project lifecycle and adversary relations that exist among the parties in the construction project.

4.4.4 Tools adopted in Electronic Communication

The key informants indicated that each department has its own WhatsApp group and outlook mail group. This aided in working as a team in every department. All departments have their own Cisco telephone line that can be accessed from within the organization or outside the organization. Furthermore, the senior managers indicated that they used video conferencing to communicate and send drawings to their team members

4.5 Electronic Records Management and Management of Road **Projects**

The second objective of the study was to determine the influence of electronic records application on the management of road projects in Kenya.

4.5.1 Aspects of Electronic Records Management and Management of Road Projects

The respondents were requested to indicate the extent to which various aspect of electronic records management influence the management of road projects in Kenya. The results were as shown in table 4.4.

Table 4. 4: Aspects of Electronic Records Management and Management of Road Projects

	Mean	Std. Deviation
Information storage	3.697	0.554
Speed of retrieval	3.860	0.489
Information security	3.755	0.631
Information dissemination	3.593	0.581

From the findings, the respondents indicated that speed of retrieval influence the management of road projects in Kenya to a great extent as shown by a mean of 3.860 and a standard deviation of 0.489. The respondents also reported that information security influence the management of road projects in Kenya to a great extent as shown by a mean of 3.755 and a standard deviation of 0.631. Further, they indicated that information storage and information dissemination influence the management of road projects in Kenya to a great extent as shown by means of 3.697 and 3.593 respectively.

4.5.2 Influence of Electronic Records Management on the Management of Road Projects

The respondents reported that electronic records influenced the management of road projects through allowing easy accessibility to the records concerning management of road projects. They also indicated that electronic records are more efficient in the management of road projects because one can access information on road projects from any point and is not necessarily to be in the office. Also the respondents reported that electronic records improved on safety of information on management of road projects and also allow easier retrieval of information on the projects**.** Moreover, the respondents indicated that the management process of IT records in the construction industry depends on the broad information that is provided, information that is provided in a good environment where there are adequate management practices of records should be appropriate, accurate and clear as decisions made on a daily basis are based on accurate information recorded. The senior managers indicated that the RMMS helps in keeping track of the data stored and also improves on the speed of record retrieval. It also helps in

gauging work done by staff thus acts as a reference of project performance. Archi and Auto-card help in planning of roads constructed thus roads are not constructed haphazardly

4.5.3 Challenges Faced in the Implementation of Electronic Records Management

The respondents reported that they were faced with a challenge of unstable network in the process of implementation of electronic records management in their organizations. Also, the respondents indicated that poor public procurement record keeping systems was a challenge to them which led to inefficient of accountability and corrupt practices. The respondents also indicated that due to inadequate adoption of the modern technology in records storage, it led to records loss whenever they are in demand. They further indicated that the practices applied on management of records were not well entrenched hence leading to undermining of service delivery and project performance. In addition, the respondents indicated that due to inadequate flows of information, poor archiving methods and the retrieval of information led to the poor performance of the projects.

4.5.4 Tools adopted in Electronic Records Management

The senior managers reported that they used electronic records management tools such as RMMS (Remote Maintenance Monitoring System) which helps engineers to keep track of what they are doing. Work done in the field is brought to the office and then updated. It is updated daily. Engineers also use Auto-Card and Archi-Card to draw and plan roads that are under construction.

4.6 Supply Chain Integration and Management of Road Projects

The third objective of the study was to determine the influence of supply chain integration on the management of road projects in Kenya.

4.6.1 Aspects of Supply Chain Integration and Management of Road Projects

The respondents were requested to indicate the extent to which various aspects of supply chain integration influence the management of road projects in Kenya. The results were as shown in table 4.5.

Table 4. 5: Aspects of Supply Chain Integration and Management of Road Projects

	Mean	Std. Deviation
Information Sharing	3.697	0.461
Buyer-seller relationship	3.651	0.569
Building of trust	3.802	0.590
Raw materials lead time	3.453	0.500
Just in time supply	3.593	0.581

According to the findings,the respondents indicated that building of trust influence the management of road projects in Kenya to agreat extent as indicated by a mean of 3.802 and standard deviation of 0.590. Also,the respondents indicated that information sharing **influence** the management of road projects in Kenya to agreat extent as indicated by a mean of 3.697and standard deviation of 0.461. **Further they indicated that** buyer-seller relationship influence the management of road projects in Kenya to agreat extent as indicated by a mean of 3.651and standard deviation of 0.569. In addition , they indicated that just in time supply influence the management of road projects in Kenya to agreat extent as indicated by a mean of 3.593 and standard deviation of 0.581. Lastly,they indicated that raw materials lead time **i**nfluence the management of road projects in Kenya to amoderate extent as shown by amean of 3.453 and standard deviation of 0.500.

