



Effect of Project Delays on the Cost Overrun Risks in Large –Scale Projects in Rwanda: A Study of Bugesera International Airport

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Abstract: The purpose of the study was to assess the effect of project delays on cost overruns risk in large –scale infrastructure projects in Rwanda focusing on Bugesera International Airport. This research dissertation used descriptive research design on 108 sample of respondent's stakeholders of bugesera international airport. Data were collected using Structured Questionnaires to obtain primary data and documentary review for secondary data, research sample were randomly selected from a total of 150 bugesera Airport stakeholders. A sample of 108 respondents was taken to assure a 95% significant result this research was supported by four theories which are critical path theory, resource-based theory, Cost Escalation theory and Iron Triangle Theory. Specific objectives of this study were to examine the effect of delays in project initiation phase on land acquisition cost, effect of delays in planning phase on labor cost and effect of delays in implementation phase on material cost. Inferential statistical analyses were employed to summarize responses and to establish correlations between variables. Afterward the study found that delays in the initiation phase of project significantly increased land acquisition cost due to bureaucracy and land disputes. The study also found that delays in planning phase increased labor cost of the project and final the study found that the delays in Implementation phase increased material cost of the project. The research confirms that the delays in project affect the cost overruns of Bugesera International Airport project where the project budget planned at initial stage up to 2026 increased at 333% which confirms that bugesera international project faced cost overruns due to the delays in all stage. From the results, the study recommends the use efficient mitigation techniques for planning efficiency rather formalities for sustainability in large-scale infrastructure projects in Rwanda. Final the study concludes that there is a significate effect of project delays in initial stage, planning phase and implementation phase on cost overruns risk of Bugesera International Airport.

Keywords: Project delays, Cost overruns risk, Large-scale infrastructure projects, Bugesera International Airport, Project initiation phase, Planning phase delays, Implementation phase delays, Land acquisition cost.

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1. Introduction

The Construction industry is large and requires remarkable capital expenditures. Construction Projects have grown larger over time, especially in developed and developing

countries, and increased size indicates higher economic risks. A recent study focusing on top management in 25 of the largest construction companies in the world showed that executives see managing and pricing risk as one of their key challenges, and 63 percent of respondents said it was their biggest issue. Executives cited poor planning forecasting

poor risk identification, and cost escalation as the three top reasons for reduced profit margins (John, 2021).

According to Wendler in his study have defined that construction industry plays key role in global economic development, its contribution to GDP, on creation of employment and infrastructure evolution. Wendler focused on large scale projects well as airports and energy facilities he said that many projects are expected to be completed by planned timelines with allocated budgets as was planned at the initial stage of that project. He said that projects should adhere the planned time and budget must ensure efficient use of all project resources, consider stakeholders' satisfaction, and sustainable development of the country but in his study, he didn't clear the cause of project delays and its consequences this is the reason why this research is needed to assess the effect of project delays on cost overruns (Wendler, 2019).

Globally, Azis and other more studies have conducted focusing on the relationship between project delays and cost overruns which is remaining persistent challenges in large projects. Azis in his study focusing on High-profile projects on the global pace like Brandenburg Airport which was constructed in German and findings results showed that project delayed caused the project budget planned to exceed by 120%. but Azis hasn't justified clearly at which stage of project delay occur. Friong in her study concentrated on the on critical correlation between project time and project financial performance the case study was the Sydney Opera House in Scotland the findings showed that this project experienced significant delays which cause budget escalations, with cost overruns exceeding 70% due to inadequate planning and scope changes (Azis, 2018).

Hendrickson in his research found that Delays occur large scale construction projects, and he said that these delays vary considerably from project to project. Some projects delay by a few days while others are delayed for over a year. At the beginning, it is essential to define the actual causes of delay in order to minimize associated costs in any construction project. Hendrickson said that to achieve construction project success, the project manager must have full understanding of behavior of infrastructure project variables and their relationship, and future monitoring control techniques will be used. (Hendrickson 2023).

In their study, Cook and Williams (2022) argue that in Africa, infrastructure development like Airport is central to economic growth and regional integration. Their said that Governments are investing heavily in large-scale projects to improve connectivity and attract investment. However, the continent faces persistent challenges of project delays and cost overruns. Many Studies conducted focusing on Nigerian show that in Nigeria seven out of ten public construction projects experienced delays but did not indicated clear its impact while in Ghana, the findings showed that approximately 75% of projects exceed their original time planned. Frimpong (2018) in his study focusing on Factors contribution of project delays due to inadequate planning, poor project monitoring and weak stakeholder engagement. Consequently, all studies

concluded that African governments faced budgetary strains, delayed project benefits which reduced public confidence in infrastructure programs, (Frimpong et al., 2018).

In their research studies, Baker et.al, and Morris (2019) emphases that in East Africa, the situation reflects on both opportunities and challenges faced in project implementation process their studies focused on east Africa Countries like Kenya and Uganda where these countries have initiated several infrastructure projects to enhance regional integration and economic competitiveness. However, the findings showed that most of those projects experienced delays and budget overruns and discovered that in most east Africa countries these challenges arising from land acquisition disputes and coordination failures among stakeholders. Owolabi in her research focused on the example Kenya's airport expansions project and frequently experience schedule change due to insufficient contract periods and bureaucratic obstacles which extended project timeline and project cost overrun. These regional experiences highlight systemic issues that increase the risk of project delays and cost overruns (Owolabi et al., 2019).

