INFORMATION TECHNOLOGY AND ORGANIZATIONAL PERFORMANCE: CASE STUDY OF DRIP IRRIGATION PROJECTS IN MATANYA LOCATION, LAIKIPIA COUNTY, KENYA.

BY

PETER KARANJA NGANGA

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MAY, 2017
DECLARATION

This research project is my original work and has not been presented for an award of a degree in any other University.

Signature_________________________ Date_______________________

Peter Karanja Nganga

D53/OL/NYI/24470/2014

Supervisor

This research project has been submitted for review with my approval as a University Supervisor.

Signature_________________________ Date_______________________

Dr John N. Mungai

Department of Accounting & Finance,

School of business,

Kenyatta University.
DEDICATION

I dedicate this work to the loving memories of my dear Father Joseph and Mother
Loise Wanjiru who gave me wings to fly. Thanks Mother for your prayers.
ACKNOWLEDGEMENT

I wish to give special gratitude to my Supervisor Dr. Mungai for his guidance in writing this research project. I also wish to thank other lectures of Kenyatta University for their support. I wish to thank my Colleges Phillip Musyoka and Alfred Macharia for supporting me throughout the course. Lastly, my deep appreciation to my family and particularly to my wife Leah for their genuine support and encouragement.
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# LIST OF ABBREVIATIONS AND ACRONYMS

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<tr>
<td>ASALs</td>
<td>Arid and Semi-Arid Lands</td>
</tr>
<tr>
<td>FAO</td>
<td>The Food and Agriculture Organization</td>
</tr>
<tr>
<td>MTP</td>
<td>National Irrigation Board Mid Term Plan</td>
</tr>
<tr>
<td>PERT</td>
<td>Program Evaluation and Review Technique</td>
</tr>
<tr>
<td>SPSS</td>
<td>Statistical Package for Social Sciences</td>
</tr>
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<td>TAM</td>
<td>Technology Acceptance IDE International Development Enterprises Model</td>
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## OPERATIONAL DEFINITION OF TERMS

<table>
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<tr>
<th>Term</th>
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<tr>
<td><strong>Communication</strong></td>
<td>Two-way process of reaching mutual understanding, in which participants exchange and share meaning of information in project management</td>
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<tr>
<td><strong>Project Performance</strong></td>
<td>Overall quality of a project in terms of its impact, value to beneficiaries, implementation effectiveness, and efficiency and sustainability.</td>
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<tr>
<td><strong>Project</strong></td>
<td>A collection of linked activities that are carried out in an organized manner and that has a clearly defined beginning and ending purposed to achieve some specific results desired to satisfy a clearly defined objective.</td>
</tr>
<tr>
<td><strong>Technology</strong></td>
<td>This is the making, usage, and knowledge of tools, machines, techniques, crafts, systems or methods of organization in order to solve a problem or perform a specific task.</td>
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<tr>
<td><strong>Time tracking tools</strong></td>
<td>Computer software that allows project managers to record time spent on tasks.</td>
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ABSTRACT

Agricultural based projects play a major part in sustaining domestic and regional economic growth and are important agents for alleviating poverty in developing countries. Utilization of technology in agricultural based projects however remains an issue of concern to researchers, government and project stakeholders. Recent studies have demonstrated that technology play a pivotal role in the performance of agricultural based projects. The purpose of this study was to establishing the effect of technology on performance of drip irrigation projects in Matanya location Laikipia County. The study was guided by four specific objectives; to establish the extent to which utilization of communication technology influence the performance of drip irrigation projects, to ascertain the influence of cost tracking technology on the performance of drip irrigation projects, to establish the extent to which utilization of time tracking technology influence the performance of drip irrigation projects and to establish the influence of the use of quality assurance tools on the performance of drip irrigation projects in Matanya location. The study used a descriptive research design. This design is best suited as it gives an exhaustive analysis of the situation as it determines and reports the way things are in terms of possible behavior, attitude, values and characteristics. The target population of this study was the officials and beneficiaries of the projects in the study. The study targeted 66 respondents who are employees of drip irrigation projects within Matanya location, Laikipia County. The sample size was drawn from all the stakeholders working in drip irrigation projects in Matanya, Laikipia. The study employed a questionnaire to collect primary data. After the data was collected, it was cleaned and analyzed using multiple regression model. Data tables was used to present frequencies and percentages based on each variable or indicator. Quantitative data was derived from the closed-ended questions in the questionnaire. Quantitative data was presented in tables and graphs and explanation was presented in prose. The study found out that there is significant relationship between use if IT tools and project performance. From the results presented, it is concluded that the use of IT tools during project monitoring has positive relationship on the performance of drip irrigation projects in Matanya location, Laikipia County. The study recommended that organizations should incorporate Information technology tools in project monitoring for the success of the project performance. Further studies need to be carried out to understand the specific relationships between each of the IT tools’ use and the project performance.
CHAPTER ONE

INTRODUCTION

1.1 Background of the Study

According to the report of Earth Trends, 2010, agriculture is a vital part of household livelihood and the economics of developing countries in Sub-Saharan Africa, approximately 60% of the labour force is employed in agriculture. The majority of this labour force is comprised of households engaged in small-scale and subsistence agriculture. The vital role a country or community’s food supply plays in the survival of her citizen sets the productivity of the agriculture sector apart from other sectors of production. In Africa, 80% of the continent’s poor live in rural areas as producers, 70% of all Africans and nearly 90% of their poor work primarily in agriculture (World Bank, 2010). If individuals are excluded from the market in other sectors because of problems in production, it does not carry the same consequences as shortfalls in the agriculture sector (Perkins et al, 2006). Therefore, the productivity of labour and technology employed in agriculture is central to household livelihood and food security in developing countries.

According to the Food and Agriculture Organization (FAO) reports, previous innovations and technology advancements in agriculture have led to increased productivity and yields in agriculture. For example, a major breakthrough in agricultural innovations and technologies, what has been termed as the Green Revolution increased productivity greatly during the 1950’s and 1960’s. The increase in agricultural productivity through the development of new seed varieties and application of chemical fertilizer and irrigation enabled the increase in food supply and food security in Asia and South America (Lipton et al., 1989). Despite the
advances that have been achieved, hunger and food insecurity still plague many parts of the developing world. The Food and Agriculture Organization (FAO) reports 30% of the population in Sub-Saharan Africa is under-nourished (FAO, 2009). In contrast, 16% in Asia and 8% in South America are undernourished. Sub-Saharan Africa still faces a considerable need for advances in its agricultural production and food security.

In Kenya, as in many parts of the sub-Saharan Africa, agriculture is the mainstay of the livelihood of her citizens. Over 75% of the population of Kenya relies heavily on subsistent farming and 52% of her entire workforce directly practices small-scale farming including pastoral activities. Small-scale/subsistence farming produce accounts for over 75% of the entire agricultural output and over 70% of the marketed agricultural produce in Kenya. Sixty six (66) percent of the country's manufacturing sector is agro based. These statistics shows the importance of small-scale farming to Kenya's economy. The same statistics underscore the importance of focusing on this sector with interventions geared towards achieving success (FAO, 1986).

The country enjoys a variety of climates and soils but less than 20% of the land size is considered arable under rained-fed condition. The remaining 80% is classified as arid and semi-arid lands (ASALs) and experiences perennial water shortage which is a major constraint to agricultural production. Due to population pressure in the high and medium potential areas, people whose livelihoods traditionally depended on subsistence farming have since moved to the ASALs and intensively cultivated them. Cultivation in these fragile ecosystems has not been sustainable without external inputs such as water and nutrients, (Okumu et al, 2004).
Both the Kenya vision 2030 and the First Medium Term Plan (MTP) 2008-2012 underscore the important role that irrigation is expected to play in improving agricultural productivity and meeting Kenya's food security needs. The MTP estimates that irrigation can increase agricultural productivity four-fold and depending on the crops, multiply incomes by up to ten times. To promote agricultural productivity, the government plans to increase the area under irrigation and drainage from the current 140,000 ha to 1.2 million ha in 2030, an expansion of irrigation acreage by 48,000ha (34%) per year. The government targets to exploit the agricultural potential in ASAL areas by putting an additional 600,000 ha under irrigation.

Laikipia County has experienced extreme population growth since independence in 1963 (Kiteme et al. 2008). Settlers have immigrated during the 1960’s and 1970’s and transformed the land from large-scale ranching to small-scale mixed agriculture (Wiesmann, 1998). Nowadays, livelihoods are primarily based on crop production and livestock keeping with land-holdings typically around 1.2 ha to 2.4 ha (Ulrich et al. 2012). However, population growth has increased pressure on the limited natural resources in the area, such as rivers and land, which impedes agricultural growth and keeps smallholder farmers caught in the poverty trap (Ulrich et al. 2012).

Matanya location is located in Laikipia East approximately 20 km West of Nanyuki in the semi-arid highland plateau (Schäfer, 2009). A very dry climate and only few seasonal rivers characterize the area. Main agricultural activities include crop cultivation and animal husbandry. Large unsettled parts can be found, which are also used for uncontrolled grazing (Schäfer, 2009).
The success of project performance depends partly on the project management approach used during planning, implementation and commissioning. Project management discipline helps implementers of projects realize good outcomes which include timely delivery, working within budget and coming up with deliverables that meet the intended utility functions. The project management phases of planning, appraisal, implementation, monitoring, commissioning, termination and evaluation are essential for project performance. In this regard, it is vital for project managers to understand the best ways with which to improve the management of each of the phases. In project monitoring, the use of information communication technology (ICT) is useful because it helps enhance information collection, storage and dissemination as well communication between the project participants (Walker, 2015). This proposal intends to study the influence of the use of ICT in project monitoring on the aids’ programs’ project performances.

Project monitoring is the observation and supervision for the people in the management team to detect and to react appropriately to the deviation and changes to project plan. Project monitoring is a phase that should be carried out by the project manager. Projects should be monitored against the cost, time and quality performance. The project manager should ensure that the time allocated for each task has been used and no lagging should be reported. As well, each task should not have a cost overrun. In project monitoring, there is a comparison of the actual versus the planned outcomes during the project implementation. Communication, collecting and sharing of information is one of the ways that can be used to enhance success of monitoring activities in projects. ICT can be an essential tool in monitoring of projects (Walker, 2015).
1.1.1 Information Technology

ICT refers to technology used to handle information and aid communication. It also refers to the amalgamation of computing and telecommunications technologies, including the Internet, which are the matrix within which information and digital media are created, distributed and accessed. Information and Communications Technology features comprise basically of: Information access and dissemination over the Internet and wireless computing. Communication features including landline and mobile telephones, wireless communication, voice over Internet communication or voice mail and facsimile. Computer hardware such as computers, printers, scanners, faxes, modems, networks and software which includes programs for accounting, spreadsheets, data processing enterprise resource planning systems (ERP) among others (D'Atri & Spagnoletti, 2011).

It is estimated that 82% of the population in Kenya live in rural areas, mainly as small-scale farmers and among the many factors that contribute in the growth of agricultural productivity, technology is the most important. The rate of adoption of a new technology is subject to its profitability and the degree of risk and uncertainty associated with it and is highly influenced by the capital requirement, agricultural policies and socio-economic characteristics of the farmers. The question of adoption and non-adoption is important, however, intensity of adoption is actually the most important criterion in the adoption process. According to Rogers (1963), there are several factors affecting farmer’s decision to adopt irrigation technologies. Extension creates awareness on existence of irrigation technology, the farmers assess whether the technologies are acceptable to them given their land sizes, crops grown, education, experience, labour availability or demand, expected improvement in fertility, availability of credit facilities input cost and other factors. According to FAO (1986),
the decision to determine whether it is feasible and profitable for farmers to adopt and implement the irrigation technology on their farms may be instantaneous, i.e. They can adopt immediately in the same year when the technology is introduced or it can take several years depending on socio-economic factors such as education, frequency of extension contact, technology input prices and literacy levels.