4.6.2 Influence of Supply Chain Integration on the Management of Road Projects

The respondents reported that through supply chain integration, everyone can access information on tenders concerned with the management of road projects in Kenya. The respondents also indicated that through supply chain integration there is time saved in the management of road projects in Kenya as most of the shareholders can be addressed within a short period of time. The respondents further reported that the usage of the supply chain integration effectively reduces the total costs of construction when there is early involvement of the suppliers and subcontractors in a similar way as the early involvement of contractors in the procurement process. Also, they indicated that supply chain integration facilitates the relationships between firms, attaining benefits that are mutual, and building trust between the main components of supply chain. Lastly, they indicated that supply chain integration is important in sharing of information process because it reinforces coordination, collaboration and connectedness, among the members in a

supply chain and it provided information which is real time to the customers necessary for determination of effectiveness management in management of stock. The senior managers reported that by having the expected qualification on the website supply chain integration helps weed out incompetent suppliers.

4.6.3 Challenges Faced in the Implementation of Supply Chain Integration

The respondents indicated that they were faced with challenges of cost, network coverage, favism among the members in the supply chain integration and inadequate support from information and technology sector in the implementation of supply chain integration. Furthermore, the respondents indicated that the prevalence of lose and win arrangements, any difficulties that are encountered in the construction processes, insufficient exchange of knowledge and information; increase in price were challenges faced in the supply chain integration.

4.6.4 Use of supply chain integration in the management of road projects

The key informants indicated that supply chain integration is used in the management of road projects by allowing sharing of information with several stakeholders since data about several tenders is posted on the website thus creating trust with them. Also, the key informants indicated that through supply chain integration, what is expected and qualification of suppliers is also highlighted in the website.

4.7 Electronic Procurement and Management of Road Projects

The fourth objective of the study was to determine the influence of electronic procurement on the management of road projects in Kenya.

4.7.1 Aspects of Electronic Procurement and Management of Road Projects

The respondents were asked to indicate the extent to which various aspects of electronic procurement influence the management of road projects in Kenya. The results were as shown in table 4.6.

Table 4. 6: Aspects of Electronic Procurement and Management of Road Projects

	Mean	Std. Deviation
E-tendering	3.697	0.461
E-evaluation	3.593	0.494
E-payment	3.697	0.461
E-invoicing	3.697	0.461

From the findings, the respondents indicated that e-tendering, e-invoicing and e-payment influence the management of road projects in Kenya to a great extent as shown by a similar mean of 3.697and a standard deviation of 0.461. The respondents also indicated that that e-evaluation influence the management of road projects in Kenya to a great extent as shown by a mean of 3.593 and a standard deviation of 0.494.

4.7.2 Influence of Electronic Procurement on the Management of Road Projects

The respondents indicated that electronic procurement influences the management of road projects in Kenya by building on trust, easement of procurement process and removal of cartels. Also, the respondents indicated that electronic procurement influenced the management of road projects in Kenya by reducing the level of collusion in the bidding process, corruption and inadequate accessibility to bid information hence increasing the number of bidders through reducing the costs of collecting information concerning a tendering process. In addition, they reported that e-procurement leads to lowering of prices that are paid by the government and also established that e-procurement is concerned with improvements in quality. The senior managers reported that that electronic procurement influences the management of road projects in Kenya through having data stored in SAGE it acts as a reference and also aids in accountability.

4.7.3 Challenges Faced in the Implementation of Electronic Procurement

The respondents reported that they were faced with a challenge of lack of skill and knowledge on electronic procurement in the implementation of electronic procurement. They further indicated that they experienced a challenge of favism among people concerned with electronic procurement in the implementation of electronic procurement**.** In addition, the respondents indicated that inability of the organization to deal with changes in management, inadequate

employee training on the way the system is used and inadequate funding was a challenge faced by organizations in the the implementation of electronic procurement .

