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RISK MANAGEMENT PRACTICES AND PERFORMANCE OF PUBLIC INFRASTRUCTURAL PROJECTS: A CASE OF THE SECOND RWANDA URBAN DEVELOPMENT PROJECT IN THE CITY OF KIGALI

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A Research Project Submitted to the school of business and economics in Partial Fulfillment of the requirement for the award of a Master of Business Administration degree (Project Management Option) of Mount Kenya University

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DECLARATION

This research study is my original work and has not been presented to any other Institution.

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Sign: _____ Date: _____

Berthe Senga

Declaration by the Supervisor

This research has been submitted with my(our) approval as the Mount Kenya University Supervisor(s).

Sign: _____ Date: _____

Dr. Gitahi Njenga

DEDICATION

To my father Kanyabugoyi Damascene and Mother Ntakobasa Pauline who devoted their resources to giving me a formal education, culminating in the present level of studies. Their support in my life is appreciated.

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ABSTRACT

The main objective of this study was to carry out an analysis of the effects of risk management practices on the performance of public infrastructure projects in Rwanda. The study was carried out in the City of Kigali using the Rwanda Urban Development Project (RUDP II) as a case study. This study follows the following objectives: to evaluate the influence of risk identification practices on the performance of RUDP II project, to assess the influence of risk analysis practices on the performance of RUDP II project, and to determine the influence of risk mitigation practices on performance of RUDP II project. The study population comprised 70 staff of the city of Kigali involved in the implementation of the RUDP II and 62 from private companies within the project, a total population of 132. The sample size of 99 was determinate using the Slovin's Formula, and only 95 respondents returned well filled responses. The researcher used primary and secondary data in this study. Descriptive research design, correlation analysis and multiple regression were used to assess the data. The results in Table 4.2 show that majority of respondents agreed with the statement about the influence of risk identification on performance of RUDIPII project. Whereby 31.6% agree and 63.2% strongly agree that RUDPII project record the risks in risk identification. The findings are supported by overall mean of 4.55 which is high mean as evidence on existence of the facts and also standard deviation of 0.50 which shows that there was homogeneity of responses. The results in Table 4.3 show that majority of the respondents 34.7% agreed and 50.5% strongly agreed that risk analysis begins at the quantitative analysis stage in RUDP II, with high mean of 4.21 and a standard deviation of 0.52 in heterogeneity. The results in Table 4.4 show that 27.4% agreed and 15.8% strong agreed that RUDIPII project consistently picked the most effective risk-acceptance to mitigate the risk with a moderate mean of 3.02 and achieved a 0.57 standard deviation heterogeneity. The regression analysis on model summary results indicated that there is significant positive relationship between risk management practices and performance of RUDP II, as it was revealed in table 4.18 that a greater variation of 54.6% in performance of RUDP II was due to changes in risk management practices measured by risks identification, risks analysis and risks mitigation practices. The results in Tables 4. (11, 14 and 17) show that risk identification ($P=0.02<0.05$), risk analysis ($P = 0.000<0.05$), risk mitigation ($P = 0.000<0.05$) are statistically significant influence the performance of RUDP II project in the city of Kigali. Hereby, the researcher rejected null hypotheses (Ho1, Ho2, and Ho3). The study recommended that RUDP II should enhance the way it manages the delayed payment and risk connected with supplier in order to improve its performance.

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LIST OF ACRONYMS AND ABBREVIATION

ANOVA	Analysis of Variance
AVE	Average Variance Extracted
CFA	Confirmatory Factor Analysis
CoK	City of Kigali
ECHNM	Enterprise de construction et hydrolique Ntihigwa Methoucela
ESCP	Environmental and Social Commitment Plan
GDP	Gross Domestic Product
GoR	Government of Rwanda
JICA	Japan International Cooperation Agency
MININFRA	Ministry of Infrastructure
OLS	Ordinary Least Squares
PM	Project Management
PMBOK	Project Management Body of Knowledge
RAP	Risks Analyze Practices
RIP	Risk Identification Practices
RMP	Risk Mitigation Practices
RSSB	Rwanda Social Security Board
RUDP II project	Second Rwanda Urban Development Project
SPSS	Statistical Product & Service Solutions
VIF	Variance Inflation Factors
WASAC	Water and Sanitation Corporation

OPERATIONAL DEFINITION OF KEY TERMS

Public infrastructure project performance	Focuses on ensuring that infrastructure facilities and services are kept up to date for general public usage in order to support economic activity and a minimum level of living that is acceptable.
Risk Analysis	In a project, risks are identified, their chance of happening, the severity of their disruptions, and countermeasures developed to ensure a successful project implementation.
Risk identification	A series of activities undertaken to detect risks, document them, and draw a plan drawn to mitigate their consequences when they occur before they could adversely affect a process.
Risk management	Risks that a business is likely to face in following its objectives are identified, analyzed and a plan of action towards a response. Business remains assured that future occurrences of the risk pose little or no adverse effect to the business attainment of its objectives.
Risk management practices	Refers to the processes and actions employees in an organization take or put in place within a project to while implementing it. The process involves identifying, assessing and controlling threats to the project's implementation.

Risk mitigation	Risk mitigation is the process that businesses undertake in anticipation of risks. A plan is devised within the confines of risk management to counter the effects of the risks which may affect their business continuity. There is a high degree of preparedness when a business puts a risk management plan in place.
Risk response	Refers to the responses, processes, or approaches used to manage risks found in a project.

CHAPTER ONE: INTRODUCTION

1.0 Introduction of the Study

The chapter outlines the background, problem statement, general and specific objectives, hypotheses given, significance, scope, and the organization of the study.

1.1 Background of the Study

Managing risks while implementing projects is important to ensure success of the project. Poorly managed risks are the main reasons why projects fail. Risk management during project implementation is important as it averts project implementation failure as a result of ignoring the risks. A good infrastructure contributes immensely to the economic development of a country more so in the developing nations. The construction industry which is responsible for infrastructure development contributes to a country's Gross Domestic Product (GDP) employing many people in the process (Qureshi, Khan, Qayyum, Malik, Sanil & Ramayah, 2020). The infrastructure development industry contributes immensely to the economic development of a nation and has other underlying benefits including production and distribution of goods and services (Qureshi, *et al.*, 2020).

Numerous researches carried out worldwide on infrastructure projects identified time and cost as contributing to the project's performance. Studies carried out by Hillson and Simon (2020) on 8,000 projects worldwide identified only 16% of the projects fitting within the performance criteria which were delivered within the stipulated timeline under the set budget and of expected quality. The World Bank study (2020) on 258 infrastructure projects across 20 countries to determine issues related to budgets concluded that 90% ran into unplanned expenditures. Hence, sticking to the infrastructure projects timelines and budget is a global challenge in projects implementation.

In Nigeria, Cross and Cross (2019) support this strategy by highlighting the significance of risk identification as the process with the greatest impact on both quantitative and communicative outcomes, followed by risk reporting, risk registration and allocation, risk analysis, and finally risk control within infrastructure projects. According to the authors, an essential component of managing infrastructure projects is communicating project risk information to stakeholders.

Shema and Hategekimana (2022) state that development infrastructure projects in Rwanda has encountered problems associated with cost overruns, implementation delays, procurement related hiccups, or lack of private financing. Other Scholars (Rwagasana, Wanyona & Kivaa, 2019; Sibomana, Diang'a & Wanyona, 2019) have attributed lack of skills in assessment of risks as a threat to public infrastructure project implementation. They contend that project managers in the construction industry are inadequately skilled in risk management process.

Infrastructure projects rank high on the City of Kigali's agenda. Up to 58 road projects are set to be implemented in the neighborhoods of the City of Kigali (CoK) before 2024 within the context of the Second Rwanda Urban Development Project (RUDP II). (City of Kigali, 2021). According to the resolutions of the CoK (2021), the capital will have a length of 215.6 kilometers of roads constructed or upgraded in six phases by 2024. The RUDP II project focusses on improving the infrastructure in the City of Kigali to achieve an integrated urban planning, evidence-based management of sustainable wetlands, flood risks controls, and a greenhouse gas monitoring in Kigali (MININFRA, 2020). Therefore, it is important to put in place robust risk management practices to stem out the losses and ensure success within public infrastructural projects

1.2 The Problem Statement

Timely completion of government projects is crucial to saving costs, and to timely avail key services to citizens aimed at improving their living conditions as enshrined in the National Strategy for Transformation (NST1). However, the office of the auditor general (OAG) report of the year ended June 2022, reported 37 cases of delayed contracts worth Frw 201,017,126,883 in 28 public entities and projects. The number of construction contracts that have been abandoned is on the rise compared to the last 3 years as eight (8) cases of abandoned contracts worth Frw 965,096,392. Auditors also identified 11 projects worth Frw 102,927,477,956 in nine (9) entities that had stalled. Contracts for these projects had been terminated due to non-performance, budget constraints, or delay in execution. However, the remaining portions of the projects had not yet resumed as initially planned by public entities (OAG, 2022).

Considering the case study of the present study, the OAG (2022) report that the RUDP II faced delay to construct planned infrastructure as the audit noted that secondary cities had not established different infrastructure that support urbanization according to the framework. For example, in the category of modern markets, expo ground and commercial centers, only 1 out of the planned 13 infrastructures was constructed by 2021-2022. In terms of tourism and recreational projects, only 4 out of the planned 52 infrastructures was constructed. This leads to delayed achievement of urbanization in secondary cities and the country as a whole. The report also indicated that 52% of the projects of RUDP II in Kigali City were not completed within the projected budget and 33% were not completed within the planned schedule. In as addition 22% of the projects had errors identified during the first (RUDP I) and second phases (RUDP II).

Hillson and Simon (2020) provides that in order to effectively manage uncertainty and unforeseen events and to successfully complete infrastructural projects, effective risk

management practices remain a key component of the project management in infrastructure projects. And Kerzner (2018) argued that for effective project performance, there is need for proper risk management practices that incorporates all the uncertainties and risks likely to be encountered in the entire time period of implementation. Therefore, the researcher of the present study aimed to assess the risk management practices and project performance in public infrastructural projects, with evidence from the Second Rwanda Urban Development Project (RUDP II).

1.3. Objectives of the Study

1.3.1. General Objective

The goal of the study was to examine the existing relationship between projects' risk management practices and performance of public infrastructure projects in Rwanda using the Second Rwanda Urban Development Project (RUDP II project.) as a case study. An understanding of the risk's management practices of a project and their performance would inspire project managers to deliver quality projects within the set time frame and be delivered within the set budget.

1.3.2. Specific Objectives

The specific objectives of the study were to:

i. Evaluate the influence of risk identification on performance of the RUDP II project.
ii. Assess the influence of risk analysis on performance of the RUDP II project.
iii. Determine the influence of risk mitigation on performance of the RUDP II project.

1.4. Hypothesis of the study

The following null hypotheses guided the study:

$H_0$1: There was no significant influence of the risk identification on the performance of the RUDP II project.

$H_0$2: There was no significant influence of the risk analysis on the performance of the RUDP II project.

$H_0$3: There was no significant influence of the risk mitigation on the performance of the RUDP II project.

1.5 Significance of the Study

The main goal of the study was to establish how risk management practices influenced performance of public infrastructure projects in Rwanda. In order to achieve their infrastructural goals at the highest level of performance, authorities in Rwanda implementing public infrastructure projects stood to benefit.

Given the dearth of information on risk management in project implementation in Rwanda, the research served as a foundational resource for scholarly and research endeavors in the future. The study aimed at advancing the body of knowledge and contribute to timely delivery of quality projects and within the set budget.

1.6 Limitations of the Study

There were potential limitations in the study including respondents' suspicions and reluctance to divulge information fearing that the information volunteered may be used for other purposes other than those stated. Part of the study sample (4 respondents) declined to return their questionnaires. Three cited being busy to fill the questionnaires and one declined to fill the questionnaire for unknown reasons. The researcher was sometimes seen intrusive in the line of questioning and therefore did not receive an objective or full response.

1.7 The Scope of the Study

The scope of the study was defined in terms of geographical coverage, time undertaken and content.

1.7.1 Geographical scope

The study was conducted in the City of Kigali Headquarters located in Nyarugenge District. The City of Kigali comprises three Districts of Gasabo, Kicukiro and Nyarugenge. The Second Rwanda Urban Development (RUDP II) project is located in the Nyarugenge District and was chosen as a case study being one of the many projects the Government of Rwanda invested in as an infrastructure project for economic development.

