INFLUENCE OF RISK MANAGEMENT STRATEGIES ON COMPLETION, COST AND QUALITY OF ROAD INFRASTRUCTURE DEVELOPMENT PROJECTS IN NAIROBI CITY COUNTY, KENYA

BY

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DECLARATION

This research project is my original work and has not been presented to any other University or institution of higher learning for an academic award.

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

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DEDICATION

This project is dedicated to my family and friends for their unwavering support, encouragement and guidance all through this journey. Special dedication to my two angels, Amy and Nadia who have been affected in every way possible by my quest. I will forever be grateful, thank you all.

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LIST OF ABBREVIATIONS

GDP - Gross Domestic Product

GoK – Government of Kenya

ICT - Information Communication Technology

RM – Risk Management

UK- United Kingdom

CI – Confidence Interval

DEFINITION OF TERMS

Infrastructure: Is the fundamental facilities and systems serving a country, city, or other areas, including the services and facilities necessary for its economy to function.

Risk: Is frequently referred to as the presence of potential or actual threats or prospects that influence the objectives of a project during construction, commissioning, or at the time of use.

Risk management: is a formal and orderly process of systematically identifying, analyzing, and responding to risks throughout the life cycle of a project to obtain the optimum degree of risk elimination, mitigation and/or control.

Cost overruns: This occurs when the costs being incurred are in excess of the amounts that had been budgeted for.

Road development / Infrastructure development: For this study these two terms have been used interchangeably to refer to the same concept

Road Completion: For this study, the term road completion has been used to refer to the successful attainment of road infrastructure development projects objectives in terms of cost, quality and within set timeliness.

ABSTRACT

The World Bank estimates a 10% rise in infrastructure assets through major infrastructure like road projects. Road infrastructure development projects however have a history of problems which are caused by; cost overruns, delays, failed procurements, or unavailability of private financing. In Kenya, many road construction projects are not completed within the initial set time which negatively affects the cost and quality of road construction projects. Effective risk management strategies allow a project manager to identify the project's strengths, weaknesses, opportunities, and threats. It is therefore important for infrastructure development projects to incorporate risk management into their projects. Despite this critical requirement, little is known about the influence of risk management strategies on cost, time and quality of completed road infrastructure development projects in Nairobi County. In scenarios where the information is available, it is held up in silos by a few in an organization and not really comprehended by all. The main objective of this study was therefore to assess the influence of risk management strategies on completion of road infrastructure projects in Nairobi County. A cross-sectional research design was adopted for this study targeting a sample of 75 road construction firms and risk managers selected from a total of 208 registered road construction firms in Nairobi County. Stratified sampling was used to select 57 local, and 14 foreign firms together with 4 other firms which had both local and foreign characteristics in their structures. One risk manager was interviewed per firm using structured questionnaires. Data were analyzed using descriptive statistics and association between variables was analyzed through cross-tabulation using chi-square tests and linear regressions. Risk avoidance was the most adopted type of management strategy and the main management strategy to mitigate all the risks. Avoidance of risks, mitigation of risks and acceptance were significantly associated with timely completion of road projects. Mitigation of risks, exploitation, sharing, and acceptance was significantly associated with the completion of road projects within the budget. The findings will enable the Ministry of Roads and Public works and Transport sector to work together with other stakeholders involved in road infrastructure development projects to address these risks.

CHAPTER ONE: INTRODUCTION

1.1 Background of the Study

In reference to Wikipedia, infrastructure is the fundamental facilities and systems serving a country, city, or other area, including the services and facilities necessary for its economy to function. (Lam, 1999) This applies to both developed and developing nations. The construction and repair of roads utilizes a great part of government expenditure in most economies around the world. This is because the development of infrastructure is one of the most important catalysts in boosting the growth of all major economic sectors in the country, thereby increasing the gross domestic product of the country (Mahendra, Pitroda and Bhavsar, 2014). The road sector is a vital sector in the economy of any country due to its impact on the welfare of its citizens and the investment involved. Good quality of road works is important for both safety and economic development reasons in any society (McKinsey Working Paper on Risk, 2013). However, most infrastructure development projects are always unique leading to risks, which rise from several different sources. The risk elements associated with road infrastructure projects influence the time, cost and the completion of the project (Akintoye and MacLeod, 1997).

The possible risk factors mentioned herein above include technological factors where construction companies may have worn out construction tools such as tractors that may create inconvenience during the construction process hence encouraging delay in project completion. To manage this, such tools should be well serviced before job and mechanics deployed at the site for any abrupt mechanical breakdown. Shortage of funds during the process may be experienced due to mismanagement or under budgeting which may also lead to incompletion of the project. This situation can be combated through ensuring that there is proper management and planning of funds. When poor management occurs, skilled individuals give up on the job due to differences amongst them. This may lead to poor work being done by the end of the project hence project failure documented. The team leader should ensure there are no such instances in a group. In the political arena, a number of politicians oppose road construction projects because they use poor roads as an excuse to fend their votes during campaigns. This, in records, has made the nation to lug behind in the infrastructural context. As my proposed solution, the National Government should stand firm on such issues and apprehend any politician who does this for his

or her personal benefit. Before project initiation, a number of designs are looked into and one is considered afterward. This may drag road construction projects behind as well as the country in terms of economic development since good roads lead to a better economy in reference to Kenya–Uganda export and import.

Environment as one of the major factors that delay infrastructural development in most countries should be assessed before the project is initiated more so in areas where planned road construction will be. For instance, a road cannot be constructed where there are annual incidents of landslides. The above-illustrated risk factors were identified through construction firm workers that were interviewed per firm and were analyzed through linear regression.

In the construction industry, the risk is frequently referred to as the presence of potential or actual threats or prospects that influence the objectives of a project during construction, commissioning, or at the time of use (Kamane and Mahadik, 2013). The construction industry and its clients are widely associated with a high degree of risk due to the nature of construction business activities, processes, environment, and organization (Akintoye and MacLeod, 1997). Road construction projects are exposed to risk at the time of their coming into being and are perceived to have more inherent risks due to the participation of many answerable parties such as owners, contractors, and designers, among others (El-Sayegh, 2008). Natural risk events associated with infrastructural development projects have a major impact on issues related to cost, time and quality of project delivery. Unexpected natural risk events result in either positive or negative outcomes often-causing deviations from project plans and making construction projects particularly prone to risk (Awotunde and Babajide, 2015).

Risk management is a formal and orderly process of systematically identifying, analyzing, and responding to risks throughout the life cycle of a project to obtain the optimum degree of risk elimination, mitigation and/or control (Wang et al., 2004). Risk management in infrastructure projects development and management context is an inclusive and methodical way of identifying, analyzing and responding to risks to achieve the project purposes (Banaitiene and Banaitis, 2012). Risk management is a vital project management planning and control tool for reducing uncertainty and improving decision-making (Tipili and Ilyasu, 2014).

Today, risk management has become the mainstay of the critical infrastructure projects' decision-making process. The objective behind risk management has shifted from enhancing an understanding of all stakeholders, to also facilitating possible agreement on what the threats to the project objectives are and how they will be managed (Ekung, Adeniran, and Adu, 2015). The

success of every project depends on how efficiently and effectively the contractor manages the risks facing the project. Risk management strategies do not remove all risks from a project but their objective is to ensure that risks are managed most effectively (Kamane and Mahadik, 2013). The benefits of the risk management process include; classifying and analyzing risks, perfection of construction project management processes and effective use of resources (Banaitiene and Banaitis, 2012).

Completion of projects within schedule is a major contribution towards the competitive edge in organizations. This is based on the understanding that the achievement of the targeted objectives is determined by the ability to deliver the targeted output within the stipulated time (Kariungi, 2014). However, projects undertaken in the road construction sector are widely complex and often have significant budgets, and thus reducing risks associated should be a priority for each project manager (Gajewska and Ropel, 2011). An effective and efficient natural risk management approach requires a proper and systematic methodology and more importantly, knowledge and experience. The absence of an effective project risk management function has several negative consequences for participants in a project due to lack of preventive action against the risks and uncertainty that any project presents (Serpella et al., 2014). Effective risk management is typically achieved when an organization undertakes an active commitment to integrating risk management into their project protocols and controls (KPMG, 2014).

In Kenya, road infrastructure contributes to economic growth and poverty reduction (Ondari and Gekara, 2013). As such, infrastructure development projects are one of the major priorities in the Government agendas, and the infrastructure development and investment pipeline are huge in Kenya. According to the Kenya National Bureau of Statistics (2012), the construction industry in Kenya contributed 3.8%, 4.1 %, 4.3% and 4.1 % towards Gross Domestic Product (GDP) for the years 2008, 2009, 2010 and 2012 respectively. In the last few years, both the national and county governments have initiated road construction projects in different regions. However, many road infrastructure projects are not completed within the stipulated time leading to cost overruns, disruptions to other economic activities and delays. In Nairobi County, several road construction projects have been initiated in the past few years including The Thika Super Highway and Outering road dual carriageway upgrade. The completion of these projects was never timely hence the need to assess and analyze the risk management strategies applied in road infrastructural development projects to address natural risks affecting the projects and ensure projects are delivered on time, are less costly and are of the desired quality as well.

1.2 Problem statement

Effective risk management strategies allow a project manager to identify the project's strengths, weaknesses, opportunities, and threats. Road infrastructure development projects delays are a reoccurring problem and have negative impacts on project success in terms of time, cost, quality, and safety. Delays in the delivery of road projects are a common problem with an immeasurable cost to society and contractors. While it is not possible to totally avoid them, risks can be managed. Kenya Urban Road Authority reported that there were many projects which were not completed due to obstacles by clients, non-availability of materials, poor infrastructure, lack of funds and lack of project managers' competency. Local newspapers have reported delayed projects across Nairobi County which may have led to losses of millions of shillings. There has been continued massive investment in road infrastructure development projects in Nairobi County by both the National and County Governments, however, little is known about the types or nature of risk management strategies being implemented and to what extent these strategies have influenced timely completion of a construction project. This study therefore aimed at evaluating risk management strategies on road projects within Nairobi County and assess the association between project risk management and project timely completion while ensuring quality outcomes too. The causes of cost overruns have been at the focal point of research; however, most studies consider cost overruns in specific countries. More ever, transport infrastructure projects have received little attention or have been under-represented in datasets comprising general construction projects. Amandin and Kule (2016). The project sought to fill this gap by carrying out an in-depth investigation of risk management and project cost in road infrastructure

Road construction should be done to enhance the economic status of the nation since most imports and exports of non – perishable goods are done in East and Eastern Africa through road and this can only be possible with worthy roads in the region.

1.3 Main Research Objective

The main objective of this study was to assess the influence of risk management strategies on the completion of road infrastructure projects in Nairobi County.

1.3.1 Specific objectives

i) To establish risk management strategies that affect project completion time in road infrastructural development projects in Nairobi City County, Kenya

ii) To analyze how risk management strategies affect project costs in road infrastructure development projects in Nairobi City County.

iii) To analyze the barriers to effective risks management in road infrastructure development projects in Nairobi City County.

1.4 Research Questions

(i) What are the risks management strategies that affect completion time in road infrastructural development projects in Nairobi City County, Kenya?

(ii) How does risk management strategies affect project costs in road infrastructure development projects in Nairobi City County, Kenya?

(iii)What are the barriers that hinder effective risk management strategies on road projects within Nairobi City County, Kenya?

1.5 Justification and Significance of the Study

When road infrastructural development projects are not completed on time, the extended time comes with costs. It calls for extra financial costs to cater for the extended period or the lost assets. This leads to an extra burden on the taxpayer. In addition, in cases of road repairs and construction, road works come with obstructions, diversions and congested pathways which bring inconveniences to the road users and significant negative impacts on various sectors of the economy in general. This study is of great importance in addressing these problems. The findings will enable the Ministry of Roads and Public works and Transport sector to work together with other stakeholders involved in road infrastructure development projects to address these risks. It will identify and analyze the exact nature of the risks on the ground as well as the challenges

faced in implementing risk management strategies. This will help them come up with effective ways of implementing these strategies and devise better strategies to address natural risks. Timely completion of projects will save the taxpayers extra burden. The extra funds that would have been used on such projects can be channeled to other needy areas of the economy. Timely completion of projects will ensure that road users get the benefits of improved road infrastructure in a good time. The disturbance by road construction works on our roads will also be confined to the planned time and minimize inconveniences caused to road users. This study will go a long way in guiding policymakers and other relevant stakeholders to plan well on periodic construction and upgrade of roads within Nairobi City County. The findings of this study will also help engineers and other contracted bodies plan their activities well and understand the challenges related to the expected natural risks and how to mitigate against them.

The study will be of benefit to policymakers including; The National Government, The County Governments, and the line ministries dealing with road infrastructure developments in Kenya to generate relevant policies regarding natural risk management in the construction industry in Kenya. Additionally, the study will be of benefit to future researchers and scholars as it will provide additional literature on risk management in the road infrastructure development industry.