1.1.2 Organizational performance

All project managers and other stakeholders are interested in the performance of their projects. The project outcomes can be used to determine their overall performances. Different success criteria can be used to evaluate the performance of a project. These criteria include technical performance, efficiency of execution, managerial and organizational implications, personal growth and manufacturer’s ability and business performance. Time, quality and cost of implementation of the project are the traditional measures that were used to measure the performance of projects. Depending on the nature of the project, the three variables can be used in isolation or they can be mixed with the other stated indicators to evaluate the success of the project outcomes (Turner, 2014).

The planned goals and objectives of a project define the scope. The project scope is thus used to determine its performance. The areas and processes affected by the project are defined as its scope, which needs to be clearly understood by all stakeholders; therefore, the scope of the project should not be changed without the client's approval, which will also require new estimates of costs and new plans. The goals of the project are normally determined by the client, but these need to be communicated clearly to the project team, and particularly the project manager. Therefore, once the goals are clear, the project manager can establish the technical and business objectives of the project that will contribute to meeting these goals,
which will inform the detailed planning for the project. From this understanding, the project manager is able to come up with the required monitoring approaches (Kerzner, 2013).

1.1.3 Drip irrigation projects in Laikipia County

The “plastic revolution” after World War II paved the way for drip irrigation. It made it possible to mass-produce plastic pipes easily and cheaply, and this sped up the use of drip irrigation systems. By the end of the 1960’s, farmers in six countries – Australia, Israel, Mexico, New Zealand, South Africa and the United States – were using drip irrigation (Sijali, 2001). While only a small portion of worldwide cropland was irrigated by drip systems at this time, the technology spread fast. According to Postel et al. (2001), this rapid expansion was attributable to the higher crop yields and water use efficiencies gained by drip irrigation. Drip systems have often been associated with capital-intensive commercial farms. The largest barriers to its expansion to small-scale farmers have been high capital costs, typically starting from US $1500 per hectare, and the lack of system sizes suitable for small plots. The high cost of most commercially available drip systems is due to components that are optimized for fields of four hectares or larger and designed to minimize labour and management costs. By contrast, early drip systems were simple, but these designs were abandoned because they did not fit the needs of large-scale farmers in developed countries. They are, however, well suited for drip irrigating small plots.

Drip irrigation is a water saving technology that delivers water through small holes or emitters in plastic tubes installed on or below the soil surface almost directly to the roots of plants. Flow rates are slow, from 0.2-20 l/h, and regular application is the basic concept underlying this method to supply the amount of water needed by the plant (Dasberg & Or, 1999). There are a number of advantages of a drip irrigation
system according to Sijali (2001): Higher crop yields: Since water is applied on a regular basis, the soil moisture is kept at an optimum level and it applies water more evenly than other irrigation methods; there is more efficient use of water: The precise application of water to plants achieved by the drip system makes irrigation much more efficient. Because of the partial soil wetting (rather than saturation), less water is lost by direct evaporation from the soil surface. Also, loss of water due to uptake from weeds between the plants is minimized. Studies have shown a water reduction of up to 30 to 70 percent compared to conventional surface irrigation (Dasberg and Or, 1999).

Drip irrigation also reduces cost for application of fertilizers and other chemicals: The ability to apply fertilizers along with irrigated water saves labor and costs. A more precise application of fertilizer, which is brought directly to the active root zones, translates to a more efficient utilization. Additionally, the concentration and amount of nutrients can be better timed to coincide with plant needs according to the stage of development and climatic conditions. The method further reduces labour: Weeds are reduced since there is no watering between plants, and weeding can be performed when plants are being irrigated. Adding fertilizer, herbicide and insecticide simultaneously with water reduce labor costs (Sijali, 2001).

There are also a number of disadvantages associated with drip irrigation: Cost: Conventional drip irrigation systems typically start at US $1500 per hectare. This is, however, changing. Technical limitations: The design, management and maintenance required for drip systems have been focused on the needs of larger farms. Good water management is necessary otherwise almost all benefits of using the system will be lost. Over irrigation will make the soil too wet and will therefore promote disease, weed growth and nutrient leaching; clogging of emitters: This is one of the biggest
problems of any drip system: It causes poor water distribution, which affects plant growth. Restricted root zone: The plant’s root activity is limited to the zone wetted by the emitters, which is usually smaller in area than with sprinkler or surface irrigation. Thus, if drip irrigation fails, the crops will suffer even more from drought than crops watered with sprinkler or surface irrigation (Shah and Keller, 2002). Salt accumulation in the root zone: Drip irrigation tends to accumulate salts to the outer edge of the wetted volume of the soil surface. In regions with an annual rainfall of less than 100 mm this can cause a problem if the rainfall is insufficient to leach the salts from the root zone. The rain can instead move the salts into the root zone which is damaging for the plant.

In recent years there have been efforts to promote irrigation technologies that have so far been perceived as exclusively for commercial farmers, but which are now available in forms that meet the above mentioned criteria such as increased affordability, divisibility, rapid payback and improved water efficiency. Chapin Watermatics, International Development Enterprises (IDE), Netafim, and some other actors have made pioneering efforts. All of these have developed and launched versions of drip systems, which are now showing promise for raising the water efficiency, land productivity, and incomes of smallholders (Shah and Keller, 2002). For example, IDE-India promotes drip kits costing almost 80% less than conventional drip systems and is thus bringing about a shift from subsistence farming to higher value production. This could translate into a doubling of the income of poor farmers, in addition to enhancing household food security and improving the nutritional status of farm families (IDE, 2004).

The drip irrigation technology frees the farmer from the limitations of rain-fed farming, enabling him/her to cultivate all year round, grow a wider variety of crops,
have higher cropping intensity and do priority farming. Good irrigation technologies and agricultural practices coupled with enhanced participation of the poor in the markets is the key to income generation (IDE, 2004).

1.2 Statement of the Problem
Projects are commonly acknowledged as successful when they are completed on time, within budget, and in accordance with specifications and to stakeholders’ satisfaction. Many projects exceed the original cost; get cancelled prior to completion, while others fail on terms of the delivered functionality. While large amounts of time and resources are dedicated to selecting and designing projects, it remains of paramount importance that projects be adequately managed if they are to achieve their performance objectives. Projects need to be managed, that is, they need to be planned, staffed, organized, monitored, controlled, and evaluated (Liberatore, 2004).

The project monitoring phase is critical to the success of the project outputs and outcomes. Tools used in the project monitoring process partly contribute to the success of this phase. The success of the project monitoring phase is linked to the project performance. It is thus useful to understand the link between project monitoring and project performance. Such a link can better be understood by focusing on the relationship between the tools used in project monitoring and the project performance. Project monitoring process uses ICT tools to ensure the success of the project phase.

ICT tools have been used before in project monitoring phases. These tools are used for communication between the project implementing teams and other project stakeholders. They are also used for information gathering, storing, retrieval, tracking and analysis. All these processes are aimed at enhancing the performance of projects.
D’Atri, et al, 2011). The relationship between the use of ICT in project management and performance has been an attractive area of study to researchers. Studies have been carried out with the purpose of establishing the kind of relationship that exists between the use of ICT and the performance of projects.

A study was carried out by Matambalya & Wolf (2001) to evaluate the role of ICT on the performance of small and medium size enterprises (SMEs) in Kenya and Tanzania. In the study, the authors sampled 300 SMEs in Kenya and Tanzania. The study found out that the use of ICT by SMEs in Kenya and Tanzania had increased over time. Fixed line phones’ use had reached a saturation point but it was lower in Kenya than in Tanzania. The percentage use of mobile phones was increasing but was more prevalent in Kenya than in Tanzania. It was found that the enterprises which use ICT had performed better than those that did not use the ICT tools.

The use of technology is seen as the best precursor to successful projects. Utilization of technology in agricultural based projects however remains an issue of concern to researchers, government and project stakeholders (Haiser, 2004). While, project performance factors have been traditionally indicated by the extent to which an organization satisfies stakeholders, meets agreed project budget, delivers on time adds value, meets quality requirements, and provides a sense of professional satisfaction to project team; the extent which technology is integrated to these project performance factors in agricultural based projects still remains unclear (Kavanagh, 2005).

Agricultural projects in rural areas may suffer consequences of poor stakeholder satisfaction, uncompleted work, poor quality and failure to produce the intended products which forms a prerequisite for project failure. Studies by Derek, (2005); Bigio, (2009); Kerzner, (2009); showed factors such as lack of community
participation, poor project management, poor project goals, and lack of quality training as common characteristics of agricultural rural based projects. A similar observation by (Shenhar, 2007) show that over 60% of agricultural based projects fail, with 45% of those undertaken up to completion stage either exceeding their intended budget or surpassing the time limit within which they are supposed to be finished. Even projects that strictly follow set project performance factors seem not to attain performance (Muller, 2005).

While technology has long been regarded as a very important aspect of communication, planning, resource allocation and scheduling, monitoring and evaluation, few studies if any have hardly discussed the relationship between technology adoption and performance of agricultural based projects. This leaves a wide knowledge gap that this study sought to fill. The study therefore sought to explore the effect of technology on performance of drip irrigation projects in Matanya location Laikipia County.

1.3 Research Objectives

1.3.1 General Objective

The main aim of this study was to investigate the effect of technology on performance of drip irrigation projects in Matanya location Laikipia County.

1.3.2 Specific Objectives

i. To investigate the extent to which utilization of communication technology influence the performance of drip irrigation projects in Matanya location, Laikipia county

ii. To investigate the influence of cost tracking technology on the performance of drip irrigation projects in Matanya location, Laikipia county
iii. To investigate the extent to which utilization of time tracking technology influence the performance of drip irrigation projects in Matanya location, Laikipia county

iv. To investigate the influence of the use of quality assurance tools on the performance of drip irrigation projects in Matanya location, Laikipia county

1.4 Research Hypothesis

\(H_1\): The use of communication technology influences the performance of drip irrigation projects in Matanya location, Laikipia County.

\(H_1\): The use of cost tracking technology influences the performance of drip irrigation projects in Matanya location, Laikipia County.

\(H_1\): The adoption of time tracking technology influences the performance of drip irrigation projects in Matanya location, Laikipia County.

\(H_1\): The use of quality assurance tools influences the performance of drip irrigation projects in Matanya location, Laikipia County.

1.5 Significance of the Study

The results of this study may be useful to various stakeholders in the field of project management. Among the beneficiaries of the study include the government, nongovernmental organizations, academicians and researchers. The statistics of the research might be of use to the government because they can act as lesson sources of how the state can incorporate technology in project management for successful project performance.

The non-governmental bodies might find the research findings useful because the information can be used in implementing projects in their community driven
development plans which may not be necessarily funded by the government. The non-
governmental bodies which collaborate with the local development parties use the
information in deciding how to contribute to the project efforts in the country.

The research study will be beneficial to future scholars and academicians who would wish to use the materials for reference. Similarly the study will be used to give further insight to the field of research and give answers to research questions not covered by this study.

1.6 Scope of the Study
The study was done to examine the relationship between technology and the performance of drip irrigation projects in Matanya location in Laikipia County. Matanya location is located in Laikipia East approximately 20 km West of Nanyuki in the semi-arid highland plateau. The study used four variables (communication technology, cost tracking technology, time tracking technology, and quality assurance tools) to explore the relationship between technology and the performance of drip irrigation projects.

1.7 Limitations of the Study
There was difficulty in information disclosure from the respondents. The researcher however worked at winning the confidence of those involved in this research project by giving them the reasons for the research and assuring them confidentiality.

1.8 Study organization
The research project was structured as follows: Chapter one provides the Research background, statement of the problem, research objectives, and significance of the study, scope and the limitations to be encountered in the course of the study. Chapter two presents literature review of existing research on the effect of technology on the performance of drip irrigation projects and conceptual framework. Chapter three
explains the methodology employed in the study and provides a description of the procedures used in conducting the study. The fourth chapter of this research project dealt with data analysis, presentations, and interpretations. Chapter five of the study gives summary of the findings, discussions, conclusions and recommendations.
CHAPTER TWO
LITERATURE REVIEW

2.1 Introduction
This chapter discusses the literature that has been established about use of technology in management of projects and their influence of the performance of projects. The chapter as well looks at the theoretical framework used as a basis for linking the use of technology in project management and its effects on the performance of projects. The chapter also carries out reviews of the past studies done by other researchers about the use of technology in management of projects.