1.7.2 Content scope

The study set out to examine the RUDP II project guided by the specific objectives around the performance of public infrastructural projects. The scope of the study concentrated on identification, analysis, and mitigation practices.

1.7.3 Time scope

The research was conducted for a limited time period spanning the months between April and October 2022.

1.8 Organization of the study

The research report comprises five Chapters. The introduction is included in Chapter one, the conceptual and theoretical frameworks that underpin the research are covered in Chapter two. The research methodology is covered in Chapter three while data presentation, analysis and interpretation are in covered in chapter four. The summary of discussions, conclusions and recommendations of the study appear in chapter five.

CHAPTER TWO: REVIEW OF RELATED LITERATURE

2.0. Introduction

This chapter reviewed the literature on practices related to risk management and infrastructural project performance purposely to identify existing gaps. The chapter introduces theoretical and conceptual framework guiding the research and defines risk management practices in infrastructural project performance.

2.1.Theoretical Literature

The section explains the meaning of the main topic. This is critical in comprehending how the key concepts are operationalized and implemented in the study by providing them with the necessary and concrete significance.

2.1.1 Risk Management Practices

Many scholars define risk management differently, Organizations are beginning to appreciate the importance of risk management practices and are increasingly embedding them in projects. Abu Hussain & Al-Ajmi (2012) define risk management as a process that brings to the fore and controls risks associated with an exercise or project which can bring about disruption and cause losses to an organization. Tereso *et al.* (2019) identified lack of a unified definition for a project. They attempted to define a project in terms of activities bound by time, purpose, and outcome. The authors saw a project as temporal having a limited time of implementation aiming at deliverables that may be tangible or intangible. Cooke-Davies (2018) offers a definition that identifies the purpose, the activities to be undertaken and a timeframe for implementation indicating commencement and end period. PMI formulated PMBOK into 10 sections that all projects should go through (Jason Westland, 2019). Among the 10 PMBOKs is project risk management.

According to Westland (2019) all risks likely to occur in a project must be known before the project is implemented and documented together with ways of countering them. Risk management in public infrastructure projects involves isolating threats with a potential of adversely influencing the implementation affecting costs, timely completion, and attainment of objectives. The more complex a project becomes, the more risks it is likely to face hence a complex project ought to look forward to more risks by putting an elaborate risk plan (Marle, 2020).

The performance of a project depends on how the risks are handled. Singh & Kalidindi (2016) identified potential risks that projects in the public and private sector ought to anticipate facing and adequately prepare to address. The public sector may lose out on the project and have land acquired without compensation together with differences in political orientation. Risks the private sector should anticipate and prepare for include inconsistencies in interest rates, increases in the cost of doing business arising from government taxation, and natural disasters.

2.1.2 Risk identification

Risk management aims at anticipating threats by identifying them in advance and planning on how to control them when they occur (Sarvari *et al*., 2019). The exercise of risk identification cannot be thorough. Some risks cannot be easily identified before they occur. According to Otaalo *et al.*, (2019), risk management can be defined in terms of what it involves. It reduces or mitigates risks, there is documentation of risk events, beginning with identification and evaluation of the events and finally, optimizing resources for monitoring and minimizing the events. Before risks can be managed they must be identified, and knowledge from previous experiences might apply to the current project (Qureshi, *et al.*, 2020).

Ahmadi *et al*. (2017) indicated that a project risk management process was used to identify and analyze risks. The former is a process that consists of interviews, checklists and brainstorming while the latter is performed through a data driven methodology (Qureshi, *et al.,* 2020). The usage of interviews with experienced project managers can be useful for solving and avoiding similar problems that might arise, all relevant participants in the project can be interviewed on factors affecting risk. According to Petrovic (2017) research, the method of using past experience or historical data from similar projects provides insights about common factors in a comparison between the projects.

Rwagasana *et al* (2019) see risk Identification process as listing risks likely to affect a project after they have been identified. Risks should be constantly and methodically assessed for their effective management (Bazin, 2017). Research findings by Kerzner (2018) and Rwagasana *et al.,* (2019) identified the common risks encountered in the construction projects falling under the categories of logistics, technology, physical safety, construction or execution, permits or approvals, subcontractors, the environment, law, design, management, finances, and politics.

According to Rabbani (2011), the common factors causing delays in construction in Pakistan would have been identified at the beginning of the projects. They are related to the financial and technical capabilities of the contractor. There were other factors hard to control due to their nature such as natural disasters including earthquakes, floods and wars among others that cause delays in the schedule of the project and affect the cost. A formal process of determining risks and putting a plan in place to face them is important and Rwagasana *et al.,* (2019) recommends a priority treatment of the identified risks and putting in place a step-by-step method to counter the risks. The risks identified during the risk analysis stage are given numerical values to indicate the severity of the likelihood of the risks taking place (Sibomana *et al.,* 2019; Jennifer, 2022).

2.1.3 Risk analysis

The construction industry relies on accumulated experience when determining, preparing and dealing with risks shunning anticipation of risks through a risk analysis process, (Akintoye & MacLeod, 1997). During risk analysis phase the influence of the risks on time, cost and scope are determined. In general, qualitative and quantitative methods guide literature review on risk analysis. When necessary, risk analysis can be initiated at the quantitative analysis stage, and the stages of analyzing can be repeated (Dehdasht *et al.,* 2015).

Quantitative method of risk analysis determines the impact of each risk in the according to whether it is high, low and its probability of occurrence. The methods employ decision tree diagrams to represent the project and show the effects of each decision (Kerzner, 2018). The impact of the risks is evaluated and a list developed and highlighted for further analysis, (Kerzner, 2018). Activities are devised and broken down into in to small hierarchical units with series of activities to address the risks. Additionally, quantitative method may include risk dependencies and a prioritization depending on how quick a response is required to address the risk (Hillson & Simon, 2020). The analysis of risks through both types of analysis should transpire on an individual level as well as include the interrelationship of their effects (Dario, 2017).

2.1.4. Risk mitigation

Risk management process in a project eliminates or minimizes risks guaranteeing that the project succeeds (Aven, 2016). Risk mitigation should not be undervalued. It is a crucial process in risk management that helps projects overcome uncertainty. As such, it is a useful tool for project risk management. Risk mitigation uses the collective information from the analysis stage to help make decisions about how to increase the likelihood that the project

be completed on schedule, on budget, and with high-quality results (Bahamid & Doh, 2017).

During the risk mitigation stage, the project implementation process prepares responses to the major risks and designate individuals in charge for each reaction (Dario, 2017). A plan to counter the risks effects together with a process to monitor the risks for control was put in place. Putting a risk mitigation mechanism is crucial in a risk management process. Project managers should make judgments concerning risks at this point. Planning for risk mitigation is a neglected aspect of project risk even when the manager lacks time and resources to address the hazards (Gitau, 2015).

A management system should be designed to ensure the effectiveness of risk mitigation to minimize the effects of risks. Dario (2017) states that while there are tools and approaches for managing risks in a project, the available studies on how risk management affects project success are few. It is well recognized that the effectiveness of response measures may vary from project to project, and it goes without saying that construction projects required different measures than those used in school projects because of their diverse uses, which call for a different reaction (Aven, 2016).

Rostami (2016) states that risk mitigation is a process of formulating alternatives steps to undertake in order to enhance a projects opportunity and lower the threats thresholds. According to Hopkinson (2017) risk mitigation is a necessary step in managing risks. Risk avoidance, followed by risk reduction, and finally risk acceptance, were the most common risk mitigation techniques used by contractors. It was quite typical among developers to transfer risks to the other side. A risk management process was followed to guide contractors in identifying risks and in responding to the risks. The study found that while Swedish contractors did not adhere to a systematic and structured approach, the risk responses they had adopted were merely similar to the theoretical idea.

2.1.4 Public infrastructure Project performance

In general, Project performance refers to the completion of projects within the budgeted cost with basic criteria of scope, cost, and timeline. Watema & Tulirinya (2021) in their study isolated three parameters of a project informing a high-performance project, project implemented within the budget, delivered in the expected time and expected time. Other scholars have identified cost, time and quality as important factors that project implementers have to pay attention to in order to register a good project performance. (Rainey & Jung, 2015), (Nguyen *et al.*, 2022).

Projects in the public infrastructure sector are disjointed, transient, and complicated in character which inevitably exposes them to risks (Petrovic, 2017). It is therefore important for project implementers to be better versed in the areas of risk management to achieve a high performance in the implementation of public infrastructure projects.

PMBOK defines Project Scope as the "The work that needs to be accomplished to deliver a product, service, or result with the specified features and functions. According to Otaalo *et al. (*2019), the scope of work in construction is the list of construction obligations, as well as work activities that all contractors, subcontractors, and suppliers are obligated to do. This is all written out in an agreement or contract, which is then called the scope of work. In the same line, Pervez, *et al.* (2016) stipulate that all the goals of the project are laid out in the project scope. This is where all the quantifiable data can be found, along with the budget and the tech specifications. This is also an excellent place to list all the different milestones for the project.

In today's highly competitive and modern workforce, every project manager's dream is for the project to run smoothly from start to finish, with no delays or budget overruns. When it comes to project management, things are not that simple. Even if all of the issues are planned in advance with the project stakeholders, something will always impact the

project's scope over time (Rwagasana, *et al.,* 2019). When the scope of a project is unknown, stakeholders have no idea how much work must be completed to satisfy its goals. As a result, the project can fall behind the project deadline. Scope creep is a key concern for project managers, affecting 52% of projects (Qureshi, *et al.,* 2020).

Scott, Young & Samson (2008) attributed project implementation success to a consideration of the cost and time taken to implement together with meeting expected quality of the project. There are other criteria to consider when determining the success of a project which according to (Hammond, 2018) are composite. Many failures of construction projects are as a result of cost escalations (Kerzner, 2018). The process of determining the project budget involves aggregating the estimated costs of individual activities or work packages to establish an authorized cost baseline (Shema & Hategekimana, 2022). The project budget and time that results from the planning cycle must be reasonable, attainable, and based on contractually negotiated costs and the statement of work.

2.2 Empirical literature

This section reviews empirical literature on risk management and their effects on performance of public infrastructure projects. It describes some studies carried out on risk identification, risk mitigation, risk analysis and public infrastructure project implementation.

2.2.1 Risk identification and performance of public infrastructure project

A research conducted by Petrovic (2017) in Swedish construction industry where they use different methods to identify risk. The checklist was used together with the experience from former projects where the selected respondents around 88%, after comes brainstorming approximately 48% and interviews at 12%. Also found that the use of checklists and

documentation was regular the initial stage of a project in terms of risk identification. The method of brainstorming also used by many so that they can contribute their experience even discusses the lesson learned from similar projects. Checklists is an important tool for identifying risk in the work atmosphere, mostly in work inventory with treats needed to measure basing in the surrounding legislation.

Sarvari *et al.* (2019) investigated approaches put in place for identifying risks in public-private partnership projects in Malaysia. They concluded that performance was enhanced in projects that included risk identification, prioritization, and managing change. They urged public-private projects in Malaysian should make use of identifying, allocating, and managing risks to improve project performance. This study is significant in that it will be a point of reference for other researchers.

Sastoque *et al.* (2016) saw risk management as significantly impacting both the public-private partnership (PPP) and public infrastructure whose origin can be traced to social infrastructure. Developing countries have involved PPP in the construction, transport, telecommunications and power generation projects. Those countries yet to use PPP in infrastructure development are hindered from doing it by poor legislation, uncertainties in risky allocation and financial constraints.

Mwangi (2015) researched on how risk management techniques are used during the planning stage of building projects in Rwanda and recommended for further studies in this field to draw up a manual developers and various agencies of the in-project implementation. The study discovered a tenuous relationship between the selection procedures for architects and engineers. Therefore, more investigation is required into how choosing an architect and engineer affects the success of a project. According to the findings of the study, a significant proportion of those in-charge of project implementation including architects and engineers lacked a knowledge of risk management, particularly the risk identification process before

project implementation. A further recommendation of the study was more research to identify training shortcoming on architects and engineers.