In a report by Rukirande (2022), the Rwanda as a country which have an emerging economy, the national budget of the Government of Rwanda for the fiscal year 2009/2010 emphasized a scaling up of infrastructure projects in order to enhance global and regional connectivity, and this development will see an increase in construction and rehabilitation investment projects in local governments among these projects Bugesera international Airport was designed to transform Rwanda into a regional aviation hub. At the initial stage Bugesera International Airport was planned to be implemented in two phases with the budget planned of USD 600 million and project duration planned was 5 years (2009-2014). But due to project delays construction began in 2017 which reflected 8 years of delay in project commencement.

According to Minecofin report (2019) indicating that under a new agreement with Qatar Airways the project completion timeline was revised for 2028 with revised budget of USD 2 Billion which representing 333% increase from the original planned budget that in 2019 the budget was revised to USD 2 Billion reflecting to budget increase at 333%, Under a new and by that time the project duration was also revise up to 2028. This is the reason why Bugesera International Airport provided a case study which analyze the link between project delays and project cost overruns of bugesera International Airport. The history of these deviations demonstrates that project delays and cost overruns of project of Bugesera International Airport are persistent threats to project success. Understanding these variables in the context of Rwanda, using Bugesera International Airport as a case study, provides a foundation for improving project planning, execution and financial management, thereby contributing to sustainable economic development of Rwanda (MINECOFIN, 2019).

1.1 Statement of the Problem

The Construction industry is large and requires remarkable capital expenditures. Construction Projects have grown larger over time, especially in developed and developing countries, and increased size indicates higher economic risks. A recent study focusing on top management in 25 of the largest construction companies in the world showed that executives see managing and pricing risk as one of their key challenges, and 63 percent of respondents said it was their biggest issue. Executives cited poor planning forecasting poor risk identification, and cost escalation as the three top reasons for reduced profit margins (John, 2021).

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In Africa and East Africa, all governments continue to invest more in infrastructure projects, yet many of these projects continually suffer from increase in project time and financial inefficiencies. These delays result in extended contract project periods resulting also increased labor cost and material costs and affect all total project expenditure. Despite this study empirical evidence linking project delays to cost overruns remains limited, particularly in the Rwandan large-scale project especially construction sector.

In Rwanda, the main cause of this study comes from the significant dilation identified in the implementation of Bugesera International Airport. Where the project was initially planned to be completed for 5years which means between 2009 and 2014 with a planned budget of USD 600 million, but due to different issues construction of Bugesera international airport only started in 2017 and cause completion time to be postponed to 2028. During this period

2. Literature Review

This section presents a comprehensive review of existing literature related to the effect of project delays on cost overruns in large-scale infrastructure projects, with particular focus on Bugesera International Airport in Rwanda. The review provides theoretical, conceptual, and empirical perspectives relevant to the study variables. It examines findings from global, regional, and local studies to identify key trends, causes, and consequences of project delays and their relationship with cost overruns. Particular attention is given to delays occurring during the initiation, planning, and implementation phases of large-scale infrastructure projects and how such delays may contribute

of project prolonged delays, the project cost increased up to USD 2 billion, which represents a 333% cost increase. This is the reason to explain that Bugesera International Airport provided a case study to analyze the link between project delays and project cost overruns. The history of these deviations demonstrates that project delays and cost overruns are persistent threats to project success. For understanding these variables in the context of Rwanda for example using Bugesera International Airport as a case study and provides a foundation for improving project planning, execution and financial management and thereby contributing to sustainable economic development of Rwanda.

Moreover, this lack of clear empirical showing how project delays affect the cost overruns in large- scale project especially in Rwanda. Despite the evident link between the prolonged delays and budget increase in Bugesera International Airport, there is no systematic analysis which explains the nature, at which extent, and stages at which delays can significantly affect project costs. This knowledge gap can limit the ability of project managers to develop good strategies for minimizing delays and controlling costs. Therefore, this study seeks to assess the effect of project delays on cost overruns in large-scale construction projects in Rwanda.

1.2 General Objective of the Study

The researchers wanted to examine the Effect of project delays on cost overruns risk in large-scale projects in Rwanda especially on Bugesera International Airport.

1.3 Specific Objectives

1. To find out the effect of delays in the project initiation phase on land acquisition cost overruns risk in large-scale construction projects in Rwanda.
2. To identify the effect of delays in the project planning phase on labor cost overruns risk in large-scale construction projects in Rwanda.
3. To analyze the effect of delays in the project implementation phase on materials cost overruns risk in large-scale construction projects in Rwanda.

to increased project costs. The review also identifies gaps in the existing literature and provides a foundation for understanding the relationship between project delays and cost overruns in the context of Bugesera International Airport, Rwanda.

Abbas, (2019) defines project delay as the late completion of the project compared to the planned of time or contract. Project delay occurs when the progress of the project falls behind the time. The cause of delay in project can be either one party in project or other circumstances such as weather conditions, government regulations, change of market condition etc.

