

# **INFORMATION TECHNOLOGY AND PERFORMANCE OF COUNTY WATER PROJECTS: A CASE OF MAKUENI COUNTY**

**Esther Mutave Ivongo**

Master of Business Administration (Project Management), Kenyatta University, Kenya

**Dr. Peris Chege**

Kenyatta University, Kenya

©2019

**International Academic Journal of Information Sciences and Project Management  
(IAJISPM) | ISSN 2519-7711**

**Received:** 4<sup>th</sup> July 2019

**Accepted:** 10<sup>th</sup> July 2019

Full Length Research

**Available Online at:**

[http://www.iajournals.org/articles/iajispm\\_v3\\_i3\\_259\\_288.pdf](http://www.iajournals.org/articles/iajispm_v3_i3_259_288.pdf)

**Citation:** Ivongo, E. M. & Chege, P. (2019). Information technology and performance of county water projects: A case of Makueni County. *International Academic Journal of Information Sciences and Project Management*, 3(3), 259-288

## **ABSTRACT**

Clean, safe and accessible water is an essential component of life in the world and even though there is sufficient fresh water in the planet for use by every person in the world today, due to poor infrastructure, millions of people every year suffer from poor water quality and inadequate water supply. In the last one decade numerous water projects have been launched in Kenya by the national government, County governments as well as local and international NGOs in an effort to improve accessibility to clean and safe water. Although these institutions are actively involved in the improvement of accessibility to clean and safe water, the water projects are still not able to meet the daily demand of water consumption from the growing population. The general objective of the study was to investigate the effect of information technology on performance of water projects in Makueni County. The specific objective of this study were to determine the effect of electronic procurement, supply chain integration, electronic records management and electronic communication on performance of water projects in Makueni County. The target population of this study was 43 water projects in Makueni County (Appendix III) and its stakeholders. Descriptive research design was selected in this study as it allows the incorporation of both quantitative and qualitative approaches in a study. Primary data was collected by use of semi-structured questionnaires. Quantitative data from the closed ended questions was analyzed using both descriptive and inferential statistics with the help of statistical package for social

sciences (SPSS version 22) which is a statistical software. The data was then presented in tables and graphs. Multiple regression analysis and correlation analysis were used to determine the relationship between the dependent and the independent variables. The results indicated that electronic procurement had a positive and significant effect on the performance of water projects in Makueni County. The study also found that electronic record management had a positive and significant effect on the performance of water projects in Makueni County. In addition, the study established that electronic communication had a positive and significant effect on the performance of water projects in Makueni County. Further, the study revealed that supply chain integration had a positive and significant effect on the performance of water projects in Makueni County. The study concludes that electronic record management was the most significant factor affecting the performance of water projects in Makueni County, followed by electronic communication, electronic procurement and supply chain integration. Therefore, the study recommends that Makueni County should fully adopt electronic procurement to allow online advertisement, online submission of tender information and electronic tender evaluation. In addition, the County government of Makueni should fully adopt electronic payments so as to reduce fraud and complaints and improve accuracy in payments. Further, the study recommends full adoption of supply chain integration among all stakeholders involved in water projects in the County. The County government of Makueni should adopt

electronic records management to automate the records system in all type of projects. Also, the management and administration of County government of Makueni should adopt increase the use of emails and local area network to improve communication.

**Key Words:** *information technology, performance, county water projects, Makueni County*

## **INTRODUCTION**

Clean, safe and accessible water is an essential component of life in the world and even though there is sufficient fresh water in the planet for use by every person in the world today, due to poor infrastructure, millions of people every year suffer from poor water quality and inadequate water supply (Abdikarim, 2013). However, over the past three decades, there has been a concerted international effort in developing countries to increase access to clean and safe drinking water. These efforts are clearly outlined in United Nations Sustainable Development goals and the vision 2030, which is a national long-term development blue-print (United Nations, 2016; Vision 2030, 2007).

In an effort to improve access to clean and safe water, various water projects have been launched all over the world by international organizations, non-governmental organizations, national governments and County governments (IFAD, 2014). However, water projects all over the world, especially in African countries, are characterized by poor performance in terms of achieving the set objectives, completion within budget, completion within schedule and sustainability. In addition, some water projects run for one or two years after completion and then collapse; therefore, they fail to meet the intended objectives. A project is said to be implemented successfully if it is completed with the scheduled time, within the budget, achieves its objectives, it is accepted by the users and it meets the purpose for which it was intended.

The significance of information technology in project management cannot be overstated. Information technology usage has become an important component in water projects and in different countries it has been found to improve project performance (Adzroe & Ingirige, 2014). Studies conducted on information technology and performance of projects show that information technology plays a major role in project communication, which in turn reduces delivery time (Anantatmula, 2008; Bardhan, Krishnan & Lin, 2013). In addition, Gachungi, and Mugambi (2017) indicate that information technology enhances the procurement process, communication between project manager and suppliers, and records management in terms of information storage, security and retrieval.

Leung (2007) also indicted that various organizations have integrated electronic procurement system so as to cope up with the dynamic change in business environment. Erridge (2011) asserts

that it constitutes the use of reverse auctions, purchase of cards, or integrated automatic procurement systems in order to expedite processing of buying in corporations. Critics argue that electronic procurement provides is advantageous, however, the extent of its implementation is less. Daniel and Jan (2012) found that integration of logistics has a positive and significant influence on performance of operations. The research conducted by Hamdan, Maryam and Abu (2011) revealed that that supply chain integration has a significant and a positive effect on business performance. In Kenya, Ogot, Nyandemo, Kenduiwo, Mokaya and Iraki (2009) assert that electronic procurement enhance customer service as well as their satisfaction, offering quality products, increase performance of product and quality, timely delivery and enhance transparency among shareholders.