1.6 Scope and Limits of the study

The study was carried out within the year 2017 and included road construction projects that have both delayed or been completed on time. The study was be carried out in Nairobi City County since in recent years Nairobi has witnessed the construction of new roads, repairs, renovation, and extension of significant road infrastructure within the County. In addition, most of the road construction companies are based in Nairobi County. The study will sample road construction firms in Nairobi County.

CHAPTER TWO: LITERATURE REVIEW

2.1 Project risk management

Risk is defined as something that occurs and which was neither foreseen in the project description nor in the contract, often being caused by a lack of knowledge with one or many of the parties involved. Risks and uncertainties appear in various shapes (Kajsa, 2006). The source of risks includes inherent uncertainties and issues relative to the company's fluctuating profit margin, competitive bidding process, weather change, job-site productivity, political situations, inflation, contractual rights, and market competition among others (Rezakhani, 2012). In the context of the road construction industry, it could be the likelihood of the occurrence of a definite event/factor or combination of events/factors, which occur during the whole process of construction to the detriment of the project (Wang et al., 2004). Risk in the road construction industry has been the object of attention because of time and cost over-runs associated with construction projects (Akintoye and MacLeod, 1997).

Road infrastructure development projects are prone to a variety of risks, such as financial, management, natural, and technical, mainly because of the materials used, nature of design, locations, and layout, physical structure and the use to which they are put (Ijigah et al., 2014). There are various ways of categorizing risk for different purposes. For example, some categorize risks in construction projects broadly into external risks and internal risks while others classify risk in more detailed categories of political risk, financial risk, market risk, intellectual property risk, social risk, safety risk (Wang et al., 2004). Due to the inherent risks and increasing complexity of modern infrastructure construction projects, delays and cost overruns have become common factors in the construction industry. Delays can lead to many negative effects such as lawsuits between owners and contractors, increased costs, loss of productivity and revenue, and contract termination (Asish and Pratheeba, 2015). This has called for effective risk management to mitigate the impact of risk on construction projects.

The unique nature of a project makes risk an important aspect that needs to be managed if the project is to be successful and meet its objectives. Project manager's ability to identify, assesses, and manage project risks have a profound impact on the general success of the project. Project risk can stem out from within the project, i.e. internal risks which are uncertainties associated

with project time, cost, and quality, or from outside the project, external project risks, which are usually environmental issues. Risk management can be divided into three main components: risk identification, risk assessment, and risk responses. This categorization helps in the analysis by identifying, quantifying and finding a way to manage those risks (Tetteh, 2014)

2.2 Risk management and completion time in road infrastructure project

Risk management is regarded as an interactive, forward-looking, proactive and formal process to achieve road project objectives as well as to accomplish business goals, thus it is an intrinsic part of project management (Caron, 2010). By keeping away adverse events and maximizing positive results, risk management is becoming an essential portion of project management quality (Monetti et al., 2006). According to Carbone, there are some important factors that determine the success of a project, but it is likely that failure to perform effective and adequate risk management will increase the possibility of project failure, for example, exceeding project budget, falling behind schedule or missing critical targets of project performance (Carbone, 2004).

Furthermore, risk management is raising and increasing its emphasis on current project planning. The increasing number of major disasters or adverse events could be avoided or better managed by proper risk management, thus stabilizing or increasing the prospective returns to owners of an organization (Stulz, 2003). Therefore, the primary objective of risk management is that it acts as a policy instrument to secure the targets of the organization, focusing on preventing the organization from risks and consequences of adverse events in achieving these targets (Claes, 2004).

Caron (2010) posits that as an integral part of the project management process, the objectives of project risk management processes are to increase the probability and impacts of positive events and decrease the probability and impacts of adverse events. To overcome the lack of informality in project risk management, the development of formal risk management processes has risen to prominence and obtained much interest recently (Carr, 2001). The Risk Management process is a formal process, via which we can achieve identification, analysis, and response to risks, throughout the lifecycle of a project, to obtain the optimum degree of risk elimination,

mitigation, and control (Wang and Dulaimi, 2004). Thus, risk management is in direct relation to the successful completion of a project.

According to Euripides (2008), the construction business, like any other business, is risky. However, construction business faces more risks due to the involvement of many parties and stakeholders, such as owners, contractors, subcontractors, suppliers, Government (County / National), residents, donors, and many others. Furthermore, construction projects due to their uniqueness and built, are inherent to many risks. They also involve many people from different cultures, and different countries and their size and their complexity increase tremendously the risk factors involved. With the addition of the political, social and economic conditions where the project is undertaken, there is a bigger need to develop a sufficient and adequate risk management plan. Construction companies in order to protect their businesses and their interests, seek to find methods that are more effective.

Project Management Book of Knowledge (2008) defines risk classification as a provider of a structure that ensures a comprehensive process of systematically identifying risks to a consistent level of detail and contributes to the effectiveness and quality of the risks process identification. Risk classification is an important step in the risk assessment process, as it attempts to structure the diverse risks that may affect a project. There are many approaches in the literature for construction risk classification. Perry & Hayes (1985) gives an extensive list of factors assembled from several sources, and classified in terms of risks retainable by contractors, consultants, and clients. Abdou, (1996) classified construction risks into three groups, that is, construction finance, construction time and construction design. Shen, (1997) in an article identified eight major risks accounting for project delay and ranked them based on a questionnaire survey with industry practitioners. Tah & Carr, (2000) classified project risks by using the hierarchical risk breakdown structure (HRBS) and classified them into internal and external risks. This shows the magnitude of project risk factors. Chapman, (2001) grouped risks into four subsets; environment, industry, client, and project. Shen, et al., (2001) categorized them into six groups in accordance with the nature of the risks, that is, financial, legal, management, market, policy, and politics.

According to Rezakhani (2012), as cited in Chen, et al., (2007) proposed fifteen (15) risks concern with project cost and divided them into three groups: resource factors, management factors, and parent factors. Assaf & Al-Hejji (2006) mentioned the risk factors as the delay

factors in construction projects. Dikmen, et al., (2007) used influence diagrams to define the factors which have an influence on project risks. Zeng, et al., (2007) classified risk factors as human, site, material and equipment factors.

In China, a study was conducted to undertake a Critical Analysis of Risk Management and Significant Impacts of its Application on the Sichuan Post-Earthquake Reconstruction Project. The study examined and evaluated the risk management process in specific phases of the Lehe Home project. In the Lehe Home project, the risk of inability to deliver a project successfully and timely has been estimated to have high potential risk exposure that might happen and cause delays in the project time schedule. The unavailability of a budget for the whole Lehe Home project is the most crucial risk that negatively affects the cost aspect. The poor quality and productivity of workers, low quality of the order and inability to deliver timely projects are the critical risks that negatively impact a project in terms of quality aspect. (Nguyen and Yuansheng 2011)

In Malaysia, Sambasivan and Soon (2007) identified causes of delays in the completion of infrastructural projects, including contractor's improper planning, poor site management, inadequate experience, inconsistent flow of payments for completed work, poor management of sub-contractors, inconsistent communication between parties, as well as shortage of materials, equipment, and labor. In South Africa, a government report linked infrastructural project delays with changes in project design, the inconsistent flow of financial resources, and contractor's lack of capacity to deliver (Government of South Africa, 1999). In Ghana, delays in payments, poor contractor management, delays in material procurement, poor technical performances, and escalation of material prices were identified as key factors accounting for about 80% of delays in the completion of infrastructural projects (Frimpong, Olowoye, & Crawford, 2003).

In Kenya, delays in the completion of infrastructural facilities have been associated with factors, such as poor financial management by government agencies, inadequate designs, and poor management of the construction process by contractors (Talukhaba, 1999). Arguably, these factors are compounded by secondary factors, such as poor management of materials and equipment by contractors, inadequate recognition and response to risks emanating from the physical and socio-economic environments, as well as inadequate regard for stakeholders' needs (Talukhaba, 1999). Another study conducted by Ondari and Gekara (2013) reported significant

correlation between project delays and factors, such as management support (r = 0.625), design specifications (r = 0.836), contractor's capacity (r = 0.567), and supervision capacity (r = 0.712). Delays in the completion of infrastructural facilities were also identified by Abiero (2010) in the study that examined challenges of stakeholder management in the implementation of the SMHP project in Kenya. The study reported that the Phase II of the SMHP project delayed for four and a half years due to delays in the release of funds, which in turn was caused by delay in the management of issues arising, including unsatisfactory accountability of funds released in the previous phase and improper management of dissenting voices among stakeholders (Abiero, 2010). The study further cited cases of delayed infrastructural projects in the lake region of Kenya, including the Kisii-Chemosite Road, which delayed for more than 15 years, as well as the Nyanza Provincial Headquarters, which stalled for more than two decades. The study noted that delayed completion of the projects has led to the loss of both the time and possession utility of the projects.

In the construction business, there are numerous sources of risks and uncertainties, many of them are not under the control of project participants (Baloi and Price, 2003). Also, construction projects have a negative reputation for failing in time and cost. For all the above, it is necessary to identify the risk sources firstly. Odeh and Battaineh (2002) studied the most typical construction risks in several countries, including the United States, the United Kingdom, Saudi Arabia, and Israel between the years 1987 to 1997. "They found seven significant causes of delays: owner interference, inadequate contractor experience, financing and payments, labor productivity, slow decision making, improper planning and subcontractors" (Odeh, Battaineh, 2002) 2.3 Risk management strategies in infrastructural development projects ANNOR (2014) conducted a study on strategies to improve the risk factors that affect cost estimation in the building construction industry in Ghana. The study which was exploratory and descriptive using qualitative methods involved 23 contractors working with Ghana Cocoa Board. Majority of the respondents (58%) indicated that there is regular assessment of risk in the execution of the projects they are engaged in while 42% of the respondents indicated that there is no regular assessment of risk in the execution of the projects they are engaged in the study revealed that the strategies adopted included reducing the risk (likelihood or impact), transferring the risk to others (insurance) and avoiding the risk. Based on means and standard deviation, all the three current risk management practices scored above an average (2.5 out of 5), meaning that the practice of risk management is above the rank and is quite effective. A more critical look at the risk

management practices shows that most of the organizations prefer to reduce the risk (likelihood or impact) with a means of 3.46. This is followed by organizations that prefer to transfer the`` risk to others (insurance) with a mean of 3.44 and then the organizations who prefer to avoid the risk with a mean of 3.36.

In another study aimed at evaluating the impact of risk factors on construction projects cost in Nigeria, Luka and Muhammad (2014) indicated a disparity in the ranking of the degree of occurrence and impact among the group. Based on the composite of risk factors, the cost related risk and the time-related risk was found to be the most likely to occur and have the most impact on a project, whereas environmental risk factor was found to be a low weighted risk, as it had the least likelihood to occur and the least impact score. In the study, a total of Seventy-Eight questionnaires were sent to construction industry professionals which comprise contractors, Architects, Quantity Surveyors, and Engineers.

2.2.1 Influence of risk management on the completion time of projects

Traditionally projects are perceived as successful when they meet the time, budget and performance goals (Shenhar, Dvir, Levy, & Maltz, 2001). The Project Management Book of Knowledge (PMBoK), 2004 refers to project success being measured in terms of time, cost, scope, quality and customer satisfaction (Project Management Institute, 2004). This is commonly known as the 'triple constraint'. The 4th edition of the Project Management Book of Knowledge (2008) is similar, with the focus of 'performance management baselines' against project schedule, scope and cost (Project Management Institute, 2008, p. 82). "Often the scope, schedule, and cost will be combined into a performance baseline that is used as an overall project baseline against which integrated performance can be measured" (Project Management Institute, 2008).

Kinywa (2015) assessed the effect of risk management strategies on project performance of small and medium information communication technology enterprises in Nairobi, Kenya. The study which adopted a descriptive research design model targeted 48 randomly sampled ICT SMEs in Nairobi, Kenya. The study found that effective risk management practices encourage ICT enterprises to identify and quantify risks and to consider risk containment and risk reduction policies. The study further established that there existed a positive relationship between risk management strategies affecting project performance and ICT project performance for SMEs in

Kenya and were statistically significant at the 0.05 level. She concluded that many ICT enterprises in Nairobi, Kenya have realized the importance of risk management practice in ICT project management to achieve process success and as such, they carry out risk management to maximize the performance. ICT enterprises that manage risk effectively and efficiently enjoy financial savings and greater productivity, improved success rates of new projects and better decision making.

Jun, Qiuzhen, and Qingguo (2010) investigated the effects of project risk planning on IT project performance focusing on a case of China vendor firms. The study sought to test the hypothesis that project risk planning and control make a greater significant positive contribution to project performance at low levels of inherent uncertainty than at high levels. The study used a questionnaire to collect data from a 181 sample of software project managers and other key informants from software houses in Hangzhou City, China, by mail and email. The respondents were requested to provide information with respect to one or more recently completed outsourced IS development projects. From the finding, the study found that there existed a significant positive relationship between project risk planning and project performance ($P< 0.05$, $r=0.015$, $b=0.813$). The results indicated that project risk planning and control improve project performance leading to project completion within the set time schedule, at the budgeted and vender firm improved on profitability level.