2.2 Theoretical Review

2.2.1 Diffusion of Innovations (DOI) theory
According to Rogers (1995), the theory of Diffusion of Innovations is well known. Rogers describes diffusion of innovations as: “the process by which an innovation is communicated through certain channels over time among the members of social systems. It is a special type of communication, in that the messages are concerned with new ideas. Technology diffusion is an indispensable process through which technological potential of innovative activities can be actually turned into productivity. Various characteristics of the economic environment in which diffusion takes place may affect the pace of diffusion, while the diffusion itself may also have feedbacks on the environment. A decision not to adopt an innovation relates to the rejection of the available new idea. However, in order to explain the rate of adoption of innovations Rogers suggests measurement of the following perceived characteristics of innovations: relative advantage compatibility; complexity; trial ability; and observability. Roger postulated that the adoption of innovations is
influenced by these five characteristics, and that they can explain the rate of technology adoption.

Cheung *et al.* (2000) defined complexity as the extent to which an innovation can be considered relatively difficult to understand and use. They found that complexity negatively influences the adoption of internet usage. Complexity is the opposite of ease of use. Ease of use refers to the extent to which technology is perceived as easy to understand and operate. Lin, (2011) suggests that there is a strong impact of perceived ease of use of new technology on its adoption.

Diffusion of Innovations (DOI) theory is one such framework that the study will use to approach the problem. DOI is a general theory of how new ideas are spread and adopted in a community, and it seeks to explain how communication channels and opinion leaders shape adoption. DOI Theory, developed by E.M. Rogers is one of the oldest social science theories. It originated in communication to explain how, over time, an idea or product gains momentum and diffuses through a specific population or social system. The end result of this diffusion is that people, as part of a social system, adopt a new idea, behavior, or product. Adoption means that a person does something differently than what they had previously (Rogers, 2010).

Medlin (2001) used Rogers’ (1995) diffusion of innovations theory to examine the selected factors that might influence a faculty member's motivation and decision to adopt new electronic technologies in classroom instruction. Medlin organized the findings into three groups: social, organizational, and personal motivational factors. As social factors, friends, mentors, peer support, and students were found to be the significant predictors that may influence a faculty member’s decision to adopt electronic technologies in the classroom.
The organizational variables, including physical resource support and mandates from the university, also were statistically significant in predicting the faculty members’ use of electronic technologies in the classroom. “Personal interest in instructional technology,” “personal interest in improvement in my teaching,” and “personal interest in enhancing student learning” were cited as three personal motivational variables that might affect faculty members’ decision to adopt instructional technologies. However, Medlin did not find a significant difference among the self-identified adopter behavior categories based on Rogers’ theory in terms of social, organizational, and personal motivational factors.

Jacobsen (1998) used Rogers’ (1995) diffusion theory to determine the adoption patterns and characteristics of faculty who integrate computer technology for teaching and learning in higher education. She used both qualitative and quantitative methods to analyze the characteristics of early adopters and the difference between early adopters and mainstream faculty. The selected factors investigated were patterns of computer use, computer expertise, generalized self-efficacy, participant information, teaching and learning changes, motivators to integrate technology for teaching and learning, impediments to integrating technology for teaching and learning, learning about technology, methods for using and integrating technology in teaching and learning, and evaluating the outcomes of using technology for teaching and learning.

Less’ (2003) quantitative research study used Rogers’ (1995) diffusion of innovations theory to investigate faculty adoption of computer technology for instruction in the North Carolina Community College System. She classified the faculty members based on Rogers’ five categories of innovation adoption and compared them on the demographic variables of age, gender, race/ethnicity, teaching experience, and highest degree attained. While a significant relationship emerged between Rogers’ adopter
categories and their years of teaching experience and highest degree attained, the results did not show an important difference between faculty adopter categories and age, gender, and race/ethnicity. Less further classified the faculty as users in any of Rogers’ five categories and non-users of computer technology in instruction. No significant difference existed between users and non-users in demographic characteristics of age, gender, race/ethnicity, teaching experience and highest degree attained.

Using Rogers’ diffusion theory, Blankenship (1998) employed both qualitative and quantitative research methods in studying the factors that were related to computer use by instructors in teaching. In his study, the variables were attitude toward computers, access to computers, training in computer use, support for computer use, age, grade level taught, curriculum area, gender, and teaching expertise. All these factors were used to predict computer use by teachers in classroom instruction. One of the major findings of the study was that grade level and curriculum area must be considered for successful training. Also, attitude, support, access, and age were statistically significant predictors of computer use in classroom instruction. Finally, Blankenship suggested the following strategies to increase computer use in classroom instruction: grade and curriculum targeted computer training, technical support, and computer labs in every building.

Using quantitative research methods, Surendra (2001) examined the diffusion factors proposed by Rogers (1995) and other sources to predict the acceptance of Web technology by professors and administrators of a college. He reviewed the training factor among the types of access. Access in general and training in particular were found to be the best predictors in the diffusion process of Web technology-based educational innovation. Moreover, he found that the diffusion factors, Rogers’
attributes of innovations, are useful predictors of the adoption of innovation. Also, a relationship was found between computer knowledge and the adoption of innovation. Carter (1998) conducted a computer survey and in-depth interviews to determine computer-based technologies that were being used by the faculty members and the factors that affect their use of these technologies. Faculty attitudes toward using computer-based technology, support, resources, and training were the selected factors needed to use these technologies effectively. Also, Carter found that word processing software, e-mail, and Internet resources were the most frequently used computer-based technologies.

Another study was conducted by Zakaria (2001) on factors related to IT implementation in the curriculum. Theselected factors in the study were the Malaysian Ministry of Education Polytechnic faculty members’ attitudes toward IT, their IT use in teaching, and the availability of IT. Despite a lack of IT use in general, faculty members usually had a very positive attitude toward IT use in their teaching. Most faculty members reported barriers to IT use in their teaching. Furthermore, Zakaria argued there was a gender difference in terms of IT use. No significant difference existed between the faculty members’ department membership and IT use in general.

Also, he found that the highest level of education was negatively correlated with IT use and other demographic variables, and the level of education was correlated with email and World Wide Web use. While age was positively correlated with teaching experience, teaching load was significantly correlated with online discussion use. Finally, the highest level of education and adoption willingness were found to be the most significant predictors of IT use in teaching.
Analyzing the data quantitatively and qualitatively, Anderson et al. (1998) studied the attitudes, skills, and behaviors of the faculty members related to their IT use at a large Canadian research university. Based on Roger’s (1995) two major adopter categories, they defined the faculty members as “earlier adopters” and “mainstream faculty” and provided strategies for reducing the gap between these two groups. Although mainstream faculty used information technologies for research and professional communication applications, their adoption of these applications in teaching was very low. To increase their adoption of computer technologies for instructional purposes, the incentives, training programs, and barriers should be taken into account in comprehensive adoption strategies.

This framework is in line with the analysis of the technology adoption in project management. The decision by any organization to adopt the technology is influenced partly by the factors highlighted in the diffusion of innovation theory. It is understood that some of the technology used is new and have to be diffused into the society using different channels and different rates. As such, among the people that adopt the technologies, there are roles played by the Innovators, the early adopters, the early majority, the late majority and the laggards.

2.2.2 Technology Acceptance Model (TAM)

TAM is a theoretical model that evaluates the effects of things like system characteristics on user acceptance (Davis, 1986). TAM assumes that a computer user generally acts quite rationally and uses information in a systematic manner to decide whether to adopt, or not to use this technology in the workplace. Davis (1986) identified three major determinants of technology acceptance that relate to cognition and effectiveness and were suggested by previous research studies. He began with the TRA and adapted this as a basis for causal links between perceived usefulness,
perceived ease of use, attitude towards using technology and behavioral intention to explain technology adoption.

Relative advantage refers to the degree to which an innovation is perceived as providing more benefits than its predecessor (Moore & Benbasat 1991). Relative advantage results in increased efficiency, economic benefits and enhanced status (Rogers 2003). Past research has found that relative advantage of an innovation is positively related to the rate of adoption (Moore & Benbasat 1991). Research suggests that when user perceives relative advantage or usefulness of a new technology over an old one, they tend to adopt it.

Several studies have examined TAM as a model to explain how people adopt and use e-learning. Selim (2003) stated that there was a need to investigate TAM with web-based learning. He put forward the course website acceptance model (CWAM) and tested the relationships among perceived usefulness, perceived ease of use and intention to use with university students using the structural equation modeling techniques of the LISREL program. He concluded that the model fit the collected data and that the usefulness and ease of use turned out to be good determinants of the acceptance and use of a course website as an effective and efficient learning technology. Perceived usefulness can be defined as the extent to which a university student believes using e-learning will boost his or her learning. Meanwhile perceived ease of use is defined as the extent to which one believes using e-learning will be free of cognitive effort. In this study, e-learning refers to pure, web-based, asynchronous learning through an Internet site operated by the university. It is also supported by the learning management system (LMS) of the university.
Lee, Cheung, & Chen (2005) did similar research with the LISREL program to investigate university students’ adoption behavior towards an Internet-based learning medium (ILM) introducing TAM, but they integrated TAM with motivational theory. They included perceived enjoyment as an intrinsic motivator in addition to perceived usefulness and perceived ease of use into the TAM. According to their results, perceived usefulness and perceived enjoyment had an impact on both students’ attitude toward and intention to use ILM. However, perceived ease of use was found to be unrelated to attitude. Meanwhile, (Liu & Peng 2005) integrated TAM with flow theory that emphasizes concentration on the structural model. They argued that university e-learning system users should be regarded as both system users and learners. In addition, Liu, Liao, and Peng adopted e-learning presentation type as an external variable into the model. They concluded that e-learning presentation type and users’ intention to use e-learning were related to one another, and concentration and perceived usefulness were considered intermediate variables.

Pituch and Lee (2006) added system and learner characteristics as external variables that were hypothesized to impact perceived usefulness, perceived ease of use, and use of an e-learning system. After conducting a structural equation modeling technique with LISREL, they concluded that system characteristics were important determinants to perceived usefulness, perceived ease of use, and use of an e-learning system, and that the theoretical model based on TAM was well supported. (Saadé and Tan 2007) also insisted that university students’ participation and involvement were important to successful e-learning systems and therefore students’ acceptance behavior should be assessed. They suggested that TAM was a solid theoretical model where its validity can extend to the multimedia and e-learning context. Venkatesh and Davis (1996) focused on understanding the antecedents of the perceived ease of use. They
concluded that computer self-efficacy acts as a determinant of perceived ease of use both before and after hands-on use and that the objective usability was found to be a determinant of ease of use only after direct experience with a system.

In the meantime, Grandon, Alshare, and Kwan (2005) insisted that e-learning self-efficacy was found to have indirect effect on students’ intentions through perceived ease of use. In addition, Mungania and Reio (2005) found a significant relationship between dispositional barriers and e-learning self-efficacy. They argued that educational practitioners should take into consideration the learners’ dispositions and find ways through which e-learning self-efficacy could be improved. In this study, e-learning self-efficacy is generally represented as the personal confidence in finding information and communicating with an instructor within the e-learning system and the necessary skills for using the system.