Assaf (2019), defined the project delays as the time overrun due to the later completion date of project compared to the planned time of projects or beyond the agreed time of project between parties of the contract for project delivering. The reasons some large –scale infrastructure projects are not completed within time scheduled are many, infrastructure project especially in construction process is too much complex and might need the effort of every parties in project process ,the researcher said that there is some conditions and unpredictable events which results from different sources such the willingness and performance of contractors, material procurement process, site condition and site management, coordination between parties and financial capabilities of the owner of the project have greater implication in the timely completion of construction project.

Azis (2019) in his study has classified project delays into two categories, as the first project delay caused by poor planning of project activities and the second caused by low skills of contractors. Project Delays caused by the poor planning such as late submission of drawings and specifications, frequent change orders, and incorrect site information generates claims from both the main contractors and sub-contractors which many times entail lengthy court battles with huge financial repercussions Delays caused by contractors can generally be attributed to poor managerial skills. Lack of planning and a poor understanding of accounting and financial principles have led to many a contractors' downfalls (Azis 2019).

According to Memon et al (2018) Project delays are a critical issue in the construction industry and refer to the situation where a project's timeline is extended beyond its original planned completion date. Delays can occur during various phases of the project, including planning, design, procurement, construction, and commissioning. In the case of Bugesera International Airport, delays were particularly notable in the planning and land acquisition phases. According to Memon et al. (2018),

Pidd in his study related to effect project delays on project performance said that Cost overruns are defined as the situation where the actual cost used during the project implementation have exceeded its budget planned during conception phase of the project (Pidd, 2020). According to Memon the Cost Overruns are common and can be attributed to several factors, including design changes of the project, unforeseen site intervention conditions, material cost increases and delays in project execution. He said that cost Overruns are often directly linked to project delays because extended timelines often result in additional costs for labor, equipment, and overheads, contributing to the overall increase in project expenditure (Memon et al., 2018).

According to Jammaz in his research study defines that stage is to take things from documents to practice identical with the plans, specifications and conditions (Jammaz, 2020). He said that implementation phase is the most important that requires the owner of the project to mobilize about 90% of total cost of the project. Continuously he said

that This stage requires a lot of supervision and monitoring of workflow to compare how actual implementation is related to the implementation plan and to determine the level of deviation. He said that the concern of the contractors at this stage is to provide all necessary resources needed for project implementation such as human resources, financial means and material in general and also contractors are in charge of managing and using all resources property in line with what planned. Also, contractors are in charge of selecting suppliers of raw materials and the choice depends on the commitment to supply, the cost of raw materials and the quality. The choice should be made based on how much suppliers are willing to supply at the right time to avoid the lack of materials on the site which may result in delays (Jammaz, 2020).

Jammaz said that this phase of implementation consists of resources mobilization, especially money and labors. Some contractors enter in contract without knowing how much cost to get skilled people to perform work, and even how financial transaction between owner of the project and contractors will be done, when the pay is required, how to get resources are needed, does the owner of the project able to cover the cost of the project? Some construction projects are delayed because the owner is not able to cover the cost of project or because contractors do not need experiences in construction work (Jammaz, 2020).

In the study conducted by Dr. Ashraf Samarah and Dr. Ghanim (2021) focused on the assess the causes and effects of delay in public construction projects in Jordan, his findings have revealed that the major causes of project delays were inadequate management and supervision by the contractor, also in the study conducted by Luu Truong Van and Nguyen (2022) about conceptual model of delay factors affecting government construction projects in Vietnam have revealed that the incompetent owner were among top five causes of delay.

Research in developing countries, especially Africa, have made progress in determining the causes behind project delays and cost overruns. Kaliba, Muya, and Mumba (2019) explain in their study that, the major causes of delay in road construction projects in Zambia were delayed payments, financial deficiencies on the part of the client or contractor, contract modification, economic problems, material procurement, changes in design drawings, staffing problems, equipment unavailability, poor supervision, construction mistakes, poor coordination on site, changes in specifications, labor disputes, and strikes. In Uganda, Agaba (2020) attributes delay in construction projects to poor designs and specifications, and problems associated with management and supervision. In their study, El-Razek, Bassioni, Mobarak, (2018) found that delayed payments, coordination difficulty, and poor communication were important causes of delay in Egypt. Studies outside the African continent seem to also have identified almost similar causes. Sambasivan and Soon (2017), and Alinaitwe (2018) established that poor planning, poor site management, inadequate supervisory skills of the contractor, delayed payments, material shortage, labor supply, equipment availability and failure, poor

communication and rework were the most important causes of delays in the Malaysian Construction Industry. Kouskili and Kartan (2021) identified the main factors affecting cost and time overrun as inadequate/inefficient equipment, tools and plant, unreliable sources of materials on the local market, and site accidents. Hence, the list of causes confirms above agree with the findings of (McCaffer (2018).

2.1 Empirical Review

2.1.1. Delays in the Project Initiation Phase and Land Acquisition Cost Overruns Risk

Flyvbjerg (2017) conducted research on the effect of land acquisition of project performance the findings argued that delayed funding approvals and resistance on negotiations in land acquisition significantly affect pre-construction costs, create change in project timeline, and escalate financial risks. Also it is said that delay initiation phase not only affects timelines but also increases in indirect costs of project. Delays during the initiation phase of project, particularly in land acquisition, and initial stakeholder engagement, have been widely documented as a primary cause of cost overruns in large-scale infrastructure projects global level.