2.3 Risks management and project cost in road infrastructure projects

In Asia causes of cost overruns in transport infrastructure projects was identified in a study done by Park and Papadopoulou (2012) the study was aimed to identify and analyze causes of cost overruns in transport infrastructure, the study identified the factors that contribute to cost overruns and using case data , regression analysis to establish statistical relationship between project size and cost overruns and to analyze questionnaire data to rank causes of cost overruns according to their frequency, severity and significance. the results confirmed a moderate correlation between cost overruns and one indicator of project size, the most significant cause of cost overruns identified was awarding contracts to the lowest bidder. Lamb-sum contracts were found to have the greatest influence on the occurrence of cost overruns Park and Papadopoulou (2012)

Abednego and Ogunlana (2006) State that parties involved in an infrastructure project under the public-private partnership procurement systems typically have different perceptions of proper risk allocation. the chances of the project's success can be reduced due to disputes that may arise among the involved parties. however, the public-private partnership projects are generally challenged with both project management problems which require day-to-day supervision as well as partnership problems which requires a more strategic and long-term approach. public-private partnerships can consequently consider having governance concerns since they deal with monitoring and overseeing strategic direction as well as strategic decision making.

From a study investigating the major causes of project delays and costs overruns that arise from project delays when implementing public construction projects in Kigali, the time-related study used a descriptive survey research design with open-ended questionnaires. Their target study population consisted of 42 construction project managers and consultants during that period. The study observed that as construction projects took a long time to execute the more they incurred more costs. The study revealed a low level of delays that could have resulted from the strict adherence to public projects procurement procedure. Major causes of the project's delay and cost overrun were delayed payments, financial deficiencies on the part of the client or constructor. The study revealed that when the project period increases, a proportionate increase in their costs or value is recorded. Amandin and Kule (2016)

Osei-Kyei and Chan (2017) show that respondents from Ghana ranked country risk factors higher, whereas their Hong Kong counterparts ranked project-specific risks higher. The top five significant risks in Ghana are corruption, inflation rate fluctuation, exchange rate fluctuation, delay in project completion and interest rate fluctuation. In Hong Kong, the top five significant risk factors are a delay in land acquisition, operational cost overruns, construction cost overruns, delay in project completion and political interference.

The wealth of any nation is gauged by its performance in infrastructure provision through its construction industry. The construction industry is large, volatile, and requires tremendous capital outlays. For developing economies, road construction constitutes a major component of the construction industry. This means that much of the national budget on infrastructure development is channeled to road construction projects. The aim of this objective was to identify the causes and effects of cost escalation and schedule delays in road construction projects. Using

a detailed literature review, structured interviews, and questionnaire surveys, the results of the study confirmed the prevalence of cost escalation and schedule delays in road construction projects in Kenya. The study established that bad or inclement weather due to heavy rains and floods, scope changes, environmental protection and mitigation costs, schedule delay, strikes, technical challenges, inflation, and county government pressures were the major causes of cost escalation in Nairobi city county road construction projects. On the other hand, delayed payments, financial processes and difficulties on the part of contractors and clients, contract modification, economic problems, materials procurement, changes in drawings, staffing problems, equipment unavailability, poor supervision, construction mistakes, and poor coordination on-site, changes in specifications and labor disputes and strikes were found to be the major causes of schedule delays in road construction projects. Appropriate project management practices are thus required to curb the causes and effects of cost escalation and schedule delays in road construction projects. (Kaliba, Muya, & Mumba, 2009)

The need for infrastructure investment around the globe is gaining momentum in emerging markets. Population growth, increasing urbanization and rising per capita incomes are driving the demand for new roads and other infrastructures.

2.4 Barriers to effective risk management on road infrastructural projects

A study on the Framework for investment decision making under risk and uncertainty for infrastructure asset management was conducted to investigate current practices on decision making under risk and uncertainty for infrastructure project investments. Globally, many European countries use scenarios for investigation of the effects of risks and uncertainty of project investments. Risks in economic evaluation needs to be addressed by calculating the sensitivity of the rate of return for a number of events. The risks and uncertainties of project development arise from various sources of errors including data, model and forecasting errors. Generally, both data errors and model errors have trivial effects. it was discussed that the probability distributions of end products of the project appraisal, such as cost-benefit ratios that make forecasting errors into account, are feasible decision tools for economic evaluation. Political, social, environmental as well as economic and other related risk issues had been addressed and included in decision-making frameworks. No suggestions were made on how to incorporate risk into investment decision making. Piyatrapoomi, Kumar, and Setunge (2004).

There has been an increase in research on risk management practices in the construction industry. The study reports the findings of an empirical Chinese industry survey on the importance of project risks, application of risk management techniques, the status of the risk management system and the barriers to risk management which were perceived by the main project participants. the studies reveal that most project risks are of concern to project participants and that the industry has shifted from risk transfer to risk reduction. Current risk management strategies are inadequate to manage project risks and adoption of joint risk management mechanisms is the key to adequate risk management (Tang, Qiang, Duffield, Young, and Lu 2007)

Enhancing the effectiveness of risk management practices in Sri Lankan road construction projects the main purpose of the study was to identify the risks that are critical for risk management of road construction projects in Sri Lanka on life cycle basis and defining the shares of the parties involved in projects in terms of handling the identified risks. a Delphi study was conducted and the findings showed that construction and design phases are prone to many major risks. More ever delays in payment by the client were the most critical factor in the construction stage. some more risks could occur in more than one phase of the project life cycle, stressing the necessity of handling these risk factors as a prerequisite for project success (Perera, Rameezdeen, Chileshe, and Hosseini 2014)

Maina et al., (2016) conducted a study on the evaluation of factors affecting effectiveness of risk management in public housing construction projects in Rwanda: Case of Batsinda housing project. The purpose of the study was to determine factors affecting the effectiveness of risk management in housing construction projects in Rwanda. The first objective was to determine how top management support affects the effectiveness of risk management in public housing construction projects. The study concluded that low level of top management support in risk commitment led to insufficient allocation of resources for risk management. Lack of effective decision making and stake holder involvement by top management affected effective risk management in Batsinda Housing Project. Effective risk management should be transparent and inclusive.

The second objective was to establish the extent to which competence of project team affect effectiveness of risk management in public housing construction projects. The study established that poor project management skills in project team affected effective risk management of the

scheme despite there being risk mitigation measures in place. Low level of administrative skill and low level of communication skill in risk management amongst project team also affected effective risk management. The study revealed that when the top management was committed to risk management the effectiveness of risk management changed by 31.8 %.

A study by Badu, Owusu-Manu, Edwards, Adesi, and Lichtenstein (2013) on Rural infrastructure development in the Volta region of Ghana, on barriers and interventions, their main objective was to explore the challenges confronting rural infrastructure development and the requisite incentives needed to boost it. An inductive methodological approach was adapted using structured questionnaire to survey the perceptions of rural contractors. Incentive systems were identified. the key challenges were lack of funds, portable water, good health systems and lack of good market to supply materials, three key challenges were identified, and explained in terms of; investment capacity, implementation and revenue mobilization

Bosire (2015) conducted a study on the determinants of success of urban infrastructure projects financed through public private partnerships in Kenya. The study employed a descriptive research design, where the study sort to establish the existence of public private partnership units in the county governments. it ranked the effectiveness of the procurement processes, project implement-ability, government guarantee and macro-economic conditions on a scale of 1 to 5. the response indicates that realistic assessment of costs and benefits is very effective, community social support was also rated to be very effective, more ever good county governance and committed public agencies were also found to be very effective. competitive procurement process, shared authority between public and private agencies were established to be least effective.

2.5 Conceptual Framework

Conceptualization is the mental process by which fuzzy and imprecise constructs (concepts) and their constituent components are defined in concrete and precise terms. According to Mugenda and Mugenda (2003), a conceptual framework is a graphical or diagrammatic representation of the relationship between independent, intervening and dependent variables in a study. The independent variables include completion time in construction projects, Cost of risk management

strategies and Barriers to effective project risk management in relation to dependent variables which is Project successful completion. For the dependent variable to be achieved, the independent variables need to be influenced by the intervening variables such as risk management strategies, Regulating authorities & Government agencies as shown by figure 2.0 below;

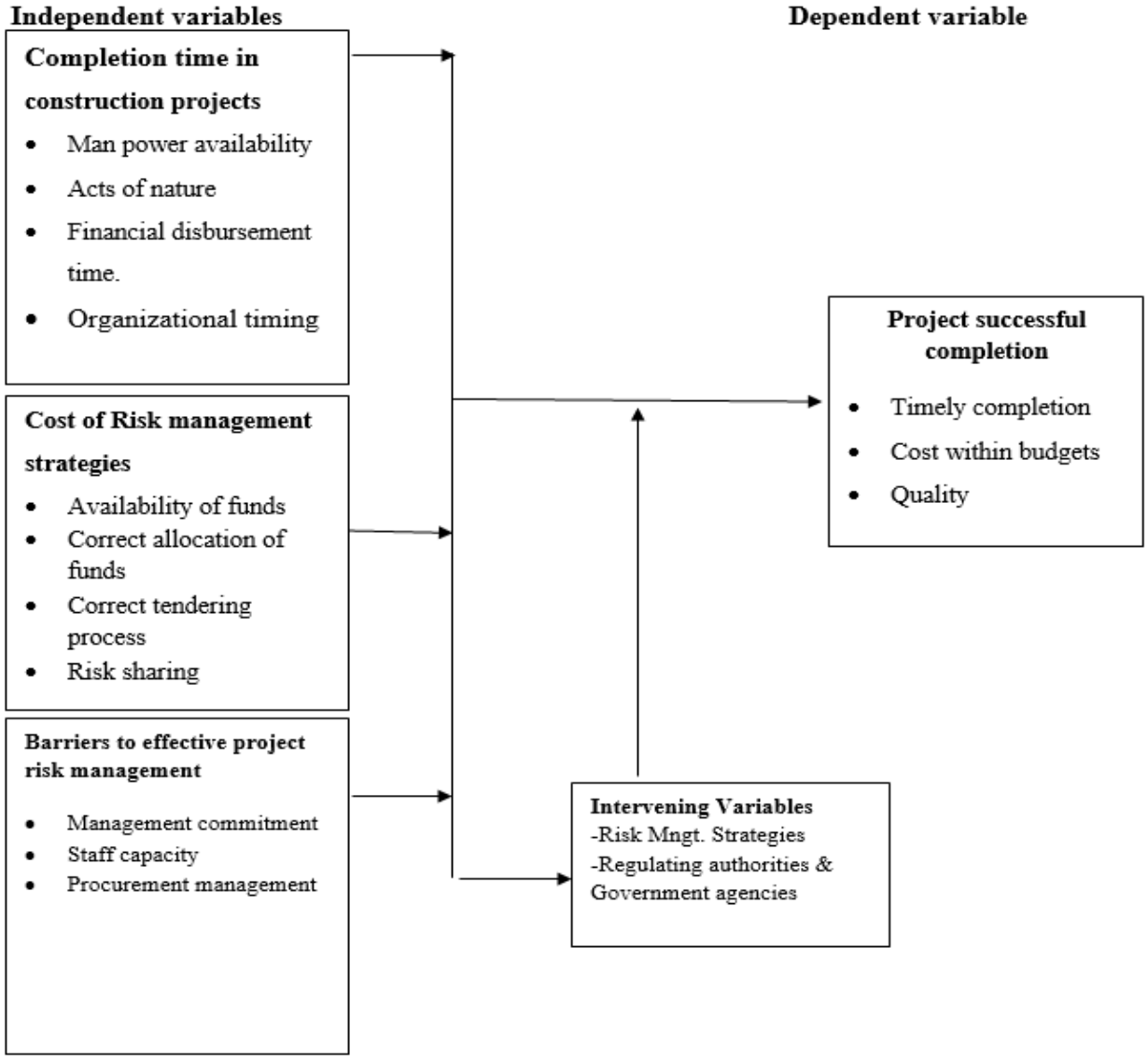


Figure 2.0 Conceptual Framework Source: Author (2017)

