IMPACT OF EXCEPTIONAL EVENTS ON COST PERFORMANCE OF HIGHWAY PROJECTS IN KENYA: A CASE OF KENHA PROJECTS

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Impact of Exceptional Events on Cost Performance of Highway Projects in Kenya: A Case of KeNHA Projects

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DECLARATION

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

Signature……Date……..……

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This thesis has been submitted for examination with our approval as the University Supervisors

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DEDICATION

This thesis is dedicated to my husband Emmanuel Miyanga, my son Rejalla Murutu Miyanga and daughter Rayna Nasimiyu Miyanga; you have made me better, stronger and more fulfilled than I could have ever imagined. To my parents Mr. Stephen Nandi Chikamai and Ms. Benrose Salome Chikamai; thank you for the sacrifices made to see me this far.

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ACRONYMS AND ABBREVIATIONS

ACEK	Association of Consulting Engineers of Kenya
AERC	African Economic Research Consortium
AFCAP	African Community Access Program
AfDB	African Development Bank
D.C	District of Columbia
DFID	Department for International Development
IEA	Institute of Economic Affairs
ILO	International Labor Organization
KeNHA	Kenya National Highways Authority
KIPPRA	Kenya Institute for Public Policy Research and Analysis
KURA	Kenya Urban Roads Authority
MDGs	Millennium Development Goals
PALWECO	Program for Agriculture and Livelihoods in Western
PIARC	Permanent International Association of Road Congress
RICS	Roads Inventory and Conditions survey
RoK	Republic of Kenya
SACTRA	Standing Advisory Committee on Trunk Road Appraisal

SIDA	Swedish International Development Cooperation Agency
SPSS	Statistical package for social sciences
WEDC	Water Engineering and Development Centre
WTO	World Trade Organization

DEFINITION OF OPERATIONAL TERMS

Cost overrun The amount by which the actual cost exceeds the budgeted amount or estimated amount (Akinsola et al., 1994).

Exceptional event A sudden or unpredictable occurrence, never contemplated whose effect can materially change the scope and cost of a project (Banaitiene & Banaitis, 2012).

ABSTRACT

The implications of cost overruns in road infrastructure projects are wide ranging. The most notable effect being the strain on the resources due to additional costs over and above the budgeted costs as well as reduced benefits to the intended users. In some cases, these costs are passed on to the road users. The problem in this study is that highway construction projects in Kenya experience huge cost overruns. However, the contribution of exceptional events to cost performance of highways projects is not well understood. Further, the current standard forms of contract have not been clear on how to address the aftermath of exceptional events considering the uncertainty of the occurrence. Therefore, this study was conducted to address these concerns. The main objective of the study was to assess the impact of exceptional events on the cost performance of highway projects in Kenya with a case study of Kenya National Highway Authority (KeNHA). The study was guided by specific objectives which include: to determine the effect of global pandemics on the cost performance of highway projects in Kenya; to determine the influence of economic recession on cost performance of highway projects in Kenya; to determine the effect of exceptional climatic conditions on the cost performance of highway projects in Kenya; to determine influence of mitigation measures on the cost performance of highway projects in Kenya. The research design adopted was both qualitative and quantitative. The target population was active KeNHA projects within Nairobi Metropolitan area where 14 projects were considered. From the target population, a sample size of 42 respondents was selected. The respondents were drawn from three levels of workmanship in the projects which included a project manager, project contractor and site engineers. In this study, emphasis was given to both primary data and secondary sources. The primary data was collected using structured questionnaires. Secondary data was sourced from journals, published reports and articles. Data collected was analysed with the aid of Statistical Package for Social Science (SPSS) Version 20. The raw data was edited and then entered in the SPSS computer program by assigning symbols in a process referred to as coding. Thereafter, the data was analysed with the output being presented in form of frequencies, descriptive charts and graphs. The findings showed that exceptional events had a significant effect on cost of infrastructure projects in Kenya. The correlation and regression analysis indicated that global pandemic, economic recession, climatic conditions and mitigating factors had significant effect on cost of projects. The study concluded that all the variables were relevant in explaining variation in cost of projects. From the regression model it was noted that the correlation of variables was explained by R^2 of 90.3% and adjusted R^2 of 90.0%. This means that the exceptional events would cause the variation of cost performance of the project by over 90%. This study therefore recommends the improvement of this model by including more variables that are relevant in explaining the variation. This study also recommends further research to include studies in other government departments on other factors other than exceptional events that affect cost performance of projects.

CHAPTER ONE

INTRODUCTION

1.1 Background to the Study

Generally, infrastructure plays an important role in the economy of any country due to the nature of impact it has on the citizen's welfare and investments. The roads sub-sector particularly is a vital factor in the socio-economic development of a country as it facilitates access to markets, which in turn enhances production and increases the level of employment. Further, the development of other sectors such as education, health and other social services depend a great deal on the roads sector. Research has shown that expensive and inadequate infrastructure is responsible for two percentage points in retarded economic growth every year in Africa (Foster and Briceño-Garmendia, 2016).

In Kenya, the roads transport accounts for 93% of all freight and passenger traffic with the balance attributed to other modes of transport mainly air, sea and water. This underscores the significance of the sub-sector to the Kenyan economy. Research suggests that close to 30% of the productivity handicap faced by Kenya is attributable to infrastructure constraints majorly the power sector closely followed by the transport sector (Briceno-Garmendia and Shkaratan, 2011). It is imperative that the Government consistently increases investment in this sector in order to improve the economic performance of the country. Due to the capital-intensive nature of such investment, cost is thus an important determinant on the level of roads network development and has a direct impact on how long the country will take to achieve an adequate and reliable road network and by extension a sustainable economic growth.

Furthermore, evidence suggests the robustness of the construction industry in Kenya is attributed to *inter alia* the improved infrastructural networks which seek to enhance connectivity and mobility in the Country. Among the notable developments thus far include; the completion of the Single-track Standard Gauge Rail (SGR) from Mombasa to Nairobi, the second Phase of SGR running 120 km from Nairobi to Naivasha, expansion and modernization of Outer Ring Road, Expansion of Ngong

Road, Construction of Kenya Western Bypass, Dongo Kundu bypass and Nuno-Modogashe Road (KRB, 2018). Importantly, The Big Four Agenda that defines the Government`s priorities and development path for the 2018-2022 planning cycle provides impetus for increased construction activities for the next five years. This study posits that for Kenya to realize the vision in its development blue-print, the construction industry must operate at optimal performance through enhanced efficiency in the management of construction projects than it is presently done.

Investment in the roads in Kenya is guided by the Roads Sector Investment Program developed in 2009 (RSIP). The RISP is a blue print by the Government of Kenya with the main objective being to guide investments, maintenance and rehabilitation of roads in Kenya to global standards and best practices for a period of 15 years (2010-2024). This was informed by the ambitious growth prospects and economic transformation outlined in the vision 2030 which hinges heavily on quality and adequate infrastructure. Funding of roads infrastructure projects is done through five main sources; the Exchequer comprising government revenues, the Road Maintenance Levy Fund (RMLF), Transit tolls, Agricultural Cess and the Development Partners. Road's expenditure constitutes about 15% of the total public expenditure annually making it one of the largest single elements of public expenditure in Kenya (Burgess eat al., 2013). Between the financial year 2011/2012 and 2014/2015, the government spent Kenya shillings 408.5 billion on construction and maintenance of roads in the country which gives a mean of Kshs 102 billion per year. In the financial year 2016/2017, 2017/2018, 2018/2019 and 2019/2020 the funding grew exponentially.

Cost is said to be an essential consideration and one of the major constraints in implementation of any project to the extent that cost overruns are sometimes viewed as a major determinant of the success or failure of the project (Wijekoon and Attanayake, 2011). Researchers have termed cost overrun as a common phenomenon in the road projects in the world and is measured by the difference between the final total cost of the project and the original contract amount. The magnitude varies from one project to another and are more prevalent in the developing countries than in Europe and North America (Flyvbjerg, Skamris Holm, and Buhl, 2004; Wijekoon and Attanayake, 2011; Chantal Cantarelli, Flyvbjerg, Molin, and Van Wee, 2010). Over

the last few decades cost overruns have remained common with some projects recording up to 60 % increase from the original contract sum (Foster and Garmendia, 2010). Of even more concern is the fact that historical data shows no improvement in cost performance in the last few decades indicating that no significant learning has occurred in this area (Flyvbjerg et al., 2009).

Researchers have wide-ranging findings on the magnitude and frequency of cost overruns in roads projects as well as the associated factors. In one study the average cost overrun for large scale projects was estimated to range between 20.4 to 44.7% (Chantal et al., 2010). Another study by the African Development Bank (AfDB) found the average cost overrun to be 35% with some cases recording as high as 50% and even 100% (Mthuli, Mugerwa, Lufumpa and Murinde, 2014). The latter also found strong evidence of scale effect where cost overruns were higher in smaller projects-less than 50 km, than in larger projects. This is consistent with the World Bank study that recorded 90% of the road projects having experienced cost overruns averaging 80% (Foster and Briceño-Garmendia, 2010).

The implications of cost overruns in the road infrastructure projects are wide ranging. The most notable effect of cost overrun is the strain on the resources due to additional costs over and above the budgeted costs as well reduced benefits accruing to the intended users. In some cases, these costs are passed on to the users leading to higher costs. Further, cost overruns have implications to the various parties attached to the project. The inability to deliver value for money brings with it reputational risk to the professionals on the project which may lead to loss of confidence by future clients. The contractor on the other hand loses on the profits in addition to facing reputational risk and possible litigation. The construction industry as whole may suffer devastating effects as increased cost overruns may lead to abandonment of projects. This may have a negative impact on financing future projects with the financiers shunning away from similar projects or charging a higher cost of finance due to presumed additional costs expected as a result of cost overruns.

At the centre of cost overruns in road projects, is the aspect of exceptional events which often lead to change orders that ultimately, alter the scope, duration, or cost of a

project. The impact of exceptional events in the Kenyan construction projects is still not well understood. The projects stakeholders (e.g., clients, contractors, and consultants) still deal with exceptional events in a corrective manner rather than a preventive one. Therefore, exceptional events have significant effects on cost, time, safety, labour productivity, and work quality.

Geraldi, Lee-Kelley, and Kutsch (2010) define unexpected events as "the outcome of a range of residual uncertainties that can threaten the viability of a project." On the other hand, Hallgren and Maaninen-Olsson (2005) regard unexpected events as deviations and define it as "a situation, regardless of consequence—positive or negative, large or small— that deviates from any plan in the project." Exceptional international events, such as natural disasters, terrorism, global economic recessions, epidemics, pandemics, war, invasions, etc have been recognized as significant disruptors in the construction sector (Aigbavboa, et al., 2022).

Geraldi et al. (2010), by interviewing 22 experienced project managers, analyzed how project managers respond to unexpected events and identified the following three pillars that support successful responses to unexpected events: (1) responsive and functioning structure at the organizational level, (2) good interpersonal relationship at the group level and (3) competent people at the individual level. Additionally, Geraldi et al. (2010) demonstrated the differentiating aspects of unexpected events based on their probability, impact, pertinence and timing. Some unexpected events are considered less likely to occur compared to other ones. Additionally, some unexpected events might occur suddenly, while some are not recognized at first and built up slowly during the project. More importantly, as a result of Geraldi and colleagues' analysis of 44 unexpected events, six different categories of unexpected events emerged, namely: technical issues, sponsor withdrawing support, external events, resource change or constraint, human behavior and project scope.