As suggested in TAM2, subjective norm, one of the social influence variables, refers to the perceived social pressure to perform or not to perform the behavior (Ajzen, 1991). It seems important to determine how social influences affect the commitment of the user toward use of the information system for understanding, explaining, and predicting system usage and acceptance behavior (Malhotra & Galletta, 1999). According to the study done by Gradon, Alshare, and Kwan (2005), subjective norm was found to be a significant factor in affecting university students’ intention to use e-learning. In contrast, the study done by Ndubisi (2006) showed that subjective norm had no significant effect on university students’ intention to use e-learning. This kind of inconsistency may be resolved through the structural equation modeling (SEM), which indicates spurious effects and indirect effects as well as direct effects (Sobel, 1987).
In general, variables related to the behavioral intention to use information technology or to the actual use of information technology could be grouped into four categories: individual context, system context, social context, and organizational context. While social context means social influence on personal acceptance of information technology use, organizational context emphasizes any organization’s influence or support on one’s information technology use. Thong, Hong, and Tam (2002) identified relevance, system visibility, and system accessibility as organizational context variables. They reported that the organizational context affects both perceived usefulness and perceived ease of use of a digital library. Lin and Lu (2000) similarly reported that higher information accessibility brings about higher use of information and higher perception of ease of use. In this study, e-learning accessibility refers to the degree of ease with which a university student can access and use a campus e-learning system as an organizational factor.

TAM model, proposed is primarily intended to foretell users’ acceptance of Information Technology and usage in an organizational perspective. By focusing on the attitude explanations of intention to use a specific technology or service, TAM model deals with perceptions as opposed to real usage, suggests while a new technology is presented to the potential adopter, two attitude-affecting factors, Perceived usefulness and perceived ease of use, influence their decision about how and when they will use it Davis (1989). As an extension of TAM, Fishbein and Ajzen (1975) proposed the Theory of Reasoned Action (TRA). The main point of this theory is that human behavior originates from their intentions and behavioral intention (BI) is a kind of cognitive activity which consists of two facets, namely attitude and subjective norm. To sum up, according to TRA both attitude and subjective norm component of individual behavior is determined by salient belief.
According to Pikkarainen et al, (2004), principally Technology Acceptance Model (TAM) is used to test clients’ intent to assent or to refuse the use of a particular technology and in this case cashless payments. TAM was developed by Davis in 1989, and explains the logic used by a customer to accepts or decline a certain technology based on “it’s perceived ease of use” and “it’s perceived usefulness” (Aldas-Manzano, et al. 2009). Perceived ease of use is “the level at which a potential consumer of a technology believes a technology or a potential system is effortless” David et al (1989). Perceived usefulness to be the level at which a potential user of a technology perceived the use of the technology will enhance their performance.

2.3 Empirical Review

2.3.1 Communication Technology

The communication and information transfer are vital for the implementation and performance of the drip irrigation projects. The use of the traditional paper based communication system has given rise to problems such as human errors, lengthy time, delayed or non-arrival of information, wrong address, information overload and poor information which consequently give rise to some significant project risks such as time and cost overrun and poor quality material and workmanship (Mundy, 2001). These are some critical issues that need to be addressed in order to ensure the implementation and performance any future drip irrigation projects. When it comes to project management, people naturally think of its eight major elements: scope, time, cost, quality, human resources, risk, procurement, communication (Harindranath et al, 2007).

Project performance is closely related to all these factors. However, in the actual participation of project, we can find the factor which associated with most of the
activities is the project stakeholders; project stakeholders generally include the customer or user, the project team, the project company's managers and other major stakeholders. In the project management, time, cost, quality, human resources, risk, and procurement are related to communication. The key goal of communication in a project is to maintain the progress of the project, identify potential problems, requests for proposals to improve project performance. If the communication is carried out improperly, the project will fail unexpectedly. Communication in project management has its inevitable and irreplaceable important role. The project manager in addition to the preparation of a good communication plan should also understand how to manage the team, and how to meet the needs of customers, standing on the roles of stakeholders, so as to achieve project targets (Mundy et al. 2001).

According to Mulira, (2006), to carry out all elements of communication, to manage all related people, project manager should stand on stakeholders' perspective, from their needs and interests to achieve their maximum value through the project. If out of these, it is difficult to ensure project performance, then other factors should be looked into e.g. the role of technology. The communication result between project members and project manager directly affect the performance of the project.

The key goal of communication in a project is to maintain the progress of the project, identify potential problems, requests for proposals to improve project performance. If the communication is carried out improperly, the project will fail unexpectedly. Communication in project management has its inevitable and irreplaceable important role. The project manager in addition to the preparation of a good communication plan should also understand how to manage the team, and how to meet the needs of customers, standing on the roles of stakeholders, so as to achieve project targets (Mundy et al. 2001).
Communication technology is one of the central elements of integrative project management. The project manager should select appropriate communication technology equipment that will help him coordinate the activities of the implementation team. The technology should be able to coordinate and monitor all the ongoing project activities in the team (Parent *et al*, 2013). One such technology that can be used for coordinated communication is the use of the intranet. This idea has been emphasized by Wilkinson (2005). The author states that there should be integration of the back office with the other systems of the project. All the project teams should be in a position to access the intranet regardless of their locations. With the availability of the intranet, it is easy for the project manager and the implementation team to access information about the progress of the project.

The virtual private network access to the intranet has been suggested by authors like Ohrtman (2004) as one of the methods that can be used to connect remote users to an intranet. It is described as a network that connects remote users securely to an enterprise. The author gives an example of the salespeople that are equipped with telecommuters and laptops who would like to connect, in an intermittent manner, from different locations like hotels, convention centers, coffee shops and airports. The working of a project team can be similar to this description. If some of the project members are working from remote areas, it is easy for them to log into the intranet from the remote locations and monitor the progress of other team members.

### 2.3.2 Cost Tracking Technology

The use of technology for cost control methods have been studied by researchers. Studies in this area suggest that organizations should realize greater financial performance benefits when technological resources are used for cost control. Using hierarchical regression analyses, Maiga *et al*. (2014) indicates that while information
technology integration and cost control systems do not provide significant independent effects on plant financial performance, they do interact to positively impact manufacturing plant financial performance. This finding implies that maximizing the performance benefits of cost control systems and information technology integration require attending to the integration between them, rather than treating the levels of cost control systems and information technology integration as independent decisions.

The cost control can be carried out using the technological tools integrated in the internet. The shared databases in the internet can be used by project implementation team for improvement of the cost performance. Forbes and Ahmed (2010) reportes that cost control was an area that could be improved with the improvement of technology systems. The authors stated that Cost-Plus was one of the software that could be used to effectively control the cost of projects during project monitoring phases. As such, it is important to understand the ways through which technology can be used to control cost during project monitoring and how this can affect the performance of the overall projects.

2.3.3 Time Tracking Technology
The time management aspect of the project preparation stage can be well handled using the Gantt chart. This chart helps the project manager monitor the progress of the project tasks. Whenever there is a deviation that could result in lagging of some tasks, the Gantt chart will indicate. Still, the sequencing of project events, by use of the Program Evaluation and Review Technique (PERT), helps the project manager understand the tasks that can be crashed in case there are some lagging tasks (Larson & Gray, 2011).
In projects, the use of the work breakdown structure is important in the progress tracking function. The tasks in the work breakdown structure have limits that are clearly defined. A project manager can determine the progress of the projects by monitoring the finished vis-à-vis the unfinished tasks (Norman et al, 2010). The project manager is also able to check the work progress within each task. This is
possible through the comparison of the completed phase of the task against the uncompleted phase. Percentage completion of each task can be evaluated basing on the distribution of the activities on the work breakdown structure. In cases where the tasks are lagging, it is possible for the project manager to pinpoint the staff responsible for the delays. The delays can also be quantified in terms of time. All this is possible because of the simplification of activities by the work breakdown structure.

As is with the work breakdown structures in projects, the work packages are also important. In project management, a work package, as defined by Kerzner (2013), is the effort needed to come up with a deliverable within a project. Such an effort could be as simple as a single task or it could be several and related tasks. An understanding of the work packages helps in analysis of its importance in projects. Each step in work packages contains steps required for completion of a task. Each step has a deadline. The work packages help the project manager to ensure that the entire project has remained on schedule. When work packages are used, it is possible to work on different pieces of project tasks and activities simultaneously, using different people. Each project team is able to work on its work package, severally, and in the end, all the packages are brought together in a seamless way.

2.3.4 Quality Assurance Tools

Technology can be used when quality assurance tools are used in project management. Statistical control is one of the ways that can be used by the management of any organization to implement quality assurance in its production processes. This tool can be applied with an aim of monitoring and controlling a process in a company. It is mostly applicable in manufacturing set ups. The important
tools used in this process include control charts, design of experiments and continuous improvement (Larson & Gray, 2011).

When using the control charts, data is collected from various points along the processing map. The data is monitored to detect any variations. While using the chart, it is easy to determine sources of variation. These sources are then fixed. This ensures that the end products have conformed to the quality specifications. Ishikawa diagrams are also useful tools in quality assurance system. This is a cause and effect diagram that shows the cause of a specific event. This is used in quality defect prevention. The tool is useful in detecting the causes of defects on a product. After data has been collected, variations are identified. The Ishikawa diagram is used to identify the causes of the defects. The causes of defects in the product are categorized into methods, people, machines, materials, measurements and the environment (Chemuturi, 2010).

Salaheldin (2009) demonstrated some critical success factors for quality implementation and their impact on performance of SMEs. The empirical analysis revealed that there exists the International Journal of Ethics in Social Sciences, Vol.2, No. 1, June 2014 substantial positive effect of the quality implementation on both the operational and organizational performances of the SMEs. The results showed the central role of the strategic factors in the successful implementation of quality programs within the SMEs. Powell (1995) indicated in his study that most features generally associated with quality such as quality training, process improvement, and benchmarking do not generally produce advantage, but that certain tacit, behavioral, imperfectly imitable features such as open culture, employee empowerment, and executive commitment can produce advantage.
(Flynn et al 1995) in the exploratory investigation of the relationship of specific quality management practices to quality performance, a framework was constructed. It focused on both core quality management practices and on the infrastructure that creates an environment supportive of their use.

(Daniel et al 2005) explored the relationship between total quality management practices and organizational culture with the purpose of identifying the particular cultures that determine the successful implementation of quality practices. Interestingly, hierarchical culture was found to have a significant relationship with certain practices of quality management.

(Mile & Samson 1999) tested the strength of the relationship between quality management practice and organizational performance with and without the covariates, company size, industry type, and ISO 9000 certification status. The study concluded that there were significant differences in the relationship between quality control and organizational performance across industry sectors and different size companies, particularly on the effect of defect rates, warranty costs and innovation of new products.

(Karia & Assari 2006) examined the impact of total quality management practices on employees' work-related attitudes, such as job involvement, job satisfaction, career satisfaction, and organizational commitment. The results indicated that training and education had a significant positive effect on job involvement, job satisfaction and organizational commitment. Empowerment and teamwork significantly enhanced job involvement, job satisfaction, career satisfaction, and organizational commitment.

(Anderson & Sohal 1999), the paper examined the relationship between quality management practices and performance in small businesses. Ching-Chow (2006)
Confirmed that HRM significantly affects quality management practices. The study concluded that HRM practices have a significantly positive effect on the implementation of quality management. Implementing HRM practices can also have a significant effect on employee and customer satisfaction.

(Aagus & Abdullah 2000) reviewed total quality management practices in public listed manufacturing companies in Malaysia. The findings of the study indicated that the length of quality implementation has a significant impact on the companies' financial performance. The industrial manufacturing companies exhibit higher quality scores than the consumer manufacturing companies.

Hua et al (2000) examined several relationships, such as the relationship between total quality management practices and business results, between ISO 9000 standards and quality, and between employee involvement and quality management results, etc.

Ridgway (1994) examined the implementation of total quality management in small and medium-sized manufacturing companies. The study identified five major components of quality management and assessed the performance of the companies relative to these components. (Rahman & Siddiqui 2006) found to be catching fast in India as a synergy between quality management and IS accrues benefits for improving the quality of products and services – the most common ones being greater customer satisfaction, increased productivity of IS personnel and enhanced quality of services and products.