Igihozo and Irechukwu (2022) assessed the risk management process and project performance of Mpazi channel construction project. The descriptive research design with a mixed qualitative and quantitative approach was used to a sample of 118 respondents selected from 168 target population using stratified sampling technique and Sloven's formula. SPSS Statistical software was used in the analysis of the collected data into descriptive statistics by the help of mean and standard deviation. The inferential statistics were also analyzed as regression and correlation analysis. The results of this research have shown that project risk identification and project performance of has a highly positive and significant relationship, with a coefficient of correlation of 0.970 and sig=.000, which is less than 0.05 level significance. The research also found that a combination of project risk identification, risk management plan and risk plan response contributed to 97.5 percent (R2= 0.975) of the Mpazi Channel construction project success. Thus, the researcher concluded that the project risk management practices has an impact on the performance of the Mpazi Channel construction project.

2.2.2 Risk analysis and performance of public infrastructure project

In (2019), Hartono *et al*. studied construction projects in China focusing on the effects of project risk management. They found that the success of infrastructure projects was determined by availability of a risk manager and the risk management processes used. The study further recommended a thorough understanding by project and risk managers of risks through risk analysis process for success of a project.

Pimchangthong and Boonjing, (2017) studied the management of risks and success of projects in the IT sector paying attention to effects of the practices and success registered. They established that risk analysis was important in risk management practices with a high

level of importance (X= 3.55; S.D.= 0.807) and process performance with a high level of importance (X= 4.05; S.D.= 0.788). They concluded that for a project to achieve a high performance, risk management process should be in place including risk analysis.

Alsaadi & Norha (2020) used quantitative methods to study risk management practices and project performance in construction projects in Oman. The outcome showed that risk management techniques used considerably enhanced the performance of building projects. Based on this finding, it is important to employ services of a qualified project manager familiar with risk management's primary processes. According to the writers, making the appropriate decisions at the appropriate times and placing the appropriate people in the appropriate positions ensures the effective completion of projects.

Otaalo et al., (2019) aimed to investigate the effect of risk management practices on road construction projects performance in Kenya. The instrument of data collection were structured questionnaires. The target population consisted of 80 project managers, road engineers, project managers, road supervisors, road inspectors, road surveyors and contractors in Kakamega County. The unit of analysis were ongoing and completed road projects implemented by Kakamega county government. Simple random sampling used to select 80 of whom 70 respondents returned the questionnaires representing 87% respondents. The findings showed that risk identification has a positive and significant effect on risk management practices in road construction projects. Risk analysis has positive and significant effect on the risk management practices in road construction projects.

Using the WASAC Rwanda and the Japan International Cooperation Agency (JICA) executed project SUS water & sanitation project no: p-rw-f00-016 as a case study, Ndungutse (2021) investigated the link between risk management and project performance. The researcher identified some issues with the project, but they were quickly discovered

and effectively resolved, resulting in successful execution. The researcher proved that the lack of collaboration by the three implementing parties caused timeline problems resulting in expenses and cost overruns.

Rwagasana *et al.* (2019) studied the risk management practices incorporated into Rwandan construction projects. They established that the construction industry employed advanced analytical decision support systems to monitor, identify and address risks in their risk management processes. Ntwali (2019) assessed the practices of risk management in energy projects and their effects on performance. The research targeted project managers and other staff working on the energy projects and used quantitative methods of data collection. The study concluded that there existed a direct relationship between managing risks and performance of projects in the energy sector. It recommended the identification and the addressing of risks in project planning and through its implementation. The study identified a need for constant improvements on the practices used on risk management.

2.2.3 Risk mitigation and performance of public infrastructure project

In his 2017 study, Dario focused on the perspective of Swedish contractors as he investigated and assessed project risk management within the construction sector. The goal was to assess the project managers understanding of risk management how they practically applied it. The methodology entailed a review of literature review on the principles of risk management, attitudes, and knowledge management. The study findings showed that risk management theory, models, and processes were not known. Organizations individually applied some methods but lacked structure and terminologies as found in the risk management theory. Research available indicates contractors and developers underutilized knowledge and risk management processes.

Hnottavange-Telleen *et al.* (2011) examined risk management for a large-scale carbon dioxide geosequestration pilot project in Illinois, USA. The project included risk mitigation actions taken to support the project's performance. They concluded that the risk responses incorporated into the project impacted decisions made during project execution, including participation in a systematic decision-making process that ultimately led to high performance. The analysis suggests that public infrastructure projects in Illinois, United States, should employ procedures for mitigating risks by identifying, assessing, monitoring, and mitigating all risks within a unified framework. Risk management procedures strive to increase the likelihood of project success. This study is significant because it will serve as a resource for other scholars.

Hwang *et al.* (2013) studied project risk factors in public private partnership (PPP) projects executed in Singapore and found that partners openly shared and allocated risks among themselves transparently for addressing resulting in high performance of the projects implemented.

Risk management was examined in a large-scale carbon dioxide geosequestration pilot project in River State, Nigeria, by Cross and Cross (2019). The project included risk mitigation actions taken to support the project's performance. They concluded that the risk responses incorporated into the project impacted decisions made during project execution, including participation in a systematic decision-making process that ultimately led to high performance. Therefore, the analysis suggests that public infrastructure projects in Illinois, United States, should employ by identifying, assessing, monitoring, and mitigating to all risks within a unified framework, risk management procedures strive to increase the likelihood of project success. This study is significant because it will serve as a resource for other scholars.

Githau (2013) conducted study to identify the skills essential for successful performance in Kenya's construction industry. The outcome was that adopting tools to schedule processes and planning for and monitoring and controlling were essential to a project's success. The projects required careful cost control and skilled human resources who could effectively handle all project communications. The study concluded that persons who can effectively use tools and follow instructions finish their assignments successfully.

Aimable (2015) studied risk responses on project performances at the Rwanda Social Security Board (RSSB) whose recommendation helped RSSB to achieve quality in multi-store constructions by 29 percent, while risk avoidance assisted them in managing resources by 41 percent, and risk avoidance assisted them in ensuring project plan by 11 percent. Risk transfer mechanism allocates the risk of a commercial contract's performance among contracting parties. Aimable's study found that risk retention tactic passed hazards from one party to another, with 44% of risk retention having an influence on multi-story constructions. The majority of respondents' regarded avoidance at 62%, mitigation at 61 percent, and acceptance at 55% in Swedish construction projects, whilst transfer received a response rate of 36 percent.

2.3 Critical Review and Research Gap Identification

The literature reviewed indicates that many researchers studied risk management and project performance in construction projects and other domains, however, it emerged that limited studies were carried in infrastructural sector. Additionally, the reviewed literature acknowledged the positive and significant effects of risk management practices on the project performance but they lack various gaps, either geographical, methodology or theoretical compared with the present study.

Several studies were carried in Rwanda, but using other methodology as the one to be used hereby. Therefore, their findings may be different of those of this study. The literature

review has shown that scholars have conducted studies on project risk management and project performance in other fields including construction and health services in Rwandan Public institutions. They have recommended a risk assessment process to be undertaken concerning the performance of the projects. However, they did not explicitly emphasize on infrastructure projects related precisely to road projects. Thus, the researcher cannot declare that the study has revealed all literature on project risk management and performance of infrastructural projects, as there are little studies conducted specifically in the Rwandan context.

Furthermore, the literature review is in consensus that risk management is a process but does not offer a clear modality of incorporating it in the implementation of infrastructure projects. Each infrastructure project is unique from the other in environment, geographical location, governance political, and social support, among other factors and would need its unique way of implementation. It is from this scenario of lack of such studies on infrastructural projects, and lack of anonymous practices regarding project risk management of public infrastructure projects that the researcher was motivated to conduct this study within infrastructural projects, and by using the RUDP II project as the case study.

2.4 Theoretical Framework

The study is informed by the Lean Construction and the Stakeholders' Theories which are reviewed here.

2.4.1. The Lean Construction Theory

Since beginning of the 1990s, the theory underlying lean construction has undergone transformation spearheaded by luminaries among them Koskela, Bertelsen and Ballard (Biton & Howell, 2013). In 1991, Koskela presented a seminal piece on lean construction

in the field of engineering construction management. Lean construction aims at bringing about efficiency in the construction industry through waste reduction and has expanded considerably (Crnkovi & Vukomanovi, 2016). As a result, a number of conceptual pillars, core values, fundamental practices, and a more or less uniform vocabulary has developed. These innovations put traditional project management's tenets, guidelines, and methods under review. The current issues in the construction sector are a result of traditional project management lacking a comprehensive underpinning theory. Lean construction is an invention that emerged as a result of established methods' failure to address a number of recurring, widespread issues on projects. Koskela borrowed heavily from the Toyota Production System and its culture (Crnkovi & Vukomanovi, 2016) in propounding the lean construction theory.

Koskela's 1992 report brought to the limelight the creed of the Lean Construction research agenda observing that the foundations upon which constructions engineers went through in academic institutions were antiquated with a need to base the training on modern conceptual and intellectual grounding. The approach was a turning point for academicians and research institutions as they felt challenged to practically translate the new thinking into in the training of construction engineers.

Cross & Cross, (2019) cautiously held that the new paradigm shift was realizable but only as a long-term research and training goal.

The new philosophy gained traction among academicians and construction engineers out of a failure of the project management styles in use. The styles emphasized predetermined relations and delivery period which adversely impacted on the projects timelines, budget and quality and led to the development of the Transformation Flow Value (TFV) generation theory of production (Koskela *et al.* 2007). The lean construction theory metamorphosed into TFV adding to it the theory of management and highlighting the usefulness of project

planning, execution, and control. The model helps in the project's completion, arbitration of misunderstandings in the construction industry by consideration of ideas from outside the industry (Ling, 2017).

Critics the theory of lean construction include Winch's failed to appreciate two critical tenets of the theory: importance of production in management and controlling waste in construction (Koskela & Howell, 2002). Bertelsen (2003) challenges the theory contending that the construction process is not the only method to view construction, despite the TFV - process model's attempt to explain construction and construction project management. It involves an interaction between individuals involved in the project and other stakeholders each undertaking their respective assignment such as suppliers, government officials and insurance (Crnkovi & Vukomanovi, 2016).

The Lean construction theory is anchored on this study in affirming that most projects follow the process of design, bid then build (DBB) or design while you build (DB). In DBB, the implementation of the project follows three phases of designing and upon acceptance and agreement on the final outlook of the finished product, bids are floated and a contract drawn with the winner to build (ProjectSight, 2022). Design build integrates all the stakeholders in the project from the onset bringing in the builder to input ideas in the design and other processes. All parties collaborate actively throughout the project until it is commissioned.

2.4.2 The Stakeholder Theory

Freeman (1984) propounded the Stakeholder Theory as a management approach that considered the ethical and moral interests of all concerned parties in an organization. The Stakeholder Theory advocates for satisfied stakeholders in every venture or business and the performance of a company or organization (Dario, 2017). Without focusing only profits for the shareholders or owners of the company, the management should consider also the

interests of the clients. also need to be satisfied with the product put on the market, and the staff at the company should be motivated enough to put in their best performance culminating in high profits. In risk management, the theory emphasizes performance by deploying a risk management process to reduce or eliminate threats to attaining the company goals (Bazin, 2017). In public infrastructure projects, the stakeholders may be donors, the public, the government, and the staff implementing the project. They all need to get value for money through the implementation of a project whose risks are minimized or eliminated. The stakeholder theory introduces the consideration of the interests of both the proprietors and non-proprietors'stakeholders. Contracts binding all types of stakeholders are entered into to safeguard their interests (Dehdasht et al, 2015).

Consumers' faith in a service industry is enhanced when assured of service continuity. In their expectations, the services should continue, hence, they attach a high value to the company. Companies can continue to exist and hence satisfy maintain high consumers' expectations by taking measures that mitigate the risks they are likely to face including financial shocks. The claims likely to be made may be way off the capability of the company and may plunge it into bankruptcy. Therefore, a prudent and well-thought risk management process considering the tenets of the stakeholder theory may mitigate those claims and save the company (Klimczak, 2011).