The recent natural disasters and extreme weather have resulted in an increase of delay claims and have raised complex issues relative to force majeure clauses (Ridder & Weller, 2014). In construction contracts, these events, and other events that have been stipulated in force majeure clauses, would exclude liability where unforeseen events,

beyond a party's control, prevent the performance of its contractual obligations, meaning that the contractor is entitled to extra time to perform without monetary compensation (FIDIC'S Law). Though force majeure delays are not considered to be compensable, the common denominator in force majeure case law involves the evaluation of essential evidence for undertaking precautions and reasonable preparation to avoid the consequences of a foreseeable condition. It is not sufficient to merely contend that the delay resulted from a severe storm or hurricane. Therefore, it should be kept in mind that it is possible for a force majeure delay to be compensable to the innocent party suffering damages (Buffalow, 2011).

In general, during a force majeure event, the service provider or the contractor is the most affected party. This happens due to Force Majeure conditions; and experiencing losses as a consequence of delays and damage and / or destruction of work, facilities and equipment. To overcome this, the contractor would ask the project owner establish force majeure conditions. It is intended to escape the responsibility of completing the project on time and avoid fines, as well as obtain claims for compensation for losses suffered due to force majeure. In reality however, most of the time, the project owner is hesitant to declare force majeure conditions. It is due to unfamiliarity with the force majeure provisions in the existing contract and consideration of receiving claims for losses suffered by the implementing contractor (Adi et al., 2022).

1.2 Problem Statement

There have been more problems of construction failures than success especially in the developing nations (World Bank, 2017). Most of the failures have been reported to occur at the implementation stage. Implementation stage is the most crucial of all stages and there are certain factors that have been identified to influence it. Some of these factors include; scarcity of resources, inadequate assessment of targets, poor timing and scheduling for the project time among other. Other important factors include force majeure also known as exception events which is not explicitly determined (Baker et al., 2020). These are an unpredictable occurrence or situation which might have a favorable or negative impact on the project's aims (Banaitiene & Banaitis, 2012).

The problem in the study was that highway construction projects in Kenya have had huge cost overruns. The contribution of exceptional events to cost performance of highways projects is not well understood. Furthermore, the current standard forms of contract lack a preventive mechanism for exceptional events in the construction of highways in Kenya. According to the Kenya National Highway Authority (KENHA) annual report (2020/2021), the Authority faced challenges emanating from inadequate budgetary allocation, with the pending bill on land acquisition and works being at KES 50.7 billion at the end of the financial year. The outbreak of COVID-19 slowed down construction works due to supply chain disruptions for both road construction materials and specialized labour. Other challenges that affected project delivery during the year included vandalism of road furniture, which compromises road safety, delays in the relocation of utilities, encroachment on road reserves. These challenges continue to hinder timely project completion and often lead to escalation in project cost due to interest charges and contractual claims.

According to Ashworth (1998), the existence of variation clauses in various standard forms of contracts is not a bad idea per se. They provide opportunities to project players to deal with unlikely events that may occur in the life of a project. Additionally, it somewhat improves the clients' potential for securing a superior end product, but at a price, for the clients then have less certainty about the completion cost and time for their projects. In addition, these clauses impose limits to the magnitude of changes so that the clients' right to vary is not mismanaged. However, none of the existing procedures addresses how the cost impact of exceptional events can be prevented hence; the grounds are often abused thereby providing a loophole for unwarranted cost overruns and time overruns in projects.

A number of studies have been carried out on construction on cost overruns under various construction projects. Mahamid (2011) investigated the statistical relationship between actual and estimated cost of road construction activities based on a sample of 100 road construction projects awarded in the West Bank in Palestine. The findings revealed that the average cost deviation in the investigated activities was as follows; earthworks, 15.7%, base works, 12.9%; asphalt works, 18.5% and furniture works, 36.4%. His findings, however fell short of investigating the cost drivers responsible

for the deviation between actual and estimated cost. Anzinger and Kostika (2015) carried out a cross-sect oral analysis of large projects in Germany based on a database of 170 cases (119 finished, 51 unfinished projects) of projects between 1960 and 2014, and found out that there were significant variations in infrastructure project outcomes across sectors in Germany.

According to Macharia (2016), approximately 55% of the country's road construction projects face various challenges that prohibit them from being completed on schedule, incurring cost overruns, or failing to satisfy quality standards. According to studies in Kenya, the number of public road development projects has been steadily increasing. However, completing projects within the stipulated cost budget and timetable has become difficult (Waithera and Susan, 2019). Scope creep, cost overruns, poor craftsmanship, and project time delays are all factors in the few projects that are completed (Waithera and Susan, 2019). None of the research done have focused on exceptional events on the cost of the Kenya. Therefore, the purpose of this study is to investigate the impact of exceptional events on the cost performance of highway projects in Kenya. A case of National Highways Authority (KeNHA) projects with a view of recommending a framework for exceptional events management for cost effectiveness.

1.3 Objectives

1.3.1 General Objective

The general objective of the study was to assess the impact of exceptional events on the cost of infrastructure projects by the Kenya National Highways Authority.

1.3.2 Specific Objectives

i. To determine the effect of global pandemics on the cost performance of highway projects in Kenya.
ii. To determine the influence of economic recession on the cost performance of highway projects in Kenya.

iii. To determine the effect of exceptional climatic conditions on the cost performance of highway projects in Kenya.
iv. To determine the influence of mitigation measures on the cost performance of highway projects in Kenya.

1.4 Hypotheses

i. Global pandemic has no significant effect on the cost performance of highway projects in Kenya.
ii. Economic recession has no significant influence on the cost performance of highway projects in Kenya.
iii. Exceptional climatic conditions have no significant effect on the cost performance of highway projects in Kenya.
iv. Mitigation measures have no significant influence on the cost performance of highway projects in Kenya.

1.5 Justification and Significance of the Study

1.5.1 Justification

The construction sector has been heavily challenged by the exceptional events taking place causing unprecedented variations. In order to address such occurrences, much needs to be done to improve construction project delivery. Evidence from previous studies done have indicated that over 50% of construction projects in Kenya were failing by not meeting their cost projections, time schedules, quality demands or safety targets. The reporting explains that there is need for an in-depth review of causes of such variations to give a solution to the root cause. This study therefore, sought to fill the existing gap by establishing how exceptional events affect construction costs. The findings guide the mitigation factors in case of occurrence of such events in the future.

1.5.2 Significance

Occurrence of exceptional events are an all-too-common part of construction projects. This is because; when an exceptional event occurs, the need to make changes in a

construction project becomes a matter of practical reality. However, changes as a result of exceptional events can be extremely expensive and may negatively impact a project's schedule. In addition, they can potentially sour the business relationships on a project. The study and its outcome were to therefore help improve the management of the impact of exceptional events. The study findings significantly contributed to theory and existing body of knowledge. This study might in future enrich the theoretical foundation of exceptional events and financial distress theories in explaining the nature of such a relationship if it ever existed in construction and other related industries.

These study findings enabled researchers and academicians identify the knowledge gaps for future research in explaining the nature of the relationship between exceptional events and cost variations. It should therefore form useful material for reference to other researchers and readers in general. The study findings will be assisting contractors to formulate and implement sound construction management strategies as mitigation measures of dealing with exceptional events so as to not only manage cost, but for the entire construction performance basing on the other balance score card items.

1.6 Scope of the Study

This study was focused on investigating the impact of exceptional events on the cost on KeNHA projects. The study was confined to KeNHA projects within the Nairobi Metropolitan in the republic of Kenya. This region comprises of five counties (Nairobi, Kiambu, Murang`a, Kajiado and Machakos Counties), Republic of Kenya (2016). The contractors and consultants on the projects were assumed to be experienced in construction of KeNHA projects and spread across the breadth and width the republic of Kenya. This was achieved through questionnaire survey and interviews. It is assumed that:

The impact of exceptional events and their magnitude varied from one type of project to the other. For the purpose of this study, it was assumed that all KeNHA projects face exceptional events.

The study assumed that, the respondents were honest and gave accurate responses to the items in the data collection instrument used in the study. The sample size chosen was adequate to help draw a valid conclusion and that it was unbiased.

The recommendations were given after the findings of the research had been adhered to by all the relevant players in the construction industry and improved the management of exceptional events in KeNHA projects.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter discusses the concepts around the cost performance of road projects and the issues of exceptional events in highway projects. Various theories explaining the existence of cost overruns are explored to gain a deeper understanding of the concept and its occurrence. Further, a review of empirical literature is done to gather more evidence on the existence of this phenomenon in the global arena. Different research findings are interrogated with respect to the magnitude, frequency of occurrence as well as the causal factors. Based on this, the conceptual framework is then developed to guide the study.

2.2 Theoretical Review

Researchers have varied findings on the occurrence of cost overruns. Part of the reasons for inconsistencies in the findings emanate from diversity of theories, which have been fronted by different authors to explain the phenomenon of cost overruns. Among these are the psychological theory of the firm projects, application of environmental theories of the firm project and the Agency Theory. The divergence of findings indicates that no one theory can explain the occurrence and causes of cost overruns in totality. However, explanations from different theories can be captured to put together a combination of factors that if considered may explain a good percentage of cost overruns. This study seeks to employ a multiplicity of theories to explain the determinants of cost overruns in the road construction industry in Kenya. The various theories can help us appreciate the multitude of factors that affect cost overruns as well as different perspective to view it.

2.2.1 Psychological Theory of the Firm to Projects

Cantarelli et al. (2010) use theories from behavioural studies to explain manifestation of cost overruns in the road construction projects. Included in this category are two

theories primarily on optimism bias; planning fallacy theory and the prospective theory. The planning fallacy theory was first proposed by Daniel Kahneman and Amos Tversky in 1979. It is a phenomenon in which predictions about how much time will be needed to complete a future task displays an optimism bias. The definition was expanded in 2003 to include individuals' tendency to underestimate time, costs and risks of future actions while overestimating the benefits of the same actions.

According to Daniel Kahneman and Amos Tversky (1979) this phenomenon occurs regardless of the individual's knowledge that past tasks of a similar nature have taken longer to complete than generally planned. The bias only affects estimates or forecasts about one's own tasks; when outside observers predict task completion times, they show a pessimistic bias, overestimating the time needed. The optimism bias is attributed to the cognitive biases of the forecasters such as scenario thinking, anchoring of estimations and extrapolation of current trends (Cantarelli et al., 2010). The anchoring trap is well explained in the "Hidden Traps in Decision Making'' by John S. Hammond and others. According to these authors, the old numbers become anchors which the forecaster adjusts based on other factors. While this approach may lead to reasonably accurate estimate, it relies too much on past events giving little weight to other factors. This may lead to misguided choices especially in a situation where the market place changes rapidly resulting to underestimation of costs and eventually lead to cost overruns. Thus the planning fallacy results not only to time overruns but cost overruns as well with reduced benefits. This theory can be used to explain the occurrence of cost overruns in that the contract price, which is compared against the actual cost to determine the cost overruns, is a function of the Engineers estimates. The engineers estimate on the other hand is a product of estimation and is largely derived from historical data. Cost overruns are likely to occur if the engineer relies too much on the historical information without incorporating other determinants that may affect the cost of a project.

Closely related to the planning fallacy theory is the prospect theory by the same authors Daniel Kahneman and Amos Tversky in 1979. This is a behavioural economic theory that designates the way people choose between probabilistic alternatives that involve risk, where the probabilities of outcomes are known. According to this theory people

make decisions based on the potential value of losses and gains rather than the final outcome and evaluate these losses and gains using certain heuristics. Under prospect theory, value is assigned to gains and losses rather than to final assets; also probabilities are replaced by decision weights. The value function is defined on deviations from a reference point and is normally concave for gains (implying risk aversion), commonly convex for losses (risk seeking) and is generally steeper for losses than for gains (loss aversion).

Decision weights are generally lower than the corresponding probabilities, except in the range of low probabilities. Like in the planning fallacy theory, the linking of the optimistic theory to cost overruns can be seen through the engineer's estimates which are the basis upon which bidding is carried out to obtain the lowest evaluated bidder. This optimistic forecast is as result of decision making process involving risk and uncertainties. (Chantal C. Cantarelli et al., 2010).