## **STATEMENT OF THE PROBLEM**

In the last one decade numerous water projects have been launched in Kenya by the national government, County governments as well as local and international NGOs in an effort to improve accessibility to clean and safe water (Shayo, 2013). Although these institutions are actively involved in the improvement of accessibility to clean and safe water, It is estimated that more than 60% of the Kenyan population do not have access to clean water despite the fact that much of the country have reliable water sources and adequate rainfall (Kariuki, 2015). Water projects in Kenya have been experiencing various challenges related to project performance and sustainability (Maimuna & Kidombo, 2017). For instance, most water projects in Kenya experience cost and time overrun, stagnation and when they are completed, their operations stop shortly after the exit of the financiers. Other water projects run for one or two years after completion and then collapse; therefore, they fail to meet the intended objectives (Kariuki, 2015). It is quite a common phenomenon to observe non-functional water projects that are not operational in most parts of the country. In the last five years, the national government and the County government of Makeni have invested heavily on water projects. However, most of these projects have experienced challenges related to time and cost overrun. For instance, Ngangani Shallow Pond Scooping, which was started in 2014 and was to be completed by 2015 is still pending. In addition, Kikuu Irrigation Project which was started in 2014 is still incomplete. Further, six water project are stuck in the procurement cycle since 2016. Some of the incomplete projects got stagnant as the cost of implementation was higher than in the intended cost. In order to make water projects efficient and effective, failure rates must be addressed and reduced. According to Kariuki (2015), information technology plays a major role in project management by improving communication, reducing errors, ensuring stakeholder involvement, reducing cost and reducing delivery time. In addition, Gachungi and Mugambi (2017) argue that information technology, by improving communication, records management and procurement process, positively influences project performance. Studies conducted in Kenya on water based projects have been limited to factors affecting the performance of water projects. For instance, Maimuna and Kidombo (2017) conducted a study on the factors influencing performance of water projects in arid and semi-arid areas, with a special focus on Ewaso Ng'iro North borehole projects in

Isiolo County. In addition, Gachungi and Mugambi (2017) examined the influence of information and communication technology application on management of road projects in Kenya. Therefore, this study sought to investigate the effect of information technology on performance of water projects in Makueni County.

## **GENERAL OBJECTIVE**

The general objective of the study was to investigate the effect of information technology on performance of water projects in Makueni County.

## **SPECIFIC OBJECTIVES**

1. To determine the effect of electronic procurement on the performance of water projects in Makueni County
2. To assess the effect of supply chain integration on the performance of water projects in Makueni County
3. To examine the effect of electronic records management on the performance of water projects in Makueni County
4. To establish the effect of electronic communication on the performance of water projects in Makueni County

## **THEORETICAL REVIEW**

### **Rogers' Diffusion of Innovation Theory**

The theory of Diffusion of Innovation was developed by Everett Rogers in the year 1962. The theory states that innovation is communicated often among the participants in social system through the process of diffusion (Akbari, Sohrabi & Zanjani, 2012). The theory also tends to explain how developments of new ideologies or innovations are adopted by various organizations to ensure they achieve anticipated outcomes. Rogers Diffusion Theory proposes that there are five attributes of technological innovation and they include: compatibility, complexity, relative advantages, trialability as well as observability. He defined relative advantage as the extent in which technological innovation is perceived to be better than the ideology it supersedes.

The theory also suggests those technological innovations which have clarified, unambiguous advantages over the previous approaches, may be easily adopted and implemented. If potential shareholders do not see the advantages of technological innovation they may not adopt it. Compatibility is defined as the extent in which innovations fit with the existing values, adopters' needs as well as past experiences. Complexity refers to the extent in which technological innovations are perceived to be very difficult to comprehend and use. Lysons and Farrington

(2006) indicated that the theory is applicable to a wide spectrum such as technological innovation in health, geospatial engineering, hydrology among others.

Moreover, Rogers suggested that categorization of innovations are based on their simplicity and complexity continuum with qualification that the meaning of the innovation may not be clearly understood by potential adopters. Therefore, when the staff in the ministry of water in Makueni County as well as the beneficiary of water projects in the County innovations as being simple to use the innovations will be more easily adopted.

Trialability is defined as the extent to which innovation may be experimented with on a limited basis. For new technological innovations (electronic procurement) to be effectively implemented, the Ministry of water in Makueni County ought to invest in electronic tendering, electronic payment as well as electronic evaluation so as to ensure effective adoption of the technology (Mohammadi, Poursaberi & Salahshoor, 2018). Observability is defined as the extent to which innovation results are readily available to the adopters. Technological innovation is more adoptable in case there is observable outcome which is of substantial importance to the adopter. Hence, the ministry of water in Makueni County should use advanced electronic procurement technology so as to ensure that the electronic tendering, payment as well as evaluation are of substantial importance to the beneficiaries of water projects in Makueni County.

In relation to compatibility, there is need for mutual interaction of all stakeholders (water resource management authority, suppliers of water as well as consumers) in supply chain integration so as to enhance effective and efficient utilization of water resources (Jamshidi & Hussin, 2016). With regard to relative advantages, integration of information technology such as electronic record management tends to enhance performance of water projects by improving on security of data as well as accessibility of records. The concept of trialability and observability relate to the competency skills of the electronic procurement system developers who are supposed to effectively and efficiently utilize the available resources by coming up with a very sophisticated electronic procurement systems which are cost effective and efficient thus enable the ministry of water in Makueni County to deliver satisfactory services to all the beneficiaries of water projects within the County.

## **System Theory**

System theory was propounded by in 1950s by Ludwig von Bertalanffy. The theory is an interdisciplinary study of systems. The theory is established on the basis of two laws: The First Law states that every system such as a project is designed in a manner which ensures achievement of anticipated outcomes as the project designer unknowingly or knowingly designs the process so as to facilitate the achievement of those outcomes. The Second Law states that if competent individuals are engaged in a bad system then the system will yield desired outcomes. System theory perfectly explains why project managers need to check and evaluate their systems so as to achieve desired outcomes (Rummler, 2009). According to Alter (2018), Jessica,



Ednilson and Scott (2014) the concept of system theory is applicable in all intentional as well as unintentional interactions between work systems that may be sociotechnical or totally automated.

Literally, the system theory tend to emphasize there is interlinkage in the process of project development and management with regard to feedbacks loops and information sharing among the project team members during its development stages. The theory also empathizes on effective coordination among stakeholders by establishing good relationship in that it indicates that any given project manager, unit or activity plays an integral part of a holistic entity in the process of management of projects and are justified by the outcomes they produce (Booth et al., 2017).