Keng-Boon et at (2012) examined the multidimensionality of quality management practices and its relationship with knowledge sharing as perceived by middle management employees in Malaysia’s ISO 9001:2000 certified firms of manufacturing sectors. The analytical results revealed that training and development,
customer focus, and teamwork showed a positive association with middle management employees’ knowledge sharing. Dizgah (2012) investigated the relationship between quality management practices and Organizational Performance. In the study have got mixed result, the relationship between quality management practices and Organizational Performance is positive but one principle (consultation) have negative relationship.

(García-Bernal & Ramírez-Aeso 2010) examined how firms can increase the benefits traditionally linked to this approach to management. The empirical results showed that adopting total quality management in a way that is consistent with organizational design postulates increases the organizational performance benefits of quality management. Shammot (2011) investigated the links between quality and high organizational performance, taking in account that achieving quality is the responsibility of all the organization members. And how total quality management practices can influence the customer behavior.

2.4 Summary of Literature review and gaps

This chapter has discussed studies that relate to the project monitoring and project performance. In the chapter, it has been found that project monitoring phase has an influence on the overall performance of the project. Empirical studies have shown that the activities undertaken in monitoring can determine if the project will be successful or not. It has been found that different tools can be used for project monitoring and technology is an important contributor to the phase. The chapter is thus essential to the understanding of the issue of the use of technology in project management, especially in project monitoring.
However, there is a gap in knowledge about the use of technology tools in monitoring of drip irrigation project and the effect of the same in project performances. There are no studies that show the extent of the use of ICT tools in project monitoring phase. The use of technology tools for communication, time, cost and quality control in project monitoring has not been documented in studies. As well, the effect of the use of such tools on the performance of the projects has not been studied. A survey will be done using a questionnaire which will be filled by the respondents. A representative of 70 respondents will be interviewed so as to make generalizations about the entire population. The study will use both primary and secondary data as its source of information. The findings of the research will help highlight areas of improvement for similar programs across the country and the world.

2.5 Conceptual Framework
A conceptual framework is a structure that tries to explain the relationship between variables in the study and shows the relationship by use of diagrams. It is a hypothesized model identifying the concepts under study and their relationship (Mugenda & Mugenda, 1999). The occurrence or change of independent variables will result in change in the dependent variable. The conceptual framework model in the study hypothesizes that, the use of technology is a function of, communication technology, cost tracking technology, time tracking technology and quality assurance tools. These four factors to a great extent, determine the performance of drip irrigation projects. These variables and their relationship are illustrated in the following conceptual framework.
CONCEPTUAL FRAMEWORK

Independent Variables | Dependent Variable
--- | ---
Communication technology  
- Use of internet  
- Use of Intranet  
- Email communication | Moderating Variables
- Literacy level  
- Infrastructure  
- Government policy

Cost tracking technology  
- Electronic payroll  
- Life cycle cost analysis  
- Use of budgetary control | Dependent Variable
- Performance of drip irrigation projects  
- Within Budget  
- Within Timeframe  
- Satisfaction of Stakeholders

Time tracking technology  
- Use of PERT  
- Use of WBS  
- Use of Gantt chart

Quality assurance tools  
- Use of electronic checklists templates  
- Failure testing software  
- Statistical Control

Figure 2.1 Conceptual Framework

Source: (Author, 2016)
CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction
This chapter describes the methodology of this study. In it there is a discussion on the research design, target population, sampling design, data collection instruments, data collection procedure piloting, data analysis and presentation and finally ethical considerations.

3.2 Research Design
The study used a descriptive research design. This is because it determines and reports the way things are. It attempts to describe attributes such as possible behavior, attitude, values and characteristics. Descriptive research is a scientific method of investigation which involves collection and analyzing of both quantitative and qualitative data. Mugenda & Mugenda, (2009) state that the descriptive design is a method, which enables the researcher to summarize and organize data in an effective and meaningful way. According to Cooper and Schindler (2008), a descriptive study is concerned with finding out the what, where and how of a phenomenon. This study therefore was able to generalize the findings to all the drip irrigation projects in the sub-county

3.3 Target Population
The study targeted officials, farmers and beneficiaries of the projects in the study around Laikipia County, Matanya Location. The study targeted 217 respondents derived from drip irrigation project groups funded by Government according to Nanyuki sub county office .Target population as described by Borg and Gall (2009) is a universal set of study of all members of real or hypothetical set of people, events or objects to which an investigator wishes to generalize the result. Mugenda & Mugenda
explained that the target population should have observable characteristics to which the researcher intents to generalize the result of the study.

3.4 Sampling Design

In the study, a stratified simple random sampling was undertaken. Four officials; Project manager, project beneficiary, supervisor and technical personnel from all the groups was selected through convenience sampling method. The sample size targeted 217 respondents as indicated in the sampling frame below.

Table 3.1 Sampling frame

<table>
<thead>
<tr>
<th>Target Group</th>
<th>Population (N)</th>
<th>Sample Rate (30%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project managers</td>
<td>20</td>
<td>6</td>
</tr>
<tr>
<td>Project Beneficiaries</td>
<td>60</td>
<td>18</td>
</tr>
<tr>
<td>Project Supervisors</td>
<td>40</td>
<td>12</td>
</tr>
<tr>
<td>Technical personnel</td>
<td>97</td>
<td>30</td>
</tr>
<tr>
<td>Total</td>
<td><strong>217</strong></td>
<td><strong>66</strong></td>
</tr>
</tbody>
</table>

Source: Researcher (2016)

3.5 Data Collection instruments

The study used questionnaires as the tool for data collection and they were constructed based on the four research objectives. A questionnaire is a research instrument consisting of series of questions and other prompts for the purpose of gathering information from respondents (Mugenda & Mugenda, 1999). The researcher
engaged the use of questionnaires which optimally used structured questions to obtain information from the respondents.

3.5.1 Validity of the Data Collection Instrument

According to Mugenda and Mugenda (1999) validity is the accuracy and meaningfulness of the instrument, the degree to which an instrument measures what it purports to measure. This implies that validity is the degree to which results obtained from the analysis of the data actually represent the phenomenon under study. To enhance content validity, the researcher consulted experts in the field of research and performed thorough literature review on the topic of study. This helped to ensure that the questionnaires represented the content, are appropriate for the sample and that the questionnaires are comprehensive enough to collect all the information needed to address the purpose and goals of the study.

3.5.2 Reliability of the data collection instrument

According to Mugenda and Mugenda (2003) reliability is a measure of the degree to which a research instrument yields consistent results or data after repeated trials. The reliability of the questionnaire was established through Cronbach’s Alpha. It determines the internal consistency or average correlation of items in a survey instrument to gauge its reliability Santos (1999).

According to Santos (1999), Cronbach’s Alpha coefficient ranges in value from 0 to 1 and may be used to describe the reliability of factors extracted from dichotomous and/or multi-point formatted questionnaires or scales. The higher the score, the more reliable the generated scale is. Nunnaly (1978) has indicated 0.7 to be an acceptable
reliability coefficient a point supported by Mugenda and Mugenda (2003). The researcher adopted 0.7 as the acceptable reliability coefficient for the study.

3.6 Data collection procedure
The researcher used the drop and pick later method. With the help of a research assistant, the researcher distributed the questionnaires to the respondents. At the time of collection of the questionnaires, the researcher addressed the problems that the respondents had in answering the questions.

3.7 Piloting
A pilot study was conducted whereby four officials from eight groups in Matanya responded to the questionnaire. Two groups were selected from each of the four wards in the constituency using convenience sampling method.

3.8 Data Analysis and Presentation
Questionnaires from the field were first checked for completeness. The data from the study was analyzed using both qualitative and quantitative techniques. Quantitative data was coded as per the research questions using the Statistical Package for Social Sciences (SPSS). On the other hand, qualitative data was analyzed through segregation into common themes.

Descriptive statistics such as percentages, frequencies, standard deviation and measures of central tendency will be used. Afterwards the research findings will be presented using frequency tables, pie charts and bar graphs.

Regression analysis was used to estimate the relationship among the research variables. The following equation was used.

\[ Y = a + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 \]
Where,

\[ a = \text{Constant} \]

\[ Y = \text{Performance of drip irrigation projects} \]

\[ X_1 = \text{Communication technology} \]

\[ X_2 = \text{Cost tracking technology} \]

\[ X_3 = \text{Time tracking technology} \]

\[ X_4 = \text{Quality assurance tools} \]

\[ b_1 = \text{coefficient of independent variable } X_1 \]

\[ b_2 = \text{coefficient of independent variable } X_2 \]

\[ b_3 = \text{coefficient of independent variable } X_3 \]

\[ b_4 = \text{coefficient of independent variable } X_4 \]

### 3.9 Ethical considerations

The questionnaires had a letter of informed consent on the first page. Prior to carrying out the study, the researcher explained the purpose of the study to participants in order for them to make informed decision on whether to participate in the study or not. To ensure anonymity, the participants were not required to write their names on questionnaires. The researcher also explained that he will treat the data collected with confidentiality and only use it for the intended purpose.
CHAPTER FOUR

DATA ANALYSIS, PRESENTATION AND INTERPRETATION

4.1 Introduction

In this chapter the results of the research on effects of technology on performance of drip irrigation projects in Matanya location, Laikipia County are presented, analysed and discussed. Descriptive and inferential statistics have been used to discuss the findings of the study. The study targeted a sample size of 66 respondents from which 54 filled in and returned the questionnaires. This represented 81.8% response rate. This conforms to Mugenda and Mugenda (2003) who recommends that a response rate of 50% is sufficient for scrutiny and exposure, 60% is good while rates over 70% are excellent. The variables analysed were: the influence of communication technology on the performance of drip irrigation projects in Matanya location, Laikipia County, the influence of cost tracking technology on the performance of drip irrigation projects in Matanya location, Laikipia County, the influence of time tracking technology on the performance of drip irrigation projects in Matanya location, Laikipia County and the influence of quality assurance tools on the performance of drip irrigation projects in Matanya location, Laikipia County.

4.2 Bio Data Analysis

4.2.1 Response Rate

The researcher analyses the return rate of the issued questionnaires in table 4.1 below.

<table>
<thead>
<tr>
<th>Strata</th>
<th>Administered</th>
<th>Returned</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project Managers</td>
<td>6</td>
<td>5</td>
</tr>
<tr>
<td>Project Beneficiaries</td>
<td>18</td>
<td>15</td>
</tr>
<tr>
<td>Project supervisors</td>
<td>12</td>
<td>9</td>
</tr>
<tr>
<td>Technical personnel</td>
<td>30</td>
<td>25</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>66</strong></td>
<td><strong>54</strong></td>
</tr>
</tbody>
</table>

Source: (Researcher, 2016)
Out of the 66 questionnaires administered to the respondents, 54 (82%) were filled and returned. This was a good response rate. Saunders et al. (2003) indicate that 30 to 50 per cent response rate is reasonable enough for statistical generalizations.

4.2.2 Gender of Respondents

The respondents were requested to state their gender and the results are presented in figure 4.1 below.

Figure 4.1 shows that the number of respondents was 39 males and 15 females representing 72% and 28% respectively.

Source: (Researcher, 2016)

**Figure 4.1 Gender of Respondents**

4.2.3 Age of Respondents

The respondents were asked to indicate their age and their responses are presented in table 4.2 below.
Table 4.2 Age of Respondents

<table>
<thead>
<tr>
<th>Age</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 30</td>
<td>8</td>
<td>14.8</td>
</tr>
<tr>
<td>31-40</td>
<td>31</td>
<td>57.4</td>
</tr>
<tr>
<td>41-50</td>
<td>8</td>
<td>14.8</td>
</tr>
<tr>
<td>Above 50</td>
<td>7</td>
<td>13</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>54</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

Source: (Researcher, 2016)

Table 4.2 shows that majority of the respondents were from the 31-40 age group accounting for 57.4% of the total number of respondents. The least were from the above 50 years age group accounting for 13% while those in the less than 30 years and 41-50 age groups accounted for 14.8% each of the total number of respondents. The spread of these respondents across the most productive age groups supports FAO (1986) that over 75% of the population of Kenya relies heavily on subsistent farming and 52% of her entire workforce directly practices small-scale farming including pastoral activities.