2.2.2 Application of Environmental Theories of the Firm to Projects

The effect of a firm's environment could be seen in the light of "environmental uncertainties", as operationalized in three basic components: munificence, dynamism and complexity (McArthur and Nystrom, 1991; Goll and Rasheed, 1997; Hamsal and Agung, 2007). Munificence refers to an environments' ability to support sustained growth of an organization (Starbuck, 1976; Aldrich, 1979). It has also been defined as "the scarcity or abundance of critical resources available to firms operating within an environment (Dess and Beard, 1984; Jogaratnam and Olsen, 1999). Castrogiovanni (1991) distinguishes three kinds of munificence: "capacity, growth/decline, and opportunity/threat". In the project situation, capacity could be related to economic (financial, technology and so on), availability of resources (material, human and plant); growth/decline could be likened to economic indicators and their movements during the project life cycle (inflation, price fluctuations, and so on); while opportunity/threat could be related to natural environment (weather, political instability etc.) and social environment.

On the other hand, Dynamism describes "the degree of the market's instability over time and the turbulence caused by interconnectedness between organisations", For

example, prevailing competition (Aldrich, 1979; Mintzberg, 1979). In the project situation this interconnectedness becomes even high when several projects are being undertaken by the same client (in this case, the government). Keat and Hitt (1988) found dynamism to be significantly related to performance. Dynamism could be related to the political, natural (weather) or social environment. Therefore, organizational environmental munificence and dynamism captures the project's external environmental factors. The factors at play are a mixture of both human and non-human. They are, most often than not, the source of changes that confront project execution and demands quick strategic response. Complexity describes the degree of heterogeneity and the dispersion of an organisation's activities (Aldrich, 1979; Duncan, 1972; Starbuck, 1976). This is related to the project's internal environment during execution and relate to the processes and structure of its implementation. They describe the contingency factors affecting the project and its performance. Bourgeois (1980) reasoned that complexity remains a relatively constant factor in task environments; and according to McArthur and Nystrom (1991) literature search failed to locate any empirical studies using objective measures of environmental complexity as moderators.

These are non-human factors and barring any variations, and when there is no undue political interference, they will remain constant throughout the project life cycle. According to Goll and Rasheed (1997), "environmental characteristics or properties have major implications for all aspect of management including strategy, structures, process and outcomes".

2.2.3 Application of Agency Theory to the Project

Agency theory offers a possible explanation for the successes and failures of information systems projects. The theory is that the stronger the outcome base of the contract between the project manager and the system developer, the fewer the trade-offs, the higher the chances of project success, the less personal information and as a result, it suggests a higher chance of success.

Research by Caers et al. (2006) predict that the principal's objectives can only be achieved if the agent's activities are controlled, while Akpanuko and Asogwa (2013)

argue that the existence of a relationship can be enhanced by the effective cooperation of the principal, as well as the adoption of open points of view and the availability of necessary information. Zu and Kaynak (2012) and Mahaney and Lederer (2011) explain that agency theory was proposed by economists in the 1960s and 1970s to understand conflicts of interests between two people known as the agent and the principal.

2.3 Empirical Review

2.3.1 Nature of the Construction Industry

The construction industry is of crucial importance to the economy of any country. It contributes directly and indirectly to various other sectors for example, the manufacturing sector, service sectors and provides various employment opportunities in a country. Therefore, it can be ascertained that a growing physical infrastructure including roads, commercial buildings, residential units, factories, ports and other monumental projects can be a sign of the growing economy of a country (Rhodes, 2019). The literature suggests that the output from construction industries averages around 3-8 % of national GDP for most of the countries worldwide (). Data from the United Nations Economic Commission for Europe (UNECE) shows a spread of contribution by construction companies to national GDP in Europe from 2-10 % for the year 2018 (UNECE, 2018). Chitkara (2009), noted that construction is an everlasting activity across the globe contributing between 6-9% of the Gross Domestic Product in most countries. What is emerging from the above is that the industry is crucial It however, has projects which are themselves dynamic and carried out in changing environments, this therefore means that changes are likely to happen in the management of projects as well as in the built facilities.

In Kenya, the construction industry is a crucial sector for the growth of the economy. According to the Kenya National Bureau of statistics (KNBS; 2015) Cited in Gwaya (2015), the construction industry contributed 3.8, 4.1, 4.3 and 4.1% towards Gross Domestic Product (GDP) for the years 2008, 2009, 2010 and 2011, respectively. However, when this growth is compared to the 10% GDP for developed countries (Kenny, 2007 and, Hillebrandit, 2000), the performance of the Kenyan construction

industry is still dismal hence there is need for growth of the construction industry in Kenya to match the developed economies. One of the challenges facing the construction industry in Kenya as shown in literature, is the cost overruns in highway projects.

2.3.2 Transportation Infrastructure Systems Review

Transportation systems form a bulk and most important infrastructural developments in any economy. Transportation systems include highway, rail, air, marine and pipelines. Of these, only marine and pipelines do not make use of pavements. The major elements of the highway system are the pavements. For air travel, runways, taxiways, and parking aprons are pavements. The pavements represent one-half of total highway expenditure and moreover expenditure on pavements continues to grow as maintenance and rehabilitation are required. Transportation infrastructure plays a vital role in the economic, social, and state of all countries and this role cannot be neglected. The impact of growth and prosperity achieved in this sector extends to include other sectors, and therefore, there is a strong relation between growth in the transportation sector and the growth of a country's economy as a whole. All this is reflected in the significant contribution made by this sector to Gross Domestic Product (GDP) and increasing financial returns to a country directly or indirectly.

Some studies indicate that costs attributable to transportation are on average almost 20% of the final cost of a product; thus, reducing transportation cost will reduce product cost (Elbart et al., 2020). For example, reduction of transport cost by 10% leads to lower cost of the final product by almost 2% (Stepien et al.,2016).

The contribution of the transportation sector to the GDP of the United States of America for example, represents almost 20% and in Germany, 4.17%, which means that the contribution of this sector in many industrialized countries has significant importance on estimated GDP of these countries. This means that it is necessary to allocate a significant proportion of the budget to the transportation sector, as the sector is considered an important source of government revenue and has a big role in the growth of the country's GDP (Stepien et al., 2016).

Some of the most productive projects are those of roads because of the potential economic savings. Therefore, the amount spent on establishing and expanding the network of paved roads and bridges has a direct and speedy return in reducing transport costs and hence stimulating economic growth. Transportation Infrastructure (roads, rail, airports and seaports) represents important infrastructure to all countries' economies. According to the Federal Highway Administration (FWHA 2008) the United States Department of Transportation (USDOTS) reports transportation (18.9%) accounts for the second largest household expenditure and the expenditure in the highway sector represents the largest amount in transportation. The US network includes more than 50,000 miles of interstate highway, and over 115,000 miles of the national highway system. The total lane mileage length is 4.82 million and the total centreline mileage length is 4.2 million.

The condition of highway pavements on the National Highway System (NHS) in the United States is such that the cost to maintain the system at existing condition levels is nearly $50 billion annually (FWHA 2008). However, the United States currently spends only about $25 billion per year, and the estimated cost to bring the entire system up from its current level to a good level is $200 billion. Judging from this, it is clear that the system cannot continue to operate with traditional approaches to pavement management at the maintenance level and that the pavement preservation strategies employed at the various levels of Department of Transportation (DOT) (i.e., state, county, and city) need to be restructured (FWHA 2008).

The sub-saharan countries also face the same problem and even much worse. South Africa has 746,978 km of road network with only 20.6% paved. This is most replicated in most other countries of the continent (Asif, 2012). The condition of urban roads in the sub-saharan can be summarized as follows: Burkina Faso 60% good, 35% fair and 5% poor; Ghana 40% good, 15% fair and 45% poor; Chad 35% good, 10% fair and 55% poor; Namibia 25% good, 20% fair and 55% poor; Ethiopia 25% good, 20% fair and 55% poor. For countries in Eastern African the conditions were ranked as follows; Tanzania 25% good, 20% fair and 55% poor; Madagascar 10% good, 5% fair and 85% poor; then finally Uganda has 0% of its urban roads in good condition, 20% fair and 80% being in poor state (AFDB, 2014).

In sum, many developing countries of Asia and Africa, a pavement by asphalt tends to deteriorate faster than expected comparing with that of developed countries, not only due to low quality control during construction but due to improper maintenance after in service (Jackson, 2011). A pavement, one of most important infrastructures, is required to provide the comfortable and safety to the people and vehicles traveling on it. However, a pavement is a kind of consumable material and must be replaced at adequate timing because it is easily and directly damaged or deteriorated by the applying load and surrounding environment such as heavy traffic, intemperate climate and so on, which depends on its location (Kodippily et al., 2018). Thus, for proper maintenance, first, it is necessary to examine and clarify the factors of that deterioration. Then, monitoring and evaluating of the condition of pavement should be done periodically to secure its performance for road network maintenance and management. Recently, infrastructure asset management has been a sensitive topic for civil engineers. Even in developed countries, the budget invested in public work tends to decrease although the aged structures to be maintained dramatically have increased, and those structures must be maintained within that limited budget (World Bank, 2017). A large number of researches related to infrastructure asset management have been disseminated. According to Kobayashi (2015), the infrastructure asset management is "the optimal allocation of the scarce budget between the new arrangement of infrastructure and rehabilitation/maintenance of the existing infrastructure to maximize the value of the stock of infrastructure and to realize the maximum outcomes for the citizens". Kobayashi has applied this concept to the road and pavement sector.

In Kenya, infrastructural development has been slow over a number of decades, but over the past few years' efforts have ensured it picks up. The Kenya's Vision 2030, especially under the economic pillar, the general development of infrastructure has been given a lot of emphasis due to its unquestionable role in ensuing there is massive economic growth. This has seen a number of projects start such as the development of standard gauge railway systems to complement the old meter gauge that has served the economy for decades, expansion of the energy and communication sectors among other significant areas (Maparu and Mazumder, 2017).

The Kenya National Bureau of Statistics (2019) estimates that 6,582 road-building projects in Kenya were finished beyond their scheduled completion dates between 2013 and 2018. Between 2013 and 2018, there was an average 6.7-month delay in the completion of road construction projects. Road construction projects had an average cost overrun of KES 14.2 million in 2018. In Kenya, 2,334 road-building projects were completely abandoned between 2013 and 2018 compared to Ghana where a report by GhanaWeb (2020) revealed there were 200 abandoned road projects between 2016 and 2020. Between 2013 and 2018, the average cost of abandoned road building projects in Kenya was USD 7.3 million compared to South Africa where an average road construction cost per kilometre was estimated at around USD 1.2 million, significantly higher than Kenya's average project cost. These statistics demonstrate that road projects in Kenya are facing serious performance challenges that necessitate further interrogation.

The Roads Act, 2007 established various authorities for the management and administration of roads in the country. Among the authorities that were created by the Roads Act of 2007, KeNHA, has the responsibility of management, development, rehabilitation and maintenance of Class A, B and S roads in Kenya. The overall mission of KeNHA is to be a leading authority in the provision of National Trunk Roads (KeNHA, 2011). Despite its robust mandate, trunk roads development in Kenya continue to face cost challenges.

2.3.3 Construction Cost Performance Challenges

Cost is one of the major considerations throughout the lifecycle of a project. Unfortunately, most of projects fail to achieve project completion with the estimated cost. Besides time overrun, cost overrun is also a serious problem in the construction industry. This is a major problem both in developed and developing countries. The trend is more severe in developing countries where these overruns sometimes exceed 100% of the anticipated cost of the project (Azhar et al. 2008). The challenge is becoming more critical as revealed in World Bank (2005) report. The report pointed out that 63% of the 1778 financed construction projects faced poor performance with overrun in budget at an average of 40%. according to Ondari and Gekara (2013), Africa

faces major challenges in the implementation of construction projects where 80% of building developments witness overruns in cost and time as a result of poor project implementation. They opined that most of these challenges are due to poor cost management. Sambasivan and Soon (2018) in a survey of completed twelve projects in different regions in Kenya, they noted that Kenya encountered between 25%-75% poorly implemented construction projects.