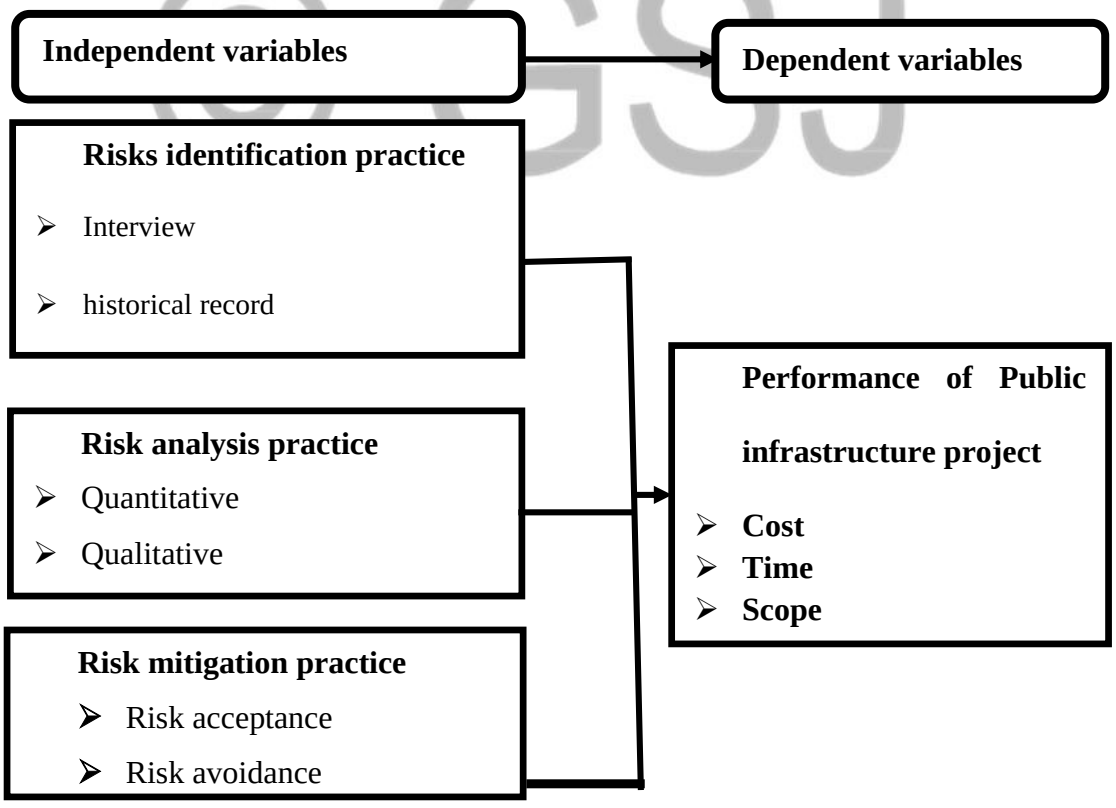
In the study of the effect of stakeholder theory on risk management, (Dario, 2017) investigated the connection between corporate goals and the risk management tactics. It focused on the interests of general stakeholders and shareholders and the risk management strategy used in both cases. The study concluded that the management that had stakeholder's interests hedged its currency exposure more than that inclined to safeguard shareholders' interests. The considerations of the stakeholders influence the risk management strategy. This study shall apply the Stakeholder Theory since the projects

implemented involved a lot of public funds. It is relevant in the choice of a risk management strategy to use considering the various stakeholders involved in any public infrastructure project in Rwanda including the RUPD II.

2.5 Conceptual Framework

The research is guided by a conceptual framework in its planning, development, and organization all contributing to the study's findings. It puts together the interrelated components that include variables and depicts their interactions, relationships, and effects on the expected results. (Creswell & Creswell, 2018), (Ito & Aruga, 2022).

Figure 1 presents variables in the present study alongside their sub-components. The independent variables depict the risk management practices in public infrastructural projects. The performance of the project was directed by the dependent variables which the study was interested in.



Source: Researcher, 2022

Figure 2. 1: Conceptual Framework

In this study, the independent variables were risk identification, risk analyses, and risk mitigation practices while the dependent variable was performance of public infrastructure project. Indicators of risk analysis were interview, and historical records. Indicators of risk analysis was quantitative, and qualitative analyses. Indicators of risk response were risk acceptance, and risk avoidance. All the variables affect time, cost, and scope of the project as indicators of performance in public infrastructure projects.

2.6 Summary

The literature reviewed dwelled on incorporating risk management processes during implementation of public infrastructure projects and their performance. It showed that scholars considerably paid attention to the area of public infrastructure project implementation against their management. The study augments the body of available in infrastructure development projects in Rwanda.

Although the variables utilized were the same, their use centered on projects involving banking and construction, and little attention was given to the research of the constructs in projects on infrastructure development. This research closes the empirical gap and assesses risk management techniques and their effect on implementation of infrastructure projects in Rwanda. The study also examined performance of infrastructure projects in a developing nation lacking adequate scholarly attention. Infrastructure in developing countries is crucial in supporting all sectors; it is a foundational element of sustainable development.

Given the enormous costs of infrastructure projects and the effort that financiers, researchers, customers, builders, owners, and engineers must put forth to ensure the least amount of risk (Guido, Juan and Maria 2016). However, due to ineffective risk management procedures, many developing nations continue to struggle with the issue of ineffective infrastructure project performance. As a result, greater project performance through effective risk management is required. No one can eliminate project risks, but we

can plan and include risk management activities in our project plans, setting up safeguards, redundancies, and additional resources to safeguard the business in the event of a catastrophe.

The argument has ramifications for both academics and policy. Most studies focus on banks and the construction industry. The research offers a comprehensive understanding of risk management of infrastructure projects which needed attention to add to the available academic literature on Rwanda in infrastructure development. The thesis has practical applications as well. The study's findings can assist project managers in improving their current risk mitigation strategies, which will benefit the many stakeholders in the infrastructure sector by streamlining the project development process and lowering the risks associated with public infrastructure projects.

CHAPTER THREE: RESEARCH METHODOLOGY

3.0. Introduction

The chapter on research methodology outlines step-by-step process of tackling and solving the research problem (Kothari, 2011). The chapter delineates a description of the methodology to solve the research problem. The outline of the research design is presented together with characteristics of the target study population. The sampling techniques used for data collection and the data collection process is given. The method of ensuring validity and reliability of the data collected is presented in terms of reliability and validity tests, and the approaches used in analyzing the data described. All the study variables and their relationships are clearly explained.

3.1 Research design

Virginia Tech (2018) avers that a research design is a plan followed towards a solution to a research question. Research advocates use of a good research design that ensures that data collected is sufficient enough to solve the research question. The study employed a cross-sectional research design using both analytical and descriptive methodologies primarily to examine risk management practices and performance of infrastructure projects. To evaluate the link between the study variables the researcher applied correlational design with multiple regressions testing the study hypotheses using collected data which was primarily primary and secondary.

The Second Rwanda Urban Development Project (RUDP II, 2019-2022) was studied as the case study. Based on RUDP II project's size, duration, and scope, the researcher gathered only pertinent data to achieve the study objectives. The City of Kigali has a lot of infrastructure projects aiming to turn the capital city into a regional hub of financial services. The researcher chose to conduct this study here because it is easily accessible and

to provide input to improve the risk management practices in infrastructural projects undertaken by Public Institutions.

3.2 The target population

Asiamah *et al.* (2017) defines the target population in a study in terms of attributes possessed by an individual solely or as a group that the study views as relevant. The study targeted staff of the City of Kigali in the Nyarugenge District working on different projects including the RUDP II project. They comprised 32 administration and finance officers, 28 consultants & support staff, 19 contractors, 32 Architectures/ Engineers and 21 project managers.

The study's overall target population was 70 staff of the city of Kigali involved in the implementation of the RUDP II and 62 from private companies within the project, a total population of 132. The individuals were chosen as the study's target audience to provide information on the risk management practices used in the project and their effects on the performance of the public infrastructure projects.

3.2.1 Determination of the size of the study sample

The sample size in the study was calculated using the Slovin's Formula $n = \frac{N}{1+N(e)^2}$

Where n represents the size of the sample, N the total size of the population, and e error margin (5%). In this study, N=132. To calculate the required sample size for the study at 5% margin of error using the formula, the sample size was calculated at 99 as table 3.1 shows.

$$n=\frac{132}{1+132(0.05)^2}=\frac{132}{1+0.33}=\frac{132}{1.33}=99$$

Table 3. 1: Population and Sample size

Nature of respondents	Population size	Sample size
Administration and Finance officers	32	20
Consultants & support staffs	28	25
Architectures/ engineers	32	26
Project managers	21	19
Contractors	19	13
Total	**132**	**99**

Source: RUDP II, 2022

3.2.2 Sampling technique

Kombo & Tromp (2006) define sampling techniques as processes followed in selecting a study group, individuals or objects from a population. In this research, random sampling method was used to select a representative population of 99 employees. Each employee was chosen by chance in a simple random sampling technique that accorded each member of the population same chance of selection.

3.3 Data collection

Both primary and secondary data was collected in the study. Information gathered from the respondents is the primary data while secondary data focuses on information gleaned from other sources such as reports, studies among others. A desk review of available literature was conducted to support the main information and tie the results to other methods already in use.

3.4 Data collection instruments

The study employed a paper-based questionnaire and undertook desk research on available documentation for data collection.

3.4.1 The data collection questionnaire

The researcher distributed a self-administered paper-based questionnaire to CoK staff. The self-structured questionnaire was based on Liker scale which is a rating scale that requires the subject selected for the study to indicate his/her level of agreement or disagreement with a given statement (Kothari & Garg, 2014). followed the five anchors on the Likert scale of strongly disagrees, disagree, neutral, agree, and strongly agree to capture respondents' perspectives on risk management and public infrastructure project performance within the case study. It was administered to 99 City of Kigali staff in charge of the RUDP II project over a period of two weeks.

3.4.2 Documentation

(Kenfield, 2019) defines documents as items that provide details about a topic that academics are interested in studying. The researcher took care to compare the information from the questionnaire with information from other sources, such as public papers. This study obtained additional information on project performance by consulting available documentation on the subject. They include books, reports, journals, newspaper articles, blog posts, and reports.

3.5 Data collection procedures

Frequency tables, statistical means, and standard deviations were used in interpreting numerical data collected. Qualitative data was collected which further clarified the respondents' perceptions of risk management practices and project performance. The

quantitative data collected was analyzed using Statistical Product & Service Solutions (SPSS) version 23.0.

3.5.1 Piloting

Piloting studies before the actual research helps in understanding the parameters and dynamics surrounding the actual research (Junyong, 2017). The researcher undertook a pilot study to test the level of understanding by respondents of the contents of the questionnaire. The pilot took place in the contractor's units of the ECHNM Ltd a construction company with more than 10 years in the field. Copies of the questionnaire were distributed to 15 respondents. The researcher amended and modified the statements on the questionnaire that were unclear, while some of them were reworded in particular those that were not correctly replied by the respondents as predicted, based on the pilot study and the instrument appraisal.

3.5.2 Validity and reliability

A measuring instrument should possess properties of validity and reliability (Sürücü and Maslakçi, 2020). The instrument may be reliable and lack validity at the same time. Researchers tested both qualities of the measuring instrument to ensure reliability. In this study, the paper-based questionnaire set out to collect information on the risk management practice at the RUDP II project in the City of Kigali. The researcher ensured reliability and validity of the instrument so that the data collected when analyzed would lead to making reliable conclusions on the research, (Erlinawati, & Muslimah, 2021).

Before the research tools being administrated to the respondents, the research first pre-tested the questionnaire to ensure their validity and reliability. A small group of 5 respondents 'staff chose randomly to represent the others for pre-testing. A set of 3 research

scientists reviewed the questionnaires until they're sent to participants to guarantee that quizzes can satisfy the goals stated for equipment validation.

Table 3. 2: Reliability statistics

Variables	Number of items	Cronbach's Alpha	Comment
Risk identification	8	.815	Accepted
Risk analysis	6	.882	Accepted
Risk mitigation	6	.912	Accepted
Project performance	9	.828	Accepted

Source: Researcher's Pilot Study (2022)

Table 3.2 shows that all of the statistical evidence from the Cronbach's Alpha Coefficients variables of independent and dependent are highly reliable. When the value is larger than 0.7, it shows that the scale's items have a higher degree of internal consistency and that the research instrument used is dependable (Saunder, 2012). All passed the minimum coefficient test requirement of 0.70, and were therefore accepted.

Table 3. 3:Content validity

Variables	Number of items	Average Variance Extracted	Comment
Risk identification	8	0.75	Accepted
Risk analysis	6	0.89	Accepted
Risk mitigation	6	0.74	Accepted
Project performance	9	0.78	Accepted

Source: Researcher's Pilot Study (2022)

In this study the content validity was 0.75 for Risk identification, 0.89 for Risk analysis, 0.74 for Risk mitigation and 0.78 for project performance. Validity by the Confirmatory Factor Analysis and the covariance between the main construct and the items of the

questionnaire were determined where variables whose factor loading was less than 0.5 were excluded from subsequent analysis or replaced with relevant content with passed the test.