4.7.4 Tools adopted in Electronic Records Management

The key informants indicated that they used SAGE and excel to pay for goods procured aids in management and tracking. The key informants also reported that e-quotations, e-sourcing and e-tendering were used as the major e-procurement applications. These tools were adopted as a way of to implementing and extending the strategy in relation to supply base.

4.8 Management of Road Projects

The respondents were asked to rate the various measures of management of Road Projects in Kenya. The results were as shown in table 4.7.

Table 4. 7: Management of Road Projects

	Mean	**Std. Deviation**
Finish in time	2.581	0.659
Finish within budget	2.476	0.663
Finish as per specifications	3.151	0.473
Finish as per the scope	3.139	0.348
Sustainability	3.639	0.572
Intended purpose	3.755	0.432
Achieved Business Objectives	3.848	0.473
Customer satisfaction	3.802	0.504

Acccording to the findings,the respondents rated achieved business objectives **and** customer satisfaction **of management of road projects as good as shown by means of** 3.848 and 3.802 respectively.In adddition,they rated the intended purpose **and** sustainability **of management of road projects as good as indicated by means of** 3.755 and 3.639 respectively. Furthermore,the respondents rated finish as per specifications **of management of Road Projects as being moderate as shown by a mean of** 3.139.In adddition they rated finishing as per the scope **(m=**3.139) and finish in time (m=2.581) of **management of road projects as moderate. Lastly they rated** finish within budget **management of road projects as bad as indicated by amean of** 2.476.

4.8.1 Factors Influencing Management of Road Projects in Kenya

The key informants reported that the key factors influencing management of road projects included the budget that was allocated from the ministry to be used in the construction of new roads and maintenance of other national trunk roads was not enough thus leading to borrowing and receipt of donor funding from IMF and World Bank. Other organizations search as JICA also aid in monetary funding. They also indicated that they employ educated and skilled staff members who aid us in attaining our goals.

4.9 Inferential Statistics

The study used correlation analysis and regression analysis to determine the influence of the independent variables (electronic communication, electronic records management, supply chain integration and electronic procurement) on the dependent variabe (management of road projects in Kenya).

4.9.1 Correlation Analysis

Correlation analysis was used to measure the relationship between customer based brand equity (brand awareness, brand loyalty, perceived quality and brand image) and organizational competitiveness. The study made use of Pearson Product Moment correlation which ranges from +1 to -1, with the positive and negative signs showing the direction of the relationship. A positive sign shows a direct relationship while a negative sign show an inverse relationship between two variables.

Table 4. 8: Correlation Coefficients

		Management of road projects	Electronic communication	Electronic Records management	Supply Chain integration	Electronic Procurement
Management of road projects	Pearson Correlation	1				
	Sig. (2-tailed)					
	N	86				
Electronic communication	Pearson Correlation	.557**	1			
	Sig. (2-tailed)	.000				
	N	86	86			
Electronic Records management	Pearson Correlation	.119	.774**	1		
	Sig. (2-tailed)	.276	.000			
	N	86	86	86		
Supply Chain integration	Pearson Correlation	.361**	-.246*	-.092	1	
	Sig. (2-tailed)	.001	.022	.398		
	N	86	86	86	86	
Electronic Procurement	Pearson Correlation	.446**	.199	-.176	.050	1
	Sig. (2-tailed)	.000	.066	.105	.650	
	N	86	86	86	86	86

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

*. Correlation is significant at the 0.05 level (2-tailed).

From the findings, there is a positive association between electronic communication and management of road projects in Kenya as shown by a correlation coefficient of 0.557. The association was significant because the p-value (0.000) was less than the significance level (0.05). The results also show that there was a negative association between electronic records management and management of road projects in Kenya as shown by a correlation coefficient of

0.119. The association was significant because the p-value (0.276) was more than the significance level (0.05).

The results further show that there was a positive association between supply chain integration and management of road projects in Kenya as shown by a correlation coefficient of 0 .361. Since the p-value (0.001) was less than the significance level, the association was significant. In addition, the results show that there is a positive association between t electronic procurement and management of road projects in Kenya as shown by a correlation coefficient of 0.446. The association was significant as the p-value (0.000) was less than the significance level (0.05).