The beginning points to understanding this challenge is perhaps to look at what constitutes a cost overrun. Exhaustive conclusion on the definition of cost overrun is hard to come by, but generally, Cost overrun is also called "cost escalation," "cost increase," or "budget overrun" (Zhu and Lin, 2004 in Enshassi, Al-Najjar, and Kumaraswamy, 2009). Cost overrun is the excess of actual cost over budgeted cost which occurs when the final cost of the project exceeds the original estimates (Avots, 1983; Azhar et al., 2008). Cost overrun has become a universal phenomenon (Endut et al., 2009) which adds pressure to investment decision (Ali and Kamaruzzaman, 2010). Cost overrun is measured as a percentage of actual costs over the estimated costs of the project (Cantarelli, 2009; Choudhury and Phatak, 2004) as shown in equation (2.1) in which C_o is cost overrun, C_a is actual cost and C_e is estimated cost.

$$C_o = \frac{C_a - C_e}{C_e} \tag{2.1}$$

Actual costs are defined as real and accounted construction costs determined at the time of project completion. Estimated costs are defined as budgeted or forecasted construction costs determined at the start of projects (Cantarelli, 2009). Despite using up to date project control methods and software packages, such as Gantt Bar Chart, Program Evaluation and Review Technique (PERT), Critical Path Method (CPM), Microsoft Project, Asta Power Project, Primavera, etc. to control cost performance of projects, many construction projects in developed countries still suffer cost overruns (Olawale and Sun, 2010).

2.3.4 Nature and Extent of Cost Overruns

A review of literature on cost overruns reveals a subject that has received considerable attention over the years, but with varying findings on the magnitude and frequency of

occurrence. The existence of cost overruns in infrastructure projects and particularly road transport sector is not contestable. The divergence in findings lies in the magnitude and frequency from one project to another and from one country to another. Singh (2009) conducted a study on the extent, causes and remedies of cost overruns in India. The sample comprised of 850 projects drawn from seventeen infrastructure sectors with a focus on the causal factors behind time and cost overruns. The results indicate that 41.6% of the projects experienced cost overruns with 56% experiencing delays in completion. The mean cost overrun across the projects amounted to 21% with the overrun in the road projects amounting to 8%. The findings on the occurrence of cost overruns are consistent with (Brunes et al., 2014) who carried out a survey of 230 project managers in the Swedish Transport administration and three large construction companies in Sweden. With a response rate of 42%, 52% of the respondents indicated that cost overruns occurred more often with 44% indicating that cost overruns occur sometimes. A mean cost overrun of 8 % however differs sharply from findings from other studies.

A report by the comptroller and Auditor General of the Republic of Tanzania on ten major projects implemented by the Ministry of Roads notes that out of the ten projects reviewed, 8 had a cost overrun. The magnitude of cost overrun out of this sample was 57% ranging from a low of 9% to a staggering 130%. Only two projects had a cost under run of 2% and 6%. This is further corroborated by the study undertaken by African Development Bank on analysis of unit costs and cost overruns on road infrastructure projects in Africa. The research focused mainly on determining unit costs and prevalence and extent of cost overruns in road infrastructure projects in Africa. The findings indicate a cost overrun of 48% and under runs of 15% with a correlation noted between the cost overruns and the project size. Contrary to what other researchers recorded, smaller projects appear to have increased cost overruns translating to higher unit cost per kilometre than larger projects. This they explain may be due to the fact that larger contractors are more sophisticated in their costing or increased efforts by funding agencies on larger projects than smaller projects. The report calls for cautious approach to cost estimation of smaller projects. (Mthuli et al., 2014). In the same report, the researchers found that geographical location of the project and origin of contractor as not significant in explaining the cost overruns.

2.3.5 Exceptional Events and Cost Overruns

Clause 18 in all three of the 2017 FIDIC Red, Yellow and Silver Books deals with events or circumstances which prevent a party from performing some or all of his obligations under the Contract. In the 2017 editions, if the notice is received by the other party after the 14-day period then the affected party is excused performance of the prevented obligations only from the date on which the notice is received by the other party. Like the 1999 editions, the party affected must nevertheless use all reasonable endeavours to minimise delay resulting from the Exceptional Event. The FIDIC forms permit the Contractor affected by an Exceptional Event to claim an extension of time and additional cost he has incurred as a result of the Event. If the effects of an Exceptional Event or force majeure continue beyond a certain point the FIDIC contracts allow either party, Contractor or Employer, to terminate the Contract.

Aigbavboa, et al., (2022) contextualize exceptional international event as significant occurrences or incidents that transpire on a global scale and have wide-ranging impacts beyond the borders of a single country. The exceptional nature of these events arises from their magnitude, scope, and the potential to cause significant disruptions and challenges to various aspects of society, including economic, social, and political systems. The COVID-19 pandemic as well as the recent invasion of the Ukraine by Russia serve as examples of such exceptional international events which had unprecedented adverse impacts on construction projects.

Alsharef et al., (2021) also noted the challenges experienced from this pandemic as permitting delays, material delivery delays, lower productivity rates, shortage of materials, potential conflicts and disputes, cash flow-related challenges, price escalations and project suspension. Ogunnusi et al., (2020) considered the negative side of COVID-19 as delays in the completion of projects, hardship encountered by daily paid labourers, budget delays, properly scheduled project disruption, real estate sector revenue slowdown (PWC, 2020).

According to Oghenekevwe et al. (2014) the major cost overrun distress is the rise in construction materials costs due to inflation. Goyal (2017) concluded in his study that the rise in materials prices is due to inflation, which contributes to cost overrun. He

also reported that not only material prices but also labour wages are affected by inflation, which has had an impact on the final project cost. Inflation not only increases the prices of materials, but also impacts labour wages (Siemiatycki, 2009). Akanni et al. (2014), worked on the rising cost of building materials in the state of Lagos, Nigeria, where variables in the cost of construction materials were quantitatively analyzed. The study showed an inflationary trend in construction materials prices from the year 2003 to 2012, with an inflation rate of 5% to 21%, respectively.

2.3.6 Other Determinants of Cost Overruns

Tejale Khandekar and others (2015) carried out a study on analysis of project cost overrun by statistical methods in Pune region in India. Their survey identified 45 common factors causing cost overruns which they ranked based on relative important index value computed on each group of respondents. The ten most factors based on the ranking were material shortage, shortage of labour, late delivery of materials and equipment, unavailability of competent staff, low productivity level of labour, quality of equipment and raw materials, delay in progress payments, financial difficulties by contractor, poor site management, escalation and fluctuation of material prices and poor communication and coordination by owner and other parties. Chileshe and Berko (2010) listed similar factors including delays in monthly payments to contractors; variations; inflation, and schedule slippage as significantly important. They identified other factors as poor communication, technical complexity and size of the project as not very important but of concern. They also found that project management practices such as value management and risk management were not being practised within the Ghanian roads sector.

A similar study by (Muianga, Granja, and Ruiz, 2015) in Mozambique identified 95 factors which they classified into eleven categories namely government relations, contractual issues, organization, management, financing, design and documentation, schedule and control, scope changes, environment and economy materials and labour and equipment. Using statistical analysis, they attached values of importance to each factor with a relevance average set at 2.5. Fifty-three (53) factors across the eleven

categories were identified as relevant. The study however did not rank the factors nor the group of factors.

In their review of ten major projects implemented by the Ministry of Roads, the Auditor General of Tanzania classified causes of cost overruns into two categories; increased costs as result of new design and new specifications and increased costs due to quantities and variation of price factors. While these may explain the occurrence of cost overruns in the road projects, however this appears as a narrow perspective as studies indicate a multiplicity of factors attributable to cost overruns.

Singh (2009) in his study of extent and causes of cost overruns in 850 infrastructure projects in India divided the causal factors in four categories; technical and natural factors, contractual failures, organizational or institutional failures and economic factors. Included in the technical and natural factors are the cost estimation techniques, technological and material requirements as well as natural factors such as flood and other natural conditions. The contractual failures relate to the ability of the contract to specify every detail of the works that are to be performed by the contractor' in each possible scenario. He refers to this as 'complete-contingent- contracts. He however notes that in reality it is difficult to develop a contract that describes in detail every possible scenario that may occur during the implementation of the project. This makes the construction contracts intrinsically 'incomplete'. The 'incompleteness' varies as the project complexity increases. Organizational or institutional failures refer to cooperation of several departments within and among various ministries. The hierarchal relationships within these organizations and conflicts between the individuals and the social objectives within the organization mean that the projects have to face the consequences of many sources of failures within the sponsoring organizations. Included in the economic factors are the state of other infrastructural development and income level.

Other researchers have identified various factors as causes of cost overruns. Brunes et al. (2014) while undertaking survey of 230 participants drawn from the Swedish Transport Administration and three large construction companies in Sweden, narrowed down the factors to only three; design of the project, misjudged price

changes and unexpected technical problems that were difficult to predict. With a response rate of 42%, 65% of the respondents ranked design changes as significant while 64% attributed cost overruns to technical problems. Only 20% recorded changes in input prices as a major cause of cost overruns.

Gupta (2012) In the book titled "Understanding and Monitoring the Cost-determining Factors of Infrastructure Projects: A User's Guide", the European union identified design changes, land acquisition problems, poor project management, unexpected ground conditions, inflation, difficulties with contractor, funding problems, exchange rates, shortages of material and plant and act of God as the main cost changing factors. They give examples of what they term as "poor practice projects" based on the projects sampled. Two of the projects had a cost overrun of 20% another one with 10% and yet another with 36%. Land acquisition costs emerged as a common factor across three projects with design and inflation appearing in two projects. In one of the projects with cost overruns of 20% it was found that the contractor had no experience of particular type of construction while in another it was the implementing authority that had no experience in projects of similar scale and magnitude. They conclude by advising that cost overruns can be reduced with adequate contingency and risk planning as well as good project management which encompass time control, cost control, quality control and change control.

These findings are in agreement with Mukuka, Aigbavboa and Thwala (2015) who identified major causes of cost overruns as cost of materials, incorrect planning, wrong method of estimation, poor contract management, and fluctuation of prices of materials. Other factors included environmental factors, construction factors such as design changes, cost estimating factors and financing factors. These are further echoed by Olawale and Ming, (2010) who in their study of inhibiting factors in construction projects in the United Kingdom identified top five factors as design changes, risks and uncertainties, complexity of works, non-performance of contractors and inaccurate evaluation of project duration.

In addition to the commonly known factors by other researchers, a study on 30 construction projects in Egypt by EL-Kholy (2015) identified 44 factors contributing

to high-cost overruns out of which 11 factors emerged as significant with a Relative Importance Weight (RIW) of more than 10. These are financial condition of owner, cash flow of contractor, method of procurement, Inflation, competition at tender stage, Currency of contract, project size, delay in design and approval risk retained by client for quantity variations, quality of drawings, and inadequate material testing. Interestingly while other studies have highlighted such factors as design changes, project complexity and weather conditions as significant factors, these factors are ranked low in this research differing from the findings by other researchers.

2.4 Summary of Literature Review and Research Gap

The literature review revealed that many studies had been done concerning cost performance of road projects. Also, the literature showed a lot on the determinants of road projects, practices and the obstacles faced in their management. However, these studies lacked detailed research on the impact of exceptional events on the cost of highway projects. This study made a modest attempt to fill the knowledge gap outlined in Table 2.1.