4.2.4 Education Level of the Respondents

The respondents were requested to indicate their level of education and their responses are summarized in table 4.3 below.
Table 4.3 Education Level of Respondents

<table>
<thead>
<tr>
<th>Level of education</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Secondary</td>
<td>35</td>
<td>64.8</td>
</tr>
<tr>
<td>College</td>
<td>13</td>
<td>24.1</td>
</tr>
<tr>
<td>University</td>
<td>4</td>
<td>7.4</td>
</tr>
<tr>
<td>Post graduate</td>
<td>2</td>
<td>3.7</td>
</tr>
<tr>
<td>Total</td>
<td>54</td>
<td>100</td>
</tr>
</tbody>
</table>

Source: (Researcher, 2016)

Table 4.3 shows that most respondents were educated up to secondary level accounting to 64.8% of the total number of respondents. Those who had college level education were 24.1%, university level were 7.4% and those with post graduate education accounted for 3.7% of the total number of respondents.

The high number of those lacking post-secondary training affirms Derek (2005), Bigio (2009) and Kerzner (2009) that lack of quality training is a common characteristic of agricultural rural based projects.

4.2.5 Length of Service

The respondents were asked to indicate the length of their service in the projects in question and their respondents are summarised in table 4.4 below.
Table 4.4 Length of Service of the Respondents

<table>
<thead>
<tr>
<th>Number of years</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-5</td>
<td>26</td>
<td>48</td>
</tr>
<tr>
<td>6-10</td>
<td>22</td>
<td>40</td>
</tr>
<tr>
<td>Above 10</td>
<td>6</td>
<td>12</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>54</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

Source: (Researcher, 2016)

Table 4.4 shows that most respondents had worked in their projects for between 1-5 years accounting for 48% of the total number of respondents. The fewest had worked for over 10 years accounting for 12% while those who had worked for between 6-10 years accounted for 40% of the total number of respondents.

The significance of years of experience in adoption of technology is supported by Less’ (2003) whose study found a significant relationship between Rogers’ (1995) adopter categories and years of the respondents’ teaching experience.

4.2.6 Position in the Project

The respondents were asked to indicate their position in the project and their responses are summarized in the figure 4.2 below.

Figure 4.2 shows that most respondents were in the technical personnel category accounting for 46% of the total number of respondents. The least were managers accounting for 9%. Beneficiaries accounted for 28% while project supervisors accounted for 17% of the total number of respondents.
4.2.7 Years of Project Existence

The respondents were requested to indicate the length of existence of their projects and their responses are summarized in table 4.5 below.

Table 4.5 Years of Project Existence

<table>
<thead>
<tr>
<th>Years of existence</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-5</td>
<td>12</td>
<td>22</td>
</tr>
<tr>
<td>6-10</td>
<td>20</td>
<td>37</td>
</tr>
<tr>
<td>11-15</td>
<td>16</td>
<td>30</td>
</tr>
<tr>
<td>Above 16</td>
<td>6</td>
<td>11</td>
</tr>
<tr>
<td>Total</td>
<td>54</td>
<td>100</td>
</tr>
</tbody>
</table>

Table 4.5 indicates that most projects have been in operation for between 6-10 years accounting for 37%. The least had been in existence for over 16 years accounting for
11%. Those which had been in existence for between 1-5 years were 22% while those which had been operational for between 11-15 years were 30%.

4.3 Study Findings

In this section, the researcher presents the study findings as per the research variables.

4.3.1 Communication Technology and Performance of Drip Irrigation Projects

In this section, the researcher sought to establish the influence of communication technology on performance of drip irrigation projects in Matanya location, Laikipia County.

4.3.1.1 Adoption of Communication Technology in Project Management

The respondents were requested to indicate whether communication technology had been adopted in their project by the management and their responses are summarized in figure 4.3 below.

Figure 4.3 shows that the majority of projects accounting for 93% have adopted communication technology. Only a paltry 7% have not adopted communication technology in management. This outcome is supported by Parent et al (2013), who argued that communication technology is one of the central elements of integrative project management.
4.3.1.2 Importance of a Good Communication Plan.

The respondents were requested to indicate whether a good communication plan was vital in project performance and their responses are summarised in figure 4.4 below.

Figure 4.4 shows that majority of the respondents accounting for 96% of the total number of respondents affirmed that a good communication plan is vital in project management. Only 4% thought otherwise. These views are supported by Mundy et al (2001) who argued that a project manager should prepare a good communication plan.

Source: (Researcher, 2016)
Figure 4.4 Importance of a Good Communication Plan.

4.3.1.3 Level of Communication Technology Influence on Project Performance

The respondents were asked to rate statements relating to communication technology and its influence on project performance on a scale of 1-5; 1=strongly disagree, 2=Disagree, 3=Neutral, 4=Agree and 5=strongly agree. Means for the statements were established in order to provide a generalised feeling of all the respondents. Means less than 1.5 implied that the respondents strongly disagreed with the statements, >1.5<2.5 =disagreed, >2.5<3.5=neutral, >3.5<4.5=agreed while means greater than 4.5 indicated that the respondents strongly agreed with the statements.

A standard deviation of >1 indicated that the responses are further spread out from the mean, 0.5-1 indicated a moderate distribution of responses around the mean whereas <0.5 depicted a concentration around the mean.
Table 4.6 Level of Communication Technology Influence on Project Performance

<table>
<thead>
<tr>
<th>Statements</th>
<th>N</th>
<th>Mean</th>
<th>Std deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intranet is used during project monitoring.</td>
<td>54</td>
<td>3.46</td>
<td>1.161</td>
</tr>
<tr>
<td>Management uses the internet regularly in the course of project management.</td>
<td>54</td>
<td>4.43</td>
<td>0.792</td>
</tr>
<tr>
<td>Emails are used regularly in project communication.</td>
<td>54</td>
<td>3.94</td>
<td>1.392</td>
</tr>
<tr>
<td>Communication and information transfer are vital for the implementation and performance of projects.</td>
<td>54</td>
<td>4.70</td>
<td>0.461</td>
</tr>
<tr>
<td>Communication between project members and project managers directly affects the performance of the project.</td>
<td>54</td>
<td>4.85</td>
<td>0.359</td>
</tr>
<tr>
<td>Key goals of communication are to maintain progress, identify potential problems, request for proposals to improve project performance.</td>
<td>54</td>
<td>4.31</td>
<td>0.886</td>
</tr>
<tr>
<td>Communication in project management has its inevitable and irreplaceable important role.</td>
<td>54</td>
<td>4.81</td>
<td>0.392</td>
</tr>
<tr>
<td>Improper communication leads to failure.</td>
<td>54</td>
<td>4.17</td>
<td>0.795</td>
</tr>
</tbody>
</table>

Source: (Researcher, 2016)

Table 4.6 shows that on average respondents strongly agreed that communication and information transfer are vital for the implementation and performance of drip irrigation projects with a mean of 4.7, that communication between project members and project managers directly affects the performance of the project (4.85) and that communication in project management has its inevitable and irreplaceable important role (4.81). Further, the respondents on average agreed that the management uses the internet regularly in the course of project management with a mean of 4.43, that E-mails are used regularly in project communication (3.94), that the key goals of
communication are to maintain progress, identify potential problems and request for proposals to improve project performance (4.31) and that improper communication leads to project failure (4.17). Finally, on average the respondents were neutral on the statement that intranet is used during project monitoring with a mean score of 3.46.

These findings are consistent with Parent et al (2013) that communication technology is one of the central elements of integrative project management. He further observed that the project manager should select appropriate communication technology that will help him coordinate the activities of the implementation team. The technology should be able to coordinate and monitor all the on-going project activities in the team.

4.3.1.4 The Extent of Communication Technology Influence on Performance of Drip Irrigation Projects

The respondents were requested to give their opinion on the extent to which communication technology influences the performance of drip irrigation projects and their responses are summarised in table 4.7 below.

Table 4.7 Extent of Communication Technology influence on performance of projects

<table>
<thead>
<tr>
<th>Response</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>To a very low extent</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>To a low extent</td>
<td>3</td>
<td>5.6</td>
</tr>
<tr>
<td>To a moderate extent</td>
<td>7</td>
<td>13</td>
</tr>
<tr>
<td>To a great extent</td>
<td>21</td>
<td>38.9</td>
</tr>
<tr>
<td>To a very great extent</td>
<td>23</td>
<td>42.6</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>54</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

Source: (Researcher, 2016)
Table 4.7 shows that majority of respondents accounting for 42.6% felt that communication technology influences the performance of drip irrigation projects to a very great extent. Those who felt that communication technology influences performance of drip irrigation projects to a great extent were 38.9%, to a moderate extent 13% and to a low extent 5.6%.

These findings are supported by Mundy (2001) who while supporting communication technology in project management argued that the use of the traditional paper based communication system gives rise to problems such as human errors, lengthy time, delayed or non-arrival of information, wrong address, information overload and poor information which consequently gives rise to some significant project risks such as time and cost overruns and poor quality material and poor workmanship.

4.3.2 Cost tracking Technology and Performance of Drip Irrigation Projects

In this section, the researcher sought to establish the influence of cost tracking technology on performance of drip irrigation projects in Matanya location, Laikipia County.

4.3.2.1 Adoption of Cost Tracking Technology

The respondents were asked whether cost tracking technology had been adopted in their projects and their responses are summarised in figure 4.5 below.

From figure 4.5 it can be seen that majority of projects have adopted cost tracking technology accounting for 98% of those surveyed.
4.3.2.2 Level of Cost Tracking Influence on Project Performance

The respondents were asked to rate statements relating to cost tracking technology and its influence on project performance on a scale of 1-5; 1=strongly disagree, 2=Disagree, 3=Neutral, 4=Agree and 5=Strongly agree. Their responses are summarised in table 4.8 below.

Table 4.8 Level of Cost Tracking Influence on Project Performance

<table>
<thead>
<tr>
<th>Statement</th>
<th>N</th>
<th>Mean</th>
<th>Std</th>
</tr>
</thead>
<tbody>
<tr>
<td>Technology is used in budgetary control in monitoring of the projects</td>
<td>54</td>
<td>4.54</td>
<td>0.503</td>
</tr>
<tr>
<td>Technology is used in life cycle cost analysis in project management</td>
<td>54</td>
<td>3.8</td>
<td>1.053</td>
</tr>
<tr>
<td>There is use of electronic payroll in the drip irrigation projects</td>
<td>54</td>
<td>3.94</td>
<td>0.920</td>
</tr>
<tr>
<td>The use of life cycle cost analysis helps in cutting down unnecessary expenses.</td>
<td>54</td>
<td>4.07</td>
<td>0.887</td>
</tr>
<tr>
<td>The use of budgetary control ensures the project is completed within budget/cost.</td>
<td>54</td>
<td>4.63</td>
<td>0.487</td>
</tr>
</tbody>
</table>

Source: (Researcher, 2016)
Table 4.8 shows that on average, the respondents strongly agreed that the use of budgetary control ensures the project is completed within budget/cost with a mean of 4.63 and that technology is used in budgetary control in monitoring of the projects with a mean score of 4.54. They agreed that the use of life cycle cost analysis helps in cutting down unnecessary expenses (4.07), there is use of electronic payroll in the drip irrigation projects (3.94) and technology is used in life cycle cost analysis in the project management (3.8).

The above findings are consistent with Maiga et al (2014) that maximizing the performance benefits of cost control systems and information technology integration require attending to the integration between them, rather than treating the levels of cost control systems and information technology integration as independent decisions.

4.3.2.3 Extent of Cost Tracking Technology Influence on Project Performance

The respondents were requested to give their opinion on the extent to which cost tracking technology influences the performance of drip irrigation projects and their responses are summarised in table 4.9 below.