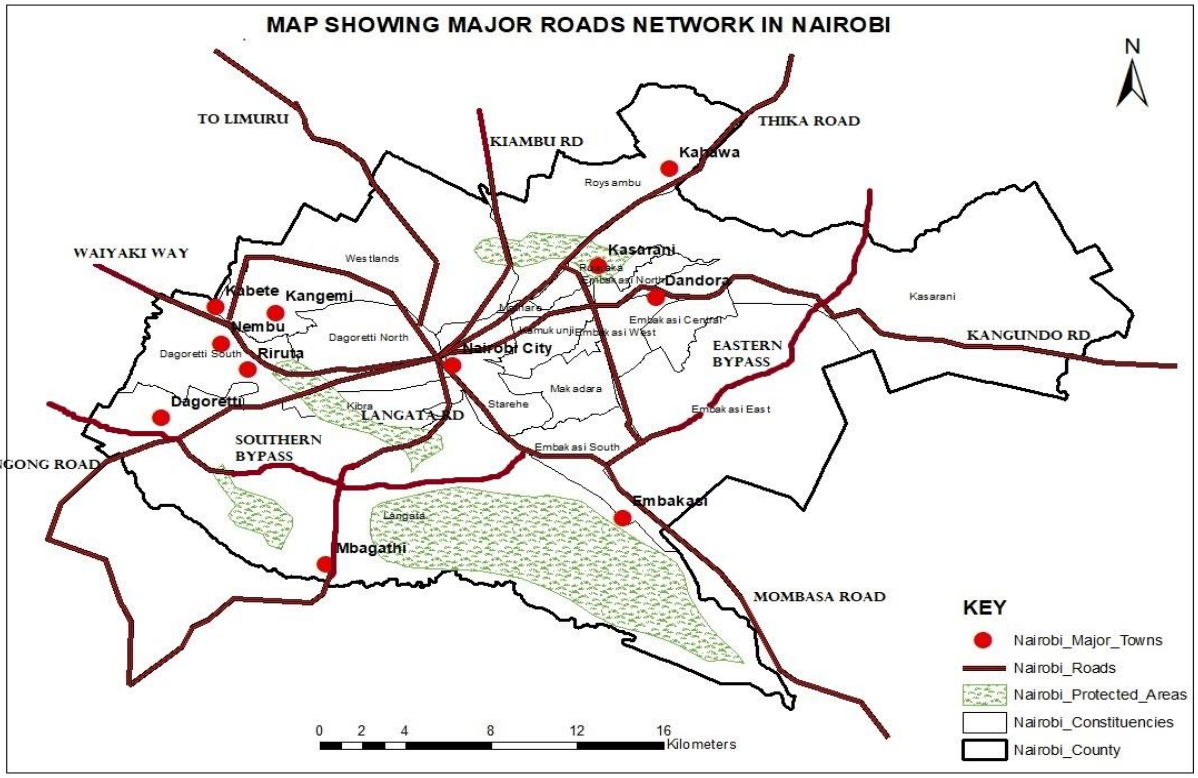
2.6 Knowledge Gap

This chapter has explored various studies on risk and risk management practices in the construction industry in different parts of the world. The examined empirical literature has revealed that natural risks affects all organizations irrespective of their nature and operations. While there have been studies undertaken around project risk management in various sectors, there remains issues with regards to applicability of the risk management strategies since the same issues affecting infrastructure development projects seem to reoccur across the board in different projects. There is also scanty literature as to the real risk factors in the construction industry in Kenya and as to whether the widely-experienced project delays in the country are associated with risk management practices adopted by the construction companies in Nairobi City County. This study therefore aims to address this gap by providing information that would address this key research question.

CHAPTER THREE: RESEARCH METHODOLOGY

3.1 Study Area

Fig: 3.0 Map of Nairobi City County showing major road network



The study was carried out in Nairobi City County which is situated at 1°17′S 36°49′E and covers an area of approximately 696 square kilometers. The study area was selected due to the fact that many road construction firms have their main offices in Nairobi and also because the County has experienced heavy investments with regards to road infrastructure development by the National and County Governments as well as developmental partners too. The area would therefore be best suitable for the study since it has a vast network of existing and new road network as well as old road networks under repair works.

Nairobi City has experienced one of the highest growth rates in Africa, with the current growth rate of 4.1%. Nairobi City is considered a business hub for East and Central Africa, with its economic activities contributing most to the Kenya's economy. Nairobi City has a good road network, which consists of international trunk roads, national roads as well as primary roads.

The city originated in the late 1890s as a colonial railway settlement, taking its name from a water hole known to the Maasai people as Enkare Nairobi ("Cold Water"). When the railhead arrived there in the year 1899, the British colonial capital of Ukambani province was transferred from Machakos (now Masaku) to the site, and in 1905 Nairobi became the capital of the British protectorate from about 1900 onward, when a small Indian bazaar was established at Nairobi, the city was also a trading Centre.

3.2 Research Design

The study adopted a descriptive cross-sectional survey since it is a blueprint for conducting a study with a maximum control over the factors that may interfere with the validity of the findings, hence the descriptive cross-sectional survey is aimed at collecting data to make inferences about a population of interest (universe) at one point in time. Cross-sectional surveys have been described as snapshots of the populations about which they gather data. The descriptive cross-sectional survey design ensures complete description of a situation, making sure that there is minimum bias in the collection of data and allows data collection from sizeable population in an economical way (Cooper & Schindler, 2008).

3.3 Study Population

The study population consisted of 208 local and foreign road construction firms in Nairobi City County. This is a specific targeted population from which data is being collected. According to the National Construction Authority (2015), there were 208 registered companies, which undertake road construction within Nairobi County. Thus, the population of the study comprised of the 208 road construction firms in Nairobi County (See Appendix I).

3.4 Research Instrument

This study used a semi-structured questionnaire to collect data. A questionnaire is a convenient tool in research especially where there are large numbers of subjects to be handled because they facilitate easy and quick derivation of information or responses within a short time (Mugenda and Mugenda, 2003). The questionnaire had sections describing socio-demographic profiles of the respondents and companies, potential risks, risk management strategies, barriers to effective project risk management, time to completions, cost and quality of completed projects.

3.5 Sampling Procedures

Sampling involves any procedure that draws conclusions based on measurements of a portion of the population (Zikmund et al., 2011). Stratified sampling was used to select 57 locals, 14 foreign and 4 other firms. The 4 other firms were firms that after sampling had a blend of both foreign and local attributes and were considered to be a crucial segment of the sampled population hence their categorization. The final sample size consists of selection of 75 companies and one manager in each firm was interviewed. Stratified sampling method ensured that certain sub-groups in the population were represented in the sample in proportion to their numbers in the population itself (Orodho, 2005). A list of registered companies who had conducted projects in Nairobi County was obtained from the Kenya Urban Roads Authority (KURA) (Appendix1). In each company, the managers and key staff working in the risk management departments were purposively identified and interviewed one responsible officer per firm through face to face interviews where the questionnaires were administered by trained data assistants and corresponding responses populated accordingly.

3.5.1 Sample size determination

A sample size determination is an act of choosing the number of observations or replicating it to include them in a statistical sample. The sample size was calculated using Israel (2009) formula which describes a sample size formula where population size and level of precision are known for a cross sectional study. Using this formula and assuming total population of construction firms as 208, precision level of 10%, 95% confidence intervals and at least 80% power, the minimum sample size was 68.

Israel 2009 formula

$n= N/ [(1+N (e)^2]$

Where N is 208 and e is the level of precision set at 10% and n is the minimum sample size

Therefore, n=208/[1+208*0.1*0.1]=68

An additional 10% of the minimum sample (n=7) was added to cater for possible non-response. The final sample size was therefore be (68+7=75). The sample size distribution is shown in table 3.0

Table 3.0 Sample Size distribution

Category	Total population [construction firms	Sample size [construction Firms]
Local	192	57
Foreign	17	14
Other firms	unknown	4
Total	208	75

Targeted respondents were risk managers or responsible staff and only one questionnaire per firm

3.6 Data Collection

This is the process of gathering both qualitative and quantitative information on specific variables with the aim of evaluating the outcomes, in which the data should be clean, consistent and reliable. The study used primary quantitative data. Primary data was collected using questionnaires. The questionnaires were administered to the sampled respondents who included the construction firms' risk managers in the risk management departments. The data was collected using trained assistants who attended one day training on the tools. The training was followed by a pilot study in a non-sampled firm to assess the reliability of the tools. The research team sought permissions and booked appointments with the respective firms and the risk managers were targeted. If they consented, they were interviewed.

3.7 Data Management and Analysis

Data management and analysis is the administrative process that includes acquiring, validating, storing, protecting and processing data while its being inspected, cleaned, transformed and modeled to ensure accessibility, reliability and timelines of the data for its users with a goal of discovering useful information that informs conclusions and supports decision-making. Completed questionnaires were checked for completeness and consistency. The data was then entered into a user-friendly interface developed using Statistical Package for Social Sciences (SPSS, version 20). Data coding and re-coding were done before the analysis was conducted.

The analysis was done per study objectives. Descriptive statistics such as percentages, frequency, mean and standard deviation were used to describe socio-demographic profiles of the respondents and companies, completion time, project cost and barriers to effective project risk management. Objective three on barriers to effective risk management strategies on timely completion of projects was further be analyzed using chi-square tests through a cross-tabulation procedure. The dependent variables were categorized into two (whether or not projects were completed in time) and also as continues variables. The independent variables included risk avoidance, risk reduction, risk transfer and risk-sharing. Inferential statistics were conducted using a linear regression model to control other extraneous factors such as socio-demographic profiles of companies and managers. For all the analyses, p-value <0.05 was considered statistically significant. A confidence interval of 95% around point estimates was used to establish the significance of the effect of risk management strategies of timely completion of projects. Separate linear regression models were used to assess the effect on cost and quality.

3.8 Reliability and Validity

Validity is the accuracy of a measure or the extent to which a score truthfully represents a concept while reliability is an indicator of a measure's internal consistency. A measure is reliable when different attempts at measuring something converge on the same result (Zikmund et al., 2011). To test the instrument reliability, Cronbach Alpha was used. The Cronbach Coefficient alpha is a multiple-item scale often adopted to assess internal reliability and a ratio of 0.7 was considered an indication of reliability. High reliability means it measures what it was intended to measure, while low reliability means it measures something else or possibly nothing at all.

Reliability was achieved through pilot testing of the tools. Validity was ensured by discussing the tools with experts and supervisors. A rule of thumb for interpreting alpha questions with two possible answers or Likert scale questions is:

Cronbach's alpha	Internal consistency
$\alpha \geq 0.9$	Excellent
$0.9 > \alpha \geq 0.8$	Good
$0.8 > \alpha \geq 0.7$	Acceptable
$0.7 > \alpha \geq 0.6$	Questionable
$0.6 > \alpha \geq 0.5$	Poor
$0.5 > \alpha$	Unacceptable

CHAPTER FOUR: RESULTS AND DISCUSSION

4.1 RESULTS

This chapter presents the findings and discussions of the study as per the specific objectives.
The main objective of this study was to assess the influence of risk management strategies on the completion of road infrastructure projects in Nairobi County. The specific objectives included; to establish risk management strategies adopted in road infrastructural development projects in Nairobi City County, Kenya; to analyze how risk management strategies affect project cost in road infrastructure development project in Nairobi City County and finally to analyze the barriers to effective risks management in road infrastructure development projects in Nairobi City County

4.1.1 Characteristics of respondents

The data was collected among 75 managers of construction industries in Nairobi city county with the majority 92% (69) of the managers being males and only 8% (6) being female. Among the managers in the study, 76% (57) were from the local firms while 18.7% (14) were from foreign firms and only 5.3% (4) of the managers being from the other unspecified firms. From the table, most of the managers 50.7%(38) had an average of 6-10 years of experience being a manager with 28% (21) having an average of 1-5 years' experience and the rest 21.3% (15) having 11- 15 years of experience as a manager.

Table 4.0: Characteristics of respondents

	Background Information	
Gender	**N**	%
Male	69	92.0
Female	6	8.0
Firm category		
Local	57	76.0
Foreign	14	18.7
Other	4	5.3
Years of experience		
1-5 years	21	28.0
6-10 years	38	50.7
11-15 years	16	21.3

4.1.2 Risk management strategies adopted in road infrastructural development.

In the study, the respondents were asked to assess the level of agreement with the potential elements of risk in view of how they affected the completion of projects in Nairobi roads construction projects. The risks were identified and rated with a rating scale of strongly disagree [1] to strongly agree [5].On average, the respondents agreed that: construction risk (mean=3.6, SD= ± 1.2), Technological risk(mean=3.5, SD= ± 1.3), Financial risk(mean=3.7, SD= ± 1.2), Management risk(mean=3.6, SD= ± 1.1), Design risk(mean=3.8, SD= ± 1.1), Procurement risk(mean=3.7, SD= ± 1.1), Subcontract risk(mean=3.7, SD= ± 1.2),and Environmental risk(mean=3.4, SD= ± 1.2), affect timely completion of road construction projects. Whereas the respondents were not sure if the political risk (mean=2.7, SD= ± 1.3) affects the timely completion of the road construction projects. (Table 4.1)

Table 4.1 Potential risk management strategies that affected the timely completion of road construction project.