Table 2.1: Summary of Literature Review and Research Gap

Author	Title	Observation	Research gap
Manikandan et al. (2018)	Investigated construction equipment management in order to boost productivity.	It was demonstrated that increasing productivity was crucial to enhancing construction system performance. High availability of equipment, which was determined by the equipment's reliability and maintainability, resulted in increased productivity.	The study failed to incorporate variables such as cost management and material management
EL-Kholy (2015)	Factors contributing to high-cost overruns on 30 construction projects in Egypt	Identified various factors that contributed to high-cost overruns out of which 11 factors emerged as significant with a Relative Importance Weight (RIW) of more than 10. These were financial condition of owner, cash flow of contractor, method of procurement, Inflation, competition at tender stage, Currency of contract, project size, delay in design and approval risk retained by client	The study was conducted in Egypt hence geographical and economical disconnect.

Author	Title	Observation	Research gap
		for quantity variations, quality of drawings, and inadequate material testing.	
Mukuka, Aigbavboa and Thwala (2015)	Effects of Construction Projects Schedule Overruns: A Case of the Gauteng Province, South Africa	Identified major causes of cost overruns as cost of materials, improper planning, wrong method of estimation, poor contract management, and fluctuation of prices of materials.	The study did not have a mitigation framework to address the challenges identified.
Pinha and Ahluwalia (2019)	Flexible resource management and its effect on project cost and duration	The study found that poor resource management was often the leading cause of cost overruns and schedule slippage.	The study was limited to flexible resource management and its effect on project cost and duration
Ronoh (2020)	Influence of project management practices on the performance of residential construction projects in Nairobi City County	The study found a significant relationship between planning, resource scheduling, project communication, and project monitoring and evaluation, and project performance.	The study generalized the aspect of project resource scheduling hence did not give clear outcome and recommendations to address cost overrun

2.5 Conceptual Framework

The study was guided by a conceptual framework developed based on the variables identified from the literature review. The dependent variable is cost performance of highway projects, which is hypothesized that its can be explained by exceptional events namely: global pandemic, economic recession, exceptional weather changes and mitigation measures. Figure 2.1 is a graphical representation indicating that cost performance of highway projects is affected by exceptional events.

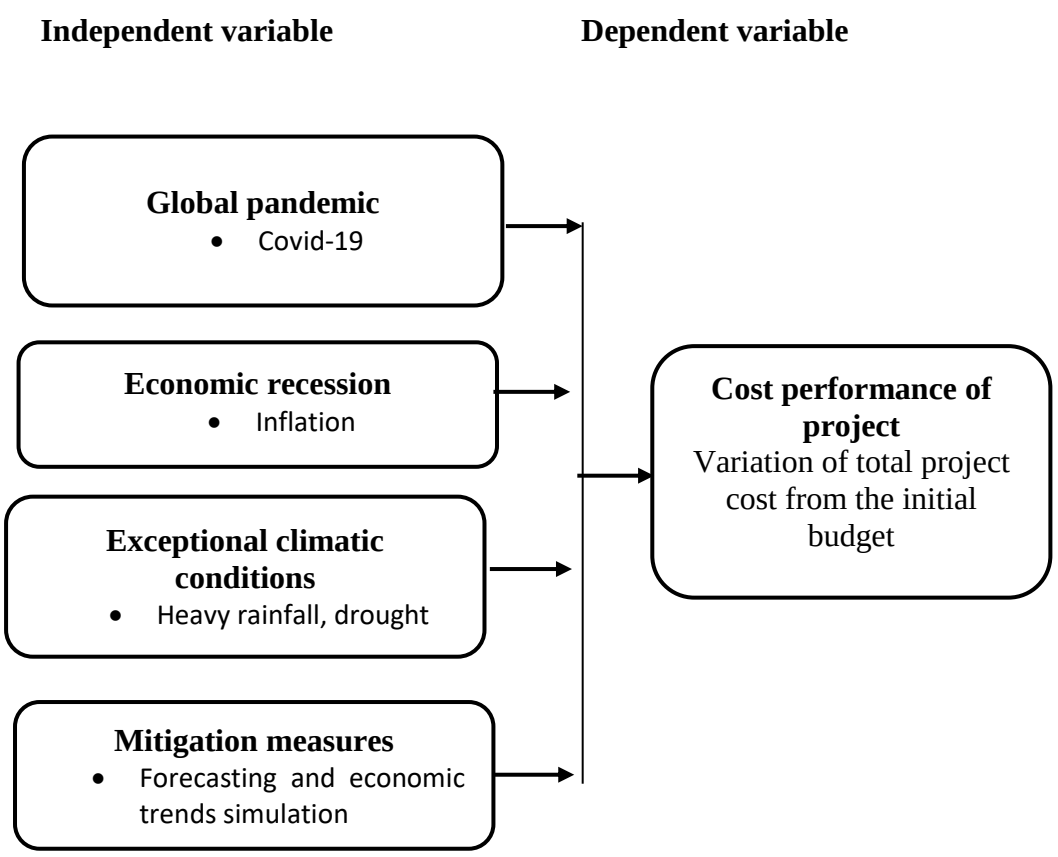

Figure 0.1: Conceptual Framework.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

The purpose of this chapter is to discuss the research methods. The chapter included the study's research design, defining and justifying why it is appropriate for the study. In addition to the research design, the chapter describes the target population, sample design, the data collection procedures to be used in the study and how the data analysis was carried out along with its presentation.

3.2 Research Design

Research design is a representation plan, the structure and the strategy of investigation used to gather, analyse, and answer research questions. A research design provides a framework for collecting and analysing data (Bryman, 2004). The study was a survey of knowledge and information which the construction industry players had regarding the impact of exceptional events on the cost performance of highway projects in Kenya. Therefore, the study sought to search for information from contractors and consultants in the industry. This study can be said to have been descriptive research using a cross-sectional survey design. Bryman, (2004) argues that, cross-sectional design entails collection of data on more than one case at a single point of time so as to collect a body of data in connection with more than one variable which is then looked at to detect patterns of connection. Additionally, descriptive research is a method of collecting information by administering questionnaires or interviews to sample of individuals (Orodho, 2004) and it may be used when collecting information about people's attitude, opinion, habits, education or social issues. Questionnaires and interview schedules were used to collect primary data from two groups namely; Contractors and Consultants.

The research design for this study was both qualitative and quantitative. Qualitative research design is that which employs narrative and quantification in the collection and analysis of data as observed (Bryman, 2004). This strategy was preferred since the

aim of the research was to collect information from sampled respondents using questionnaires and interviews and later quantitative techniques were used in data analysis. The questionnaire administered was first subjected to a pilot study of 11 respondents. Based on the feedback from the pilot study respondents, corrections were done on the research instrument in form of questionnaires for mass distribution.

Furthermore, according to Kothari (2014), the combination of qualitative and quantitative methods is advantageous because they supplement each other. This is in the sense that qualitative methods provide the in-depth explanations while quantitative methods provided the hard data needed to meet required objectives. Moreover, since both methods have some bias, using both types of research helped to avoid such bias in that each method was used to check the other. For example, the subjectivity associated with qualitative analysis research was minimized by the objectivity of quantitative research. The findings derived from one approach validated the other.

3.3 Target Population

Population refers to an entire group of individuals, events, or objects having a common observable characteristic (Mugenda and Mugenda, 2003). The target population for this study were active KeNHA projects within Nairobi Metropolitan. As at December 2023, there were 14 KeNHA projects within Nairobi Metropolitan (KeNHA Annual report, 2023).

Table 3.1: Active KeNHA Projects in Nairobi Metropolitan as at Dec 2023

S/No.	County	No of ongoing projects	Project title	Level of implementation
1.	Nairobi city county	2	Nairobi Western Bypass	50%
			Nairobi Express way	98%
2.	Kiambu County	8	Uplands-Githunguri	26 %
			Mamau Road-Lot1A	43%
			Mamau Road-Lot1B	43%
			Thika - Magumu Road	48%
			Kenol – Sagana	
			Kambu River Bridge and Approach Roads	23%
			Construction of footbridge at Juja Highpoint (Centurion)	5%
			Construction of footbridge at Juja Witiithie	95%
3.	Machakos county	1	Athi river- Machakos	85%
4.	Kajiado County	1	Isinya-Konza-Malili Road Project	15%
5.	Murang'a county	2	Kinyona - Gatura – Njabini	35%
			Kenol – Sagana	84%

3.4 Sampling Techniques and Sample Size

3.4.1 Sampling Techniques

Wood and Haber (1998) defined a sample as a small proportion of a population selected for observation and analysis. The sampling process comprised of defining the population, sampling frame, sampling method, sample size and sample plan. This view is in line with Bryman (2012) who advises that a sample should be a segment of the population that is selected for investigation. However; the same author believes there is no such complete formal list that can adequately satisfy a researcher as a sampling frame. It's therefore suggested that the researcher develops a sampling frame that represents a representative sample of the population elements with the desired characteristics. In the current Study; in determining the sample size for projects, the KeNHA Annual Report 2022-2023 was used. This study used stratified sampling to

identify the sampling units where the counties in the areas formed the strata. Then from every stratum, a subset of active projects was selected as shown in the sampling frame. The study sample size was identified through simple random selection where the contractor, project manager and in charge engineer were picked from every project.

3.4.2 Sample Size

Purposive sampling was used to select the respondents based on their involvement in construction projects. Purposive type of sampling was adequate as the target population was heterogeneous hence making it difficult to be specific (Kothari, 2014). Hence through purposive sampling workers were specifically targeted from the projects sampled above. The respondents were drawn from three levels of workmanship in the projects which included the contractor, projects managers and site engineers from KeNHA. The sample size for the study was 42 respondents.

Table 3.2: Sampling Size

Region	Selected projects	Number of respondents (1 contractor, 1 project manager & Project Engineer
Nairobi	2	6
Kiambu	8	24
Machakos	1	3
Kajiado	1	3
Murang'a	2	6
Total	**14**	**42**

3.5 Data Collection Instrumentations

In this study, emphasis was given to both primary data and secondary sources. The primary data was collected using a structured questionnaire. According to Leed and Ormrod (2005) data is said to be primary if it is collected first-hand by inquirer for a determinable purpose. The primary data was obtained directly from respondents through administration of self-completion questionnaires and interviews. The primary data provided first-hand information to this study about exceptional events, how they influence cost of projects implementation and other issues necessary for this research. Secondary data was obtained from literature review obtained from written theses,

journal papers, textbooks, newspapers, and literature on change orders. The aim of the secondary source was to interpret, offer commentary, analysis and draw conclusions about events described in primary sources.

3.6 Pilot Survey

The purpose of the pilot testing was to establish the validity and reliability of the research instrument (Joppe, 2000). Pilot testing gave an opportunity to make revisions to instruments and data collection procedures to ensure that appropriate questions were asked, the right data was collected and that the data collection methods worked (Myers, et al., 2003).

3.6.1 Validity

According to Mugenda and Mugenda (2003), validity is the accuracy and meaningfulness of inferences based on the research results. One of the main reasons for conducting the pilot study was to ascertain the validity of the questionnaires. Content validity draws an inference from test scores to a large domain of items similar to those on the test. Content validity is also concerned with sample- population representativeness (Rousson, Gasser and seifer, 2002). Gillman (2008) stated that the knowledge and skills covered by the test items should be representative to the lager domain of knowledge and skills. The validity of the questionnaire was tested through the review and guidance of the university supervisors to ensure that the question set was adequate to provide information required for further analysis.

3.6.2 Reliability

Reliability of the questionnaire was evaluated through administration of the said instrument to the pilot group. Cronbanch Alpha (α) was used to test the reliability of the research instruments. A construct composite reliability co-efficient (Cronbanch Alpha) of 0.7 or above, for all the constructs was considered adequate for this study. The acceptable reliability coefficient is 0.7 and above (Rousson, Gasser and Seifer, 2002).