Electronic communication media such as e mail, telephone as well as local area network plays a key role in enhancing effective communication among the beneficiaries of water projects in a particular social construct. Electronic communication channel is an integrated system of interdependent structures and functions consisting of various components which enable the beneficiaries of water projects to effective communicate. For instance, there is need for effective communication between the ministry of water in Makueni County and the beneficiaries of water project in the county so as to enhance delivery of water services within the stipulated timeframe as some part of the County experience water shortages due to persist drought in the region. For the process to be effective, the relationship between the buyer and the seller should be good, the ministry of water in Makueni County should also ensure that there is trust between them and the beneficiaries of water projects. Moreover, there should be effective information sharing process between the ministry of water in Makueni County and the beneficiaries of water projects in the county so as to enhance timely delivery of water services. Hence, for the ministry of water in Makueni County to ensure efficient delivery of services, there is need for all beneficiaries within the county to work in harmony for them to achieve anticipated outcome (Valentinov, 2013).

Furthermore, for the ministry of water in Makueni county to ensure that all the resident benefit from the water projects there must be effective communication between various departments in the county government (finance, procurement and water) and between stakeholders. Electronic communication enhances communication and coordination or various project activities. Supply chain integration reduces waiting time and improves coordination among stakeholders. Electronic records management enhances storage of project information, retrieval and dissemination among different stakeholders. . Therefore, the theory in related to this study since it emphasizes on teamwork and coordination of all stakeholders in the process of project management cycle thus ensure effective management of water project in Makueni County.

### **Records Life Cycle Theory**

The theory of life cycle theory was developed in United State of America by the NRAA after the Second World War in the late 1940s, so as to develop a conceptual framework to enhance record management strategies within the organization. The theory provides a framework which enhances operationalization of record management systems. According to Yu-Fan (2009) the

concept of record life cycle is categories in four main phases which include: creation, dissemination, maintenance and use, appraisal as well as disposition. Since the year 1950, several variants of the concept of life cycle have been model to indicate the progression actions which are taken into consideration at different times of record management life cycle such as record creation, capture, storage as well as their disposal (Buckland, 2011).

Various academicians as well as scholars have shown this as a linear progression while other tends to describe it as a cycle. According to the observation made by Buckland (1990) record management cycle undergo through three fundamental stages which include: record creation, semi-active and dormant stages. Meenaghan and Turnbull (2010) stated that the theory of record life cycle tend to create a distinction between the archivists and the record mangers during the process of record management lifecycle. However, Nengomasha and Nyanga (2012) pointed out the limitation of record life cycle theory especially in electronic record management. They emphasized on development of new model which reflects on the special attributes of electronic record management system since the concept was only applicable to manual record management. The authors also emphasized that the record was subject to conversion as well as technological transformation. The concept of record life cycle theory is widely applicable in record management systems as it tend to address the management of electronic records as well as hardcopy records.

In the first stage of record management life cycle, the record is created, presumably for legal reasons as well as according to predefined standards. In the second phase, the records undergoes through active periods when it has maximum primary values as is often used by the creating office as well as other individuals involve in the process of decision making (Buckland, 2011). During this stage, the records are stored on site in the current files of the creating offices. At the end of the second phase, the record may be subjected to review so as to determine that they do not have values, and they are destroyed or enter the third phase. In the third phase, the records are relegated to semi-active status, which indicate that they do not have value and they are not needed for daily decision making process. Since the records are not referred most of the time, they are normally stored in offsite warehouses. At the end of the third phase, another review process is conducted and at this point the record may also be strayed or send to the next stage (four). In the fourth stage, the records are reserved for long term values. The main activities which are carried out within archive involve description as well as preservation of the records (Yu-Fan, 2009). Finally, in the inactive stage, the archivist takes the lead in preserving, describing, and providing access to the archival record.

The theory is relevant to this study as it enable the management in the ministry of water to determine what will happen to records and who will be mandated to manage the records during each record management stage. This will also facilitate the development of flowchart which will be used in development of electronic management systems (Nengomasha & Nyanga, 2012). During the creation as well as active stages, the records creators have the responsibility of



ensuring effective record management so as to enhance sustainability of information which may be used for decision making on how to improve the performance of water projects in Makueni County.

## **EMPIRICAL REVIEW**

### **Electronic Procurement**

Rai, Brown and Tang (2009) investigated the assimilation of electronic procurement (electronic catalog management, online reverse auctions, digital order fulfillment as well as electronic payments) on technological innovations and its effect on procurement productivity in buyers organizations within the United State of America. The study used survey data from the EPIS from one hundred and sixty six buyers' organizations. The study found that electronic procurement innovations had a significant effect on the performance of organizations. The finding also revealed that assimilation of electronic procurement innovations had a substantial impact of organizational productivity.

Nanjundeswaraswamy and Swamy (2014) researched on the effect of electronic procurement on performance of industrial organizations in India. The study focused on six dimensions to measure the performance of electronic procurement, they include: effectiveness, efficiency, transparency, green supply chain as well as competitive advantages. The study adopted descriptive survey research design. The results revealed that electronic procurement had a positive influence on performance of industrial organizations in India.

In the state of Uganda, Sharifai, Mbaraka and Agaba (2013) conducted a research to determine the influence of electronic procurement on performance of selected service organizations in Uganda. Descriptive survey which involved qualitative and quantitative approaches was employed during the study. The study found that there was a positive and a significant association between electronic procurement and the performance of the service organizations. It also established that integration of information technology among various organizations in Uganda resulted to effective implementation of electronic procurement systems.

Muthoka (2016) conducted a study to establish the influence of implementation of electronic procurement on organizational performance, a case study of Government ministries within Kenya. The components of electronic procurement which were measured include: electronic ordering, electronic sourcing, electronic reverse auction as well as electronic tendering. Survey design was used during the study. The study found that electronic procurement had a significant impact on performance of government ministries.

In addition, Shale (2014) conducted a research to establish the influence of e-procurement strategy on the performance of state corporations in Kenya. A cross sectional survey research

design was used during the study. The study found out that there was a positive and significant association between e-procurement and performance of state corporations. Ngunyi (2014) based his study on the influence electronic procurement practices (customer orientation, document management, information sharing) on performance of parastatals. Cross sectional research design was used during the study. The finding revealed that electronic procurement practices that were employed by various parastatals were not much conclusive as the parastatals selectively employed a few techniques.