4.9.2 Regression Analysis

A multivariate regression analysis was also carried out to determine the relationship between dependent variable and the four independent variables. The regression equation was;

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

Whereby; Y = Management; X_1 = Electronic communication, X_2 = Electronic records management, X_3 = Supply chain integration, X_4 = Electronic procurement, ε = Error Term, β_0 = Constant Term and β_1, β_2, β_3, β_4 = Beta Co-efficient

Table 4. 9: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.767	0.588	0.528	0.533

The R-Squared is the proportion of variance in the dependent variable which can be explained by the independent variables. From the findings, the R-squared in this study was 0.588, which shows that the four independent variables (electronic communication, electronic records management, supply chain integration and electronic procurement) can explain 58.8% of the variation in the dependent variable. This clearly shows that other factors not considered in this study explain 41.2% of the variation in the dependent variable, management of road projects in Kenya.

Table 4. 10: Analysis of Variance

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	50.944	4	12.736	44.676	.000[b]
	Residual	23.091	81	0.285		
	Total	74.035	85			

From Table 4.10, the analysis of variance in this study was used to determine whether the model is a good fit for the data. The results indicate that the model was significant since the p-value (0.000) was less than 0.05 thus the model is statistically significant in establishing the influence of electronic communication, electronic records management, supply chain integration and electronic procurement on management of road projects in Kenya. Further, the F-calculated (44.676) was found to be more than the F-critical (2.48) which shows that the models was fit in establishing the influence of the four independent variables on the dependent variable.

Table 4. 11: Regression Coefficients

	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	3.838	1.018		3.770	0.000
Electronic communication	0.676	0.12	0.547	5.633	0.000
Electronic Records management	0.040	0.185	0.032	0.216	0.830
Supply Chain integration	0.212	0.073	0.065	2.904	0.000
Electronic Procurement	0.431	0.119	0.088	3.622	0.000

The regression model was;

$Y = 3.838 + 0.676X_1 + 0.040X_2 + 0.212X_3 + 0.431X_4 + \varepsilon$

From Table 4.11, the findings show that there is a positive significant relationship between electronic communication and management of road projects in Kenya with a regression coefficient of 0.676. This shows that a unit increase in electronic communication would lead to a 0.676 improvement in the management of road projects in Kenya. The p-value (0.000) was less than the significance level (0.05), hence the relationship was significant.

The results also show that there is a negative insignificant relationship between electronic records management and management of road projects in Kenya with a regression coefficient of 0.040. This shows that a unit increase in electronic records management would lead to a 0.040 improvement in the management of road projects in Kenya. The relationship was insignificant as the p-value (0.830) was more than the significance level (0.05).

From the findings, the study found that there is a positive relationship between supply chain integration and the management of road projects in Kenya with a regression coefficient of 0.212. This indicates that a unit increase in supply chain integration would lead to a 0.212 improvement in the management of road projects in Kenya. The relationship was found to be significant as the p-value (0.000) was less than the significance level (0.05).

Lastly, the study results show that there is a positive significant relationship between electronic procurement and management of road projects in Kenya as shown by a regression coefficient of 0.431. This indicates that a unit improvement of electronic procurement would lead to a 0.431 improvement in the management of road projects in Kenya. This relationship was significant as the p-value (0.000) was less that of the significance level (0.05).

4.10 Discussion of the Findings

The findings of the study according to each objective were as discussed below.

4.10.1 Influence of Electronic Communication on the Management of Road Projects

The study found that electronic communication influences the management of road projects in Kenya. Raulea and Raulea (2014) indicate that ineffectiveness in communication is a major contributor to project failures as it contributes to 95% of most project failures. Also, the findings agree with Turkulainen, Aaltonen and Lohikoski (2015), argument that effective communication

is among the major factors which account for the success of a project.

The study found that stakeholders support and frequency of communication influence the management of road projects to a great extent. These findings agree with Jameson (2013) findings that stakeholders support and frequency of communication through emails, professionals can send drawings to their team members on a timely basis and the stakeholders can keep track of the information. In addition, communication coverage and effectiveness of communication influence the management of road project to a great extent.

These findings are similar to Aaltonen and Lohikoski (2015) argument that communication coverage and effectiveness is among the major factors which account for the success of a project. The quality of flows in communication determines the effectiveness that is required in project construction. The study also established that unstable network was a challenge in the process of implementation of electronic communication. These findings agree with Hart, Vroman and Stulz, (2015) argument that good communication in all project lifecycle stages depends on stability of network so as to ensure the success of the project; it is the main factor which brings together all the factors which affect project implementation.