3.7 Data Collection Procedure

The semi-structured interviews and use of questionnaires were administered to the respondents personally to shorten the response time and enable on the spot clarification of any doubt that the respondents might have regarding any questions. This gave the researcher an opportunity to introduce the topic and motivated respondents to give their honest answers. However, for respondents who had time constraints; questionnaires were dropped and picked later after self-administration.

In order to select the appropriate method of analysis, the level of measurement had to be understood (Walliman, 2011). For each type of measurement, there were appropriate methods that could be applied as opposed to others. In this research, ordinal scales were used. Ordinal scale is a ranking or a rating data that used integers in ascending or descending order as provided in the questionnaire (Appendix I).

Prior to data collection, an introduction letter authorizing data collection was obtained from the school of Civil Engineering, Jomo Kenyatta University of Agriculture and Technology. Secondary data was obtained from journals, website of various firms and governing bodies annual reports, books and researched work. Kothari (2004) states that, the researcher must scrutinize the secondary data because it may be unsuitable for the area under study, or may be inadequate for the context to which the researcher is undertaking during the study. According to Saunders et al (2007), questionnaires are classified into several types based on the way they are administered. Figure 3.1 shows the approach the current study was used in administering the questionnaire. As indicated, this study used a self-administered deliver and collect questionnaire.

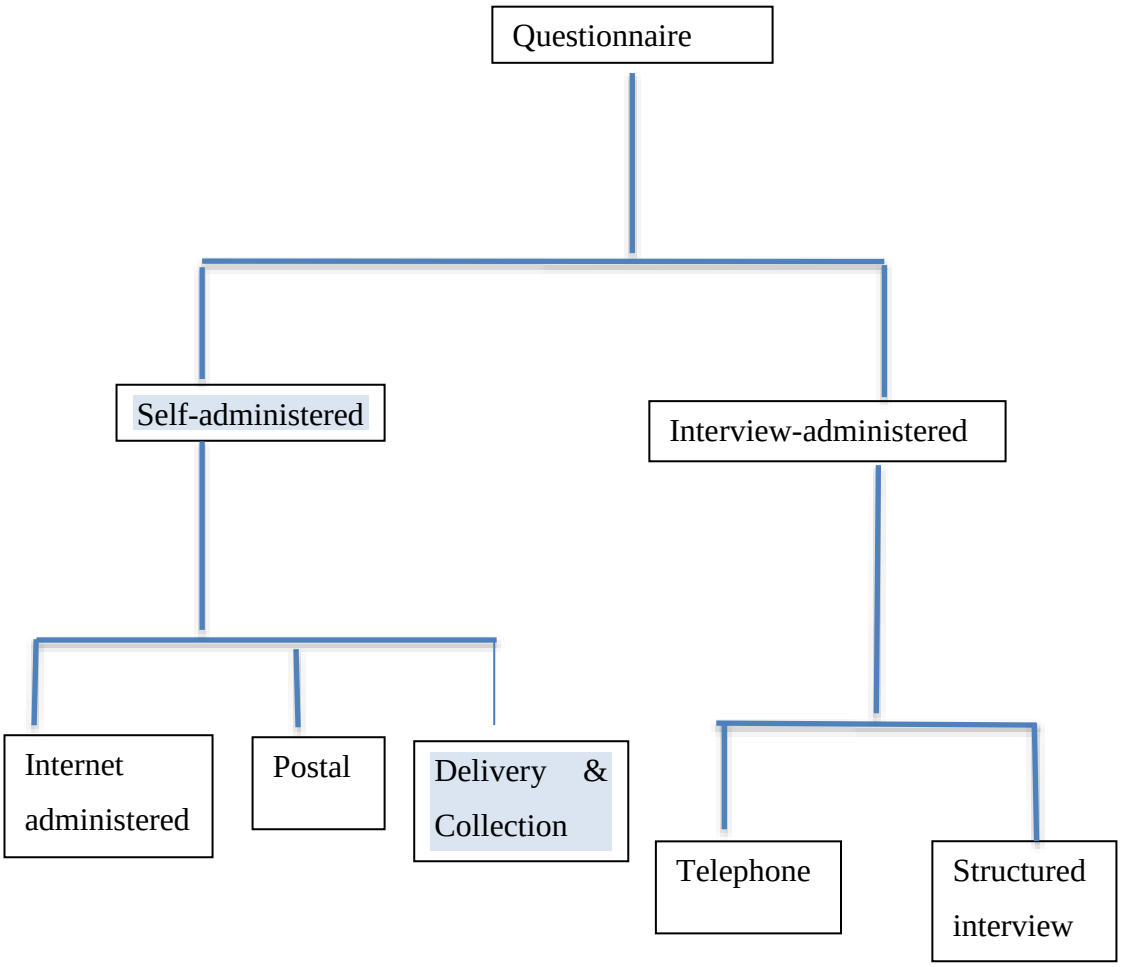

Figure 0.1: Types of Questionnaires

Source: (Saunders et al., 2007)

3.8 Data Processing, Analysis and Presentation

According to Kothari (2004), data analysis involves editing, coding, classification, and tabulation of collected data so that it can be analysed easily. The field data collected using questionnaires was subjected to both qualitative and quantitative analysis techniques through use of Statistical Package for Social Science (SPSS) Version 20. The responses from closed-ended questions were categorized as numerical data and open-ended questions categorized as string (text) data. The raw data was edited, and then entered in the SPSS computer program by assigning symbols in a process referred to as coding. Thereafter, descriptive and inferential statistics analysis was done to

generate the relevant frequencies, descriptive charts and graphs. Data gathered from opened ended questions and interviews was used to support the explanations of the analysis outcome.

CHAPTER FOUR

RESULTS AND DISCUSSION

4.1 Introduction

This chapter presents the results generated from the data collected from the respondents on the effects of exceptional events on Cost Performance of Project. The chapter presents findings on reliability test, response rate, demographics, descriptive results, Normality test, auto correlation, heteroscedasticity, and multi-collinearity tests.

4.2 Biodata, Response Rate and Reliability

4.2.1 Biodata

4.2.1.1 Position Held by Respondent

Table 4.1 presents the results on the position held by respondent. The findings showed that; 14 of the respondents were supervisors which represented 35.0%, 13 were contractors representing 32.5% and 13 were engineers, representing 32.5%. The interpretation was that the targeted population for the study was accessed to provide information for the study. Further, the representation of the various cadres gave diverse views of the information required for this study.

Table 0.1: Position Held by Respondent

Position held by respondent	Frequency	Percent
Project manager	14	35.0
Contractor	13	32.5
Engineer	13	32.5
Total	**40**	**100.0**

4.2.1.2 Experience of Respondent

Table 4.2 presents the results on the number of years of experience. The findings showed that those in the range of 1-10 years were 15 a representation of 37.5%, between 11-20 years were 15 which was a representation 37.5% and between 21-30 years were 10 which was a presentation of 25.0%. Implying that a majority of the respondents had worked between 1-20 years, followed by 21-30 years and above. The overall findings showed that the respondents had adequate information in the field of study due to the number of years in practice.

Table 4.2: Experience of Respondent

No. of years of Experience	Frequency	Percent
1-10	15	37.5
11-20	15	37.5
21-30 and above	10	25.0
Total	**40**	**100.0**

4.2.1.3 Highest Level of Education

Table 4.3 presents the results on the education level of the respondents. From the findings those with Masters degree were 10. Undergraduate degree were 19, PhD were 4 and other academic qualification were 7. The percentage representation has been provided in table 4.3. The deduction here is that majority of the respondents have attended tertiary college or training and thus could read and understand the questionnaires to provide adequate information. Further, they were trained to understand the various concepts of the study such as exceptional events and its occurrence.

Table 4.3: Highest Level of Education

Highest Level of Education	Frequency	Percent
Masters	10	25.0
Degree	19	47.5
PhD	4	10.0
Others	7	17.5
Total	**40**	**100.0**

4.2.2 Response Rate

Table 4.4, indicates that out of the 42 questionnaires administered, only 40 were returned. The overall response rate was found to be 95.2%, which was very high. 4.8% of the respondents did not respond. According to Bryman (2016) and Walliman (2016) a response rate of 85% and above is excellent, 70%-85% is very good, 60%-69% is acceptable, 50%-59% barely acceptable, while below 50% is not acceptable. The interpretation was that the high response rate for this study was excellent and adequate to obtain sufficient observations for further analysis.

Table 4.4: Response Rate

Response rate	Frequency	Percent
Responded	40	95.2
Did not respond	2	4.8
Total	**42**	**100**

4.2.3 Reliability Test

This study used Cronbach alpha model for internal consistency based on the correlation to test scaled items. According to Brown (2002) Cronbach's alpha reliability coefficient normally ranges between 0 (if no variance is consistent) and 1 (if all variance is consistent). The closer the coefficient is to 1.0 the greater the internal consistency of the items in the scale. An alpha (α) score of 0.70 or higher is considered satisfactory (Gliem and Gliem, 2003). Table 4.5 presents the results on reliability test. It was observed that the reliability and internal consistency of the items constituting; cost performance of project, global pandemic, economic recession, exceptional climatic conditions and mitigation framework constructs were established. The individual Cronbach's alphas for these variables were 0.890, 0.865, 0.894, 0.890 and 0.889 respectively which were above the required cut-off minimum value of 0.7; therefore, all the items in the questionnaire were reliable.

Table 4.5: Reliability Test

Variables	Number of Items	Cronbach's Alpha
Cost Performance of Project	5	0.890
Global Pandemic	7	0.865
Economic Recession	7	0.894
Exceptional Climatic Conditions	5	0.890
Mitigation Framework	5	0.889

4.3 Effect of Global Pandemic on Cost of Infrastructure Projects

Table 4.6 presents the results on the level of respondents' agreement or disagreement on various questions asked on how global pandemic influenced cost of construction projects in Kenya. The mean of the various constructs was as follows: pandemic has caused time escalation, 3.33; pandemic has caused cost variation, 3.43; pandemic has led to destruction of material, 3.80; pandemic has caused repairs and replacement, 3.70; pandemic has reduced cost of materials, 3.70; pandemic has led to termination of employees, 3.67, and; pandemic has led to shortage of various materials in the construction site, 3.77. These findings imply that on average the respondent moderately agree that global pandemic adversely affected the performance of construction projects in terms of cost escalation. Similar finding was reported by Brunes et al. (2014) and EL-Kholy (2015) who found that cost overrun in construction projects can be explained by forces from the macro-environment such as global pandemic.

Table 0.2: Effect of Global Pandemic on Cost of Infrastructure

Global Pandemic	Mean	Standard deviation
Pandemic has caused time escalation	3.33	1.100
Pandemic has caused cost variation	3.43	1.110
Pandemic has led to destruction of material	3.80	1.102
Pandemic has caused repairs and replacement	3.70	1.062
Reduced cost of materials	3.70	1.030
Termination of employees	3.67	0.985
Shortage of various materials in the construction site	3.77	1.125

4.4 Influence of Economic Recession on Cost of Infrastructure Projects

Table 4.7 shows the results on the respondents' level of agreement on influence of economic recession on cost of infrastructure projects in Kenya. The mean of the various constructs was as follows: delays and inadequate supply of construction materials,3.7667; high rate of unemployment, 3.5367; increased lending rate and lack of financing channels, 3.6500; fluctuation in cost of construction material, 3.8000; fluctuation in cost of transportation and distribution, 3.5555; difficulty in obtaining credit insurance, 3.8000. and; a drop in the volume of construction material imports, 3.6667. The findings recorded a low standard deviation with very minimal variance across the contracts. These findings were similar to those of Pinha and Ahluwalia (2019) that variations in the economic conditions is a major cause of construction project cost escalation due to variations in construction material.