Rotich (2015) conducted a study to determine the relationship between electronic procurement and performance of county governments in Kenya. Descriptive research methodology was used during the study. The study found that Enterprise Resource Planning was a key determinant of procurement performance among the county governments in Kenya. The finding also revealed that county governments need to adopt electronic procurement at each stage of the cycle so as to enhance their performance. However, the study limited itself to the county governments in Kenya.

Simiyu and Simba (2016) investigated on the effect of electronic procurement (document management and project management) on performance of organizations in Kenya, a case study of Kenya Revenue Authority. Descriptive research design was used during the study. The study found that Kenya Revenue Authority has integrated electronic procurement systems with the aim of enhancing its performance. The result also revealed that information technology plays a key role in enhancing success of electronic procurement.

Avedi (2016) researched on the effect of electronic procurement on performance of organizations in Kenya, a case study on Nairobi County. The measurements of performance were: method of data transmission, system management and suppliers' collaboration. The study adopted descriptive research design to select 102 respondents in selected manufacturing companies in Kenya. The results revealed that there was a positive and significant association between the components of electronic procurement and performance of organizations.

### **Supply Chain Integration**

In United State of America, Jessica, Ednilson and Scott (2014) researched on the relationship between strategic SCI and performance. Meta analytic evaluation was adopted during the study. The study found out that there was a significant relationship between strategic supply chain integration and performance. Daniel and Jan (2012) conducted a research to investigate the effect of integrations of information and material flows between supply chain partners on operational performance in Australian firms. The study found that integration of logistics has a positive and significant influence on performance of operations. It also revealed that integration of information technology and dissemination of information has a positive and significant impact

on logistic integration. Moreover, long term suppliers' relationship has direct and indirect influence on performance.

In China, Barbara, Flynn, Baofeng and Xiande (2008) conducted a study to determine the impact of the impact of supply chain integration on performance with regard to contingency as well as configuration perspectives. Hierarchical regression was used to the impact of individual supply chain integration dimensions (supplier, customer as well as internal integration) and their association with performance. In relation to configuration perspective, cluster analysis technique was used in development of patterns of supply chain integration, which were effectively analyzed in term of the balance and strength of SCI. The study found out that supply chain integration was positively and significantly related to operational and business performance. In addition, the findings indicated that customer and internal integration were strongly related to improvement of organizational performance.

In Japan, Ram and Soo (2002) conducted a research to examine the effect of supply chain integration on the relationship between diversification and competitive performance of organization. The finding indicated that supply chain integration modified the association between diversification and competitive performance of the organization. Moreover, it found out that effective coordination of supply chain integration and diversification strategies have a positive and a positive effect on organizational performance.

Hamdan, Maryam and Abu (2011) conducted a research to analyze the effect of supply chain integration on performance of business in United Arab Emirates. The study used secondary data from various publications related to its discipline. The study found that supply chain integration has a significant and a positive effect on business performance. Alexis (2018) conducted a research to determine the effect of supply chain integration on performance manufacturing firms in Rwanda. Cross sectional approach was used during the study. The study found out that supply chain integration is significantly and positively related to the performance of manufacturing firms. The finding also revealed that internal as well as customer integration was strongly and significantly related to the improvement of performance.

In Kenya, Ijomba (2010) conducted a study to determine the effect of supply chain integration on performance of Nairobi bottlers. A case study research methodology was used during the study. The finding indicated that Nairobi bottlers benefitted from the adoption of supply chain integration in its business operations thus resulting to the organization performance in terms of increase profitability and customer satisfaction. Kibera (2016) conducted a research to determine the effect of implementing supply chain integration in Bidco oil refineries limited. The study adopted descriptive survey design. The finding revealed that integrated supply chain enhanced the performance of the organization by providing a systematic approach to keep up with organizational processes thus leading to minimization of cost as well as enhanced efficiency. Moreover, the finding also revealed that supply chain integration enhanced flexibility, increase in

profitability as well as inventory management thus leading to improvement of the overall performance of the organization.

### **Electronic Record Management**

In USA, Buell (2009) researched on importance of electronic record management systems on performance health organizations. The components of electronic management which considered during the study include: security, information accessibility as well as information storage. Descriptive research design was adopted during the research. The finding revealed that electronic record management positively influenced the performance of health organizations by enhancing accessibility of patient records as well as long term storage of records.

In Spain, Anahí and Agustí (2017) conducted a study effect of digital record management performance of public organizations in Spain. The components of electronic record management which were considered in this study include: security and accessibility of information. The study found that electronic record management had a significant and positive influence of performance of public administration in Spain since the system enhanced accessibility and security of data in public organization in Spain.

In the state of Botswana, Mampe and Kalusopa (2012) researched on record management practices and delivery of services in Corporate Service Divisions. The study adopted mixed method research technique. The study found out the Corporate Service Division had not effectively implemented record management practices thus undermined efficient service delivery. The finding also revealed that poor record management policy, lack of awareness as well as poor procedural manual based were the key challenges which resulted to poor record management.

Henry (2009) conducted a research on the management of electronic records of projects in Eastern and Southern Africa states, a case study of Kenya. The study used secondary data from literatures containing information related to electronic record management. The study found that most countries in the Eastern and Southern Africa Regional Branch of the International Council on Archives (ESARBICA) states have poor electronic record management strategies due to lack of stringent policies and legislations, standardization, data authenticity, capacity building mechanism, poor physical infrastructure and lack of competent record keeping professionals.

In the state of Nigeria, Asogwa (2012) conducted a research to examine the challenges project managers were facing and the strategies for electronic record management in Sub-Saharan Africa. The study used secondary data from various literature containing detailed insights on electronic record management. The finding revealed that technical induced issues and administrative challenges were the major challenges facing effective implementation of electronic record management of projects in sub-Saharan Africa. The study also found that the benefits of electronic record management can only be realized when the governments of Sub-

Saharan states establish appropriate infrastructure, workable administration, adequate finance, regulatory frameworks as well as enhancing competencies of record keepers through training.

Samuel (2015) conducted a research to determine the contribution of electronic record management on growth and development of public sector projects in the state of Ghana, a case study in public institutions. Descriptive research design was adopted during the study. The study found that electronic record management enhanced the performance of Geographical Information System projects.