Variable (n=75)	Level of agreement on the effect of risk on completion	Scale Analysis
Risks	**Mean(±SD) ***	
Construction	3.6(1.2)	Agree
Technological	3.5(1.3)	Agree
Financial	3.7(1.2)	Agree
Management	3.6(1.1)	Agree
Political	2.7(1.3)	Not Sure
Design	3.8(1.1)	Agree
Procurement	3.7(1.1)	Agree
Subcontract	3.7(1.2)	Agree
Environmental	3.4(1.2)	Agree

Likert scales **1.** Strongly disagree **2.** Disagree **3.** Not Sure **4.** Agree **5.** Strongly Agree

4.1.3 Risk management strategies adopted in road infrastructural development projects.

Results shown in figure 4.0 reveal that of the management strategies put in place by the firms to mitigate the risks indoor importance (highest percent reported) included avoidance (33.8%), mitigation (16.4%) transfer (16.0%), and acceptance (10.3%). The strategies which were less reported included exploits (9.9%), sharing (9.4%), enhancing (3.3%) and other (0.9%) Figure 4.0

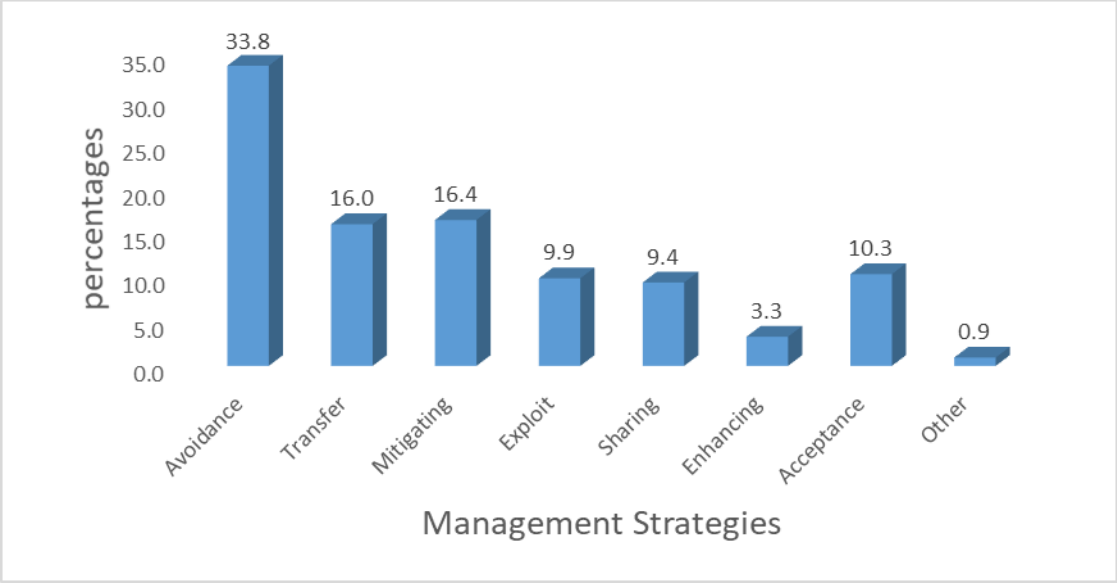


Figure 4.0 Proportion of Management Strategies

4.1.4 Stratification of risk management strategies in road construction projects

The results in Table 4.2 show that 70.7% of construction risks could be mitigated through avoidance. About 57.3% of design risks were mostly handled through avoidance of the risk, 12.0% through mitigation and 12% through exploits. Avoidance of risk was the main management strategy to mitigate all the risks, followed by transfer and mitigation. Transfer of risk was mostly used to mitigate management risks according to 16% of the firms and subcontract risk (18.7%). Mitigation strategy was mainly adopted to address construction risk in 16.0% of the firms, exploits were used to address design risks by 12.0% of the firms (Table 4.2)

Table 4.2 Stratification of management strategies on risks

Risks	Avoidance	Transfer	Mitigating	Exploit	Sharing	Enhancing	Acceptance	Other
Construction	53(70.7)	8(10.7)	12(16.0)	-	1(1.3)	-	1(1.3)	-
Design	43(57.3)	4(5.3)	9(12.0)	9(12.0)	8(10.70)	1(1.3)	-	1(1.3)
Financial	56(74.7)	10(13.3)	4(5.3)	1(1.3)	2(2.7)	-	1(1.3)	1(1.3)
Management	41(54.7)	12(16.0)	11(14.7)	4(5.3)	5(6.7)	-	2(2.7)	-
Political	55(73.3)	8(10.7)	9(12.0)	-	2(2.7)	-	-	1(1.3)
Procurement	57(76.0)	8(10.7)	6(8.0)	1(1.3)	2(2.7)	-	-	1(1.3)
Subcontract	44(58.7)	14(18.7)	6(8.0)	3(4.0)	5(6.7)	3(4.0)	-	-
Technological	40(53.3)	7(9.3)	7(9.3)	5(6.7)	4(5.3)	3(4.0)	9(12.0)	-
Environment	49(65.3)	4(5.3)	7(9.3)	1(1.3)	1(1.3)	-	13(17.3)	-

4.1.5 Risk management strategies on timely completion of road construction.

The study established the association between risk management strategies and the timely completion of road construction projects in Nairobi County. From Table 4.3 there is no significant association between; Avoidance (P-Value =0.988), Transfer (P-Value =0.1), Mitigating (P-Value =0.617), Exploit (P-Value =0.201), Sharing (P-Value =0.974), Enhancing (P-Value =0.235), Acceptance (P-Value =0.855) with the timely completion of road construction projects in Nairobi county since all the P-Values are >0.05.

Table 4.3 Risk management strategies on timely completion of road construction

Timeliness	Coef.	[95% Conf.	Interval]	P-Value
Avoidance	-0.0058727	-0.7770282	0.7652827	0.988
Transfer	-0.4056464	-0.8921851	0.0808923	0.1
Mitigating	0.177062	-0.5296541	0.883778	0.617
Exploit	0.2136223	-0.1168559	0.5441004	0.201
Sharing	0.0110845	-0.67317	0.6953391	0.974
Enhancing	0.3319548	-0.2217131	0.8856228	0.235
Acceptance	-0.0579109	-0.6901432	0.5743214	0.855

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \varepsilon$$

Timeliness=0.2784 −0.0058Avoidance, – 0.4056Transfer, +0.1770 Mitigating, + 0.2136 Exploit, + 0.0110Sharing, + 0.3319 Enhancing, – 0.0579 Acceptance

4.1.6 Effects of Potential risk management strategies on timely completion of road construction

The study further established the association between the potential risk management strategies and the time of completion of the projects based on the respondents' views on each risk management strategy. From Table 4.4, we realize no significance between any of the risk management strategies and the timely completion of road construction projects in Nairobi City County since all the P-Values are > 0.05. From the table, we notice majority of the respondents 95.89%(70) stating avoidance, 85.92% (61) stating transfer,95.83%(69) sting Mitigating, 73.13(49) stating Exploit, 93.15% (68)Sharing, 86.75%(58)Enhancing, 95.83%Acceptance as management strategies affecting the timely completion of road construction projects.

Table 4.4 Potential risk management strategies that affected the timely completion of road construction projects in Nairobi City County

		TIMELINESS		P-Value
AVOIDANCE				
Yes	70(95.89)	29(41.43)	41(58.57)	0.78
No	3(4.11)	1(33.33)	2(66.67)	
TRANSFER				
Yes	61(85.92)	38(62.3)	23(37.7)	0.184
No	10(14.08)	6(60)	4(40)	
MITIGATING				
Yes	69(95.83)	29(42.03)	40(57.97)	0.765
No	3(4.17)	1(33.33)	2(66.67)	
EXPLOIT				
Yes	49(73.13)	23(46.94)	26(53.06)	0.319
No	18(26.87)	6(33.33)	12(66.67)	
SHARING				
Yes	68(93.15)	28(41.18)	40(58.82)	0.959
No	5(6.85)	2(40)	3(60)	
ENHANCING				
Yes	58(86.57)	25(43.1)	33(56.9)	0.235
No	9(13.43)	2(22.22)	7(77.78)	
ACCEPTANCE				
Yes	69(95.83)	28(40.58)	41(59.42)	0.802
No	3(4.17)	1(33.33)	2(66.67)	

4.1.7 Multivariate analysis on Risk management strategies on the cost of road construction.

The table below (Table 4.5) shows the study on the association between the potential risk management strategies and the cost of road construction. The results of linear regression analysis indicated that of all the seven strategies, there was no significant association between Avoidance (p=0.206), Transfer (p=0.355), Mitigating (p=0.752), Exploit (p=0.253), Sharing (p=0.436), Enhancing (p=0.148), Acceptance p=0.655) and the cost of road construction project where all the variables had a P-Value >0.05

Table 4.5 Risk management strategies on the cost of road construction projects in Nairobi County

Project Cost	Coef.	[95% Conf.	Interval]	P-value
Avoidance	-0.3392806	-0.8692957	0.1907344	0.206
Transfer	-0.1399321	-0.4394584	0.1595941	0.355
Mitigating	0.069503	-0.3668216	0.5058276	0.752
Exploit	0.1065426	-0.0777704	0.2908556	0.253
Sharing	0.1792909	-0.2769128	0.6354947	0.436
Enhancing	-0.1401258	-0.3312442	0.0509926	0.148
Acceptance	0.0788718	-0.2715006	0.4292443	0.655

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \varepsilon$$

Cost = 0.5644 – 0.3392Avoidance – 0.1399Transfer + 0.0695Mitigating + 0.1065Exploit +0.1792Sharing – 0.1401Enhancing + 0.07887Acceptance

4.1.8 Influence of risk management strategies on the cost of road infrastructure development.

Through this study association between the risk management strategies and the total cost of completing a road infrastructure development project was realized by, a summary of chi-square test analysis to assess the association between the risk management strategies and cost of completed projects. The results show that there was a significant association of (P-value 0.110) between avoidance risk management strategy and the cost of road infrastructural projects. There was also a significant association (P-Value 0.003) between mitigation and the cost of road infrastructural projects. Exploit on the other hand was significantly associated with the cost of road infrastructural projects with (P-Value 0.048) Acceptance was also significantly associated with the cost of road infrastructural projects (P-Value =0.018). The least association was between sharing and the cost of infrastructural projects with the (P-Value = 0.001). However, there was no significant association between Transfer of risk and enhancing with the cost of infrastructural projects. From the table, most of the respondents 96% (72) chose avoidance as one of the main risk management strategies on the cost of road infrastructural projects. (Table 4.6)

Table 4.6 Influence of risk management strategies on the cost of road infrastructural projects

	Overall n (%)	Cost Yes n (%)	No n (%)	p value
Avoidance				
Yes	72(96.0)	54(75.0)	18(25.0)	0.110
No	3(4.0)	1(33.3)	2(66.7)	
Transfer of risks				
Yes	34(45.3)	23(67.7)	11(32.3)	0.311
No	41(54.7)	32(78.1)	9(21.9)	
Mitigating				
Yes	35(46.7)	20(57.1)	15(42.9)	**0.003**
No	40(53.3)	35(87.5)	5(12.5)	
Exploit				
Yes	21(28.0)	12(57.1)	9(42.9)	**0.048**
No	54(72.0)	43(79.6)	11(20.4)	
Sharing				
Yes	20(26.7)	9(45.0)	11(55.0)	**0.001**
No	55(73.3)	46(83.6)	9(16.4)	
Enhancing				
Yes	7(9.3)	5(71.4)	2(28.6)	0.905
No	68(90.7)	50(73.5)	18(26.5)	
Acceptance				
Yes	22(29.3)	12(54.6)	10(45.4)	**0.018**
No	53(70.7)	43(81.1)	10(18.9)	

4.1.9 Barriers to effective risk management strategies on-road infrastructure

Strategies for risk management on road infrastructure project in Nairobi City is faced by different barriers which include; Institutional culture, Tolerance, Inadequate communication, and Management system among others.

Results in Figure 4.1 show that 84.0% of the construction firms identified management system barriers, 85.3% reported inadequate communications as barriers to effective risk management on

road projects. Tolerance was mentioned by 73.3% of the firms while the same percent (73.3%) mention institutional culture (Figure 4.1)

Figure 4.1 Barriers to effective risk management

4.1.10 Effects of barriers to effective risk management of timelines of road construction projects

Of the firms and managers interviewed, 73.3% of them identified institutional culture as a barrier to effective risk management of timelines for the construction projects. Of these, 62.8% reported that they also completed the projects in a timely manner compared to 50% of those who did not think institutional culture was a barrier. This difference was not statistically significant (OR=1.68; 95%CI=0.54-5.23, p=0.367). Similarly, there was no statistical significance between

tolerance, inadequate communication, management systems and timeliness of completion of road construction projects (p>0.05) table 4.7

Table 4.7 Barriers to effective risk management and timelines for construction projects.