4.10.2 Influence of Electronic Records Management on the Management of Road **Projects**

The study found that electronic records management influences management of road projects in Kenya. The study established that speed of retrieval influence the management of road projects in Kenya to a great extent. These findings agree with Xiangjun and Weimei, (2016) argument that the fast pace and complexity of the contemporary large-scale construction activity affects heavily the process of record management. The records on construction project need to be current and quickly retrievable. Also, these findings agree with Veal (2011) argument that in the recent past, road construction companies have been changing from paper records management system to electronic records management systems (RMS) so as to improve on the speed of record retrieval and also storage of vast quantities with various records formats.

The study revealed that information security influences the management of road projects. These findings agree with Lusuli and Rotich (2014) argument that there was poor public procurement record keeping systems which led to inefficient of accountability and corrupt practices hence

influencing the security of the stored information. Inadequate adoption of the modern technology in records storage has led to records loss whenever they are in demand.

The study also found out that information storage and information dissemination influence the management of road projects in Kenya to a great extent. These findings agree with Mampe and Kalusopa (2012) argument that the practices applied on management of records were not well entrenched hence leading to undermining of service delivery and project performance. This was evidenced by the practices that were applied on information storage and information dissemination which resulted in missing of some electronic records. The study also found out that unstable network was a challenge in the process of implementation of electronic records management in their organizations. These findings agree Duranti, (2011) argument that with despite the benefits of ICT, the road construction industry is still viewed by many as lagging behind in terms of deployment of technology as compared to other industries.

4.10.3 Influence of Supply Chain Integration on the Management of Road Projects

The study found that supply chain integration on the management of road projects in Kenya. The study revealed that building of trust influence the management of road projects in Kenya to a great extent. These findings agree with Ofori (2011) that the ways included ensuring fair payments; trust between parties; educating the construction workforce; early involvement with projects and many others.

Also, the established that information sharing influence the management of road projects in Kenya to agreat extent. These findings agree with Khalfan, Khan and Maqsood, (2015) argument that the problems that are resolved arise mainly as a result of prevalence of lose and win arrangements; any difficulties that are encountered in the construction processes, insufficient exchange of knowledge and information; increase in price as a result of competition that result from purchases from many suppliers; presence of an environment that is full of dishonest, frustration and fear. Further, the study established that buyer-seller relationship influence the management of road projects in Kenya to a great extent. The study found out that the implementation of supply chain integration in the organization was faced by challenges of cost, network coverage, and inadequate support from information and technology. These findings

agree with Proverbs and Holt (2010) argument that the usage of the philosophy of supply chain integration as way of effectively reducing the total costs of construction.

4.10.4 Influence of Electronic Procurement on the Management of Road Projects

The study found out that electronic procurement influence the management of road projects in Kenya. The study found out that e-tendering, e-invoicing and e-payment influence the management of road projects in Kenya to a great extent. These findings agree with Matunga and Okibo (2013) argument that e-quotations, e-sourcing and e-tendering as the major e-procurement applications and also that the major challenges faced when e-market provider is used is the problem of inability of the organization to deal with changes in management, inadequate employee training on the way the system is used and inadequate funding.

In addition, the study found that e-evaluation influence the management of road projects in Kenya to a great extent. These findings agree with Lewis-Faupel *et al*. (2014) argument that e-valuation leads to lowering of prices that are paid by the government and also leads to improvements in quality. The study found out that organizations were faced with a challenge of lack of skill and knowledge on electronic procurement in the implementation of electronic procurement. These findings agree with Caniato, Longoni and Moretto, (2012) argument that skill and knowledge on electronic procurement were necessary so as to reduce the collusions among the bidders through provision of information on tenders to various firms that are outside a local cartel, hence allowing the non-cartel firms to take part and dissolving the local bidding cartels

CHAPTER FIVE: SUMMARY OF THE FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This chapter presents the summary of the research findings; it indicates the conclusions drawn from these findings, offers recommendations, and suggestions for further studies.

5.2 Summary of the Findings

The section comprises of the summary of the findings as per the objectives of the study. Specifically, it comprises of the study of the effect of electronic communication on the management of road projects; effect of electronic records management on the management of road projects; effect of supply chain integration on management of road projects; and effect of electronic procurement and management of road projects.