Oyaro (2013) researched on the influence of records management on service delivery in the immigration department in Kenya. The study found out that efficient record management enhanced service delivery by making work easy, establishing good work relationship between staff and client, improved the image of the cooperation and increased productivity as well as enhancing efficiency and effectiveness of service delivery. Oyaro (2013) stated that many organizations have integrated information technology in their record management thus resulting to positive benefits such as reduction of labor cost as well as enhancing production efficiency.

In Kenya, Rahab (2017) conducted a research to assess how electronic record management influenced the management of road projects, a case study of Kenya high way authority. The study adopted descriptive research design. The study found that electronic record management has a positive influence on the management of roads projects in Kenya.

Similarly, Rotich (2015) conducted a research to determine the influence of effective record management on delivery of service in the department of land in Kenya. The study found that the land department was using manual and digital record management systems however the processes were rarely audited for compliance thus affected record management and service delivery in the land department. Hence, the study recommended that the department of lands need to fully integrate the electronic record management system since the manual system had a lot of limitations such as inefficient and ineffective delivery of services.

### **Electronic Communication**

In France, Chiocchio (2017) researched on the influence of the electronic task and communication coordination on the performance of projects' team members. The study adopted the use of time series analysis to collect synchronized electronic messages sent to a group of 34 individuals. The study found that the teams which exhibited low performance were attributed to exchange of less messages compared to high performing teams which exchanged more messages, modified their data transmission and enhanced there organizations which ultimately result to project success. The study also found out the high performing team members benefited from monitoring the performance of their members and discussion of project task which ultimately resulted to project success.

In United State of America, Brock (2017) conducted a study to determine the effect of electronic communication (electronic mail and local area network) on performance public schools. The study adopted descriptive research design. The study found that electronic communication had a positive and significant effect on performance of schools since most of the students were using local areas network to conduct a research on assignments as well as using email addresses to as a way of communication with their teachers. In addition, Mitchell, Crawford and Madden (2005) conducted a study to determine the effect of automated communication systems on performance of organizations in USA. Secondary data was obtained Office System Research Association Members as well as Association for Business Members. The study found that computerized communication system has a significant influence of organizational performance.

Remingtone, Dickens and Pasquire (2015) conducted a research to determine the effect of electronic communication on performance of road construction projects in UK. The study used descriptive research design and found that electronic communication has a significant effect of performance of road construction projects. Further, the study established that intranet was the most preferred method of communication within the construction industry.

In Israel, Weiner (2012) conducted a research to determine the effect of electronic communication on performance of healthcare organizations. Descriptive research technique was adopted during the research. The findings revealed that electronic communication positively influenced performance of healthcare service by enhancing accessibility of information among patients.

In Pakistan, Jangraiz, Zilakat and Suleman (2014) researched on the effect of mobile phones (a key component of electronic communication) on performance of higher learning academic institutions, a case study of Peshawar University. The sample size of study consisted of 100 students from different departments of Peshawar University. The study also adopted descriptive research design. The study found that mobile phone positively influenced the performance of academic institutions since most of the students were using the mobile phone application dictionaries and internet browser as a source of academic information.

Phathiswa and Dongdong (2017) researched on the effect of electronic communication on Transnet projects communication and performance in South Africa. The study used descriptive research design and found that electronic communication such as telephone and email are highly effective in communicating information thus lead to improvement in performance of Transnet projects.

El-Saboni, Aouad and Sabouni (2009) conducted a research to determine the use of electronic communication management systems and their effect on success of construction projects in United Arab Emirates. The study used secondary data from successful construction projects in the UAE, previously identified by the authors. The finding case revealed an organizational transformation trend, from functional, towards matrix and project structures. The second case



took into consideration the co-existence of modern project electronic communication systems with the other traditional communication systems. The findings revealed that such arrangement were working in strategic benefit of projects as well as the project stakeholders

In Kenya, Gachungi and Mugambi (2017) researched on the effect of electronic communication on performance of road construction projects, a case study of Kenya High Way Authority. Descriptive exploratory research technique was adopted during the study. The study found that electronic communication had a positive and significant influence on performance of road construction projects. The results also revealed that electronic communication had a significance influence on organizational performance

## **RESEARCH METHODOLOGY**

### **Research Design**

A research design is the plan and structure of investigation so conceived as to obtain answers to study objectives (Cooper & Schindler, 2006). Research design refers to the way the study is designed, that is, the method used to carry out a research. This study utilized a descriptive research design. According to Creswell (2014), a descriptive study is one in which information is collected without changing the environment (nothing is manipulated) or the variables in any way. Descriptive studies are usually the best methods for collecting information that demonstrates relationships and describes the variables as they exist. Descriptive research design was selected in this study as it allows the incorporation of both quantitative and qualitative approaches in a study. In addition, descriptive research design was used because it enables the researcher to generalize the findings to a larger population.

### **Target Population**

Cooper and Schindler (2006) described population as the entire group of individuals or items under consideration in any field of inquiry and have a common attribute. The study covered 43 water projects in Makueni County. The target population of the study was the beneficiaries of the water projects in Makueni County, staff in the ministry of water in Makueni County, and the project managers. When conducting the study, the beneficiaries were represented by community representatives. A total of 43 community representatives participated. The staff working in the Ministry of water in Makueni County were 28 and the project managers were 43. The total target population was therefore 114.

### **Sample Size and Sampling Techniques**

Greener (2008) indicates that the sample size should be large enough to represent the entire population. Bhattacharjee (2012) further points out that the researcher should choose a sample large enough to provide adequate information on the population and one which was easy to

analyze. The study adopted a census survey. According to Bryman and Cramer (2012) a census yields more reliable results than a sample, and whenever it is possible it should be undertaken. The census approach is justified since data gathered using census contributes towards gathering of unbiased data representing all individuals' opinions on a study problem. Census provides a true measure of the population since there is no sampling error and more detailed information about the study problem within the population is likely to be gathered when there are study units are equal or less than 200 (Bhattacharjee, 2012).