3.6 Methods of data analysis

Original, excellent publications that emphasize many aspects of current statistical theory as well as significant applications were found in the field of statistical methods. In addition to fostering links between statisticians and scientists from other domains who are interested in statistical techniques generally, this thesis intends to stimulate research. Descriptive and inferential statistics of correlation and multiple regression analysis were used for data analysis and computed applying the SPSS 23.0.

3.6.1 Descriptive statistics

The research used descriptive statistics of mean, frequencies and standard deviation to characterize risk management practices. The practices of risk identification, risk analysis, and risk mitigation helped determine the degree of public infrastructure project performance related to scope, cost, and timeline.

3.6.2 Pearson Correlation

The statistical relationship between risk management methods and project performance for public infrastructure projects was measured extremely well using the Pearson correlation coefficient.

3.6.3 Multiple linear regressions

With multiple regression analysis, the impacts of several predictor variables (rather than just one) on the dependent measure are evaluated. Linear regression was used in the identification of the mean change that observed in a variable when a unit change occured in each independent variable. Ordinary Least Squares regression (OLS) is utilized when the dependent variable is continuous (ratio or interval data) and the independent variable is

another variable that could be categorical, continuous, or ordinal. Since the dependent variable in this study is a ratio data rather than an ordinal data (Likert scale of five responses), multiple linear regression analysis was performed after testing the hypotheses. Multiple regression models examined significance independent variables exerted on the dependent variables. Based on previously utilized models that have been used to assess the impact of each predictor, the current study used the Multiple Linear Regression Formula.

$Y=\beta_0+\beta_1X_1+\beta_2 X_2+\beta_3 X_3+\varepsilon$:

X = Independent Variable (Risk management Practices)

Y = Dependent variables (project performance)

β_0 = Constant coefficient

X1= Risk identification practices (RIP),

X2= Risk analysis practices (RAP),

X3= Risk mitigation practices (RMP).

ε= error term

3.6.4 Diagnostic Tests

After the model has been run, post-estimation tests were carried out to make sure the model fits the data well and that the estimates it produces are accurate and trustworthy. Conditional diagnostics statistical tests were successfully completed by this investigation. The study check for multicollinearity, and normalcy.

Multicollinearity is present in a situation of correlations between independent variables when no correlation should be observed, (Corbin *et al.,* 2014, Shrestha, 2020). Variance inflation factors (VIF) and tolerance levels tested for multicollinearity consistency. Where two or more variables attained a VIF equal to or greater than five then one of them was eliminated from the regression analysis (Akinwande, Dikko, & Agboola, 2015).

Normality which predicts outcomes of dependent variables and depicts the distribution's shape (Paul & Zhang, 2010) was determined by the Kolmogorov-Sminorv test. A normal distribution registered result less than 0.05.

3.7 Ethical Consideration

The researcher administered the data gathering tools carefully to safeguard the respondents. The three main ethical factors in every research study are informed consent, voluntary involvement, and privacy / anonymity. The following were satisfied by the research on these issues.

Informed consent: The researcher paid attention to ethical concerns while carrying out the study. The researcher requested for permission from MKU and other concerned organizations including the management of the City of Kigali to conduct the research on RUDP II project.

Prior to starting the study, care the researcher avoided requesting the respondents' sensitive or offending personal information when designing the questionnaire. In order to prevent upsetting the respondents, the researcher scheduled appointments in advance. The researcher helped the respondents understand the usefulness and difficulties of participating in the study by outlining the nature and aim of the research indicating that there were no financial gains in participating.

The respondents' privacy and professional handling of the information provided was assured through maintenance of anonymity by coding without use of names.

CHAPTER FOUR: RESEARCH FINDINGS AND DISCUSSIONS

4.0. Introduction

The chapter presents data analysis, presentation and interpretation of the results as well as a discussion of the findings according to the study objective and aims. The study set out to investigate the relationship between risk management practices with respect to performance of infrastructural projects in Rwanda taking the Second Rwanda Urban Development Project (RUDP II) as the case study. The elements tackled in the chapter are the rate of response to the questionnaire, demographic attributes possessed by the respondents, a scrutiny of the study findings, and discussions followed by their interpretation. Data obtained was subjected to an analysis using the IBM's application Statistical Product and Service Solutions (SPSS) version 23.0. This information was grouped based on the research objectives and results then presented through tables and cross tabulations. The sample size comprised 99 respondents working in the RUDP II project.

A total of 99 questionnaires were distributed out of which 95 returned duly giving a response rate of 95.9%. The adequacy of the response rate followed Kothari's (2011) who stated that a score of 60% is consider poor, 70% is acceptable, 80% is good and 90% is excellent. For this study the response rate is excellent.

4.1 Respondent's demographic characteristics

The respondent's ability to supply credible information according to the study variable hinged on their individual characteristics including their demographic factors. The study collected their demographic profiles under gender, age, educational qualifications and experience in terms of the number of years served under the project.

Table 4. 1: Respondent's demographic characteristics

Factor	Characteristics	Frequency	Percentage (%)
Age	18-25 years	17	18
	26-35years	39	41
	36-45 years	28	29
	Above 45 years	11	12
	TOTAL	**95**	**100**
Educational qualifications	Certificate	0	-
	Diploma	18	19
	Bachelor's degree	50	53
	Masters	21	22
	PHD	6	6
	Total	**95**	**100**
Experience within RUDP	Less than 1 year	25	26
	1 year to 3 years	36	38
	3 years to 5 years	20	21
	Above 5 years	14	15
	Total	**95**	**100**

Source: Primary Data (2022)

As depicted in Table 4.1, 41% of the respondents had ages ranging between 26-35 years, followed by 36-45 years representing 29% of the sample size. Those aged between 18-25 years amounted to 18%, and employees aged above 45 years were fewest at 12%. This shows that the RUDP II project has youthful employees who are expected to be energetic and enduring for a better performance. Considering that the youthful segment of personnel has just left college, it is expected that they would be more conversant with risk management practices.

The findings on demographic characteristics further indicated that majority of employees were well educated and had attained either a Diploma, Bachelor's, Master's or a PhD certificate. The highest number, 73% possessed a Bachelor's degree. Master's degree holders accounted for 22% while the remaining 2.7% had a PhD degree. The study found that Diploma holders were 19% of the RUDP II employees. Hence, most of the respondents 95% had either a Diploma or a degree as their highest level of education. Considering that risk management is taught at the Diploma and university levels, it can be inferred that almost all the respondents were conversant with the concept and how it can be embedded into a project to enhance project performance.

According to the study's findings, 28% of employees had worked on the project for less than a year, while the majority, or 38%, had done so for between one and three years. Then 21% of respondents said they had worked for RUDP II for between three and five years, while the remaining 15% said they had worked there for more than five years. The findings indicate that majority of the staff of the RUDP II project had served for long periods and were conversant with the issues the study set out to establish.

4.2 Descriptive results

In this section, the research findings are presented according to the study's specific research objectives. Descriptive statistics of frequencies, percentages, means and standard deviation were used. An was assumption made on the basis of the magnitude of the measure under consideration, that the higher the score, the more important the variables are as evaluative criteria. The means and standard deviations interpretation were grouped into very low if the values were between 1.00 – 2.00 indicating that the fact was not present. Means in the range of 2.01- 3.00 showed a less occurrence of the Phenomenon under measure. A moderate occurrence where the mean fell between 3.01- 4.00 indicated that the fact occurred moderately. A fact that occurred quite often had a mean of 4.01- 4.50. It is when

the mean range was between 4.51-5.00 implies that there was a strong evidence of the existence of the fact. Standard deviations less than or equal to 0.5 ($\sigma \leq 0.5$) implies homogeneity otherwise heterogeneity.

4.2.1 Risks identification practice in RUDP II

The study sought to assess input of risks identification practice used by RUDP II. The respondents' reactions as to their level of agreement or disagreement with given statements on risk identification practices within RUPD II was analyzed. The results of their responses are presented in Table 4.2.

Table 4. 2:Risks Identification Practice in RUDP

Risk Identification Practice	SD	D	N	A	SA	Mean	SD
	%	%	%	%	%		
We typically define what we mean by project risk.	3.2	2.1	8.4	43.2	38.9	4.13	0.52
Because of institution policy, we always use the same format to identify risks.	5.3	5.3	3.2	47.4	33.7	3.99	0.49
We constantly record project risks in a central repository.	1.1	1.1	9.4	31.6	63.2	4.55	0.50
We frequently employ multiple risk identification methods and tools, (For instance, PESTEL, SWOT, etc.)	5.3	6.3	9.5	40.0	38.9	3.65	0.58
We effectively identify risk using historical records.	2.1	2.1	5.3	56.8	33.7	3.56	0.55
We interview participants in the project (stakeholders and experts) to map out risks.	8.4	11.6	8.4	36.8	34.7	3.68	0.52
We circulate a checklist of risks for identification.	20.0	18.9	26.3	18.9	15.8	2.92	0.52
Reviewing project-related documents is used to identify risk.	8.4	15.8	8.4	40.0	27.4	3.62	0.49
Overall Mean						**3.76**	**0.52**

Source: Primary Data (2022)

The results in Table 4.2 show that majority of respondents agreed with the statement about the influence of risk identification on performance of RUDIPII project. Whereby 31.6% agree and 63.2% strongly agree that RUDPII project record the risks in risk identification. The findings are supported by overall mean of 4.55 which is high mean as evidence on existence of the facts and also standard deviation of 0.50 which shows that there was homogeneity of responses.

The findings indicate that majority 43.2% agreed that they define their understanding and perception of project risks. A mean of 4.13 and a standard deviation of 0.52 indicate

heterogeneity in responses. Majority of respondents 47.4% agreed that they are always guided by the institution policy in the format for identification of risks. This response recorded a moderate mean of 3.99 and standard deviation of 0.49 in homogeneity implying concurrence of the assertion. Respondents 56.8% agreed that they effectively identified risks guided by documentation such as historical records of RUPD II. This item recorded a moderate mean of 3.56 and a standard deviation of 0.55 which indicates divergent views on the item. The responded differed on use of participatory methods in risks identification. A moderate 36.8% of the respondents indicated agreement on involving stakeholders in risk mapping exercises with a moderate of 3.68 and standard deviation of 0.52. The responds' mean views differed.

Respondents 40% agreed that they frequently employed multiple risk identification methods and mapped out a Strengths, Weaknesses, Opportunities, and Threats, (SWOT) analyses among others, in identifying risks. The mean recorded was moderate at 3.65 and a standard deviation of 0.58 exceeding 0.5, hence there is no heterogeneity in their responses and so, they labored differing views. For risk identification, 26.3% of the respondents were neutral on the question that a checklist is distributed to identify risks. A low mean of 2.92 and heterogeneity standard deviation of 0.52 was recorded exposing their dissimilar views on the issue. There was a consensus on review of project related documents as a means of risk identification. Respondents 40% agreed with a moderate mean of 3.62 and a standard deviation of 0.49 indicating a unanimous view on the item.

The overall view of respondents on risks identification practices was at moderate with a mean of 3.76 and a standard deviation of 0.52 pointing to a moderate heterogeneity. Hence, there exists a moderate risks identification practice within RUDP II project in the day-to-day operations. The findings match those of Sarvari *et al.* (2019) who investigated

approaches put in place to identify risks in public private partnership projects in Malaysia, the conclusion was that in order to enhance project performance, risk identification, prioritization, and change management should be incorporated in the project design, planning, implementation, monitoring and evaluation.

4.2.2 Risks analysis practices

The study set out to elicit perception of respondents in terms of risks analysis practices used within RUDP II. They were required to agree or disagree with statements regarding risk analysis practices within the RUDP I project. The findings are presented in Table 4.3.