5.2.1 Electronic Communication and Management of Road Projects

The study established that electronic communication influences the management of road projects in Kenya. The study found out that collaboration influences the management of road projects in Kenya to a great extent (M=3.755). In addition, communication coverage (M=3.604), effectiveness of communication (M=3.546), frequency of communication (M=3.651) and stakeholders support (M=3.651). Electronic communication influences the management of road projects in Kenya through liaising with other departments making work easier and effective in road projects in Kenya. The study also established that unstable network was a challenge in the process of implementation of electronic communication. In addition, the study found out that electronic communication assists in sharing of information in the management of road project. Furthermore, the study established that good communication that is provided through electronic communication throughout the phases of the lifecycle of the project is a vital factor in the success of the project as it is the prime factor which connects all of the project success factors together.

5.2.2 Electronic Records Management and Management of Road **Projects**

The study found that electronic records management influences the management of road projects in Kenya. The study found out that the speed of retrieval of electronic influence the management of road projects in Kenya to a great extent (M=3.860). Also, the study found that information storage (M=3.697), information security (M=3.755) and information dissemination (M=3.593) had an influence on management of road projects in Kenya to a great extent. Electronic records influence the management of road projects through allowing easy accessibility to the records concerning management of road projects. The study also found out that electronic records improved on safety of information on management of road projects and also allow easier retrieval of information on the projectS**.** Moreover, the study revealed that the management process of IT records in the construction industry depends on the broad information that is provided, information that is provided in a good environment where there are adequate management practices of records should be appropriate, accurate and clear as decisions made on a daily basis are based on accurate information recorded. The study found out that unstable network was a challenge in the process of implementation of electronic records management in their organizations.

5.2.3 Supply Chain Integration and Management of Road Projects

The study revealed that supply chain integration influences the management of road projects in Kenya. The study found out that building of trust influence the management of road projects in Kenya to a great extent (M=3.802). In addition, information sharing (M=3.697), buyer-seller relationship (M=3.651) and just in time supply (M=3.593) influence management of road projects in Kenya to a great extent. Through supply chain integration, everyone can access information on tenders concerned with the management of road projects in Kenya. The study found out that the implementation of supply chain integration in the organization was faced by challenges of cost, network coverage, and inadequate support from information and technology. The study also revealed that by having the expected qualification on the website supply chain integration helps weed out incompetent suppliers.

5.2.4 Electronic Procurement and Management of Road Projects

In addition, the study found that electronic procurement influences the management of road projects in Kenya. The study found out that that e-tendering (M=3.697), e-invoicing (M=3.697), e-valuation (M=3.593) and e-payment (M=3.697) influence the management of road projects in Kenya to a great extent. Electronic procurement influences the management of road projects in Kenya by building on trust, easement of procurement process and removal of cartels. The study found out that organizations were faced with a challenge of lack of skill and knowledge on electronic procurement in the implementation of electronic procurement. The study revealed that SAGE and excel tools were being used to pay for goods procured aids in management and tracking. The key informants also reported that e-quotations, e-sourcing and e-tendering were used as the major e-procurement applications.

5.3 Conclusions of the Study

The study concludes that there is a positive association between electronic communication and management of road projects in Kenya. The study found out that collaboration influence the management of road projects in Kenya to a great extent. Electronic communication influences the management of road projects in Kenya through liaising with other departments making work easier and effective in road projects in Kenya.

The study also concludes that there was a negative association between electronic records management and management of road projects in Kenya. Electronic records management influences the management of road projects through allowing easy accessibility to the records concerning management of road projects. The study found out that unstable network was a challenge in the process of implementation of electronic records management in their organizations.

The study further concludes that there was a positive association between supply chain integration influences the management of road projects in Kenya. The study found out that building of trust influence the management of road projects in Kenya to a great extent. Through supply chain integration, everyone can access information on tenders concerned with the management of road projects in Kenya. The study found out that the implementation of supply chain integration in the organization was faced by challenges of cost, network coverage, and

inadequate support from information and technology.

In addition, the study concludes that there is a positive association between electronic procurement and the management of road projects in Kenya. The study found out that that e-tendering, e-invoicing and e-payment influence the management of road projects in Kenya to a great extent. Electronic procurement influences the management of road projects in Kenya by building on trust, easement of procurement process and removal of cartels. The study found out that organizations were faced with a challenge of lack of skill and knowledge on electronic procurement in the implementation of electronic procurement.