Doloi et al. (2018) and other researchers in Asia have demonstrated that delayed feasibility studies, environmental assessments, and land acquisition in Indian construction projects directly postponed project commencement, resulting in higher pre-construction costs and risk exposure. Ahsan & Gunawan (2019) conducted research on the effect of stakeholder's engagement on project performance findings indicated that delayed stakeholder engagement in Southeast Asian projects caused budget overruns during the initiation phase.

Ndayisaba (2019) and other African researchers conducted the study on the role of bureaucratic on delays in land acquisition during the initiation phase he used the example of Bugesera International Airport contributed significantly to increased land costs. According to the New Times report (2016) also observed that the process of expropriating over 2,000 households caused a substantial delay in the project launch, escalating land acquisition costs due to prolonged compensation requirements and administrative overheads. Yung (2019) conducted research with the case study of Nairobi International Airport and found that disputes over land ownership and delayed compensation processes were significant contributors to cost overruns.

Musirikare M.& Julius Warren Kule , 2016) conducted research about the delay and cost overrun risk in construction projects undertaken by Gasabo District from 2009- 2012, the objective of their studies was to assess the effects of time to the cost of the project and the findings of their research showed that 65.7% of public construction projects implemented during the period of 2009-2012 delayed at rate of 58% of their expected completion time and 52% of these projects suffered cost increase of 15.9%. In their study, they assessed the effects of delay on cost

overrun but they didn't assess the causes of delay, and it would be better to access the causes of construction project time overrun before the assessment of the effects of time overrun on the cost of construction project.

These studies justify the need to analyze initiation-phase delays as an independent variable affecting cost overruns at Bugesera International Airport and this study provided measurable indicators to guide data collection and analysis.

2.1.2. Delays in the Project Planning Phase and Labor Cost Overruns Risk

A study conducted by (Mohammad& LEED AP, March 2017) to Investigate the causes of delay in United State construction projects where 30 factors causing delays were developed and the findings show that among these 30 factors, the most 5 factors causing delay in construction projects in United State were Excessive change orders by owners during construction process, Time consuming during decision making by the owner, design error, delay in approving design documents by the owner and errors in contract documents, according to this findings from this research, the main delay factors were associated to the owner of the project. However, all research conducted by no one focused on the effect of project delays on performance large scale infrastructure project, this is the reason why this research was needed to evaluate the effect of project delays on cost overruns of the project especially on Bugesera International airport

Research conducted by (Le- Hoai, Lee & Y.D, 2018) on the causes of delay in construction project in Vietnam which led to the cost overruns and the findings of his research show that there are three factors which lead to the cost overruns and these factors were the increase in cost of materials due to the inflation, inaccurate quantity take-off and increase in labor cost due to the environmental restriction.

Research conducted Ogunlana et al. (2022) highlighted that delayed approvals, poor stakeholder coordination, and underestimated timelines frequently result in increased labor costs in large-scale construction projects in Thailand. The planning phase is critical for scheduling, resource allocation, risk assessment, and budgeting. Delays in this phase are closely associated with labor cost overruns, primarily due to extended project timelines, inefficient workforce deployment, and additional labor requirements.

Liu & Wang (2015) examined the planning phase of Beijing Capital International Airport's expansion and found that delays in design finalization, zoning approvals, and securing permits extended project timelines and directly increased labor expenditures. Sun Onde (2020) reported similar findings in sub-Saharan Africa, where bureaucratic inefficiencies and inadequate feasibility studies extended planning periods, driving up labor costs due to longer engagement of workers, higher overtime payments, and increased supervisory requirements.

In Rwanda, Ndayisaba (2019) emphasized that prolonged planning-phase approvals and poor coordination in the Bugesera International Airport project caused labor

inefficiency, underutilization of skilled labor, and increased overtime payments, thereby inflating labor costs. These findings demonstrate the direct relationship between planning-phase delays and labor cost overruns, supporting the second specific objective of this study.

Although studies demonstrate that planning delays increase labor costs, few have empirically measured specific planning-phase indicators (scheduling, resource allocation, budgeting, risk assessment, procurement) and their quantitative impact on labor cost overruns in large-scale Rwandan projects.

Provides the foundation to evaluate planning-phase delays as predictors of labor cost overruns, guiding measurable indicators and data analysis methods and delay in project scheduling, delayed resource allocation, postponed budgeting and cost estimation, delayed risk assessment, delayed procurement planning.

2.1.3. Delays in the Project Implementation Phase and Materials Cost Overruns Risk

Kaliba et al. (2019) argue that if projects costs or schedules exceed their planned targets, client satisfaction would be compromised, the funding profile no longer matches the budget requirement and further slippage in the schedule could result. In addition, project delays and cost overruns also have devastating effect on contractors and consultants in terms of growth in adversarial relationships, mistrust, litigation, arbitration, cash-flow problems, and a general feeling of trepidation towards other stakeholders (Ahmed et al., 2022). Although this problem is not unique to developing countries; it is also experienced in most developed economies (Kaliba et al. 2019).