Table 4. 3:Risks Analysis Practices within RUDP II project

Risk analysis practices	SD (%)	D (%)	N (%)	A (%)	SA (%)	Mean	SD
Risk analysis begins with the quantitative analysis stage.	5.3	4.2	5.3	34.7	50.5	4.21	0.52
Techniques used to prioritize identified risks for a follow-up action included in risk analysis.	4.2	5.3	5.3	36.8	48.4	4.20	0.49
There is a board that studies the risks associated with the projects.	1.1	1.1	9.4	31.6	63.2	4.55	0.50
There is a proper risk analysis procedure in place	10.5	11.6	12.6	40.0	25.3	3.58	0.52
Risk analysis requires active management.	2.1	2.1	10.5	47.4	37.9	4.17	0.49
There are appropriate channels of communication in RUDP II	12.6	17.9	15.8	31.6	22.1	3.33	0.50
Overall Mean						**4.01**	**0.50**

Source: Primary Data (2022)

Majority of the respondents 50.5% strongly agreed that risk analysis begins at the quantitative analysis stage, with high mean of 4.21 and a standard deviation of 0.52 in heterogeneity. A large proportion of respondents 48.4% strongly agreed that the techniques to prioritize the identified risks for a follow-up action are included in risk analysis. The item had a high mean of 4.20 and a standard deviation of 0.49 in homogeneity. On this item, the respondents demonstrated a uniform perception and strongly agreed with the statement.

There is a board tasked with studying the risks associated with RUDP II project. 63.2% of respondents strongly agreed with the statement with a very high mean of 4.55 and a homogeneity standard deviation of 0.50 indicating convergence of views among the respondents. A good number of respondents (40%) agreed on the existence of a proper risk analysis procedure within the RUPD II project. A moderate mean of 3.58 with a standard deviation of 0.52 were recorded indicating respondents' divergent views on the item.

The respondents surveyed 47.5% agreed and held same views that risk analysis requires an active management with moderate mean of 4.17 and a homogeneity standard deviation of 0.49.

The survey findings show that 31.6% of respondents agreed that RUPD II employed appropriate channels of communication. A moderate mean of 3.33 with a standard deviation of 0.50 homogeneity confirming respondent's similarity of views on the item.

The overall view of respondents on risks analysis practices was established at a high mean of 4.01 and a standard deviation of 0.50 homogeneity. It therefore confirms presence and use of effective risks analysis practices in the implementation of RUPD II project.

The findings on rank analysis are in line with those of Pimchangthong and Boonjing, (2017) who concluded that for a project to achieve a high performance, risk management process and risk analysis should be in place.

4.2.3 Risk Mitigation and performance of RUDP II project

The study set out to find out respondents' perception on risk mitigation measures and the performance of RUDP II project. Respondents' agreement or disagreement with given statements related to risk mitigation measures in place were established and presented in Table 4.4.

Table 4. 4:Risk Mitigation within RUDP II project

Risk Mitigation Practices	SD (%)	D (%)	N (%)	A (%)	SA (%)	Mean	SD
We consistently pick the most effective risk-reduction strategy (accept, avoid, control, transfer or monitor risk)	15.8	25.3	15.8	27.4	15.8	3.02	0.57
We consistently seek the advice of experts on risk mitigation	9.5	8.4	15.8	33.7	32.6	3.72	0.52
We frequently provide resources for risk mitigation	12.6	17.9	15.8	31.6	22.1	3.33	0.57
We regularly do risk monitoring on all projects	5.3	5.3	5.3	48.4	35.8	4.04	0.57
We always hire a skilled and suitable risk manager.	13.7	16.8	15.8	26.3	27.4	3.37	0.58
We regularly prepare mitigation plan content.	12.6	17.9	15.8	31.6	22.1	3.33	0.57
Overall Mean						**3.47**	**0.56**

Source: Primary Data (2022)

The findings show that 27.4% of the respondents agreed that they consistently picked the most effective risk-reduction strategy (accept, avoid, control, transfer or monitor risk), with a moderate mean of 3.02 and achieved a 0.57 standard deviation heterogeneity. Therefore, respondents concurred on the statement even though they demonstrated a difference in perception. It was established that 33.7% of the respondents agreed that they consistently sought the advice of experts on risk mitigation. The variable attained a moderate mean of 3.72 with a standard deviation of 0.52 heterogeneity an indication of dissimilar perception while agreeing upon the statement.

On the question of frequency of provision of resources for risk mitigation, 31.6% of respondents agreed that they frequently provided the resources achieving a moderate mean of 3.33 and a heterogeneity standard deviation of 0.57. Hence respondents' views did not agree on the statement and that they held different views on the statement. On the statement on risk monitoring on all projects, almost half of the respondents (48.4%) agreed that it was regularly done to all projects. The mean recorded was high at 4.04 and a standard deviation of 0.57 of heterogeneity, hence, respondents' views on risk management on all projects differed significantly.

On the question of skills and suitability of hired risk manager, 27.4% of respondents agreed that a skilled and suitable risk manager was always hired with a moderate mean of 3.37 and heterogeneity standard deviation of 0.58 point at respondents' dissimilar views on the question. Finally, 31.6% of respondents agreed that they prepared content for mitigation plans with a moderate mean of 3.33 and a standard deviation of 0.57 heterogeneity pointing to dissimilarity in their views on the item. The overall view of respondents on risks mitigation practices in the RUDP II project was at a moderate mean of 3.47 and a standard deviation of 0.56 heterogeneity. Therefore, the RUDP II project had embedded moderate risks mitigation practices in the course of its implementation.

These findings agree with Dario (2017) in the study of project risk management in the construction industry in Sweden. There was a relationship between the familiarity and understanding of risk mitigation practices among contractors and developers who tended to underutilize the mitigation practices in the projects.

4.2.4 Performance of RUDP II project

The perception of respondents on the RUDP II project performance in terms of scope, cost and time was sought the respondents were requested to either agree or disagree with the statements related to project performance. The findings are as presented in Table 4.5

Table 4. 5:The Performance of RUDP II

Performance	SD (%)	D (%)	N (%)	A (%)	SA (%)	Mean	SD
Scope							
There is good project implementation thanks to effective risk management practices.	2.1	7.4	5.3	46.3	38.9	4.13	0.57
Regular risk management meetings are undertaken to monitor and control project implementation	5.3	5.3	4.2	37.9	47.4	4.17	0.47
Due to risk management we ensure effective delivery of good construction within the scope established	4.2	5.3	5.3	40.0	45.3	4.17	0.45
Cost							
We frequently spend a lot of money on the inputs.	25.3	35.8	10.5	12.6	15.8	2.58	0.58
We use our resources efficiently thanks to our risk management practices	4.2	5.3	6.3	38.9	45.3	4.16	0.47
We frequently incur additional costs for projects (overspend budget)	28.4	32.6	12.6	16.8	9.5	2.46	0.45
Time							
Planning risks (poor planning) in RUDP II delay the project's expected timely completion.	23.2	26.3	18.9	13.7	17.9	2.77	0.58
Delayed payment (financial risk) impacts project completion time.	21.1	15.8	15.8	21.1	26.3	3.16	0.49
Expected completion time is impacted by the risks associated with suppliers (late deliveries, inexperienced suppliers, etc.), which occurs when they are not properly managed.	12.6	13.7	15.8	35.8	22.1	3.41	0.55
Overall Mean						**3.39**	**0.58**

Note: Source: Primary Data (2022)

Regarding the scope, almost half of the respondents (46.3%) agreed that there is a good project implementation plan with effective risk management practices with a high mean of 4.13 and a standard deviation of 0.57 heterogeneity pointing to respondents' agreement on the statement but with different perceptions. Respondents strongly agreed 47.4% strongly agreed that regular risk management meetings were held to monitor and control project implementation with high a mean of 4.17 and a standard deviation of 0.47 homogeneity. Respondents held both same perception while agreeing upon the statement. A good number of respondents (45.3%) strongly agreed that due to risk management practices in place, they ensured effective delivery of good construction within the scope established with a high mean of 4.17 and a standard deviation of 0.45 of homogeneity Respondents held the same view on the statement.

Considering cost performance, the project frequently incurred additional costs as shown by 35.8% of respondents. Additional costs scored a moderate mean of 3.28 implying that the fact occurred less with a standard deviation of 0.58 in heterogeneity. The respondents showed dissimilar views on the statement. However, almost half of respondents 45.3% strongly agreed that there was efficient use of resources evidenced by a high mean of 4.16 and a standard deviation of 0.47 in homogeneity. Respondents held similar views on the statement. The research considered the sub variable cost on the performance of RUDP II project. The results as presented in table 4.5 indicated that 32.6% of the respondents disagreed on the We frequently incur additional costs for projects (overspend budget) by a moderate mean of 2.46 and a standard deviation of 0.45 in heterogeneity. Respondents showed different views on the statement.

The research considered the sub variable of time of delivery with respect to the performance of RUDP II project whose findings presented in Table 4.5. There was a disagreement among 26.3% of respondents that planning for risks (poor planning) in RUDP II delayed

the project's expected timely completion with a low mean of 2.77 and standard deviation of 0.58 in homogeneity implying respondents' divergent views upon the statement. There was an indication of agreement on projects delayed payments impacting the timely completion of RUDP II project. Respondents 26.3% strongly agreed that delayed payment (financial risk) impacts the timely completion of the project with a moderate mean of 3.16 and standard deviation of 0.49 in homogeneity, an indication of common point of view on the item. Risks associated with suppliers considered attributes of timely deliveries and the suppliers' experience. Respondents 35.8% agreed that the project's timely completion was impacted by the risks attributable to suppliers (late deliveries, inexperienced suppliers, etc.). It occurred when suppliers are not properly managed with moderate mean of 3.41 and standard deviation of 0.55 in heterogeneity. The respondents held dissimilar views on the item.

These results of the study are consistent with Githau (2013) who conducted a study to identify the skills essential for a successful performance in Kenya's construction industry. The outcome emphasized that adopting tools to schedule processes and planning for and monitoring and controlling were essential to a project's success. The projects also require careful costing and time control in order to successfully finish the assignments.

4.3 Inferential statistics

The study sought to ascertain the influence of risk management practices on performance of infrastructural projects in Rwanda using inferential statistics represented by correlation analysis and multiple regression. The contribution of the risk identification practices on the performance of the RUDP II project were evaluated as well as an assessment of the contribution of the risk analysis practices on the performance of RUDP II project carried out. The contribution of the risk mitigation practices on performance of RUDP II project

was also determined. The regression analysis results for each of the predictors shows its effect on the project performance.

4.3.1. Correlation analysis

A correlation between variables is one of the most common and most useful statistics used in establishing existence of a relationship between two variables together with the strength of the association. Pearson's product moment coefficient lies between +1 to -1 which guided the research in establishing a linear correlation coefficient as a measure of the strength and the direction of the association existing within the study variables. When the coefficient is zero, then there is no relationship between variables. A coefficient value greater than 0 points to a positive relationship where an increase or decrease in the value of one variable leads to an increase or decrease in the value of the other variable. A negative value indicates a negative association between variables. An increase in the values of one variable is accompanied by a decrease of the value of the other variable (Okwonu, Asaju, and Arunaye, 2020).

The correlation linking the independent variables (risk identification practices, risk analysis practices, and risk mitigation practices) and the dependent variable performance measured by scope, cost and time) was determined through Pearson's product moment coefficient of correlation (r) calculations of the survey data between the study variables were calculated and the findings presented in Table 4.6

Table 4. 6:Correlation Coefficients

		X1	X2	X3	Y
Risk identification Practices	Pearson Correlation	1			
Risk analysis Practices	Pearson Correlation	435**	1		
Risk Mitigation Practices	Pearson Correlation	309**	574**	1	
Performance Practices	Pearson Correlation	409**	781**	703**	1
	Sig. (2-tailed)	.002	.000	.000	

Note. ** A two tailed test, correlation level of significance is at 0.05

The study findings reveal a significant weak correlation between risks identification practices and performance with a correlation value of 0.409 at a ρ-value of 0.002 which is less than 0.05 level on a 2-tailed measure. This confirms that improvement in risks identification practices results in performance increase. The results support Aven (2016) who concluded that there is a significant positive effect on a project performance with risks identification practices.

The study findings further revealed a significant correlation between risks analysis practices and project performance with a correlation of 0.78, a ρ-value of 0.000 which is less than 0.05 on a 2-tailed measure. A better risks identification practice can contribute to a high performance. The results tally with Ntwari (2019) who identified an existence of an effective risk analysis and a follow-up process of risk findings led to an improvement in project effectiveness, thereby enhancing project performance. The study findings reveal a moderate correlation between risks mitigation practices and performance with a correlation of 0.703, a ρ-value of 0.000 which is less than 0.05 level on a 2-tailed measure. An improvement in risks mitigation practices leads to an increase in performance.

These results agree with Rabbani (2011) who established that mitigating risks resulted into a positive and significant effect on performance and that the higher the degree of risk mitigation, the more likelihood of the project to attain its goals.