Table 4.7: Influence of Economic Recession on Cost of Infrastructure

Economic recession	Mean	Standard deviation
Delays and Inadequate supply of construction materials	3.7667	1.15519
High rate of unemployment	3.5367	1.11487
Increased lending rate and lack of financing channels	3.6500	1.11728
Fluctuation in cost of construction material	3.8000	1.13197
Fluctuation in cost of transportation and distribution	3.5555	1.11487
Difficult in obtaining credit insurance	3.8000	1.13197
Drop in the volume of construction material imports	3.6667	1.01487

4.5 Effect of Exceptional Climatic Conditions on Cost of Infrastructure Projects

The descriptive results on the effect of exceptional climatic conditions on cost of infrastructural projects in Kenya are presented in Table 4.8. The mean of the various constructs was as follows: flooding has increased cost of the projects by a significant margin, 3.90; heavy rains cause delays in the project hence cost escalation, 3.81; exceptional weather changes cause review of the project schedules, 3.78; projects are affected by adverse climatic conditions, 3.93. and; weather changes lower labourers' productivity, 3.80. The average mean across the contracts was above 3.5 meaning that the respondents agreed on the various constructs that exceptional climatic condition has an effect on contraction cost. The standard deviation was low with a minima

variance implying that the respondents were almost of the same opinion regarding the questions asked. These finding are supported by those of EL-Kholy (2015) and Ronog (2020) who noted that the success of infrastructure projects relies on many other surrounding factors. The studies further noted that climatic conditions would hinder construction work plan as well as improvising costs that were not initially factored in the budget.

Table 0.3: Effect of Exceptional Climatic Conditions on the Cost of Infrastructure Projects

Exceptional climatic conditions	Mean	Standard deviation
Flooding has increased cost of the projects by a significant margin	3.90	1.130
Heavy rains cause delays in the project hence cost escalation	3.81	1.112
Exceptional whether changes cause review of the project schedules	3.78	1.106
Projects are affected by adverse climatic conditions	3.93	1.103
Weather changes lowers labourers' productivity	3.80	1.102

4.6 Influence of Mitigation Measures on Cost of Infrastructure Projects

The results on the level of response regarding the influence of mitigation measures on cost of infrastructure projects are shown in Table 4.9. From the results it was found that: negotiation of salaries with employees has helped manage construction cost, had a mean of 3.55; seeking of moratorium from funding entities during a pandemic had a mean of 3.52; including a budget for adverse climatic conditions had a mean of 3.70; adopting alternative methods/source of materials to avoid delays had a mean of 3.60, and; that there is adequate supply of construction materials at all the time had a mean of 3.63. The interpretation of this findings is that the respondents were in agreement on various measures undertaken as a mitigation factor. In the eventuality of exceptional events, the managers and supervisors adopted some strategies which would reduce cost. Similar findings were reported by Ronog (2020) that there was a significant relationship between planning, resource scheduling, project communication, and project monitoring and evaluation, and project performance.

Ronog (2020) recommended that application of cost management strategies in the construction projects would be good for project performance.

Table 4.9: Influence of Mitigation Measures on the Cost of Infrastructure

Mitigation Framework	Mean	Standard deviation
Negotiation of salaries with employees has helped manage construction cost	3.55	1.281
Seeking of moratorium from funding entities during a pandemic	3.52	1.157
Including a budget for adverse climatic conditions	3.70	1.154
Adopt alternative methods / source of materials to avoid delays	3.60	1.108
There is adequate supply of construction materials at all the time	3.63	1.073

4.7 Cost Performance of Project

The results on the level of agreement on the various constructs regarding cost performance of construction project in Kenya are presented in Table 4.10. From the results, the established means of the various cost variables are; our operating cost have gone up, 3.8333; our variables cost has been growing constantly, 3.5333; sometime it is difficult to sustain the budget, 3.7167; we have changes in repairing machineries due to high cost involved, 3.8667, and; we have experienced challenges in sustaining our field cost, 3.7333. The findings show that various exceptional events such as economic conditions, were a cause for cost escalation.

Table 4.10: Cost Performance of Project

Cost Performance of Project	Mean	Standard deviation
Our operating cost has gone up in our company	3.8333	1.09183
Our variables cost has been growing constantly in our company	3.5333	1.05552
Sometime it is difficult to sustain the budget	3.7167	1.05913
We have changes in repairing machineries due to high cost involved	3.8667	1.06511
We have experienced challenges in sustaining our field cost in our company	3.7333	1.15552

4.8 Diagnostic Tests

4.8.1 Normality Test

The results for the normality test are presented in Table 4.11. The results show that all the variables are normally distributed. The respective Shapiro- whisk normality test statistics were found to be within the recommended range as follows: cost performance of project, 0.50031; global pandemic, 0.70395; economic recession, 0.30045; exceptional climatic conditions, 0.80103, and; mitigation measures, 0.92589. If the Sig. value of the Shapiro-Wilk Test is greater than 0.05, the data is normal. If it is below 0.05, the data significantly deviate from a normal distribution.

Table 4.11: Shapiro- Whisk

Variable	W'	V'	z	Prob>z
Cost Performance of Project	0.90066	5.977	3.419	0.50031
Global Pandemic	0.93335	4.010	2.656	0.70395
Economic Recession	0.90568	5.675	3.320	0.30045
Exceptional Climatic Conditions	0.91674	5.010	3.082	0.80103
Mitigation Framework	0.95405	2.765	1.945	0.92589

4.8.2 Autocorrelation Test

On the other hand, Table 4.12 shows the results on the stability of variance using the Breusch-Godfrey serial correlation LM test. The results show that the Breusch-Godfrey Serial Correlation LM Test had a value of 2.039218, p-value of 0.0780 Chi-square value of 11.98848 and probability of 0.0622. The results show that the variance is homogeneous and the results from the regression model was reliable. Breusch-Godfrey Serial Correlation LM test result in Table 4.12 shows that the probability values (0.0780 and 0.0622) were greater than 0.05 levels of significance which imply that the null hypothesis of no serial correlation cannot be rejected. This concludes that the model has no serial correlation problem.

Table 4.12: Breusch-Godfrey Serial Correlation LM Test

Breusch-Godfrey Serial Correlation LM Test:			
F-statistic	2.039218	Prob. F(6,49)	0.0780
Obs*R-squared	11.98848	Prob. Chi-Square(6)	0.0622

4.8.3 Heteroskedasticity Test

Table 4.13 presents the results on the stability of variance using the Breusch-Pagan Test with the p-value of 0.01483 and 0.01182. From the findings it can be observed that there is Heteroskedasticity test among the study variables and residuals since all the p-values for the two test statistics are insignificant (less than 0.05). If the p-value of the test is less than some significance level (i.e. $\alpha \leq 0.05$) then we reject the null hypothesis and conclude that heteroskedasticity is present in the regression model. The results show that the variance is homogeneous and the results from the regression model.

Table 4.13: Heteroskedasticity Test

Heteroskedasticity test: Breusch-Pagan-Godfrey			
F-statistic	0.574929	Prob. F(6,47)	0.01483
Obs*R-squared	3.692338	Prob. Chi-Square(6)	0.01182

4.8.4 Collinearity Test

Conversely, Table 4.14 shows the results on the collinearity test. The recommended range is that the level of tolerance should not be below 0.2 and the VIF should not fall between 5-10. From the findings since the tolerance and the variance inflated factor are within the expected ranges the variables can be used in the same regression model: global pandemic,0.734 to.872; economic recession, 0.741 to 3.078; exceptional climatic conditions, 0.852; VIF, 2.589; and, mitigation measures, 0.915 to 4.647. The results shows that no multicollinearity in the model and the independent variables would give a clear representation of the dependent variable.

Table 4.14: Collinearity Test

Collinearity Test	Tolerance	VIF
Global Pandemic	0.734	1.872
Economic Recession	0.741	3.078
Exceptional Climatic Conditions	0.852	2.589
Mitigation Framework	0.915	4.647

4.8.5 Correlation Matrix

From Table 4.15, it can be observed that the correlation between the independent variables and the dependent variable was high and positive at 0.679**, 0.930**, 0.973** and 0.886** for global pandemic, economic recession, exceptional climatic conditions, and mitigation measures, respectively. The implication was that the high correlation between the exceptional events and performance of project explains that they were a main cause of cost and time variations in construction projects. The largest correlation coefficient among the independent variables was 0.355, hence, no multi-collinearity problem was detected. The interpretation was that there was a high positive relationship between the independent variables, hence, predicting the variations in dependent variable.

Table 4.15: Correlation Results

Variables		Performance of project	Global pandemic	Economic recession	Exceptional climatic conditions	Mitigation measures
performance of project	Pearson Correlation	1.000				
	P-value					
Global pandemic	Pearson Correlation	0.679**	1.000			
	P-value	0.000				
Economic recession	Pearson Correlation	0.930**	0.355**	1.000		
	P-value	0.000	0.000			
Exceptional climatic conditions	Pearson Correlation	0.973**	0.268**	0.308**	1.000	
	P-value	0.000	0.000	0.000		
Mitigation measures	Pearson Correlation	0.886**	0.333**	0.271**	0.256**	1.000
	P-value	0.000	0.000	0.000	0.000	

4.8.6 Regression Results

Table 4.16 shows the fitting statistics in terms of explanation power of the global pandemic, economic recession, exceptional climatic conditions and mitigation measure variables included in the model. The results show that the variables four variables explain up to 90.3% influence on performance of construction projects in terms of cost. This implies that the factoring exceptional events (i.e., global pandemic, economic recession, exceptional climatic conditions and mitigation measures) in the model may cause up to about 90.3% variations on cost of infrastructure projects in Kenya. Thus, the general null hypothesis of no significant relationship between exceptional events and cost of infrastructure projects in Kenya was rejected in this case.

Table 4.16: Good-of-Fit Statistics

Model	**R**	R^2	**Adjusted R^2**
	0.901[a]	**0.903**	**0.900**

On the other hand, Table 4.17 presents the fitting statistics in terms of explanation power of the global pandemic, economic recession, exceptional climatic conditions and mitigation measures. The results show that the four variables explained by the F-statistics value was 356.897. This indicates that the model provided a better fit. The associated p-value was found to be 0.000 which is significant and less than 0.05, meaning that the null hypothesis was rejected and concluded that there is a significant association between exceptional events and cost of infrastructure projects in Kenya.

Table 4.17: Analysis of Variance

Model		**Sum of Squares**	**df**	**Mean Square**	**F**	**P-value**
	Regression	61.941	4	15.485	356.897	0.000
	Residual	2.386	55	0.043		
	Total	**64.327**	**59**			

4.8.5.1 Global Pandemic

The first specific objective of the study was to determine the effect of global pandemic on the cost of infrastructure projects by KeNHA. From Table 4.18, the regression coefficient of global pandemic was found to be 0.422. This value shows that holding other variables in the model constant, an increase in global pandemic by one unit causes the cost of project in Kenya to increase by 0.422 units. The positive effect shows that there was a positive association between global pandemic and cost performance of projects in Kenya. The coefficient was statistically significant with a t-statistic value of 11.105. The p-value, which indicated the probability of getting a t-statistic value bigger that than 11.105, was found to be 0.000.

Based on the findings above the null hypothesis (H_0): *Global pandemic has no significant effect on the cost of infrastructure projects by the Kenya National Highway Authority* is hereby rejected. The study adopts the alternative hypothesis that global pandemic has significant effect on the cost of infrastructure projects. The findings were similar to those of Waithera and Susan (2019) who found that environmental conditions may cause variations on cost of construction projects.