Barriers	Overall n(%)	Timelines Yes n%	No n%	Odds Ratio (95%CI)*	P value
Institutional culture					
Yes	55(73.3)	32(62.8)	19(37.3)	1.68(0.54-5.23)	0.367
No	16(21.3)	8(50.0)	8(50.0)	Ref	
Tolerance					
Yes	55(73.3)	33(60.0)	21(38.2)	1.57(0.51-4.83)	0.430
No	19(25.3)	8(42.1)	8(42.1)	Ref	
Inadequate communication					
Yes	64(86.3)	37(59.7)	25(40.3)	1.48(0.34-6.47)	0.603
No	10(13.3)	4(40.0)	4(40.0)	Ref	
Management systems					
Yes	63(84.0)	37(58.7)	24(38.1)	2.31(0.59-9.06)	0.229
No	12(16.0)	4(33.3)	6(50.0)	Ref	

*Odds ratio and 95% confidence intervals show the effect size. Odds ratios show the likely of event occurrence comparing the proportions on each category for each barrier
Ref= reference category

4.1.11 Barriers to effective risk management and costs of road infrastructure development projects

The study assessed the association between the barriers to effective risk management and the cost of construction of completed projects (Table 4.8). The results show that overall the barriers had no effect on whether or not cost was within the budgets. Of the firms which reported that completed projects were within the budget costs, 78.2% of them also identified institutional culture as a barrier to the effective management of risk management compared to 68.6% of those who thought institutional culture was not a barrier (p=0.439). Similar trends were reported for other barriers such as tolerance (p=0.941), inadequate communication (p=0.737) and management process (p=0.570) Hence, there was no significant association between the barriers

and the cost of road infrastructure development projects in Nairobi city County, Kenya since all the P-Values are > 0.05 table 4.8

Table 4.8 Barriers to effective risk management and costs of road infrastructure development projects.

Barriers	Overall n(%)	Costs Yes n%	No n%	Odds Ratio	P-value
Institutional culture					
Yes	55(73.3)	43(78.2)	12(21.8)	1.63(0.47-5.60)	0.439
No	16(21.3)	11(68.6)	5(31.3)	Ref	
Tolerance					
Yes	55(73.3)	41(74.6)	14(25.5)	1.05(0.32-3.43)	0.941
No	19(25.3)	14(73.7)	5(25.3)	Ref	
Inadequate communication					
Yes	64(86.3)	48(75.0)	16(25.0)	1.29(0.30-5.57)	0.737
No	10(13.3)	7(70.0)	3(30.0)	Ref	
Management systems					
Yes	63(84.0)	47(74.6)	16(25.4)	1.47(0.39-5.54)	0.570
No	12(16.0)	8(66.7)	4(33.3)	Ref	

4.1.12 Barriers to effective risk management and quality of road construction projects.

The study assessed the association between the barriers to effective risk management and the quality of construction of completed projects (Table 4.8). The results show that overall the barriers had no effect on the quality of completed projects. Of all the firms which reported that completed projects were of high quality, 98.2% of them also identified institutional culture as a barrier to the effective management of risk management compared to 100% of those who thought institutional culture was no a barrier (p=0.832). Similar trends were reported for other barriers

such as tolerance (p=0.832), inadequate communication (p=0.917) and management process (p=0.660) table 4.12

4.2 Discussion of the findings

This section discusses the findings per specific objectives.

4.2.1 Potential risks in road infrastructure development projects

The study sought to identify potential risks in road construction projects. The findings of the study found that the highly rated potential risks that affected the completion of the construction of road projects were design risk, procurement, financial and subcontracting risks. These findings agreed with the findings of a study in Ghana which illustrated that delays in payments, poor contractor management, material procurement, poor technical performances, and escalation of material prices were key factors accounting for about 80% of delays in the completion of infrastructural projects (Frimpong, Olowoye, & Crawford, 2003).

The results are also in agreement with a study carried out in Kenya which showed that delays in the completion of infrastructural facilities had been associated with factors, such as poor financial management by government agencies, inadequate designs, and poor management of the construction process by contractors (Talukhaba, 1999).

4.2.2 Influence of risks on timely completion of road construction projects

According to the study findings, six of the nine potential risks were positively associated with the timely completion of the road project. The risks were; construction risk, technological risk, financial risk, management risks, procurement risks, and environmental risk. The study findings agreed with the findings of Odeh and Battaineh (2002) except that technological risk was also found to influence the timely completion of road projects. The study by Odeh and Battaineh (2002) investigated the most typical construction risks in several countries, including the United States, the United Kingdom, Saudi Arabia and Israel between 1987-1997. They found seven significant causes of delays: owner interference, inadequate contractor experience, financing and payments, labour productivity, slow decision making, improper planning, and subcontractors.

The current study also investigated the association of the potential risks and quality of completed projects and the findings proved that the risks have no effect on the quality of the completed projects ($p>0.05$). The relationship between the potential risks and the cost of completed projects showed that construction risks, procurement risks, technological risks, environment, and management risks had a significant effect on the cost of completed projects. The study showed that there was an association between potential risk and cost of completion of road projects

4.2.3 Risk management strategies in road construction projects

This study investigated various management strategies in various construction companies with avoidance strategy being the most preferred (33.8%) while the less reported strategies were sharing (9.4%), enhancing (3.3%) and other (0.9%). These findings contrast with ANNOR (2014) where it was deduced that most organizations prefer to transfer the risk to others (insurance) with a mean of 3.44 and the organizations prefer to avoid the risk with a mean of 3.36.

The study further established an association between management strategies and risk and found that 70.7 % of construction risks can the mitigated through avoidance. About 57.3% of design risks were mostly handled through avoidance of the risk, 12.0% through mitigation and 12% through exploits. Avoidance of risk was the main management strategy to mitigate all the risks, followed by transfer and mitigation.

4.2.4 Influence of risk management on the completion of road infrastructural projects, cost, and quality of the projects.

The study also assessed the influence of risk management on the completion of infrastructural projects. Based on the chi-square test, the results showed that avoidance of risks had a statistically significant association with the timely completion of the road projects. Similarly, acceptance of risks and mitigation of risks were associated with a likelihood of timely completion of projects.

For the assessment on the influence of the risk management on the cost of the projects, the result shows that the use of mitigation, exploits, sharing, and acceptance was significantly likely to result in the cost being within budgets.

The results on an investigation on the influence of the risk management on the quality of the projects reveal that none of the risk management strategies identified by the firms had any influence on the quality of infrastructural projects. The findings agree with a study by Jun, Qiuzhen, and Qingguo (2010) which investigated the effects of project risk planning on IT project performance focusing on a case of China vendor firms. The results indicated that project risk planning and control improve project performance making the project completed within the time schedule, at the budgeted and vender firm improved on profitability level.

4.2.5 Barriers to effective risk management on road projects

The study assessed the association between barriers namely institutional culture, tolerance, inadequate communication and management systems. According to the findings, the overall barriers had no effect on the timely completion of road projects, quality of completed projects and cost within budgets. ($p>0.005$). This contrasts with a study on evaluation of factors affecting the effectiveness of risk management in public housing construction projects in Rwanda which established that poor management skills, low level of administrative skill and low level of communication skill in risk management amongst project teams affected effective risk management. (Maina et al 2016).

CHAPTER FIVE: SUMMARY OF FINDINGS, CONCLUSIONS, AND RECOMMENDATIONS

5.1 Overview

The chapter presents the conclusions that were made in this study with reference to the study findings. It also presents the recommendations given for the policy in the study as well as the suggestions made for further areas of research.

5.2 Summary of findings

Regarding the study findings and discussion, the following conclusions were made in line with the study objectives which guided the research in data collection and analysis. Out of the potential risks in infrastructure development projects investigated, design risks were identified most. Financial risk, procurement risk, and subcontracting risks were also highly rated. Moreover, construction risk, technological risk, financial risk, environmental risk, and management risks were positively associated with timely completion of road projects as well as a cost within budgets. However, on the contrary, political risk was negatively associated with the timely completion of road projects and cost within budgets. Design risk and subcontracting risks were negatively related to the cost of road projects within budgets.

Several risk management strategies were employed with the avoidance of risk being the most adopted type of management strategy. Avoidance of risk was the main management strategy to mitigate all the risks. Avoidance of risks, mitigation of risks and acceptance were significantly associated with timely completion of road projects. Mitigation of risks, exploitation, sharing, and acceptance was significantly associated with the completion of road projects within the budget. None of the management strategies identified had an influence on the quality of infrastructural projects.

The most identified barrier to effective risk management on road projects was a management system barrier. However, there was no statistical association between barriers to effective risk management and timely completion of road projects, cost within budgets and the quality of the road projects.

5.3 Recommendations

Following the study findings and discussions as well as the conclusions presented above, the study gives policy recommendations seeking to address the untimely completion of road projects which are as follows;

1. The successful completion of the study on the relationship between risk management strategies and timely completion of road construction projects, cost of the projects within budgets and quality of the projects show that a great deal of unexploited potential.
2. This, therefore, calls for a more strategic approach to road construction projects. This could be achieved by utilizing the less practiced methods such as enhancing and sharing of risks.
3. There is a need to educate the road construction companies on the risk management strategies that can be best employed to mitigate the existing potential risks in the construction firms.
4. The county governments should put into place policies aiming at reducing road construction design risks right from the project conception stage.
5. The national government should implement fiscal and monetary policies aimed at stabilizing the economic conditions to minimize if not eliminate financial risks such as inflation, fluctuation of the currency, lack of solvency, etc.
6. The county government must also ensure competent road contractors are selected as this has been found to ensure road project completion to minimize if not to eliminate subcontracting risks.

5.4 Suggestion for further research

Although the study was successfully conducted and the objectives met, it was limited to one geographical area and therefore its findings have a limitation of generalization as a representative of the status across the country. There is need for further study therefore to examine the risk management strategies and their influence on timely completion of road infrastructural development projects in other regions of the country which would compare the current findings from Nairobi City County.

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Appendix I: List of Road Construction Firms in Nairobi

Local Companies

1. Birdi Civil Engineering Ltd
2. Crescent Construction Company.
3. Draft & Develop Engineers Limited
4. Epco Builders Limited.
5. Ernie Campbell & Co. Ltd.
6. Intex Construction Ltd.
7. Lalji Bhimji Sanghani.
8. Masosa Construction Ltd.
9. Mulji Devraj & Brothers.
10. Ongata Works Ltd.
11. Twiga Construction Company
12. Hari-cons (K) Ltd
13. Spencon Services Ltd.
14. Dinesh Construction Ltd
15. Njuca Consolidated Co. Ltd
16. Italbuild Imports Limited
17. Magic General Contractors Ltd.
18. Ray Enginering & Construction International Ltd
19. Landmark Holding Ltd.
20. Cementers Limited
21. Northline Ltd.
22. Centurion Engineers & Builders Ltd.
23. Unispan Limited
24. Milicon's Ltd.
25. Nyon Construction Company Ltd
26. Tulsi Construction Limited
27. Mile-ed Enterprises & Company Ltd
28. Seo and sons Limited
29. Kitho Civil & Engineering Contractors
30. Kenya Builders & Concrete Company Limited
31. Thwama Building Services Ltd
32. Buildmore Construction Company Ltd.
33. Laton Engineering Limited
34. Ikall Projects (A) Limited
35. Monaco Engineering.
36. Rajwa Company limited
37. Marimo Construction Limited
38. Nicona Construction Company
39. Equitorial Builders.
40. Kenya Koch-Lighting Industries.
41. Sim Building Contractors Limited
42. Mick Builders & Civil Engineering Contractors
43. Lee Construction Ltd.
44. Kima & Partners Limited
45. Bahati Industries Limited
46. T.K.M. Maestro Limited
47. Shalfa Holding Ltd
48. Sivad Construction Ltd.
49. Lunao Enterprises.
50. Landmark General Works
51. Corban Construction Limited
52. Territorial Works (K) Ltd.
53. Kibinico Enterprises Limited
54. Skillman Construction Limited
55. Hunjan Construction Limited
56. Ereto Builders
57. Toshe Construction & Engineering Ltd
58. Ring Building & Contractors Ltd
59. Mweha Enterprises Limited
60. Spacelink Building & Civil Engineering Contractors Ltd
61. Jilk Construction Company Limited
62. Alf Construction Company Limited
63. Jaset Supplies & Contractors Ltd
64. Mellech Engineering & Construction Ltd
65. Swiss Grade Consult Limited
66. Associated Construction Company (K) Limited
67. Marphen Engineering & Construction.
68. Bomunda Building Contractors & General Repairs
69. Delmant Ltd
70. Yamu Engineering Services.
71. Dannga Services Ltd