4.3.2 Diagnostics test of the regression model

After running the regression model, post-estimation tests were conducted to ensure the model was suitable and the model estimates were efficient and reliable. The performed diagnostic statistical tests of normality, and multicollinearity whose results were satisfactory.

When the independent variables exhibit strong correlations there is a multicollinearity which is not good. Researchers use Variance Inflation Factor (VIF) to estimate the degree of multicollinearity. According to Zikmund, Babin, Carr and Griffin (2013) a Variance Inflation Factor (VIF) of 5 or more between two or more variables indicates multicollinearity where one variable should be eliminated in the regression analysis.

Table 4. 7:Test for Multicollinearity

		Collinearity Statistics	
Model		**Tolerance**	**VIF**
	Risk identification practices	0.803	1.245
	Risk analysis practices	0.596	1.678
	Risk Mitigation practices	0.461	2.167

Note. Source - Primary Data (2022)

The VIF values of the three variables – Table 4.7 in the study for the variables fell between 1 and 3 which is less than 5 hence, there was no need to eliminate any since they showed no multicollinearity and were not correlated with each other. Therefore, all variables of the predictors were incorporated into the model of the study. Tests of normality were performed to determine whether the data was well modelled and normally distributed. The null hypothesis is that both groups were sampled from populations with identical distributions. If the Sig. value of Kolmogorov-Sminorv tests is greater than 0.05, the data

is normal. If it is below 0.05, the data significantly deviate from a normal distribution (Zikmund *et al*, 2013).

Table 4. 8:One-Sample Kolmogorov-Smirnov Test

Variables	N	Normal parametersa		Most extreme differences			Kolmogrov-smirnov Z	Asymp. Sig. (2-tailed)
		Mean	SD	Absolute	Positive	Negative		
Risk identification practices	95	3.9684	0.84582	0.266	0.23	-0.266	3.98	0.056
Risk analysis practices	95	4.1305	0.5181	0.191	0.144	-0.191	2.854	0.864
Risk Mitigation practices	95	4.1773	0.31232	0.132	0.071	-0.132	1.975	0.051
Project Performance	95	4.1223	0.45418	0.167	0.122	-0.167	2.504	1

Note. Source: Primary Data (2022)

From Table 4.8 a significant Kolmogorov-Sminorv value of risks identification practices is equal to 0.0560 which is great than 0.05 hence risks identification practices of the RUDP II project is normal. Also shows that the Kolmogorov-Sminorv value of risks analysis practices was equal to 0.0864 and greater than 0.05 implies that risks analysis practices data of the RUDP II project was normal.

Table 4.8, shows that Sig. value of Kolmogorov-Sminorv of risks mitigation practices is equal to 0.0510 which is great than 0.05 this implies that risks mitigation practices data is normal because Sig. value of Kolmogorov-Sminorv is great than 0.05 level of significant

The table 4.8, further shows that Sig. value of Kolmogorov-Sminorv of project performance is equal to 1.000 which is great than 0.05 implies that performance data was normal. The study concluded that since all the variables both independent and dependent were normally distributed allowing the researcher to regress the model by using linear regression analysis.

4.3.3 Multiple linear regression on effect of risks identification practices

The study used multiple linear regression model to identify how predictors such as documentation, interview, checklist, and historical records as components of risks identification practices affected performance of infrastructural projects in Rwanda. Regression tests were used to determine the model's significance. Coefficient (β), t-

statistic and probability determined the statistical significance of the data. Statistically significant relationships between the dependent and independent variables were accepted at 5% significance level. The Statistical Product & Service Solutions (SPSS) was used in the calculation of the measures of the multiple regressions for the study. To determine how risk management practices related to performance of a project, the Linear Regression model with two predictor value function below was considered:

Performance $Y=\beta0+\beta1\ X1+\beta2\ X2+\ \beta3\ X3+\beta4\ X4+\ \varepsilon$, Model 1

X1 = Documentation, X2= Interview, X3= checklist, and X4 = historical record

Table 4. 9:Model summary on risks identification practices and performance

Model	R	R Square	Adjusted R Square	Std Error of the estimate
1	.144a	.021	.259	.3195

Note: a. Predictors: (Constant): Interview and historical records.

The findings from the table 4.9, the value of coefficient of determination (R-Square) was .021 (21%) and the adjusted coefficient of determination (Adjusted R square) was -0.259 (25.9%) an indication that there was variation of 25.9% in performance was due to changes in risks identification practices, which implies that the two variables of risks identification practices (Interview and historical record) contributes to 25.9% on performance in RUDP II as represented by R2. Since the variables in the model or not in count 100%, therefore there are other factors that influence performance of infrastructural projects in Rwanda that are not included in the model which account for 74.1%.

An ANOVA was performed on the risk identification practices and performance of the RUDP II project. The results are presented in Table 4.10

Table 4. 10:ANOVA on risks identification practices and performance

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	.015	2	.008	1.074	.030a
	Residual	.715	7	.102		
	Total	**0.73**	**9**			

Note: a. Predictors (Constant): Interview, and historical record

b. Dependent variable: Performance

The results in Table 4.10 show that the model as a whole was significant at 5% level of significance. The calculated F statistic of 1.074 and the calculated p-value of =.030 is less than the Critical p-value of =.05 level of significance, making the entire model significant. Therefore, this implies that the variables: Interview and historical record had significant effect to the variation of performance. Therefore, it can be concluded that the R and R2 between risks identification practices and performance of RUDP II is statistically significant, and risks identification practices can significantly influence performance.

Table 4. 11:Regression coefficients of risks identification practices on performance

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	**Std. Error**	**Beta**		
1	(Constant)	14.532	48.608		0.299	0.774
	Interview	0.417	74.696	1.907	0.367	0.024
	Historical Record	0.189	2.763	1.861	0.358	0.031

Note: a. Dependent Variable: Performance

Table 4.11 summarizes the findings of the regression analysis for the effect of interview, checklist and historical record on performance of the RUDP II project. The results indicated that interview (β1= .417; t= .367, p-value=0.024<0.05), and historical record (β2= .189; t= .358, p-value=0.031 <0.05) have positive and significant effect on performance of RUDP II project. This shows that 1 per cent increase in interview and historical record will lead to 0.417% and 0.189% increase on performance of RUDP II project.

4.3.4. Multiple linear regression on effect of risks analysis practices

The study sought to examine how the risks analysis practices affect performance of infrastructural projects in Rwanda was used. To ascertain the impact of each predictor, such as quantitative, prioritizing, and channel of communication as elements of risks analysis procedures, a multiple linear regression model was used. The regression models were run to test whether the model was significant or not. The Coefficient (β), t-statistic, and probability all confirmed the statistical significance of the study. Additionally, at a 5% level of significance, a statistically significant association between the dependent and independent variables from the model was accepted. Statistical Product & Service Solutions (SPSS) 23.0 was used in the computation of the multiple regressions for the study. Model relationships for risk identification practices and performance of a project can be arranged in the following function:

Performance $Y= \beta 0+ \beta 1X1 + \beta 2X2 + \beta 3X3+ \varepsilon$ (Model 2)

X1 = Quantitative; X2= Prioritizing; and X3= Channel of communication

Table 4. 12:Model summary on risks analysis practices and performance

Model	R	R Square	Adjusted R Square	Std Error of the estimate
2	.764a	0.563	0.464	1.0515

Note: a. Predictors (Constant), Quantitative, and qualitative method.

The findings as shown in Table 4.12 the value of coefficient of determination (R-Square) was 0.563(56.3%) and the adjusted coefficient of determination (Adjusted R square) was 0.464 an indication that 46.4% in performance was due to changes in risks analysis practices, which implies that the two variables of risks analysis practices (Qualitative and Quantitative method) contributes to 46.4% on performance in RUDP II. Since factors either in the model or not in the model count 100% change in performance, therefore, there are

other factors that influence performance that are not included in the model which account for 56.3% towards performance of RUDP II project

Table 4. 13: ANOVA on risks analysis practices and performance

Model		Sum of squares	df	Mean square	F	Sig.
2	Regression	3.559	2	0.593	3.033	0.000a
	Residual	42.44	217	0.196		
	Total	**45.999**	**219**			

a. Predictors: (Constant), Qualitative method and Quantitative method

b. Dependable variable: Performance

Table 4.13 findings show that the overall model was significant since the computed F statistic of 4.897 and the calculated p-value of =0.000 is lower than the key p-value of =0.05 level of significance. Therefore, this implies that the variables: Qualitative method and Quantitative method jointly had significant contribution to the variation of performance in RUDP II.

Table 4. 14:: Regression coefficients on risks analysis practices and performance

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
2	(Constant)	21.646	7.324		1.514	0.1740
	QLM	0.081	6.766	1.89	1.587	0.047
	QNM	0.303	0.809	-2.508	2.106	0.073

a. Dependent Variable: Performance

Table 4.14 provides a summary of results of regression analysis for the effect of qualitative method and quantitative methods on performance of the RUDP II project in Rwanda. The results indicate that qualitative method (β1= 0.081, t=1.587, p-value=0.047<0.05) has positive and significant effect on performance of RUDP II, while quantitative method (β2= 0.703, t= 0. 2.106, p-value=0.073>0.05) has positive and insignificant effect on performance of RUDP II. This shows that 1 per cent increase in the qualitative method will lead to 0.081% increase on performance of the RUDP II project, while 1 per cent increase in quantitative method will lead to 0.303% increase on performance of RUDP II but insignificant.

4.3.5. Multiple linear regression on effect of risks mitigation practices

The study analyzed the extent to which risk mitigation practices influenced performance of the RUDP II project by using the multiple linear regression model to determine the effect of each risk predictor such as acceptance, allocation, avoidance and transfer as a component of risks mitigation practices on the performance of the RUDP II project. Regression analysis tests were used to determine the significance of the model. The Coefficient (β), t-

statistic and probability statistical significance were used for verification. Additionally, the dependent and independent variables were statistically accepted at 5% significance level. Statistical Product & Service Solutions (SPSS) application was used in the calculation of the measures of multiple regressions. Relationship model for risk management practices and their influence on the project performance can be fitted into an equation as follows:

Performance $Y=\beta 0+\beta 1\ X1+\beta 2\ X2+\ \beta 3\ X3+\beta 4\ X4+\ \varepsilon$, Model 3

X1 = Risk acceptance X2= Risk allocation, X3= Risk avoidance, X4 = Risk transfer.

Table 4. 15::Model Summary on risks mitigation practices and performance

Model	R	R Square	Adjusted R Square	Std Error of the estimate
3	.816a	0.667	0.333	0.517

Note: a. Predictors: (Constant), Risk acceptance, and Risk avoidance.

The Findings (Table 4.15) indicated a coefficient of determination value (R-Square) of 0.667 (66.7%) and the adjusted coefficient of determination (Adjusted R square) was 0.333 an indication that there was variation of 33.3% in performance of RUDP II due to changes in risks mitigation practices which implies that the two variables of risks mitigation practices (Risk acceptance and Risk avoidance) contributes to 33.3% on performance as represented by R2. Since the contribution of all factors either in the model or not in the model count 100%, therefore, there are other factors that influence performance of RUDP II that are not included in the model 3 which account for 66.7% towards performance of RUDP II project.

Table 4. 16: ANOVA on risks mitigation practices and performance

Model		Sum of Squares	Df	Mean Square	F	Sig.
3	Regression	3.749	2	1.874	6.995	.021b
	Residual	1.876	7	0.268		
	Total	**5.624**	**9**			

a. Predictors: (Constant), Risk acceptance, Risk avoidance

b. Dependent Variable: performance

Table 4.16 results show that the overall model was significant since the estimated F statistic of 1.874 and the p-value of 0.021 is less than the critical p-value of 0.05. Therefore, this implies that jointly the variables: Risk acceptance and Risk avoidance had significant contribution to the variation of performance in RUDP II. Therefore, it can be concluded that the R and R2 between risks mitigation practices and performance of RUDP II is statistically significant.

Table 4. 17:: Regression coefficients on risks mitigation practices and performance

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	**Std. Error**	**Beta**		
3	(Constant)	353.06	33.368		1.068	.0321
	DAR	0.049	6.282	3.986	1.111	0.033
	DER	0.051	8.633	4.758	1.326	0.029

a. Dependent Variable: Financial performance

Table 4.17 provides the summary of results of regression analysis for the effect of Risk acceptance and Risk avoidance on performance of RUDP II. The results indicate that risk

acceptance (β1= 0.049, t=1.111, p-value=0.033<0.05) and Risk avoidance (β2= 0.051, t=1.326, p-value=0.029<0.05) have positive and significant effect on performance of RUDP II. This shows that 1 per cent increase in Risk acceptance and Risk avoidance will lead respectively to 0.049% and 0.051% increase on performance of RUDP II project in Rwanda.