5.4 Recommendations

Based on the findings of the study and the conclusion made, the study offers the following recommendations:

1. The study found out that KeNHA experienced a challenge of unstable network in the process of implementation of electronic communication. Therefore this study recommends that KeNHA should develop strategies to improve on stability of network which can be done by establishment of other communication tools such as the adoption of video conferencing, use of mobile phones to communicate and emails.

2. The study found out that poor public procurement record keeping systems was a challenge to KeNHA which led to inefficient of accountability and corrupt practices. Therefore, this study recommends that KeNHA should develop strategies on public procurement record keeping so as improve on electronic records management.

3. The study established that KeNHA was faced by a challenge of cost, network coverage, favism among the members in the supply chain integration and inadequate support from information and technology sector in the implementation of supply chain integration. Therefore, this study recommends that KeNHA should establish new policies on adoption of adoption of supply chain integration so as to reduce on cost, network coverage, favism among the members in the supply chain integration.

4. The study found out that KeNHA was faced by a challenge of lack of skill and knowledge on electronic procurement in the implementation of electronic procurement.

This study, therefore recommends that should improve on skill and knowledge on electronic procurement. This is done as a way of building on trust, easement of procurement process and removal of cartels.

5.5 Suggestions for Further Research

1. This research only focused on Kenya National Highways Authority. Therefore, further studies should be conducted on the influence of information and communication technology application on management of road projects in Kenya in other road projects in Kenya.
2. A comparative study of the challenges influencing the adoption of information and communication technology in the management of road projects in Kenya should be conducted.
3. A research should be carried out to establish the influence on information and communication technology application in the Kenyan economy.

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APPENDICES

Appendix I: Introduction Letter

TO WHOM IT MAY CONCERN

Dear Sir/Madam,

REF: Request for participation in a research study on 'the influence of information and communication technology on the performance of road projects in Kenya'

I am a student at the University of Nairobi conducting a research project which is part of course fulfillment for Master of Arts in Project Planning and Management. This study seeks to evaluate the influence of information and communication technology on the management of road projects in Kenya National Highway Authority

The findings of the study will be treated with high confidentiality and will be used in academia only and there will be no mentioning of your name anywhere in this report. Honest participation in the study will be appreciated highly.

Yours faithfully

RAHAB WAMBUI GACHUNGI

Appendix II: Questionnaire

This is an academic study assessing the influence of information and communication technology on the management of road projects in Kenya. The information herein requested is for use to meet academic requirements and as such shall be treated with maximum confidentiality.

SECTION A: General Information

1. Gender
   Male [ ]
   Female [ ]

2. Kindly indicate the age bracket you belong
   Below 25 years [ ]
   Between 25 and 35 years [ ]
   Between 35 and 45 years [ ]
   Above 45 years [ ]

3. For how long have you been working in your organization?
   Below 1 year [ ]
   Between 1 and 5 years [ ]
   Between 5 and 10 years [ ]
   Above 10 years [ ]

4. Indicate your department

Design & Construction	[ ]	Planning & Environment	[ ]
Finance	[ ]	Maintenance	[ ]
Quality Assuarance	[ ]	Procurement	[ ]
Internal Audit	[ ]	ICT	[ ]
Legal and Regulatory Affairs	[ ]	Enterprise & Risk Management	[ ]
Human Resource Management & Development	[ ]		

5. Which is your highest level of education?

Secondary Certificate [ ]

Diploma [ ]

Undergraduate Degree [ ]

Postgraduate Degree [ ]

Any other (specify) …….

SECTION B: Electronic Communication and Management of Road Projects in Kenya

6. Using the below Likert scale, state the extent to which the following dimensions of electronic communication influence the management of road projects in Kenya. (5=very great extent, 4=great extent, 3=moderate extent, 2=low extent, 1=No extent at all) Please tick in the applicable box .

Aspects of electronic communication	**No extent at all**	**Low extent**	**Moderate**	**Great extent**	**Very great extent**
Communication coverage					
Effectiveness of communication					
Frequency of communication					
Stakeholders support					
Collaboration					

7. How else does electronic communication influence the management of road projects in Kenya?

   …….

   …….

   …….

8. Which challenges do you face in the implementation of electronic communication in your organization?

   …….

   …….

……

SECTION C: Electronics Records Management and Management of Road Projects

9. Using the below Likert scale, state the extent to which the following aspects of electronic records management influence the management of road projects in Kenya. (5=very great extent, 4=great extent, 3=moderate extent, 2=low extent, 1=No extent at all) Please tick in the applicable box .