72. Muamala Enterprises.
73. Acumen Construction Company Ltd
74. Samima Investments Limited
75. Beamms City Merchants Limited
76. Rida Holdings Ltd
77. Integral Construction Ltd.
78. Daysey Construction Limited
79. Cosniprof Investment Limited
80. Brisma Africa Ltd
81. Calben Enterprises & Engineering (E.A) Limited
82. Watercore Services Ltd.
83. Tazama Builders Limited
84. Urban Building Contractors Ltd.
85. Damka Construction Company Ltd
86. Azimath Company Limited
87. Blackwood Limited
88. Milele Limited.
89. Briant Enterprises
90. Build Arch Images
91. Buildventure Enterprises Limited
92. Cal-State Construction Company Ltd
93. Jakiwa Engineering Works
94. Juskim Enterprises.
95. Valeopo General Agencies Ltd
96. Hawaka General Contractors.
97. Crest Group Limited
98. Amarolle Civil Contractors Limited
99. Dexton Agencies Limited
100. Kam Transport & Commercial Agencies Limited
101. Kikwetu Services Limited
102. Wassidi Enerprises Limited
103. Emmaus Building & Civil Contractors Ltd
104. New-look General Contractors Ltd
105. Beverly Technologies Ltd
106. Valtech Services Ltd
107. Prime Quantifiers
108. Nekham Engineering Services
109. Kiwason Investments Limited
110. Le Buneei Diversity Limited
111. Marcann Contractors Co. Ltd
112. Mihoe General Contractors.
113. Butechs Construction Company Limited
114. Belfast Engineering Works Limited
115. Cape Hatteras Limited
116. Bright Orion Construction Co. Ltd
117. Gakeu Contractors & Civil Engineering Company Limited
118. Sasy Enterprises
119. Alzak Building Contractors
120. Shelyem Enterprises
121. Nyakibia General Contractors
122. Dabasia Builders Limited
123. Three N International Limited
124. All-Pha Constructions Limited
125. JN Investments Limited
126. Turkwell Construction Company Limited
127. Nu-Plan Engineering & Design Limited
128. Powergen Technologies Limited
129. Hanamal Construction Limited
130. Artech Construction Limited
131. Dahwab Enterprises Limited
132. Maaya Construction
133. Three D'S Services Limited
134. Diamond Structures Limited
135. Mavji Construction Company Ltd.
136. Oriental Construction Company Limited.
137. Eunitech Engineering Limited
138. Blackwood Construction & Engineering Limited
139. Pawico Enterprises.
140. Kensten Limited
141. Crissam Acres Limited.
142. Arceng Construction Company
143. Nyoro Construction Company Limited
144. Dane Investment (K) Limited
145. Pamigo Limited
146. Blaxton General Building Contractor Limited
147. Septiemme Ventures
148. Pathway Construction Company Ltd
149. Kaka Self Services Limited
150. African Boreholes Initiative Limited
151. Jinsing Enterprises Company Ltd
152. Kabew Kenya Limited

153. Berkai Engineering & Agricultural Supplies
154. Interways Works Limited
155. Solex Building Contractors Limited
156. Mugoya Construction & Engineering Ltd.
157. Maridadi Building Contractors Limited
158. Nyakinda Construction
159. Bellway Building & Civil Contractors Limited
160. Pacific Construction Company Limited
161. Wadia Construction Company Limited
162. Jap international Limited
163. Kerosia Investment & Construction Company Limited
164. Roadmap Contractors Company Limited
165. Bukuru Contractors Limited
166. Simis Engineering & Construction Company Limited
167. Gabu Contractors Limited
168. Custom General Construction Limited
169. Filma General Building Contractors Limited
170. Indepth Stationers Limited
171. Broadband Communication Networks Limited
172. Rhombus Construction Company Limited
173. Jayshiv Builders Limited
174. Sirak Builders
175. Parbat Siyani Construction Limited
176. Electro Research Limited
177. Funan Construction Company Ltd
178. Kibet General Contractors Ltd.
179. Venture Limited
180. Laxminarayan Builders Limited
181. Vibrany General Contractors Limited
182. Chirag Builders Limited
183. Superfit Steelcon Limited
184. Msuya Construction Limited
185. Kingsley Construction Company Lim ited
186. Mbame Construction Limited
187. Channa Construction Limited
188. Ndeithi General Contractors Limited
189. Shukri Construction Company Limited
190. Petoma Works Limited
191. Kandi Contractors Limited

Foreign Companies

1. China Overseas Engineering Group Co. Limited
2. Shengli Engineering Construction (Group) Company Limited
3. China Railway No.10 Engineering Group Company Limited
4. Horsebridge Network Systems (East Africa) Limited
5. Hua Xiang Construction Company Limited
6. China Communications Construction (K) Company Limited
7. China Railway No.5 Engineering Group Company Limited
8. Guangxi Hydroelectric Construction Bureau
9. China Wu Yi (Kenya) Company Limited
10. H. Young & Company (E.A) Ltd.
11. Qiongzhou Building Engineering (K) Company Limited
12. Sichuan Yongzhi Construction Company Ltd
13. China Wu Yi Company Limited
14. China Zhongxing Construction Company Ltd
15. Portco Construction(Africa)
16. China Jiangxi International (K) Limited
17. Nanchang Foreign Engineering Company (k) Ltd

APPENDIX II: Workplan

WORKPLAN								
2017	**May**	**June**	**July**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Brainstorming of research topic	xxx							
Presentation to supervisor for acceptance	xxx	xxx						
Research proposal		xxx						
Acceptance of research proposal		xxx						
Library research, Internet, etc. for literature review			xxx					
Field research at place of study				xxx				
Data analysis					xxx			
Data compilation						xxx		
Typing/presentation for consultation						xxx	xxx	
Final draft hand-in							xxx	xxx

APPENDIX III: Budget

BUDGET		
ITEM	**DESCRIPTION**	**COST**
Transport	Within Nairobi	**20,000**
Food/Lunch	During research	**5,000**
Typing (approx. 100pages)	700pages x 10 pp	**7,000**
Printing questionnaires	1,000	**2,000**
Printing & Binding research report	3,000	**3,000**
Internet costs	8,000	**8,000**
Photocopy & printing of research materials	5,000	**10,000**
Phone credit	5,000	**5,000**
Stationery	5,000	**5,000**
Library fees	2,000	**5,000**
Miscellaneous	10,000	**20,000**
TOTAL COST		**Ksh. 95,000**

APPENDIX IV: A Map Showing Major Road Network in Nairobi.

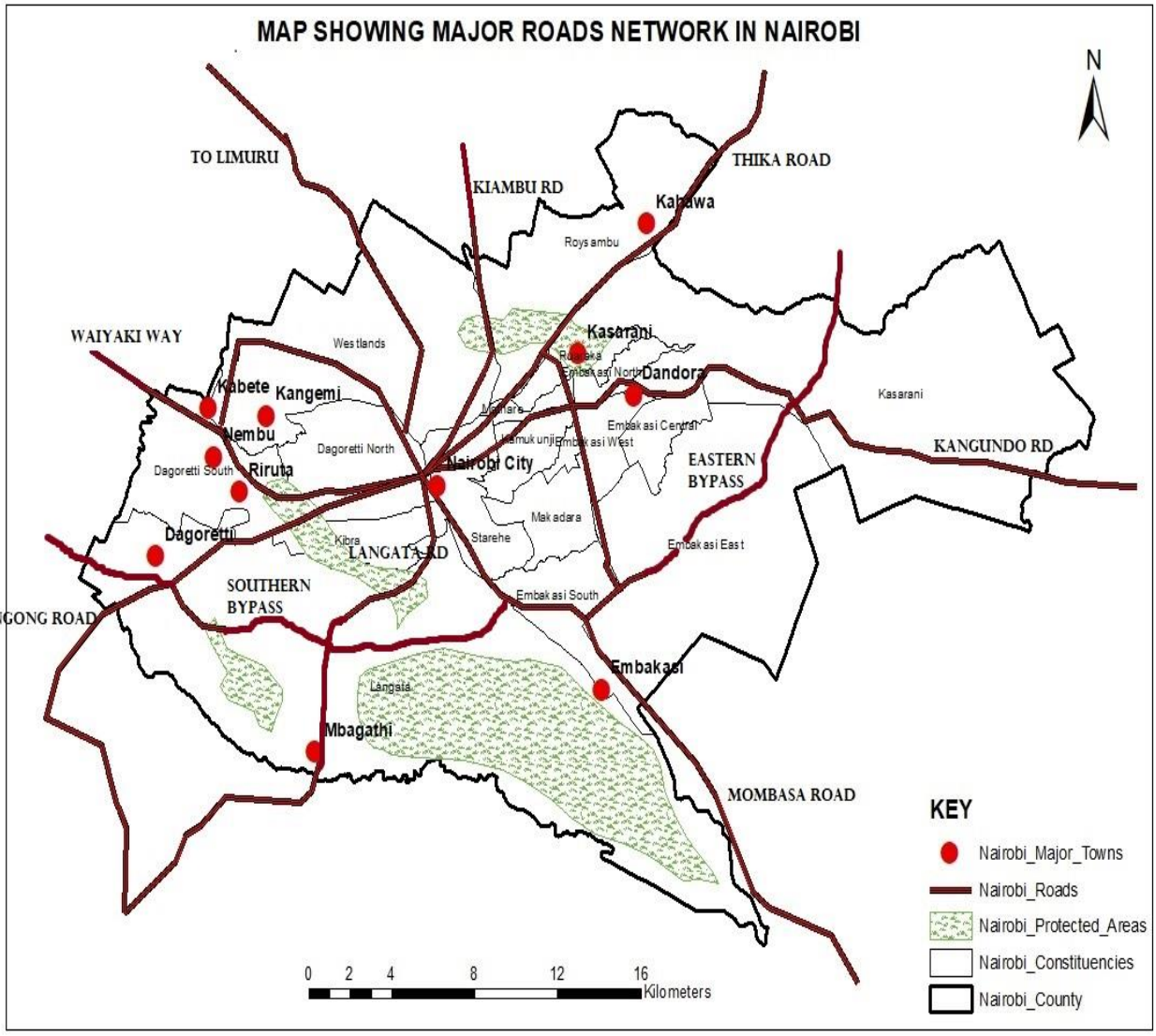


Table 6.0: Table showing some of the major Completed Projects undertaken by KURA since its inception in 2008.

PROJECT NAME	LENGTH (KM)	COST (KES MILLION)	CONTRACTOR	START DATE	FINISH DATE
Rehabilitation of Kenyatta Avenue	1.5	114.7	Samar Construction Ltd	10th May 2012	9th January 2013
Rehabilitation of Kayole Spine	5.0	139.9	Mattan Construction Company Ltd	10th May 2012	9th March, 2013
Rehabilitation of Karanja-Makina-Kibera Law Courts road	2.3	88.1	Sinoe Construction Ltd	10th May 2012	9th Jan, 2013
Rehabilitation of Park road	1.2	66	Jilk Construction Ltd	10th May 2012	9th January, 2013
Rehabilitation of Itesyo Lane	1.2	15.38	Tagza Engineering Ltd	7th August, 2012	6th Nov, 2012
Maintenance of Kolobot/Mushembi road	1.2	19.26	Olepolos Company Ltd	7th August, 2012	6th Dec, 2012

Maintenance of Harambee estates	5.0	17.38	Fatah Construction Co. Ltd	30th July, 2012	29th Nov, 2012
Improvement of Kibiku road (Mihango by-pass loop)	2.1	94.3	Duale Investment Ltd	30th July, 2012	29th March, 2013
Maintenance of off Kwarara road	0.35	17.8	Sparkle Company Ltd	6th Nov, 2012	13th Feb, 2013
Rehabilitation of Chogoria/Wajir road	0.45	21.4	Hanat Construction Ltd	4th January, 2013	3rd May, 2013
Maintenance of Kauria Close	0.56	21.75	Savvy Enterprises Ltd	27th Dec, 2012	26th April, 2013
Rehabilitation of Kinyanjui road	1.8	93.27	Frontier Engineering Ltd	31st Dec, 2012	1st July, 2013
Rehabilitation of Kibera Station road	1.6	93.06	Microbit Systems Ltd	27th Dec, 2012	26th June, 2013

Table 6.1: Table showing some of the major Vision 2030 flagship and other related on-going projects.