4.3.6. Effect of risk management practices on the project

The study used the multiple linear regression model in the determination of the significance of each predictor affecting risk management. The independent variables were risks identification practices (RIP), risks analysis practices (RAP), and risks mitigation practices (RMP). The regression models were run to test whether the model is significant or not. The Coefficient (β), t-statistic, and probability were used to determine their statistical significance. Acceptance of an association between a dependent and independent variable dependent on its statistical level of significance. At 5% level of significance, the association was statistically significant and was accepted. Statistical Product & Service Solutions (SPSS) was used in the calculation of the measures of the multiple regressions. The variables can be arranged in a function or equation of a linear relationship model with risk management practices as follows:

$Y= \beta0+\beta1X1 + \beta2X2 + \beta3X3+ \varepsilon$

Where: Y = performance of infrastructural projects in Rwanda;

β0= Constant, β01, β02 and

β03 = regression coefficients, X1 = Risks identification practices, X2 = Risks analysis practices, X3= Risks mitigation practices and e = error / confounding variables

Table 4. 18: Model Summary on risk management practices and Performance

Model	R	R Square	Adjusted R Square	Std Error of the estimate
4	.739a	0.546	0.538	0.30875

Note: a. Predictors (Constant), risks identification practices (RIP), risks analysis practices (RAP), and risks mitigation practices (RMP)

b. Dependent Variable: performance

The findings (Table 4.18) show that the coefficient of determination (R-Square) value was 0.546 (54.6%). There was a variation of 54.6% in the performance of the RUDP II project due to the changes in the risk management practices. The three independent variables (risks identification practices, risks analysis practices, and risks mitigation practices) contributed to 54.6% to the performance of the RUDP II project as represented by R2. There were other factors influencing the performance of the RUDP II project that were not considered in the model. The contributed to 45.4% towards the performance of the RUDP II project.

Table 4. 19: ANOVA on Risk Management Practices on Performance

Model		Sum of squares	df	Mean square	F	Sig.
4	Regression	16.852	3	5.617	4.704	.009a
	Residual	32.245	27	1.194		
	Total	**49.097**	**30**			

Note: a. Predictors (Constant), risks identification practices (RIP), risks analysis practices (RAP), and risks mitigation practices (RMP)

b. Dependent Variable: performance

The findings (Table 4.19) portray a significant overall model used in the study. The calculated F statistic of of 4.704 and the calculated p-value of =0.009 is less than the Critical p-value of =0.05 level of significance. Therefore, this implies that the variables: risks identification practices (RIP), risks analysis practices (RAP), and risks mitigation practices (RMP) had significant effects to the variation of performance. The values of R and R2 for risk management practices and performance of RUDP II project are statistically significant and risk management practices can significantly influence performance. The values demonstrated that risk management practices significantly affect the performance of RUDP II project.

Table 4. 20: Regression Coefficients on Risk Management Practices and Performance

Model		Unstandardized Coefficients		Standardized coefficients	t	Sig.
		B	**Std. Error**	**Beta**		
	(Constant)	1.744	5.738		2.304	0.8
	RIP (X1)	0.126	0.291	0.015	1.089	0.009
4	RAP (X2)	0.369	0.19	0.647	3.518	0.002
	RMP (X3)	0.221	0.159	0.243	1.391	0.026

Note: Dependent variable: Performance

As per the SPSS generated table 4.20, the equation $Y = \beta0 + \beta1X1 + \beta2X2 + \beta3X3 + \varepsilon$ becomes:

Performance = 1.744+ 0.126X1+0.369X2+ 0.221X3=2.46

The regression equation above has established that taking all factors into account (risks identification practices (RIP), risks analysis practices (RAP), and risks mitigation practices (RMP) constant at zero. Performance was 2.46.

The regression results revealed that risks identification has significance positive effect on performance as indicated by $\beta1= 0.026$, $t= 1.089$; $p=0.009<0.05$. The implication is that an increase of one unit in risks identification would lead to an increase in performance by 0.126%. Therefore, the study rejected the null hypotheses Ho1 that stated that is no significant effects of risk identification practices on performance of RUDP II, as it was proven that risk identification practices in RUDP II project had statistically significant contribution on its performance. The findings agreed with Sarvari *et al.* (2019) who concluded that risk management practices through risks identification practices play a significant positive effect on performance of public-private partnership projects in Malaysia.

The regression results revealed that risks analysis practices have significance positive effect on performance as shown by β2= 0.369, t= 3.518, p=0.002<0.05. This shows that when there is an increase of one unit in risks analysis practices, this would lead to an increase in performance by 0. 369%. Therefore, the study rejected the null hypotheses that stated that there is no significant effects of risk analysis on performance of RUDP II project, as it was proven that risk analysis in RUDP II had statistical significant contribution on its performance. These results are in line with the study by Rwagasana *et al.* (2019) where they indicated that construction firms with an advanced analytical decision support system to monitor and address risks in their risk management processes improve their effectiveness, which enhance their performance.

Finally, the regression results revealed that risks mitigation practices have significance positive effect on performance as indicated by β3= 0.221, t=1.391, p=0.026<0.05. The implication is that an increase of one unit in risks mitigation practices will increase performance by 0.221%. Therefore, the study rejected the null hypotheses that stated that there is no significant contribution of the risk mitigation practices on the performance of the RUDP II. The findings are in agreement with Igihozo and Irechukwu (2022) who concluded that risk mitigation practices through putting a management and a response plan play a significant positive effect on performance of Mpazi channel construction project in Kigali.

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CHAPTER FIVE: SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.0.Introduction

This chapter presents the research findings against specific objectives of the study. It outlines the conclusions drawn together with recommendations and suggested areas for further research.

5.1 Summary of Findings

This section presents the findings based on the research objectives. The research studied the RUDP II project to determine its performance against the following practices: risk identification; risk analysis; and risk mitigation.

5.2.1. Effect of risks identification practices.

The findings showed weak correlation existed between risks identification practices and the performance of the RUDP II project. However, regression model 1 revealed that the variables risk identification practices (measured by interview and historical record) and the performance infrastructural projects (measured by scope, cost, and time) contributes to 25.9% on performance in RUDP II. The findings in table 4.10 indicate that the overall model was positive and significant as the calculated F statistic of 1.074 was large than the critical F and p-value calculated =0.00 is less than Critical p-value =0.05 level of significant. Therefore, jointly the sub-variables interview and historical records significantly contributed to the variation of performance (scope, cost, and timeline). The study concluded that the R and R2 values between risks identification practices and performance of RUDP II are statistically significant. Risks identification practices positively and significantly influenced the performance of RUDP II. Results in Table 4.11 provides that interview ($\beta 1 = .417$; $t = .367$, p-value=0.024<0.05), and historical record ($\beta 2 =$

.189; t= .358, p-value=0.031 <0.05) positively and significantly affected the performance of RUDP II. This shows that 1 per cent increase in interview and historical record would lead to 0.417% and 0.189% increase on performance of RUDP II project.

5.2.2. Effect of risks analysis practices on performance

Findings on this variable showed that the correlation was high between risks analysis practices and performance of RUDP II as shown by a correlation figure of 0.781**, ρ-value was equal to 0.000 and less than 0.05 level in a 2-tailed measure. Regression model 2 revealed that the variables risk analysis practices (measured by Qualitative method and Quantitative method) and the performance of infrastructural projects (measured by scope, cost, and timeline), the findings in the table 4.12 show that the two variables of risks analysis practices (Qualitative method and Quantitative method) contributes to 46.4% on performance in RUDP II. Findings in Table 4.13, indicate that the overall model was significant since the computed F statistic of 4.897 and the calculated p-value of =0.000 is lower than the key p-value of =0.05 level of significance.

Therefore, this implies that the variables: Qualitative method and Quantitative method jointly had significant effect to the variation of performance in RUDP II. The results in Table 4.14 indicate that qualitative (β1= 0.081, t=1.587, p-value=0.047<0.05) has positive and significant effect on performance of RUDP II, while Quantitative method (β2= 0.703, t= 0. 2.106, p-value=0.073>0.05) has positive but insignificant effect on performance of RUDP II. This shows that 1 per cent increase in qualitative method will lead to 0.081% increase on performance of RUDP II, while 1 per cent increase in Quantitative method will lead to 0.303% increase on performance of RUDP II but insignificant.

5.2.3 Influence of risk mitigation practices on performance

The findings revealed that there was a moderate correlation existed between risks mitigation practices and the performance of the RUDP II project. A correlation value of 0.703** at a ρ-value =0.000<0.05 level in a 2-tailed measure was observed. The findings of the multiple regression analysis showed that the variables risk mitigation (measured by Risk acceptance and Risk avoidance) and the performance of infrastructural projects (measured by scope, cost, and time), the findings in the Table 4.15 revealed that two variables of risks mitigation practices (Risk acceptance and Risk avoidance) contributes to 33.3% on performance.

Findings in Table 4.16, indicate that the overall model was significant, because calculated F statistic of 1.874 and the p-value of 0.021 is less than the critical p-value of 0.05. Therefore, this implies that jointly the variables: Risk acceptance and Risk avoidance had significant effect on the variation of performance in RUDP II. Therefore, it was concluded that the R and R2 between risks mitigation practices and performance of RUDP II is statistically significant. The results in Table 4.17 indicate that risk acceptance (β1= 0.049, t=1.111, p-value=0.033<0.05) and Risk avoidance (β2= 0.051, t=1.326, p-value=0.029<0.05) have positive and significant effect on performance of RUDP II. This shows that 1 per cent increase in Risk acceptance and Risk avoidance will lead respectively to 0.049% and 0.051% increase on performance of RUDP II project in Rwanda.

5.2. Conclusion

The study concluded that a positive significant relationship with a variation of 54.5% existed between risk management practices and the performance of the RUDP II project due to changes in risks practices of identification, analysis and mitigation. The findings also suggested that the RUDP II project's performance had been evaluated in terms of its scope, cost, and timeline.

The study also concludes that all null hypotheses were rejected at all levels of significance as shown in ANOVA tests (Tables 10, 13, 16 and 19). The results indicated that a positive and significant relationship existed between risk management practices and the performance of a project. Therefore, objectives of the study were so achieved very well

5.3. Recommendations

Considering the results of the study and some identified weaknesses the research proposed the following recommendations towards the improvement of the performance of the RUDP II project:

The findings showed that respondents disagreed with a statement stating that RUDP II never faced delayed payment (financial risk) that may impact the timely completion of the project as indicated with a low mean= 2.16 and heterogeneity standard deviation of 0.57 implying that the respondents have dissimilar views upon the statement. Hence, the study recommends that RUDP II assures on-time payment of the suppliers in order to avoid delays in supplying materials or other services to the project, which may in turn delay the completion of the project.

The recommendation applies equally to the findings related to the questionnaire item “In RUDP II we never face the risk connected with suppliers (late deliveries, inexperienced suppliers, etc.) as they are properly managed”. The results also indicated that majority of the respondents (35.8%) disagreed with the item with low mean= 2.41 and standard deviation which is 0.55 is more than 0.5 (heterogeneity) and implies that the respondents have dissimilar views on the item. Hence, the study recommended that RUDP II should enhance the way it manages the delayed payments to avoid the risks associated with suppliers. The study recommended that RUDP II project managers of ensures that payments are in a timely manner to maintain trust with suppliers.

5.4.Suggestions for Further Studies

Based on findings of the study, the research recommends that future studies may be carried out on the following:

The study was carried out on RUDP II, thus the same study should be carried out in another project in Rwanda to find out if the same results will be obtained. The study may include a component of comparative analysis but within the private sector.

This research did not exhaust all variables related to risk management practices that may have affected the performance in RUDP II. Researchers with interests in similar problems may conduct a continuation research with additional variables such as risk planning or risk monitoring. Further research should be also undertaken on the other variables of performance.

Another study should be conducted to see other variables which affect the performance of RUDP II because findings showed that risk management practices (risks identification practices, risks analysis practices, and risks mitigation practices) contributed to only 54.6% on the performance of RUDPII as represented by R2 (table 4.18), while .454 representing 45.4% of performance in RUDP II comes from other variables.

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