Morris (2018) highlighted that labor strikes, insufficient materials, equipment breakdowns, and unforeseen site conditions significantly increase material costs and project expenditures globally. The implementation (execution) phase is often the most visible period where delays translate directly into cost overruns, particularly for materials.

Sohail and Baldwin (2024) observed that construction professionals seem to pay more attention to cost performance of projects than time performance. According to a survey research by Yakubu and Sun (2020) in the United Kingdom, only 58% of respondents always apply time controls to their project, a further 29% indicated that they frequently apply time control techniques, and 11% respondents indicate that they rarely or do not apply time control during their projects.

Büyükekeşi et al. (2020) conducted research on effect of project delays on cost performance of New Istanbul airport and found that delays in project equipment supply and construction coordination at New Istanbul Airport extended project timelines and resulting in higher material costs and contractual penalties. Amponsah et al. (2019) reported that material procurement delays and labor shortages in

Ghanaian infrastructure projects led to increased expenditure and schedule slippage. Olawale (2020) observed similar patterns at Kotoka International Airport, where delays in material deliveries contributed to cost overruns.

Most research have focused on global cause or general delays during implementation, but there is limited studies empirical measurement of phase-specific indicators of delays in implementation delays and their quantitative effect on material cost overruns in Rwanda. This is the reason why this study was needed focused on data collection and analysis for Bugesera International Airport.

2.1.4. Causes of cost overruns

Since the 1980s various studies of many researchers have investigated the causes of project cost overruns on large scale infrastructure projects. Kaming, Olomolaiye, Holt, and Harris (2017), who studied on 31 construction projects in Asia focused on Indonesia found that from a contractor's point of view, cost overruns were mainly caused by increase in material costs. Le-Hoai et al. (2018) conducted research in Vietnam and the findings ranked that there are the three top causes as material cost increase due to inflation, inaccurate quantity take - off, and labor cost increase due to environment restriction. Kaliba, et al. (2019) conducted the research on the cause of cost overruns in construction project in Zambia, they concluded that cost escalation of construction projects in Zambia is caused by many factors such as project scope changes, environment protection and technical challenges and inflation.

Bubshait and Al-Juwait (2020) conducted the researches focused the effect of cost overruns on construction projects in Saudi Arabia in their findings listed the following as factors that cause cost overrun on construction projects in Saudi Arabia; effects of weather, number of projects going on at the same time, social and project location, lack of productivity standards in Saudi Arabia, level of competitors, supplier companies, inadequate production of raw materials by the country, absence of construction cost data. In another study on construction projects in Nigeria, conducted by Okpala and Aniekwu (1988), it was found that architects, consultants and clients agreed that shortage of materials, finance and payment of completed works and poor contract management were the most important causes of cost overruns. Mansfield, Ugwu and Doran (1994) studied the performance of transportation infrastructure projects in Nigeria and concluded that material price fluctuations, inaccurate estimates, project delays and additional work contributed most to cost overruns. During a review of public sector construction projects in Nigeria, Dlakwa and Culpin (1990) found that the three main reasons for cost overruns are "fluctuations in material, labor and plant costs, construction delays and inadequate pre-planning. Unfortunately, both research are only specific to Nigeria.

infrastructure projects, focusing on Bugesera International Airport in Rwanda. It covered research design, target population, sample size, sampling techniques, data collection instruments, model specification, and data analysis methods. The adopted methodology provided a

3. Methodology

This section described the methodology adopted to examine the effect of project delays on cost overruns in large-scale

systematic approach for analyzing data collected from 108 respondents and assessing the effects of delays during the

initiation, planning, and implementation phases on project cost overruns.

3.1. Research Design

According to Saunders and Miller (2019), the research design describes how the research carried out and gave limits within which research focused on. The research design is the plan of how the study is carried out. This study adopts a descriptive research design with inferential analysis to examine the effect of project delays on cost overruns in Bugesera International Airport.

3.2. Target population

A population is the total number of people or objects in study that want to get information from. In this study the target population was 150 individuals who were involved or who were affected by the construction of Bugesera International Airport. The population have broken down as follows:

Table1: Total Population

Population	Number
Bugesera Airport Field staffs	50
Bugesera district staffs	10
Site Supervisors	10
Rwanda Civil Aviation Authority(RCAA)	10
Residents (Owner of land in Project Intervention area)	70
Total Population (N)	150

3.3. Sample Size of the Study

Before identifying the respondents to this research, it is necessary to indicate how the sample size is determined. To determine the sample size, the following mathematical formula designed by William G is used; where, **n** is the sample size; **N** is size of the population and **e** is marginal error or level of confidence.

General scientific formula: ; $n = \frac{N \times n_0}{N + (n_0 - 1)}$;

N= 150 population size

n₀= 384 is the sample size for an infinite population

And then the sample size is:

$$n = \frac{150 \times 384}{150 + (384 - 1)};$$

$$n = \frac{57600}{533} = 108.06$$

Therefore, for the case of this study, the total sample size is 108 respondents as stakeholders involved in Bugesera International Airport.