### **Data Collection Instrument**

Primary data and secondary data are the two main types of data used in academic research. Primary data is normally collected from first-hand events that have not been processed. Primary data can be qualitative or quantitative. Quantitative data collection instruments include observation guides, interview guides and focus group discussions while qualitative data collection instruments comprises of questionnaires (Bryman & Cramer, 2012). Primary data was main data collection tool in this study. It was collected by use of semi-structured questionnaires. Semi-structured questionnaires were used to collect data from project managers, beneficiaries (community representatives) and staff in the ministry of water in Makueni County. The open ended questions (unstructured questions) in the questionnaire was used to encourage the participants to provide in-felt and in-depth responses without feeling held back to provide more information in regard to the objectives of the study. In addition, the closed ended questions (structured questions) were used in this study because they conserve money and time and also facilitate easier analysis. Another advantage of using a questionnaire is that it facilitates anonymity (Bhattacharjee, 2012). The questionnaire was structured into six sections. The first section covered the demographic information of the respondents. The second, third, fourth and fifth sections obtained information on the four independent variables (electronic procurement, supply chain integration, electronic records management and electronic communication). The sixth section obtained information on the dependent variable (performance of water projects).

### **Data Collection Procedures**

The researcher obtained a permit of data collection from the relevant authorities (NACOSTI, The University and the management in the County Government of Makueni). The researcher wrote transmittal letter to each study participant (Appendix II). The researcher also used a drop and pick method when administering questionnaires. Moreover, the researcher sought for permission to collect data from the administration of Makueni County. A follow up activity was carried out on daily routine by the researcher so as to monitor the participants' progress in filling the provided research questions.

## **Data Analysis and Presentation**

Analysis of data entails packaging of finding obtained from the field and systematically arranging them in a manner which can be easily communicated (Greener, 2008). The research instrument was used for generation of qualitative and quantitative data. Content analysis was used for analysing qualitative data and the result was resented in narrative form. Descriptive statistic was used for analysis of quantitative data through the use of SPSS version 22. The descriptive statistic consisted of the measuring of the frequency, standard deviation, mean and percentages. Furthermore, the multivariate regression analysis was conducted so as to enable the researcher determine the relationship between the independent and dependent variables. A correlation analysis and multiple regression analysis determined the relationship between the independent and dependent variables. The study used a 95% confidence level and the significance level was 0.05. The researcher used a confident interval of 95%. Since this study has 4 independent variables, the multivariate regression model was used to determine the general impact of the 4 variables on the performance of water projects and the relationship between independent and dependent variables.

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

Where: Y = Performance of water projects;  $\beta_0$  = Constant;  $\beta_1 - \beta_3$  = Coefficients of determination;  $X_1$  = Electronic procurement;  $X_2$  = Supply chain integration;  $X_3$  = Electronic records management;  $X_4$  = Electronic communication;  $\varepsilon$  = Error term

## **RESEARCH RESULTS**

### **Electronic Procurement and Performance of Water projects**

From the descriptive statistics, the study found that electronic procurement influences the performance of water projects in Makueni County to a very great extent. These findings agreed with Muthoka (2016) findings that electronic procurement measured in terms of electronic ordering, electronic sourcing, electronic reverse auction as well as electronic tendering had a significant impact on performance of various government. In addition, the study found that electronic procurement system was used to enhance communication among the water projects managers, reduced fraud as well as complaints among service providers, and improved on the accuracy of employees' payment.

The study found that Makueni County was committed to implementation of electronic system and the findings revealed that electronic evaluation enhanced system efficiency as well as service delivery. In addition, electronic system allowed beneficiaries of water projects to comment on the project performance through a digital channel. This was in agreement with Ahuja, Yang and Shankar (2009) findings that information technology was used in enhancing information exchange between stakeholders and in enhancing the procurement process. Further, the study

found that mobile money platform was used as a mode of payment to service providers. The study also established that beneficiaries of water projects were able to track the progress of tendering process and electronic procurement allowed service providers to access tender application documents online.

From correlation analysis, the study found that there was a positive association between electronic procurement and performance of water projects in Makueni County. In addition, the regression results showed that electronic procurement had a positive and significant effect on the performance of water projects in Makueni County. This implied that improvement in electronic procurement would lead to an improvement in the performance of water projects in Makueni County. These findings agreed with Simiyu and Simba (2016) findings that electronic procurement (document management and project management) had a positive effect on the performance of projects in Kenya Revenue Authority.

### **Supply Chain Integration and Performance of Water projects**

From descriptive statistics, the study found that supply chain integration influences the performance of water projects in Makueni County to a very great extent. These findings concur with Barbara *et al.*, (2008) findings that that supply chain integration had a positive influence on project performance. In addition, electronic system enabled the county to monitor, evaluate and improve its internal procurement practices accordingly. The study found that electronic system track and monitors the information flow between the sender and the recipient; enabled project managers to improve on the quality of service deliver; enabled the County to respond effectively to water projects demands and results to real time communication about water projects.

The study also established that electronic system enhances transparency and information sharing among the stakeholders in water projects; enhanced involvement of all beneficiaries in management of water projects; and enhanced good relationship between the county and project managers through timely delivery of services. The findings concurred with Hamdan, Maryam and Abu (2011) findings that supply chain integration improves stakeholders' involvement and coordination in projects. The study also established that electronic communication enhanced accurate forecasting based on previously stored record on water demands.

The correlation analysis results indicated that there was a positive association between supply chain integration and performance of water projects in Makueni County. The regression results revealed that supply chain integration had a positive and significant effect on the performance of water projects in Makueni County. This showed that an improvement in supply chain integration would lead to an improvement in the performance of water projects in Makueni County. These findings concurred with Ijomba (2010) argument that supply chain integration has a positive effect on the performance of Nairobi bottlers' projects. Also, the findings concurred with Ram and Soo (2002) findings that supply chain integration enhances effective coordination of services and information sharing, which enhances project performance.

### **Electronic Record Management and Performance of Water projects**

From descriptive statistics, the study found that electronic record management influences the performance of water projects in Makueni County to a very great extent. These findings were in line with Rahab (2017) findings that electronic record management had a positive influence on the management of roads projects in Kenya. In addition, electronic record management was used to enhance communication among the water projects managers in the project. The study also established that the use of electronic record management system had enhanced information sharing in the county; allow authorized personnel access and receive information; led to reduction of cases relating to file lose in the organization; automatically preserve all transmission data; and retained record in accessible format during the transmission process. These findings agreed with Komives *et al.* (2008) findings that information technology facilitated storage and quick retrieval of large amounts of data and information.