Table 4.9 Extent of Cost Tracking Technology Influence on Project Performance

<table>
<thead>
<tr>
<th>Response</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>To a very low extent</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>To a low extent</td>
<td>3</td>
<td>6</td>
</tr>
<tr>
<td>To a moderate extent</td>
<td>10</td>
<td>18</td>
</tr>
<tr>
<td>To a great extent</td>
<td>14</td>
<td>26</td>
</tr>
<tr>
<td>To a very great extent</td>
<td>27</td>
<td>50</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>54</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

Source: (Researcher, 2016)
Table 4.9 shows that half of the respondents (50%) felt that cost tracking technology influences performance of drip irrigation projects to a very great extent. Those who felt that it influenced performance of drip irrigation projects to a great extent were 26%, to a moderate extent (18%), to a low extent (6%) while none felt that its influence was to a very low extent. These findings find support in Maiga et al (2014) who argued that organizations should realize greater financial performance benefits when technological resources are used for cost control.

4.3.3 Time Tracking Technology and Performance of Drip Irrigation Projects.

In this section, the researcher sought to establish the influence of cost tracking technology on performance of drip irrigation projects in Matanya location, Laikipia County.

4.3.3.1 Adoption of Time Tracking Technology

The respondents were asked whether time tracking technology had been adopted in their projects and their responses are presented in figure 4.6 below.

Figure 4.6 shows that majority of projects accounting for 98% have adopted time tracking technology in their management.
4.3.3.2 Level of Time Tracking Technology Influence on Performance of Projects

The respondents were asked to rate statements relating to time tracking technology and its influence on project performance on a scale of 1-5; 1=strongly disagree, 2=Disagree, 3=Neutral, 4=Agree and 5=strongly agree. Their responses are summarised in table 4.10 below.

Source: (Researcher, 2016)

Figure 4.6 Adoption of Time Tracking Technology
Table 4.10 Level of Time Tracking Technology Influence on Performance of Projects

<table>
<thead>
<tr>
<th>Statement</th>
<th>N</th>
<th>Mean</th>
<th>Std deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>WBS is always used in monitoring of projects</td>
<td>54</td>
<td>4.39</td>
<td>0.920</td>
</tr>
<tr>
<td>Use of Gant charts improves productivity through tracking of results</td>
<td>54</td>
<td>3.80</td>
<td>0.959</td>
</tr>
<tr>
<td>CPM helps in identification of urgent needs within the project cycle</td>
<td>54</td>
<td>4.28</td>
<td>0.920</td>
</tr>
<tr>
<td>PERT helps the project manager understand the tasks that can be crashed in case there are some lagging tasks</td>
<td>54</td>
<td>3.61</td>
<td>1.220</td>
</tr>
<tr>
<td>The time management aspect of the project preparation stage can be well handled using the Gant chart</td>
<td>54</td>
<td>4.39</td>
<td>0.738</td>
</tr>
<tr>
<td>The use of WBS helps in the scope management which in consequence helps in completion of the project within scheduled time.</td>
<td>54</td>
<td>4.37</td>
<td>1.051</td>
</tr>
</tbody>
</table>

Source: (Researcher, 2016)

Table 4.10 shows that the respondents agreed to the statements that WBS is always used in monitoring projects with a mean score of 4.39, the time management aspect of the project preparation stage can be well handled using the Gant chart (4.39), the use of the WBS helps in the scope management which in consequence helps in completion of the project within scheduled time (4.37), CPM helps in identification of urgent needs within the project cycle (4.28), use of Gant charts improves productivity through tracking results (3.80) and PERT helps the project manager understand the tasks that can be crashed in case there are some lagging tasks (3.61).

These findings are consistent with Liberatore (2004) who argued that while large amounts of time and resources are dedicated to selecting and designing projects, it
remains of paramount importance that projects be adequately managed if they are to achieve their performance objectives. Projects need to be managed, that is, they need to be planned, staffed, organized, monitored, controlled, and evaluated.

4.3.3.3 Extent of Time Tracking Technology Influence on Performance of Projects

The respondents were asked to indicate the extent to which they felt that time tracking technology influenced the performance of drip irrigation projects and their responses are summarised in table 4.11 below.

Table 4.11 Extent of Time Tracking Technology Influence on Performance of Projects

<table>
<thead>
<tr>
<th>Response Percentage</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>To a very low extent</td>
<td>0</td>
</tr>
<tr>
<td>To a low extent</td>
<td>2</td>
</tr>
<tr>
<td>To a moderate extent</td>
<td>8</td>
</tr>
<tr>
<td>To a great extent</td>
<td>18</td>
</tr>
<tr>
<td>To a very great extent</td>
<td>26</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>54</strong></td>
</tr>
</tbody>
</table>

Source: (Researcher, 2016)

Table 4.11 shows that most respondents accounting for 48.1% felt that time tracking technology influenced to a very great extent the performance of drip irrigation projects. Those who felt that the influence was to a great extent were 33.3%, to a moderate extent (14.8%), to a low extent (3.7%) while none felt that the influence was to a very low extent. These findings affirm D’Atri et al (2011) argument that ICT
tools used in project monitoring phases are aimed at enhancing the performance of projects.

4.3.4 Quality Assurance Tools and Performance of Drip Irrigation Projects.

In this section, the researcher sought to establish the influence of quality assurance tools on performance of drip irrigation projects in Matanya location, Laikipia County.

4.3.4.1 Adoption of Quality Assurance Tools in Project Management

The respondents were requested to indicate whether quality assurance tools had been adopted in the management of their projects and their responses are presented in figure 4.7 below.

Figure 4.7 shows that majority of the respondents accounting for 96% of the total number of respondents shared that quality assurance tools have been adopted in the management of their projects. Only 4% felt that the tools had not been adopted.

Source: (Researcher, 2016)

Figure 4.7 Adoption of Quality Assurance Tools in Project Management


4.3.4.2 Level of Quality Assurance Tools Influence on Performance of Projects

The respondents were asked to rate statements relating to quality assurance tools and its influence on project performance on a scale of 1-5; 1=strongly disagree, 2=Disagree, 3=Neutral, 4=Agree and 5=strongly agree. Their responses are summarised in the table 4.12 below.

Table 4.12 Level of Quality Assurance Tools Influence on Performance of Projects

<table>
<thead>
<tr>
<th>Statement</th>
<th>N</th>
<th>Mean</th>
<th>Std deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>There is use of checklists in monitoring of the drip irrigation projects</td>
<td>54</td>
<td>3.19</td>
<td>1.214</td>
</tr>
<tr>
<td>Statistical control is used to implement quality assurance in the drip irrigation projects</td>
<td>54</td>
<td>4.41</td>
<td>0.962</td>
</tr>
<tr>
<td>Ishikawa diagrams are useful tools in quality assurance System</td>
<td>54</td>
<td>3.87</td>
<td>0.810</td>
</tr>
<tr>
<td>Management uses technology during failure tests in drip irrigation project monitoring</td>
<td>54</td>
<td>3.61</td>
<td>0.960</td>
</tr>
</tbody>
</table>

Source: (Researcher, 2016)

Table 4.12 shows that on average the respondents agreed that statistical control is used to implement quality assurance in the drip irrigation projects with a mean score of 4.41, Ishikawa diagrams are useful tools in the quality assurance system (3.87) and management uses technology during failure tests in drip irrigation project monitoring (3.61). On average the respondents were neutral on the statement that there is use of checklists in monitoring of the drip irrigation projects with a mean score of 3.19.
These findings support Larson & Gray (2011) that technology can be used when quality assurance tools are used in project management.

4.3.4.3 Extent of Quality assurance Tools Influence on Performance of Projects

The respondents were asked to indicate the extent to which they felt that quality assurance tools influence the performance of drip irrigation projects and their responses are summarised in table 4.13 below.

Table 4.13 Extent of Quality assurance Tools Influence on Performance of Projects

<table>
<thead>
<tr>
<th>Response</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percentages</td>
<td></td>
</tr>
<tr>
<td>To a very low extent</td>
<td>1</td>
</tr>
<tr>
<td>To a low extent</td>
<td>4</td>
</tr>
<tr>
<td>To a moderate extent</td>
<td>7</td>
</tr>
<tr>
<td>To a great extent</td>
<td>17</td>
</tr>
<tr>
<td>To a very great extent</td>
<td>25</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>54</strong></td>
</tr>
</tbody>
</table>

Source: (Researcher, 2016)

Table 4.13 shows that most respondents accounting for 46% felt that quality assurance tools influenced to a very great extent the performance of drip irrigation projects. Those who felt that it influenced to a great extent were 31%, to a moderate extent 13%, to a low extent 8% and to a very low extent 2%. These findings confirm conclusions made by Mile & Samson (1999) that there is a significant relationship between quality control and organizational performance.
4.4 Hypothesis Testing

The previous section had presented descriptive statistics on the effects of technology on performance of drip irrigation projects in Matanya location, Laikipia County. However, to draw inferences about the population there was need to empirically analyse the data. The study hypotheses based on the study objectives that the researcher sought to test are addressed in this section. They are: to establish the extent to which utilization of communication technology influences the performance of drip irrigation projects in Matanya location, Laikipia County (H₁), to determine the influence of cost tracking technology on the performance of drip irrigation projects in Matanya location, Laikipia County (H₂), to establish the extent to which utilization of time tracking technology influences the performance of drip irrigation projects in Matanya location, Laikipia County (H₃) and to determine the influence of the use of quality assurance tools on the performance of drip irrigation projects in Matanya location, Laikipia County (H₄).

The following was the study model that was tested.

\[ Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \varepsilon \]
Table 4.14 Coefficients of the Study Model

The researcher sought to test his hypotheses and the data is availed in the table below.

<table>
<thead>
<tr>
<th>Model</th>
<th>Unstandardized Coefficients</th>
<th>Standardized Coefficients</th>
<th>t</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>B</td>
<td>Std. Error</td>
<td>Beta</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>(Constant)</td>
<td>.663</td>
<td>.187</td>
<td>3.542</td>
</tr>
<tr>
<td></td>
<td>Communication technology</td>
<td>.368</td>
<td>.025</td>
<td>.597</td>
</tr>
<tr>
<td></td>
<td>Cost tracking technology</td>
<td>.287</td>
<td>.028</td>
<td>.519</td>
</tr>
<tr>
<td></td>
<td>Time tracking technology</td>
<td>.266</td>
<td>.030</td>
<td>.442</td>
</tr>
<tr>
<td></td>
<td>Quality assurance tools</td>
<td>.301</td>
<td>.027</td>
<td>.565</td>
</tr>
</tbody>
</table>

Source: (Researcher, 2016)

The results indicated that utilization of communication technology had a significance level of 0.002<0.05, use of cost tracking technology had a significance level of 0.04<0.05, utilization of time tracking technology had a significance level of 0.000<0.05 and use of quality assurance tools had a significance level of 0.001<0.05. This called for the rejection of the null hypotheses $H_1$, $H_2$, $H_3$, and $H_4$ and adoption of their alternative forms. This is because the variables of the study had P values less than 0.05 indicating they had a statistically significant influence on the dependent variable.

Since all the variables had a significant effect the study model remained as:

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

The study sought to estimate the relationship among the variables governed by the regression analysis formulae shown below.

\[ Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \epsilon \]

Where, \( Y \) is the performance of drip irrigation projects.

\( \beta_i \) is a multiple regression coefficient indicating the expected change in \( X_1 \) assuming other \( X \)'s are entirely held constant.