Table 4.18: Regression Coefficients

Variables	Coefficients	Std. Error	t-statistic	P-Value
(Constant)	0.108	0.111	0.969	0.337
Global Pandemic	0.422	0.038	11.105	0.000
Economic Recession	0.178	0.065	2.729	0.009
Exceptional Climatic Conditions	0.650	0.064	10.158	0.000
Mitigation Measures	0.119	0.052	2.307	0.025

Cost Performance of Project = 0.108 + 0.422 Global Pandemic + 0.178 Economic Recession + 0.650 Exceptional Climatic Conditions + 0.119 Mitigation Measures + ε

4.8.5.2 Economic Recession

The second specific objective was to determine the influence of economic recession on the cost of infrastructure projects by the Kenya National Highway Authority. From Table 4.18, the regression coefficient for economic recession was found to be 0.178.

This value shows that holding other variables in the model constant, an increase in Economic Recession by one unit causes the cost performance of project in Kenya to increase by 0.178 units. The positive effect showed that there was a positive association between economic recession and cost performance of projects in Kenya. The coefficient was statistically significant with a t-statistic value of 2.729. The p-value, which indicated the probability of getting a t-statistic value bigger that than 2.729, was found to be 0.009.

From the findings above the null hypothesis (H_0): Economic recession has no significant influence on the cost of infrastructure projects by the Kenya National Highway Authority is hereby rejected. The study adopts the alternative hypothesis that economic recession has significant effect on the cost of infrastructure projects. These findings were similar to those of Waithera and Susan (2019); Olawale, Adisa and Sun (2010) who noted that economic conditions were a cause of cost escalation in construction projects.

4.8.5.3 Exceptional Climatic Conditions

The third specific objective of the study was to determine the effect of exceptional climatic conditions on the cost of infrastructure projects by the Kenya National Highway Authority. From Table 4.18, the regression coefficient of exceptional climatic conditions was found to be 0.650. This value shows that holding other variables in the model constant, an increase in exceptional climatic conditions by one unit causes the cost performance of projects in Kenya to increase by 0.650 units. The positive effect showed that there was a positive association between exceptional climatic conditions and cost performance of project in Kenya. The coefficient was statistically significant with a t-statistic value of 10.158. The p-value, which indicated the probability of getting a t-statistic value bigger that than 10.158, was found to be 0.000.

Based on the findings above the null hypothesis (H_0): Exceptional climatic conditions have no significant effect on the cost of infrastructure projects by the Kenya National Highway Authority is hereby rejected. The study adopts the alternative hypothesis that exceptional climatic conditions have significant effect on the cost of infrastructure

projects. This finding supported those of EL-Kholy (2015) and Ronog (2020) who noted that the success of infrastructure projects relies on many other surrounding factors.

4.8.5.4 Mitigation Measures

The fourth specific objective of the study was to determine the influence of mitigation framework on the cost of infrastructure projects by the Kenya National Highway Authority. From Table 4.18, the regression coefficient of mitigation measures was found to be 0.119. This value shows that holding other variables in the model constant, an increase in mitigation measures by one unit causes the cost performance of projects in Kenya to increase by 0.119 units. The positive effect showed that there was a positive association between global pandemic and cost performance of project in Kenya. The coefficient was statistically significant with a t-statistic value of 2.307. The p-value, which indicated the probability of getting a t-statistic value bigger that than 2.307, was found to be 0.000.

From the findings above the null hypothesis (H_0): Mitigation measures have no significant influence on the cost of infrastructure projects by the Kenya National Highway Authority is hereby rejected. The study adopts the alternative hypothesis that mitigation framework has significant effect on the cost of infrastructure projects.

CHAPTER FIVE

SUMMARY OF FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This chapter presents summary of the findings, conclusions and recommendations on the exceptional events on cost performance of highways projects in Kenya.

5.2 Summary of Findings

Global pandemic was found to have an effect on cost performance of projects as depicted by the various responses from the respondents that were presented. The constructs were found to be of good reliability that allowed the researcher to proceed to the qualitative and inferential analysis. This variable was found to have a positive effect on cost performance of project implying that global pandemic would cause an increase in cost of the project. The regression coefficient was found to be significant. This coefficient meant that a unit increase in global pandemic, would cause the rate of cost performance of project to increase significantly.

Economic recession was found to have influence on cost performance of projects as depicted by the various responses from the respondents that were presented using tables where the response was also in mean and standard deviations. The constructs were found to be of good reliability that allowed the researcher to proceed to the, qualitative and inferential analysis. This variable was found to have a positive effect on cost performance of project. The positive effect implies that the occurrence of economic recession would cause cost of the projects to increase. The regression coefficient was found to be significant. This coefficient meant that a unit increase in economic recession would cause the rate of cost performance of project to increase.

All the constructs used for exceptional climatic conditions were found to have influence on cost performance of project as depicted by the various responses from the respondents that were presented using tables where the response was also in mean and standard deviations. The constructs were found to be of good reliability that allowed

the researcher to proceed to the, qualitative and inferential analysis. This variable was found to have a positive effect on cost performance of project. The regression coefficient was found to be significant. This coefficient meant that a unit increase in exceptional climatic conditions, would cause the rate of cost performance of project to increase.

The mitigation measures were found to have influence on cost performance of project as depicted by the various responses from the respondents that were presented using tables where the response was also in mean and standard deviations. The constructs were found to be of good reliability that allowed the researcher to proceed to the, qualitative and inferential analysis. This variable was found to have a positive effect on cost performance of project. The regression coefficient was found to be significant. Based on how the questions were formulated, an increase in mitigation measures would cause a decrease in cost. This coefficient meant that a unit increase in mitigation framework, would cause the rate of cost performance of project to increase.

5.3 Conclusions

1. The study established that global pandemic has influence on cost performance of projects in Kenya. This is evidenced by the strong positive correlation. Based on the findings the study concluded that global pandemic causes the escalation on project cost. This implies that an occurrence of global pandemic such as covid-19 may causes overall project cost to increase.
2. Further, the study found that economic recession has influence on cost performance of projects in Kenya. Based on the findings, the study concluded that an increase in economic condition such as high inflation would cause an increase in cost performance of project. This variable was found to have a statistically significant effect on cost performance of project.
3. The findings of the study revealed that exceptional climatic conditions affect the cost performance of projects in Kenya. Therefore, the study concluded that when the climatic conditions are not favourable also cost performance of construction projects is negatively affected.

4. Finally, the findings show that mitigation measures influence the cost performance of projects in Kenya. The results that mitigation measures had a positive effect on cost performance of project was a good indication that increase in mitigation measures motivate cost performance of projects in the country. This variable was found to have a statistically significant effect on cost performance of project.

5.4 Recommendations

5.4.1 Recommendations from the Study

1. The study found that the occurrence of global pandemic was a key determinant of cost performance of project, the stakeholders of the cost performance of project should ensure that the contract signed includes a clause to cover for exceptional events such global pandemic, economic recession, exceptional climatic conditions among others. The study further recommendation more innovative ways of handling exceptional events for example adoption of new technology in construction projects. For example use of robotics.
2. Mitigation measures were found to be a key determinant of cost performance of projects; therefore, project managers should keep on adopting more mitigation measures to curb the adverse effects of exceptional events on cost performance. This study found a positive effect of mitigation measures. The project managers in Kenya should therefore come up with more innovative ways of increasing mitigation measures for better project cost management.
3. The study recommends a framework that entails; critical assessment of possible risks surrounding a project before commencement. The stakeholders should ensure that the contract outlines very well on the possibility of occurrence of exceptional events and how such occurrences would be handled as per the force majeure.

5.4.2 Recommendations for Further Study

Future research should be directed towards identifying more variables that affect cost performance of project. From the regression model it was noted that the variables included were only able to explained R^2 90.3% and adjusted R^2 90.0% of the variation cost performance of project. This study therefore recommends the improvement of this model by including more variables that are relevant in explaining the variation, some of which have been mentioned above. This paper also recommends further research to include studies in other government departments apart from exceptional events on cost performance of project.

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APPENDICES

Appendix I: Research Questionnaire

Dear Respondent:

My name is Rinah Chikamai. I am a Masters student at Jomo Kenyatta University of Agriculture and Technology conducting a study on the "***Impact of exceptional events on the cost of infrastructure projects by the Kenya National Highway Authority***". This study is purely academic and the information obtained was not used for any other purpose other than for its intended use and was treated with utmost confidentiality. Your assistance in this research was highly appreciated.

Thanking you for your invaluable contribution(s)

SECTION A: BIODATA

(please check the correct box).

i. Position (Title)

1. [ ] Supervisor 2. [ ] Skilled worker 3. [ ] Engineer

ii. No. of years of experience

1. [ ] 1-10 2. [ ] 11-20 3. [ ] 21-30

iii. What is your highest level of education?

1. [ ] Degree 2. [ ] Masters 3. [ ] PhD 4. [ ] Other (specify)

SECTION B: EXCEPTIONAL EVENTS ON THE COST OF INFRASTRUCTURE PROJECTS

I. Global Pandemic

Please indicate to what extent the following exceptional events affect the cost of infrastructure projects in KeNHA *(please check the correct box).*

Where: 1= strongly disagree, 2= disagree, 3= Neutral, 4= Agree and 5= Strongly Agree

	Global Pandemic	1	2	3	4	5
1.	Pandemic has caused time escalation					
2.	Pandemic has caused cost variation					
3.	Pandemic has led to destruction of materials					
4.	Pandemic has caused repairs and replacement					
5.	Reduced cost of materials					
6.	Termination of employees					
7.	Shortage of various materials in the construction site					

II. Economic Recession

Please indicate to what extent the following exceptional events affect the cost of infrastructure projects in KeNHA *(please check the correct box).*

Where: 1= strongly disagree, 2= disagree, 3= Moderately Agree, 4= Agree and 5= Strongly Agree

	Economic recession	**1**	**2**	**3**	**4**	**5**
1.	Delays and Inadequate supply of construction materials					
2.	High rate of unemployment					
3.	Increased lending rate and lack of financing channels					
4.	Fluctuation in cost of construction materials					
5.	Fluctuation in cost of transportation and distribution					
6.	Difficult in obtaining credit insurance					
7.	Drop in the volume of construction material imports					

III. Exceptional Climatic Conditions

Please indicate to what extent the following exceptional events affect the cost of infrastructure projects in KeNHA *(please check the correct box).*

Where: 1= strongly disagree, 2= disagree, 3= Moderately Agree, 4= Agree and 5= Strongly Agree

	Exceptional climatic conditions	**1**	**2**	**3**	**4**	**5**
1.	Flooding has increased cost of the projects by a significant margin					
2.	Heavy rains causes delays in the project hence cost escalation					
3.	Exceptional whether changes causes review of the project schedules					

4.	Projects are affected by adverse climatic conditions					
5.	Weather changes lowers laborers' productivity					

IV. Mitigation Framework

Please indicate to what extent the following Mitigation Framework affect the cost of infrastructure projects in KeNHA *(please check the correct box).*

Where: 1= Strongly Disagree, 2= Disagree, 3= Moderately Agree, 4= Agree and 5= Strongly Agree

	Mitigation Framework	**1**	**2**	**3**	**4**	**5**
1.	Negotiation of salaries with employees has helped manage construction cost					
2.	Seeking of moratorium from funding entities during a pandemic					
3.	Including a budget for adverse climatic conditions					
4.	Adopt alternative methods / source of materials to avoid delays					
5.	There is adequate supply of construction materials at all the time					

V. Cost Performance of Project

Please indicate to what extent the following measurers affect the Cost Performance of Project affect the cost of infrastructure projects in KeNHA *(please check the correct box).*

Where: 1= strongly disagree, 2= disagree, 3= Moderate Agree, 4= Agree and 5= Strongly Agree

	Cost Performance of Project	**1**	**2**	**3**	**4**	**5**
1	Our operating cost have gone up in our company					
2	Our variables cost have been growing constantly in our company					
3	Sometime is difficult to sustain the budget					
4	We have changes in repairing machineries due to high cost involved					
5	We have experienced challenges in sustaining our field cost in our company					