3.4. Sampling Techniques

To ensure the sample is representative of the entire target population of this research which involves Bugesera International Airport divided into strata based and random sample was taken from each stratum proportional to its size in the target population. Below is table that clearly a sample size distribution

Table2: Sample size

Population	Total Population	Sample Size
Bugesera Airport Field Staffs	50	37
Bugesera District Staffs	10	7
Site Supervisors	10	7
Rwanda Civil Aviation Authority(RCAA)	10	7
Residents (Owner of land in Project Intervention area)	70	50
Total	150	108

3.5. Data Collection Instruments

Data used in this study have been collected through Structured questionnaires, Observation and Document analysis. These instruments helped the collection of reliable

and valid data that supported all quantitative and qualitative analysis related to Construction of Bugesera International Airport.

3.6. Model Specification

Primary data were used, and data were primarily sourced with structured questionnaire. This study adopted the model used by Okhiria, Paul, Obadeyi, and Afuye, (2016) when they examined the effect of Project delays on the Cost Overruns in Rwanda and specified the following model

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \varepsilon \dots \dots \dots (1)$$

Where:

Y: Cost Overruns
 β_0 : Intercept.
 ε : Error Term

X_1 : Delays in initiation phase
 X_2 : Delays in planning phase
 X_3 : Delays in implementation phase

Descriptive statistics were used to summarize data in an organized manner by describing the relationship between variables in a sample or population. The analysis included the calculation of the mean, for delays in the initiation, planning, and implementation phases, as well as budget overruns expressed in percentage terms and standard deviation were computed to assess the variability and distribution of project delays and cost overruns.

Mean (M)

Table 3: Evaluation of Mean

Mean	Evaluation
1.00- 1.49	Weak
1.50- 2.49	Tend to weak.
2.50- 3.49	Tend to strong.
3.50 - 5.00	Strong

3.9. Regression Analysis

Regression analysis is a statistical method that shows the relationship between two or more variables. Usually expressed in a graph, the method tests the relationship between a dependent variable against independent variables. In this study regression analysis were used to analyses the relationship between project delays and cost overruns risks in construction of Bugesera International Airport project.

3.10. Correlation Analysis

This research used Pearson’s correlation coefficient to examine the strength and direction of linear relationships between the study variables. The study analysis assessed

This study adopted the above model by introducing Project delays variables and cost overruns risk Variables.

3.7. Data Analysis

In this research collected data were analyzed, providing a structured approach to test the hypotheses and examining the relationships between project delays and cost overruns. Where explained the methods used to analyze the data collected are descriptive statistics and inferential analysis. The researcher demonstrated how these methods aligned with the research objectives. In this case descriptive statistics summarized the data, while inferential analysis tested the hypothesized relationships between project delays and cost overruns.

3.8. Descriptive statistics

The best known and frequently used measurement of the center of a distribution of a quantitative variable is known as the mean. The mean refers to “average or arithmetic mean of the values”; adding up the data points and dividing by how many they are (Aggressti& Franklin, 2009).

By the formula, $\bar{M} = \frac{1}{n} \sum_{i=1}^n x_i$

correlation between project delays and cost overruns. A correlation coefficient closes to +1 or -1 and indicates a strong relationship, while a value near 0 suggested that there is no relationship.

Formula: $r = \frac{(\sum (X_i - \bar{X})(Y_i - \bar{Y}))}{\sqrt{(\sum (X_i - \bar{X})^2 (\sum (Y_i - \bar{Y})^2)}}$

From the Above formula X_i and Y_i are the individual sample points, and $\bar{x}$ and $\bar{y}$ are the mean values of the x and y variables.

4. Results and Discussion

4.1. Findings

This Section presents the discussions of the empirical findings of the study. It presents the descriptive statistics; the study examined the effect of project delays on cost overruns of Bugesera International Airport. Descriptive statistics was adopted to analyses means and standard

deviation behavior while inferential analysis was to assess the effect of project delays on Cost overrun of project. Hence, (108) respondents were simply considered, and empirical results were arranged according to the study objectives.

Table 4: Cronbach's Alpha reliability test for the key Variables

	N	Inter item covariance	Variance of items	Cronbach's Alpha
Delay in project Initiation phase	5	.408	.048	.928
Delay in Project planning phase	5	.353	.009	.879
Delay in project Implementation phase	5	.353	.002	.876

Source: Field data 2026.

The researcher was assessed Cronbach's Alpha for the key variables of project delays on project cost overruns in all stage of project with five items and recorded a Cronbach's Alpha of 0.928 this indicating excellent internal consistency and showing that the items reliably measured delays in

initiation phase ,delays in planning phase had Cronbach's Alpha of 0.879 and 0.876 for delays in implementation phase this means that overall variables exceeded 0.70 and confirming that the data collection instruments were reliable and for further statistical analysis .

Table 5: Tests of Normality

Gender		Kolmogorov-Smirnov ^a			Shapiro-Wilk		
		Statistic	Df	Sig.	Statistic	df	Sig.
Age	Male	.040	63	.200*	.991	63	.919
	Female	.078	45	.200*	.970	45	.290

Source: Field data 2026

According to the table4 above shows that Kolmogorov–Smirnov statistic for male respondents were 0.040 with a significance value of 0.200, while the Shapiro–Wilk statistic were 0.991 and have a significance value of 0.919. while for female respondents, the Kolmogorov–Smirnov test

statistic was 0.078 with a significance value of 0.200, and the Shapiro–Wilk test statistic was 0.970 with a significance value of 0.290. Since all significance values are greater than 0.05, this shows that the age for both male and female respondents were normally distributed.