\( X_1 = \) Communication technology

\( X_2 = \) Cost tracking technology

\( X_3 = \) Time tracking technology

\( X_4 = \) Quality assurance tools

\( \epsilon = \) Error term

By using the beta values in table 4.xxx above the function changes as shown below.

\[ Y = 0.663 + 0.368 X_1 + 0.287 X_2 + 0.266 X_3 + 0.301 X_4 \]

4.5 Model Testing

The researcher sought to establish the goodness of fit of the study’s regression analysis model and this is presented in table 4.16 below.
Table 4.15 Goodness of Fit of the Study Model

<table>
<thead>
<tr>
<th>Model</th>
<th>R</th>
<th>R Square</th>
<th>Adjusted R Square</th>
<th>Std. Error of the Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>.937(a)</td>
<td>.879</td>
<td>.871</td>
<td>.06850</td>
</tr>
</tbody>
</table>

a Predictors: (Constant), Communication technology, Cost tracking technology, Time tracking technology, Quality assurance tools.
Source: (Researcher, 2016)

From table 4.15 above, Adjusted R is 0.871 and this means that there was a 0.871 positive variation in performance of drip irrigation projects index due to changes in the independent variables of the study: Communication technology, Cost tracking technology, Time tracking technology and Quality assurance tools. This means that 0.871 of variation in the dependent variable is explained by the model’s independent variables.
CHAPTER FIVE

SUMMARY OF FINDINGS, CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

This chapter presents the summary, the conclusion and the recommendations for further studies. The summary gives an overview of the entire work. It summarizes the results and the inferences. The conclusion section attempts to answer the question that prompted the study. The recommendation points out some of the weak points that might have been in the study and suggests areas that should be considered for further studies.

5.2 Summary of Findings

This study intended to find out the relationship between the use of IT tools in project monitoring and the performance of drip irrigation projects in Matanya, Laikipia County. In the analysis, the project performance indicators of timely completion of projects, quality conformance, and completion of project within budget, cost performance and customer satisfaction were used as the dependent variables. Time control, cost control, quality control and communication using IT were used as independent variables. They were used for measurement of use of IT tools during project monitoring.

To determine the relationship between utilization of communication technology and the performance of drip irrigation projects in Matanya location, Laikipia county, a multiple regression analysis model was used. The results of the model indicated the existence of a significant relationship between the two variables and the null hypothesis was rejected and its alternative form adopted.

To assess the relationship between cost tracking technology and the performance of drip irrigation projects in Matanya location, Laikipia County, the multiple regression
model was employed. The results of the model indicated that there indeed existed a significant relationship between the two variables. This led to the rejection of the null hypothesis and adoption of its alternative form.

To establish the relationship between utilization of time tracking technology and the performance of drip irrigation projects in Laikipia County, the multiple regression analysis model also was employed. The results of the model indicated that there existed a significant relationship between the two variables and as such the null hypothesis was rejected and its alternative form adopted.

To assess the relationship between quality assurance tools and the performance of drip irrigation projects in Matanya location, Laikipia County, the multiple regression analysis model was employed. The results of the model indicated that there existed a significant relationship between the two variables and as such the null hypothesis was rejected and its alternative form adopted.

To assess the relationship between the moderating variables and performance of drip irrigation projects in Laikipia County, the multiple regression analysis model was employed. The results of the model indicted that there existed no significant relationship between the two variables and the study failed to reject the null hypothesis.

5.3 Conclusion

From the results presented in this section, it is concluded that the use of IT tools during project monitoring does indeed influence the performance of drip irrigation projects. There is a correlation between the IT tools’ use and the project performance.

The study concludes that there is a positive relationship between the use of communication technology and performance of drip irrigation projects in Matanya
location, Laikipia County. The implication of this is that well defined communication technology helps in achievement of key milestones through well co-ordinated activities of the implementation team that are critical to the success and sustainability of a project.

The study also concludes that there is a positive relationship between cost tracking technology and performance of drip irrigation projects in Matanya location, Laikipia County. This implies that budgetary control helps in cutting down unnecessary expenses and that organizations realizes greater financial performance benefits when technological resources are used for cost control.

The study also concludes that there is a positive relationship between time tracking technology and performance of drip irrigation projects in Matanya location, Laikipia County. This implies that time tracking control helps in tracking results and understanding the tasks that can be crashed in case there are some lagging tasks thereby improving productivity.

The study also concludes that there is a positive relationship between quality control tools and performance of drip irrigation projects in Matanya location, Laikipia County. This implies that project teams are able to detect problems in their products early and correct in a timely manner any deviations and enhance to a great extent the performance of their projects.

**5.4 Recommendations**

Based on the findings, the study came up with the following recommendations:

Organizations should incorporate use of IT tools in project monitoring for the success of the project performance.
Organizations should invest in laying down a valid IT infrastructure to help in the monitoring of the projects.

Organizations should do capacity building for its volunteers the use IT tools in monitoring of projects to enhance project performance.

Organizations should install structured network at a central place to support voice and data. The departments should then be interlinked to improve on information sharing during monitoring of projects.

5.5 Areas for further study

Even though the study has been exhaustive in achieving its objectives, there are areas of improvement that could be adopted. The explanation to the relationship between some of the IT tools’ variables and project performances is not exhaustive. More studies need to be carried out to understand the specific relationships between each of the IT tools’ use and the project performance. A thesis can be developed and tested to understand this relationship in a better way. Document analysis should also be incorporated into such studies in future.
REFERENCES


APPENDICES

APPENDIX I: LETTER OF INTRODUCTION

TO WHOM IT MAY CONCERN

Dear Sir/Madam,

REF: COLLECTION OF RESEARCH DATA

I am a student pursuing a master’s degree in business administration, in Kenyatta University. As part of my course work assessment, I am required to submit a research project report on Information technology and organizational performance: Case study of drip irrigation projects in Matanya location, Laikipia County. In this regard I kindly request you to assist me in this study by filling the attached questionnaire to the best of your ability.

Please be assured that the information you provide will be used solely for academic purposes and all responses will remain confidential. Thank you very much for your time.

Yours Faithfully,

Peter Karanja

Researcher

Kenyatta University
APPENDIX II: QUESTIONNAIRE

Please answer all the questions by ticking on the spaces provided or use the spaces left for you.

PART A: Demographic Information

1. Gender
   Male [ ]
   Female [ ]

2. Age:
   Less than 30 Years [ ]
   31-40 Years [ ]
   41-50 years [ ]
   More than 50 Years [ ]

3. Highest level of education
   Secondary level [ ]
   College level [ ]
   University level [ ]
   Post graduate level [ ]

4. How long have you worked in this Project?
   1- 5 years [ ] 6 - 10years [ ]
   Above 10 years [ ]

5. Kindly indicate the position that you hold in the Project.
   Manager [ ] Supervisor [ ]
Farmer [ ] Technical personnel [ ]
Beneficiary [ ]
Any other (specify) ..........................................................

6. How long has your project been operational?
   1-5 years [ ] 6-10 years [ ]
   11-15 [ ] Above 16 years [ ]

7. Has the Project adopted technology in its operations?
   Yes [ ] No [ ]

8. If yes for how long has the project used technology?
   1-3 years [ ] 4-6 years [ ]
   7-10 years [ ] Above 10 years [ ]

Part B: Communication Technology

9. Has your project adopted communication technology in the management?
   Yes [ ] No [ ]

10. In your own opinion do you think good communication plan is vital in project performance?
   Yes [ ] No [ ]

11. Kindly indicate your level of agreement to the statements below relating to communication technology and its influence on the project performance. Use a scale of 1-5, where 1- Strongly disagree, 2- Disagree, 3- Neutral, 4- Agree, 5- Strongly agree.
Intranet is used during project monitoring

The management uses the internet regularly in the course of project management

E-mails are used regularly for communication between the project managers and employees

The communication and information transfer are vital for the implementation and performance of the drip irrigation projects

The communication between project members and project manager directly affect the performance of the project

The key goal of communication in a project is to maintain the progress of the project, identify potential problems, requests for proposals to improve project performance

Communication in project management has its inevitable and irreplaceable important role

If the communication is carried out improperly, the project will fail unexpectedly.

12. To what extent does Communication technology influence the performance of drip irrigation projects?

To a very low extent [ ]
To a low extent [ ]
To a moderate extent [ ]
To a great extent [ ]
To a very great extent [ ]
Part C: Cost Tracking Technology

13. Has the management adopted the cost tracking technology in the project?

   Yes [ ]     No [ ]

14. Kindly indicate your level of agreement to the statements below relating to cost tracking technology and its influence on the project performance. Use a scale of 1-5, where 1- Strongly disagree, 2- Disagree, 3- Neutral, 4- Agree, 5- Strongly agree.

<table>
<thead>
<tr>
<th>Statements</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Technology is used in budgetary control in monitoring of the projects</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Technology is used in life cycle cost analysis in the project management</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>There is use of electronic payroll in the drip irrigation projects</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The use of life cycle cost analysis helps in cutting down unnecessary expenses</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The use of budgetary control ensures the project is completed within budget/cost</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

15. To what extent does cost tracking technology influence the performance of drip irrigation projects?

   To a very low extent [ ]     To a low extent [ ]
   To a moderate extent [ ]     To a great extent [ ]
   To a very great extent [ ]
Part D: Time Tracking Technology

16. Has the management adopted the time tracking technology in the project?

Yes [ ] No [ ]

17. Kindly indicate your level of agreement to the statements below relating to time tracking technology and its influence on the project performance. Use a scale of 1-5, where 1- Strongly disagree, 2- Disagree, 3- Neutral, 4- Agree, 5- Strongly agree.

<table>
<thead>
<tr>
<th>Statements</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Work Breakdown Structure is always used in monitoring of projects</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Use of Gant Charts improve productivity through tracking of results</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Critical Path Method helps in identification of urgent needs within the project cycle</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Program Evaluation and Review Technique (PERT), helps the project manager understand the tasks that can be crashed in case there are some lagging tasks</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The time management aspect of the project preparation stage can be well handled using the Gantt chart</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The use of the work breakdown structure helps in the scope management which in consequence helps in completion of the project within scheduled time</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
18. To what extent does time tracking technology influence the performance of drip irrigation projects?

- To a very low extent [ ]
- To a low extent [ ]
- To a moderate extent [ ]
- To a great extent [ ]
- To a very great extent [ ]

Y

Part E: Quality Assurance Tools

19. Does the management use the quality assurance tools for the project to be successful?

- Yes [ ]
- No [ ]

20. Kindly indicate your level of agreement to the statements below relating to quality assurance tools and its influence on the project performance. Use a scale of 1-5, where 1- Strongly disagree, 2- Disagree, 3- Neutral, 4- Agree, 5- Strongly agree.

<table>
<thead>
<tr>
<th>Statements</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>There is use of e-checklists in monitoring of the drip irrigation projects</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Statistical control is used to implement quality assurance in the drip irrigation projects</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ishikawa diagrams are useful tools in quality assurance system.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Management uses technology during failure tests in drip irrigation project monitoring</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
21. To what extent do quality assurance tools influence the performance of drip irrigation projects?

To a very low extent [  ]
To a low extent [  ]
To a moderate extent [  ]
To a great extent [  ]
To a very great extent [  ]

Thank you for taking time to respond to this questionnaire.
### APPENDIX III: BUDGET

<table>
<thead>
<tr>
<th>ITEMS</th>
<th>JUSTIFICATION</th>
<th>COST</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stationery</td>
<td>Writing materials (pens paper, notebooks)</td>
<td>3,000</td>
</tr>
<tr>
<td>Internet cost</td>
<td>cost of browsing and printing</td>
<td>4,000</td>
</tr>
<tr>
<td>Typing and Printing, binding and Photocopying</td>
<td>The typesetting charges, printouts and photocopies</td>
<td>5,000</td>
</tr>
<tr>
<td>Library costs</td>
<td>User charges</td>
<td>2,000</td>
</tr>
<tr>
<td>Travelling</td>
<td>To the library and to meet supervisors</td>
<td>5,000</td>
</tr>
<tr>
<td></td>
<td>Administering Questionnaires &amp; Interviews</td>
<td></td>
</tr>
<tr>
<td>Contingencies</td>
<td>Other costs</td>
<td>2,500</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td><strong>21,500</strong></td>
</tr>
</tbody>
</table>
# APPENDIX IV: WORK PLAN

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Proposal writing</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Proposal corrections</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Defense</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Piloting and revision of instruments and Data collection</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Data analysis and submission</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>