The study further revealed that use of electronic had enhanced the ease of accessing information and the County had reduced the use of paper base system since the adoption of electronic record management. Also, the study found that electronic record system send notification that any transmitted information had been received. Further, the study revealed that Makueni County used electronic storage platform to store information. These findings agreed with Kwatsha (2010) findings that project managers were using information technology to enhance records management activities such as information creation, storage, maintenance, disposal and retrieval

From correlation analysis, the study found that there was a positive association between electronic record management and performance of water projects in Makueni County. The regression results indicated that electronic record management had a positive and significant effect on the performance of water projects in Makueni County. This implied that an improvement electronic record management would lead to an improvement in the performance of water projects in Makueni County. The findings were in agreement with Samuel (2015) findings that electronic record management has a positive effect on growth and development of public sector projects in Ghana.

### **Electronic Communication and Performance of Water projects**

From descriptive statistics, the study established that electronic communication influences the performance of water projects in Makueni County to a very great extent. These findings are in line with Gachungi and Mugambi (2017) findings that electronic communication had a positive and significant influence on performance of road construction projects. In addition, telephone was the most commonly used form of electronic communication in water projects, followed local area network and email. These findings are in line with Brock (2017) findings that electronic communication had a positive effect on performance and most of the managers used telephone followed by local area network and email addresses to enhance two way communication. The

study revealed that Makueni County used mobile phone to communicate with staff, service providers as well as residents, and the use of mobile phone had led to improvement in service delivery. In addition, the study found that there was one to one electronic communication between the water project managers and beneficiaries.

Further, the study found that the use of e-mail had led to improvement on service delivery; enhances timely communication; and enhanced communication with the beneficiaries prior to project completion. Also, the study established that data transmission through local area network had enhanced better customer service; reduced the cost of operation; and enhanced information sharing among authorized personnel. These findings agreed with Remingtone, Dickens and Pasquire (2015) findings that local area network improved service delivery and reduces cost of movement in offices and projects.

The correlation analysis results indicated that there was a positive association between electronic communication and performance of water projects in Makueni County. The regression results showed that electronic communication had a positive and significant effect on the performance of water projects in Makueni County. This showed that an improvement in electronic communication would lead to an improvement in the performance of water projects in Makueni County. These findings were in line with Phathiswa and Dongdong (2017) findings that electronic communication such as telephone and email were highly effective in communicating information thus lead to improvement in performance of Transnet projects.

## **INFERENCE STATISTICS**

Inferential statistics, correlation analysis and multivariate regression analysis, were used to examine the relationship between the independent variables and the dependent variable.

### **Correlation Analysis**

According to the findings, there was a positive association between electronic procurement and performance of water projects in Makueni County as shown by a correlation coefficient of 0.974 and a p-value of 0.000. The p-value is less than 0.05 and hence the association was significant. These findings were in line with Rai, Brown and Tang (2009) findings that electronic procurement had a substantial impact of organizational productivity and performance of projects.

The study also found that there was a positive association between electronic record management and performance of water projects in Makueni County as shown by a correlation coefficient of 0.978 and a p-value of 0.000. The p-value (0.000) is less than 0.05 and hence the association was significant. These findings were in line with Anahí and Agustí (2017) argument that electronic record management has a significant and positive influence of performance of projects in Spain.



The study further established that there was a positive association between electronic communication and performance of water projects in Makueni County as shown by a correlation coefficient of 0.970 and a p-value of 0.000. The p-value (0.000) was less than 0.05 and hence the association was significant. These findings concur with Brock (2017) findings that electronic communication (electronic mail and local area network) had a positive effect on performance of projects.

Also, the study found that there was a positive association between supply chain integration and performance of water projects in Makueni County as shown by a correlation coefficient of 0.959 and a p-value of 0.000. The p-value (0.000) was less than 0.05 and hence the association was significant. These findings agree with Jessica, Ednilson and Scott (2014) argument that supply chain integration has a positive effect on performance of projects in the United States.

This study made use of Pearson product-moment correlation analysis to determine whether there was a relationship between the independent variables (electronic procurement, supply chain integration, electronic records management and electronic communication) and the dependent variable, performance of water projects in Makueni County.

**Table 1: Correlation Analysis**

		<b>Performance of Water Projects</b>	<b>Electronic procurement</b>	<b>Electronic Record Management</b>	<b>Electronic Communication</b>	<b>Supply Chain Integration</b>
Performance of Water Projects	Pearson Correlation	1				
	Sig. (2-tailed)					
	N	108				
Electronic procurement	Pearson Correlation	0.974**	1			
	Sig. (2-tailed)	.000				
	N	108	108			
Electronic Record Management	Pearson Correlation	0.978**	.373	1		
	Sig. (2-tailed)	.000	.212			
	N	108	108	108		
Electronic Communication	Pearson Correlation	0.970**	.273	.485	1	
	Sig. (2-tailed)	.000	.243	.167		
	N	108	108	108	108	
Supply Chain Integration	Pearson Correlation	0.959**	.485	.273	.373	1
	Sig. (2-tailed)	.000	.167	.243	.212	
	N	108	108	108	108	108

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

### Regression Analysis

A multivariate regression analysis was used to determine the relationship between the dependent and the independent variables. The multivariate regression model was:

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

Where: Y = Performance of water projects; B<sub>0</sub> = Constant; β<sub>1</sub>- β<sub>3</sub> = Coefficients of determination; X<sub>1</sub> = Electronic procurement; X<sub>2</sub> = Supply chain integration; X<sub>3</sub> = Electronic records management; X<sub>4</sub> = Electronic communication; and ε = Error term.

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 0.785, which shows that the four independent variables (electronic procurement, supply chain integration, electronic records management and electronic communication) can explain 78.5% of the dependent variable. This clearly shows that other factors not considered in this study explain 21.5% of the dependent variable, performance of water projects in Makueni County.