Aspects of electronic records management	**No extent at all**	**Low extent**	**Moderate**	**Great extent**	**Very great extent**
Information storage					
Speed of retrieval					
Information security					
Information dissemination					

10. How else does electronic records management influence the management of road projects in Kenya?

……

……

……

11. Which challenges do you face when implementing electronic records management in your organization?

……

……

……

SECTION D: Supply Chain Integration and Management of Road Projects

12. Using the below Likert scale, state the extent to which the following aspects of supply chain integration influence the management of road projects in Kenya. (5=very great

extent, 4=great extent, 3=moderate extent, 2=low extent, 1=No extent at all) Please tick in the applicable box.

Aspects of supply chain integration	No extent at all	Low extent	Moderate extent	Great extent	Very great extent
Information Sharing					
Buyer-seller relationship					
Building of trust					
Raw materials lead time					
Just in time supply					

13. How else does supply chain integration influence the management of road projects in Kenya

    …….

    …….

    …….

14. Which challenges do you face when implementing the supply chain integration in your organization?

    …….

    …….

    …….

SECTION E: Electronic procurement and Management of Road Projects

15. Using the Likert scale, state the extent to which the following dimensions of electronic communication influence the management of road projects in Kenya. (5=very great extent, 4=great extent, 3=moderate extent, 2=low extent, 1=No extent at all) Please tick in the applicable box.

Aspects of electronic communication	No extent at all	Low extent	Moderate	Great extent	Very great extent
E-tendering					
E-evaluation					
E-payment					
E-invoicing					

16. How else does electronic procurement influence the the management of road projects in Kenya?

    …….

    …….

    …….

17. Which challenges do you face in the implementation of electronic procurement in your organization?

    …….

    …….

SECTION F: **Management of Road Projects in Kenya**

18. How do you rate the following measures of the management of road projects in Kenya?

    (5=Excellent, 4=Good, 3=Moderate, 2=Bad, 1=Poor)

Measures of management of road projects	Excellent	Good	Moderate	Bad	Poor
Finish in time					
Finish within budget					
Finish as per specifications					
Finish as per the scope					
Sustainability					
Intended purpose					
Achieved Business Objectives					
Customer satisfaction					

Appendix III: Senior Managers Interview Guide

1. What is your job title?
2. What is your area of specialization in the organization?
3. What role do you play in your department?
4. For how many years have you been working in Kenya National Highways Authority?
5. Which are the key factors influencing management of road projects in Kenya?
6. Which electronic communication tools have been adopted in the management of road projects in Kenya?
7. How does electronic communication influence the management of road projects in Kenya?
8. Which electronic record tools have been adopted in the management of road projects in Kenya?
9. How do electronic records influence the management of road projects in Kenya?
10. In which ways has supply chain integration been used in the management of road projects in Kenya?
11. How does supply chain integration influence the management of road projects in Kenya?
12. Which electronic procurement tools have been adopted in the management of road projects in Kenya?
13. How does electronic procurement influence the management of road projects in Kenya?

Appendix IV: NACOSTI Research Authorization Letter

NATIONAL COMMISSION FORSCIENCE,
TECHNOLOGY ANDINNOVATION

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When replying please quote

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NAIROBI-KENYA

Ref: No. **NACOSTI/P/17/39100/17193** Date: **24th May, 2017**

Rahab Wambui Gachungi
University of Nairobi
P.O. Box 30197-00100
NAIROBI.

RE: RESEARCH AUTHORIZATION

Following your application for authority to carry out research on ***"Influence of Information and Communication Technology application on management of road projects in Kenya: A case of National Highway Authority,"*** I am pleased to inform you that you have been authorized to undertake research in **Nairobi County** for the period ending 23rd **May, 2018.**

You are advised to report to **the Director General, Kenya National Highway Authority, the County Commissioner and the County Director of Education, Nairobi County** before embarking on the research project.

On completion of the research, you are expected to submit **two hard copies and one soft copy in pdf** of the research report/thesis to our office.

GODFREY P. KALERWA MSc., MBA, MKIM
FOR: DIRECTOR-GENERAL/CEO

Copy to:

The Director General
Kenya National Highway Authority.

The County Commissioner
Nairobi County.

Appendix V: NACOSTI Research Permit