PROJECT NAME	LENGTH (KM)	COST (KES)	CONTRACTOR	START DATE	FINISH DATE	PROGRESS
Upper Hill Roads	5.0	2.002 Billion	Mattan Construction Co.	22 May, 2012	27 Aug, 2014	50%
Kapsoya Roads, Eldoret	8.1	887.1 Million	Dittman Construction Co.	22 May, 2012	22 Sept, 2014	64.1%
Pangani Girls foot-bridge		100.76 Million	Frontier Engineering Ltd	19 May, 2014	19 May, 2015	2%
Mombasa Road /City Cabanas Interchange		2.51 Billion	China Road & Bridge Corp.	3 June, 2013	3 June, 2014	73%
Rehabilitation & Upgrading of First Avenue Eastleigh and General Waruinge Roads	5.1	2.52 Billion	H. Young & Co. Ltd	25 May, 2012	29 July, 2014	65%
KWS Gate/Bomas Junction	3.0	2.67 Billion	China Wu Yi Co. Ltd	9 Feb, 2012	7 June, 2014	90%

Upgrading of Githurai-Kimbo Link (Phase 1)	2.7	340 Million	Dickways Construction Co. Ltd	17 July, 2013	16 July, 2014	51%
UNSOA Road, Mombasa	1.5	182.8 Million	Joycot General Construction Ltd	Jan 2013	2014	22%
KCB-Hospital Road Voi Town	0.5	12.3 Million	Dedroso Construction Ltd	10 March, 2014	9 September, 2014	13%
Utawala Road Voi Town	0.35	8.18 Million	Skyways Africa Ltd	10 March, 2014	9 September, 2014	17%
Ngala-Town Hall, Malindi Town Road	0.25	3.36 Million	Mariposa Construction Company Ltd	10 March, 2014	9 September, 2014	
Lodwar Municipality Roads	3.17	168.89 Million	Frontier Engineering Ltd	26 February, 2013	26 May, 2014	Substantially Complete
Kimuyu-Kinunga Road, Nyeri County	2	127 Million	Elite Earthmovers Ltd	July, 2013	17th July 2014	40%

Table 6.2: Table showing some of the major planned projects and their status.

PROJECT DESCRIPTION	LENGTH(KM)	STATUS
Missing Link Road (Langata-NHC-Kibera-Ngong Road)	4	Under design
Design and Construction of the Greater Eastern Bypass Project	77	Under design
Construction of Nairobi Link Road:(Waiyaki Way-Redhill Road)	5	Awaiting funding
Dualling of Ngong Road: All Saints Cathedral to Adams Arcade	4.7	Awaiting tendering
Dualling of Ngong Road: Adams Arcade-Karen-Ngong-Bomas	30	Under design
Design of Upper Hill Roads Phase 2(Construction)	12.3	Under design
Eastleigh Roads Phase 2 (Construction)	7.6	Under design
Dualling of Outering Road	13	Tender under evaluation
Upgrading of Kasarani-Mwiki-Githurai Link Road (Phase 2)	0.8	Under design

Upgrading of Syokimau-Katani Road phase 2	3	Under design
Kisumu Foot Bridge	1	Under design
Construction of Kapsoya Roads in Eldoret Municipality Phase 2	6	Under design
Construction of Meru Bypass	17	On-going
Nakuru Bypass	20	Under design
Design of Ilala-Murhanda-Lubao, Ilesi-Sterman-Emaondo, and Mwiyala-Mungulu-Ikonyero Roads	42	Under design
Construction of Missing Link 1a (River Road-Ngara)	0.7	Consultations with stakehlders ongoing
Construction of Missing Link 5(Muratina –General Waruinge street to Juja Road)	3	Awaiting tendering
Construction of Missing Link 5a(Ring Road – parklands)	4	Awaiting tendering
Mombasa Road-Lukenya-Daystar University, Shell-Pepe, Kinanie-Joska and Quarry Roads in Mavoko	43.7	Under design by Kiri Consultants Ltd
Construction of Missing Link 5b(Limuru rd–Thika Rd	1.6	Awaiting tendering

Source: https://kura.go.ke

APPENDIX V:Letter for data collection

MASENO UNIVERSITY
SCHOOL OF PLANNING AND ARCHITECTURE
DEPARTMENT OF URBAN & REGIONAL PLANNING

P.O. BOX 333 MASENO

TEL 51008, 51622
Date: 07/06/2017

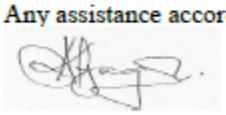
TO WHOM IT MAY CONCERN

Course Code:- PPM 899-Project
M.A in Project Planning and Management-
Student: - Fredrick Obade--EL/SPM/00512/2013

Dear Sir/Madam

The above mentioned is a student of Maseno University in the Department of Urban and Regional Planning. The student has completed course work and is collecting data for the Project report. The Project title is *"The influence of Risk Management Strategies on timely completion of road infrastructure development projects in Nairobi City County, Kenya"*

Any assistance accorded to the student towards this end will be highly appreciated.



Dr. Leah Onyango
Chairman, Department of Urban & Regional Planning.

MASENO UNIVERSITY IS ISO 9001:2008 CERTIFIED-FOUNTAIN OF EXCELLENCE

APPENDIX VI: Questionnaire

RISK MANAGEMENT STRATEGIES AND INFLUENCE ON TIMELY COMPLETION OF ROAD INFRASTRUCTURE DEVELOPMENT PROJECTS IN NAIROBI CITY COUNTY, KENYA

Introduction

My name is Fred Obade currently pursuing a Master's Degree in Project Planning and Management at Maseno University. I am carrying out a research study on risk management strategies and its influence on timely completion of road infrastructure development projects in Nairobi County, Kenya. I would like to understand your experience and that of your firm regarding risk management strategies and how they have impacted on time, cost and quality of construction projects you have conducted in the recent past

I would like to request for your kind participation in this study by providing answers to the questions as honestly and precisely as possible. Your response to these questions will be treated with confidence. Please do not write your name on this questionnaire. Kindly tick (√) where appropriate or fill the required information on the spaces provided as requested.

The results of the study are expected to improve the understanding of the relationship between risk management and project success among project management teams in the construction industry.

Contact Information

Any questions and concerns may be addressed to;

Fredrick Obade,
P. O. Box 51438-00100, Nairobi.
Mobile: 0720105306
E-mail address: fobade@gmail.com

Would you like to participate in this survey? Yes____ No_____

SECTION A-- General information

SECTION B- Demographic information

SECTION C- Potential risks in infrastructure development projects in Nairobi City County

SECTION D- Risk management strategies in infrastructural development projects in Nairobi City County

SECTION E- The influence of risk management on the completion of infrastructural projects in Nairobi City County

SECTION F- Barriers to effective risk management on road projects within Nairobi City County.

Section A: Background Information

Title of the respondent: _____

Professional qualification of the respondent: _____

Gender; Male _____Female_____

Years of experience in the construction industry: _____

Name of the firm: _____

A1. Date of Interview_____

A2. Firm category 1. Local _____ 2. Foreign_____

A2b. Project County: _____Sub County: _____Ward: _____

A3. Have you conducted any construction projects since 2008? 1. Yes ____ 2. No____
3. Don't Know____

A3b. If yes, how many projects have you conducted since 2008? _____

A4. Please name the recent major project(s) you have undertaken? - _____

_____

A5. How many kilometers did the project (s) cover? _____

A6. What was the estimated period of completion in months? _____

A6. Please indicate the start date? _____ and End date? _____

A7. How long did it take? _____

Section B: Potential risks in construction projects

Please state your level of agreement with the following elements of risk in view of how they have affected completion of construction projects

1. Strongly disagree **2.** Disagree **3.** Not Sure **4.** Agree **5.** Strongly Agree

Type of Risk	**No**	**Risk elements**	**Level of agreement; [1-5]**
Construction Risks			
	1	Disputes amongst workers	
	2	Changing sequences in construction activity	
	3	Unavailability of resources	
	4	Revision of project designs	
	5	Availability of social amenities for workers	
	6	Changes in work load	
	7	Turnaround time in obtaining approvals and making decisions	
	8	Safety and security of workers	
	9	Stoppage of work due to health issues	
Technological Risks			
	10	Knowledge of handling equipment	
	11	System downtimes- breakdown	
	12	Loss of data or software/hardware of computer	
Financial Risks			
	13	Delays from clients	
	14	Increment of staff benefits & allowances	
	15	Increase in prices of raw materials	

	16	Fluctuations of requested resources	
Management Risks			
	17	Documents and processes directed as per agreement for mitigation of risk	
	18	Project team discussions on risk	
	19	Use of Work Breakdown Schedule and project milestones to help identify project risks	
	20	Availability of time for planning	
	21	Staff turnover, especially technical personnel	
	22	Documented process for identifying project risks	
Political Risks			
	23	Political interference	
	24	Workers union interference	
Design Risks			
	25	Late changes of design from client side	
	26	The level of details of design demanded by the project owner affecting over all construction time	
	27	Sub-standard project designs and specifications	
Procurement risks			
	28	Fluctuations/ increase in prices of raw materials	
	29	Specialized labour for fixation/ installation	
	30	Sub-standard goods & services procured	
Sub-contracting risks	31	Chances of sub-contractor walking out	
	32	Delay in work execution	
Environment Risks	33	Impact of weather condition on completion of project	
	34	Pollution by construction waste	
	35	Procedure to facilitate construction waste cleanup or disposal	
	35	Impact of weather condition on completion of project	

Section C: Risk management strategies

C1: What management strategies does your firm mostly adopt in response to risks?

1. Avoidance of risk **1. Yes _____** **2. No _____** **3. Don't Know_____**

2. Transfer of risks **1. Yes _____** **2. No _____** **3. Don't Know_____**

3. Mitigating **1. Yes _____** **2. No _____** **3. Don't Know_____**

4. Exploit **1. Yes _____** **2. No _____** **3. Don't Know_____**

5. Sharing **1. Yes _____** **2. No _____** **3. Don't Know_____**

6. Enhancing **1. Yes _____** **2. No _____** **3. Don't Know_____**

7. Acceptance **1.Yes _____** **2. No _____** **3. Don't Know_____**

8. Others, please specify: _____

C2: Using the type of strategy mentioned above, please state which strategy you adopt for the following risk types

	RISK	**Risk serial Number**
1.	Construction Risks	
2.	Design Risks	
3.	Financial Risks	
4.	Management Risks	
5.	Political Risks	
6.	Procurement risks	
7.	Subcontracts risks	
8.	Technological Risks	
9.	Environmental/natural risks	

Section D: Project Success assessment

D1. In general, has the project been successfully completed within the agreed……?

a) Timeline? **1.Yes _____ 2. No _____ 3. Don't Know_____**

b) Cost? **1.Yes _____ 2. No _____ 3. Don't Know_____**

C) Quality? **1.Yes _____ 2. No _____ 3. Don't Know_____**

D2. To what level have the below mentioned risks impacted on time, cost and quality of the project?

1. Very Low 2. Low 3. Moderate 4. High 5. Very high

Type of Risk	**No.**	**Risk elements**	**Level of agreement Record [1-5]**		
Construction risks			Time	Cost	Quality
	1	Disputes amongst workers			
	2	Changing sequences in construction activity			
	3	Unavailability of resources			
	4	Revision of project designs			

	5	Availability of social amenities for workers			
	6	Changes in work load			
	7	Turnaround time in obtaining approvals and making decisions			
	8	Safety and security of workers			
	9	Stoppage of work due to health issues			
Technological risks					
	10	Knowledge of handling equipment			
	11	System downtimes- breakdown			
	12	Loss of data or software/hardware of computer			
Financial risks					
	13	Delays from clients			
	14	Increment of staff benefits & allowances			
	15	Increase in prices of raw materials			
	16	Fluctuations of requested resources			
Management risks					
	17	Documents and processes directed as per agreement for mitigation of risk			
	18	Project team discussions on risk			
	19	Use of Work Breakdown Schedule and project milestones to help identify project risks			
	20	Availability of time for planning			
	21	Staff turnover, especially technical personnel			
	22	Documented process for identifying project risks			
Political risks					
	23	Political interference			
	24	Workers union interference			
Design risks					
	25	Late changes of design from client side			
		The level of details of design			

	26	demanded by the project owner affecting over all construction time			
	27	Sub-standard project designs and specifications			
Procurement risks					
	28	Fluctuations/ increase in prices of raw materials			
	29	Specialized labour for fixation/ installation			
	30	Sub-standard goods & services procured			
Subcontracts risks	31	Chances of sub-contractor walking out			
	32	Delay in work execution			
Environment Risks	33	Impact of weather condition on completion of project			
	34	Pollution by construction waste			
	35	Procedure to facilitate construction waste clean-up or disposal			
	35	Impact of weather condition on completion of project			

Section E: Barriers to effective project risk management

E1: Please state whether the following barriers have influenced your projects risk management

1. Institutional culture which has put more weight on positive information about the service than on information suggesting there is cause for concern

   Yes / No / Don't know _____

2. Too great a degree of tolerance of poor standards and of risk

   Yes / No / Don't know _____

3. Inadequate communication within and between teams, departments and organisations

   Yes / No / Don't know _____

4. Inadequate communications within and between teams, departments and organisations

   Yes / No / Don't know _____

5. Inadequate communications within and between teams, departments and organisations

   Yes / No / Don't know _____

6. Management systems that are both deficient and not followed properly

   Yes / No / Don't know _____

7. Others, please specify_____

Section F: Regulating Authorities and Government agencies

F1: How have regulating authorities and Government agencies affected:

F1. Cost

1. Negatively____ 2. Positive _____ 3. No effect _____ 4. Don't Know_____

F2. Timelines

1. Negatively_____ 2. Positive _____ 3. No effect _____ 4. Don't Know_____

F3. Quality

1. Negatively_____ 2. Positive _____ 3. No effect _____ 4. Don't Know_____

END