**Table 2: summary**

<b>R</b>	<b>R Square</b>	<b>Adjusted R Square</b>	<b>Std. Error of the Estimate</b>
0.886 <sup>a</sup>	0.785	0.771	0.09891

a. Predictors: (Constant), Supply Chain Integration, Electronic Record Management, Electronic Communication, Electronic procurement

From Table 3, 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 was statistically significant in establishing the influence of electronic procurement, supply chain integration, electronic records management and electronic communication on the performance of water projects in Makueni County. Further, the F-calculated (880.414) was found to be more than the F-critical (2.4472) which shows that the model was fit in establishing the influence of the four independent variables on the dependent variable.

**Table 3: ANOVA**

	<b>Sum of Squares</b>	<b>df</b>	<b>Mean Square</b>	<b>F</b>	<b>Sig.</b>
Regression	34.450	4	8.613	880.414	.000 <sup>b</sup>
Residual	1.008	103	.010		
Total	35.458	107			

a. Dependent Variable: Performance of Water Projects

b. Predictors: (Constant), Supply Chain Integration, Electronic Record Management, Electronic Communication, Electronic procurement

## Regression Coefficients

From the Table 4, the findings show that electronic procurement had a positive and significant effect on the performance of water projects in Makueni County as shown by a regression coefficient of 0.343. This implied that a unit improvement in electronic procurement would lead to a 0.343 improvement in the performance of water projects in Makueni County. The p-value (0.002) was less than the significance level (0.05), hence the relationship was significant. These findings agreed with Muthoka (2016) findings that electronic procurement in terms of electronic ordering, electronic sourcing, electronic reverse auction as well as electronic tendering affects the performance of projects in Government ministries in Kenya.

The study also found that electronic record management had a positive and significant effect on the performance of water projects in Makueni County as shown by a regression coefficient of 0.470. This implied that a unit improvement in electronic record management would lead to a 0.470 improvement in the performance of water projects in Makueni County. The p-value (0.000) was less than the significance level (0.05), hence the relationship was significant. These findings concurred with Mampe and Kalusopa (2012) findings that electronic record management practices had a positive effect on the performance of projects in Botswana.

The study further revealed that electronic communication had a positive and significant effect on the performance of water projects in Makueni County as shown by a regression coefficient of 0.402. These findings implied that a unit improvement in electronic communication would lead to a 0.402 improvement in the performance of water projects in Makueni County. The p-value (0.000) was less than the significance level (0.05), hence the relationship was significant. The findings were in line with Weiner (2012) findings that electronic communication has a positive effect on the performance of healthcare projects in Israel.

**Table 4: Regression Coefficients**

	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	.401	.136		20.946	.004
Electronic procurement	.343	.109	.381	3.142	.002
Electronic Record Management	.470	.078	.454	6.006	.000
Electronic Communication	.402	.085	.421	4.753	.000
Supply Chain Integration	.284	.125	.263	2.277	.025

a. Dependent Variable: Performance of Water Projects

Also, the study found that supply chain integration had a positive and significant effect on the performance of water projects in Makueni County as shown by a regression coefficient of 0.284. The findings implied that a unit improvement in supply chain integration would lead to a 0.284

improvement in the performance of water projects in Makueni County. The p-value (0.025) was less than the significance level (0.05), hence the relationship was significant. The findings were in line with Hamdan, Maryam and Abu (2011) findings that supply chain integration has a positive effect on performance of projects in United Arab Emirates. From the findings, we can infer that Electronic Record Management was the most significant factor affecting the performance of water projects in Makueni County, followed by electronic communication, electronic procurement and supply chain integration.

## **CONCLUSION**

The study concludes that electronic procurement had a positive and significant effect on the performance of water projects in Makueni County. The study found that electronic tendering, electronic payment and electronic evaluation affected the performance of water projects. The results revealed that electronic procurement system was used to enhance communication in water projects, reduce fraud as well as complaints among service providers, and improve on the accuracy of employees' payment. Further, beneficiaries of water projects were able to track the progress of tendering process and electronic procurement allows service providers to access tender application documents.

The study also concludes that electronic record management had a positive and significant effect on the performance of water projects in Makueni County. The study established that data storage, retrieval of information and dissemination of information affected the performance of water projects. The use of electronic record management system had enhanced information sharing; allowed authorized personnel access and receive information; led to reduction of cases relating to file lose in the organization; automatically preserve all transmission data; and retained record in accessible format during the transmission process. Also, the use of electronic had enhanced the ease of accessing information and the County had reduced the use of paper based system since the adoption of electronic record management.

In addition, the study concluded that electronic communication had a positive and significant effect on the performance of water projects in Makueni County. The study revealed that information sharing, buyer-seller relationship and building trust affected the performance of water projects. The study revealed that the use of mobile phone had led to improvement in service delivery. Further, the study found that the use of e-mail had led to improvement on service delivery; enhanced timely communication; and enhanced communication with the beneficiaries prior to project completion. Also, the study established that data transmission through local area network had enhanced better customer service; reduced the cost of operation; and enhanced information sharing among authorized personnel.

Further, the study concluded that supply chain integration had a positive and significant effect on the performance of water projects in Makueni County. The study established that e-mail, local area network and telephone affected the performance of water projects. An electronic system

track and monitored the information flow between the sender and the recipient; enabled project managers to improve on the quality of service deliver; enabled the County to respond effectively to water projects demands; and results to real time communication about water projects. The study also established that an electronic system enhanced transparency and information sharing; and enhanced involvement of all beneficiaries.

## **RECOMMENDATIONS**

The study found that electronic procurement enhanced the procurement process and increased efficiency. This study therefore recommends that Makueni County should fully adopt electronic procurement to allow online advertisement, online access and submission of tender documents and electronic tender evaluation.

The study also found that electronic payment reduced fraud as well as complaints among service providers and improved the accuracy of employees' payment. This study therefore recommends that the County government of Makueni should fully adopt electronic payments so as to reduce fraud and complaints and improve accuracy in payments.

The study found that supply chain integration improved information sharing, transparency, and real-time communication in projects. This study therefore recommends fully adoption of supply chain integration among all stakeholders involved in water projects in the County.

The study found that electronic records management enhanced data storage, data retrieval and information sharing. This study recommends that the County government of Makueni should adopt electronic records management to automate the records system in all type of projects.

The study found that the County government of Makueni was using emails and local area network as forms of electronic communication to a low extent. This study therefore recommends that the management and administration of County government of Makueni should adopt increase the use of emails to improve communication.

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