Table 6: Respondent View on Effect of Delays in the Project Initiation Phase on Land Acquisition Cost Overruns

Statement	N	Mean	Std. Deviation
Conflicts caused by land ownership extended project timelines and increased costs.	108	3.92	1.224
Delays in land identification contributed to increased land acquisition costs.	108	3.90	1.253
Bureaucratic delays in processing compensation payments led to cost escalations.	108	3.88	1.243
Delayed resolution of land disputes contributed to overall project cost overruns.	108	3.86	1.249
Inefficient coordination of land increased acquisition costs.	108	3.85	1.324
Delays in securing ownership documents led to significant budget overruns.	108	3.84	1.276
Resistance from landowners and local communities caused delays and increased costs of land.	108	3.79	1.305
Delays in land acquisition planning caused additional management and legal costs.	108	3.75	1.269
Valid N	108		

Source: Field data 2026

Table 6 above has shown the mean scores of respondents 'views focused the effect of project delays in the initiation phase on land acquisition cost overruns. As presented from the statements in Table 6, showed that 'conflicts over land ownership has mean of 3.92 was ranked first; 'delays in land identification has mean of 3.90 was ranked second;

'bureaucratic delays in land compensation' has 3.88 and was ranked third; and last was delays in acquisition planning' (3.75) was ranked eight them and overall, the mean scores have ranged from (3.75–3.92). This indicates that all respondents agreed that delays in the initiation phase significantly contribute to land acquisition cost overrun.

Table7: Respondent View on Effect of Delays in the Project Planning Phase on Labor Cost Overruns

Statement	N	Mean	Std. Deviation
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Delays in obtaining necessary permits increased project labor costs.	108	4.06	1.170
Ineffective planning of resource allocation caused increase in labor cost.	108	4.03	1.172
Frequent revisions in project plans caused increase in labor costs.	108	4.02	1.207
Insufficient feasibility studies during planning caused budget overruns.	108	4.01	1.204
Inadequate identification of risks in the planning phase increased unexpected labor costs.	108	3.99	1.204
Weak in monitoring of planning activities increased labor-related expenditures.	108	3.95	1.263
Poor scheduling during planning cause extended project timelines and increased labor costs.	108	3.94	1.244
Lack of proper project coordination during planning increased labor costs.	108	3.88	1.236
Valid N (listwise)	108		

Source: Field data 2026

Table 7 above showed the mean scores of all respondents on the effect of delays in planning-phase on labor cost overruns. As shown in the table 7, delays in getting permits increased project labor costs with the mean of 4.06 was ranked first; 'ineffective planning of resource allocation caused increase in labor cost' with the mean of 4.03 and was ranked second; revisions in project plans caused increase in labor costs with mean of 4.02 and was ranked third; insufficient feasibility studies during planning caused budget overruns with the mean of 4.01 and was ranked

fourth; inadequate identification of risks in the planning phase increased unexpected labor costs with the mean of 3.99 and was ranked fifth and 'lack of proper project coordination during planning increased labor costs with the mean of 3.88 and was ranked eighth, and overall the mean scores of respondents have ranged from (3.88–4.06). This indicates that respondents have agreed that the delays in planning-phase significantly contributed to increased labor costs in the project, especially in construction of Bugesera International Airport.

Table 8: Respondent View on Effect of Delays in Implementation Phase on Material Cost Overruns

Statements	N	Mean	Std. Deviation
Poor contractor performance caused delays and increased material costs.	108	4.02	1.268
Inadequate management of project timelines increased budget overruns.	108	3.99	1.249
Unforeseen implementation delays caused additional management costs.	108	3.98	1.282
Delays in delivery of construction materials led to significant budget overruns.	108	3.97	1.279
Poor communication between contractors and project managers led to delays and cost escalation.	108	3.95	1.278
Lack of coordination among stakeholders increased inefficiencies and material costs.	108	3.93	1.316
Labor shortages during implementation increased project costs.	108	3.92	1.298
Delays in subcontractor performance contributed to overall material cost overruns.	108	3.83	1.322
Valid N (listwise)	108		

Source: Field data 2026

Table 8 above indicated the mean scores of all respondents on the effect of delays in the project implementation phase on material cost overruns. As shown in the statements in Table 8 the poor contractor performance caused delays and increased material costs with the mean of 4.02 and was ranked first; inadequate management of project timelines increased budget overruns with the mean of 3.99 and was ranked second; unforeseen implementation delays caused additional management costs with the mean of 3.98 and was ranked third; delays in delivery of construction materials led

to significant budget overruns with the mean of 3.97 and was ranked fourth and lastly delays in subcontractor performance contributed to overall material cost overruns with the mean of 3.83 and was ranked eighth, and overall the mean scores of respondents have ranged from (3.83–4.02). The above findings indicate that respondents agreed that delays in the implementation phase significantly influenced the material cost overruns in the project in construction of Bugesera International Airport.

Table 9: Respondent View on Effect of project delays on overall cost overruns risk in large-scale projects

Statements	N	Mean	Std. Deviation
Delays in project initiation directly increased land acquisition costs.	108	4.00	1.304
Implementation delays caused significant cost increases in materials and project management.	108	3.97	1.300
Delays in the planning phase directly increased labor costs.	108	3.95	1.314
Cumulative delays in initiation, planning, and implementation significantly increased overall project costs.	108	3.94	1.313
Delays across all project phases contributed to overall cost overruns in the Bugesera International Airport project.	108	3.92	1.333

Planning delays caused inefficiencies that led to labor and material cost escalations.	108	3.91	1.378
Delays in the implementation phase directly increased material costs.	108	3.90	1.332
Delays in project initiation extended timelines and increased management costs.	108	3.81	1.354
Valid N (listwise)	108		

Source: Field data 2026

Table 9 above showed the mean scores of respondents on the effect of project delays on overall cost overrun risk in large-scale projects like Bugesera International Airport. As indicated in the statements in Table 8 delays in project initiation directly increased land acquisition costs with the mean of 4.00 and was ranked first, after that delays in implementation caused significant cost increases in materials with the mean of 3.97 and was ranked second, delays in the planning phase directly increased labor costs with the mean of 3.95 and was ranked third; cumulative delays in initiation, planning, and implementation significantly increased overall project costs with mean of 3.94 and was ranked fourth; delays across all project phases contributed to overall cost overruns

in the Bugesera International Airport project with the mean of 3.92 and was ranked fifth; planning delays caused inefficiencies that led to labor and material cost escalations with the mean of 3.91 and was ranked sixth; delays in the implementation phase directly increased material costs with the mean of 3.90 and was ranked seventh; and 'delays in project initiation extended timelines and increased management costs with the mean of 3.81 and was ranked eighth. The table showed that overall, the mean scores ranged from (3.81–4.00). The findings indicated that respondents agreed that project delays across all phases significantly contribute to overall cost overrun risks in large-scale projects like Bugesera International Airport.

Table 10: Coefficients regression results

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
1 (Constant)	.052	.062		.827	.410
project delays in the project initiation phase	.414	.075	.421	5.509	.000
project delays in the project planning phase	.336	.092	.336	3.656	.000
project delays in the project implementation phase	.241	.056	.242	4.281	.000

Source: Field data 2026

From Table 10 Above, the coefficient regression results showed that the project delays in the project initiation phase is statistically significant even at 0.01 level of significance. This is because the t-statistic for the coefficient of delays in initiation phase is 5.509, which is high, and the probability of error is 0.000.

The coefficient of project delays in the project planning phase is statistically significant at 0.01 level of significance. Because

the t-statistic for the coefficient of planning phase delays is 3.656, which is sufficiently high, and the probability of error was 0.000. Lastly, the coefficient of project delays in the project implementation phase is statistically significant at 0.01 level of significance. Because the t-statistic is 4.281, which is high, and the probability of error is 0.000. The table above confirmed that project delays in the initiation, planning, and implementation phases have statistically significant impact on cost overrun risks in large-scale projects in Rwanda like in Bugesera International Airport.

Table 11: ANOVA Result Test

	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	149.807	4	37.452	493.122	.000
Within Groups	7.823	103	.076		
Total	157.630	107			

Source: Field data 2026

To assess the statistical significance of the results of the R Square, it was necessary to look at the above ANOVA Result test. From Table 11 showed that the F-Statistics of

493.122 was very high, and the P-value (0.000) which is less than 0.05, which indicates that the overall effect of the independent variables such as project delays in different phases on cost overruns risks as dependent variable was

statistically significant. The findings confirmed that the regression model is significant in explaining cost overrun

risks in large-scale projects in Rwanda like Bugesera International Airport.

Table 12: Correlations Analysis

		Delays in the project initiation phase	Delays in the project planning phase	Delays in the project implementation phase
Delays in the project initiation phase	Pearson Correlation	1	.960**	.963**
	Sig. (2-tailed)		.000	.000
	N	108	108	108
Delays in the project planning phase	Pearson Correlation	.960**	1	.972**
	Sig. (2-tailed)	.000		.000
	N	108	108	108
Delays in the project implementation phase	Pearson Correlation	.963**	.972**	1
	Sig. (2-tailed)	.000	.000	
	N	108	108	108

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

Table 12 present correlations analysis and show the Pearson correlation between project delays in the project initiation phase and delays in the project planning phase is (0.960) with the significance level of 0.000, which indicated that is very high and shows a strong positive relationship between. The correlation between delays in the project initiation phase and delays in the project implementation phase is (0.963) with a significance level of 0.000, also this indicates a very strong positive relationship. Furthermore, the correlation between

delays in the project planning phase and delays in the project implementation phase is (0.972) indicating a significance level of 0.000, that is the highest among all objectives.

The findings showed that delays in the initiation, planning, and implementation phases were strongly and positively related to each other, meaning that delays in one phase are closely associated with delays in other phases in large-scale projects in the Bugesera International Airport.

5. Conclusion and Recommendations

5.1. Conclusion

This study analyzed the effect of project delays on cost overruns risk large-scale projects in Rwanda, using the case study of Bugesera International. Data have been collected from 108 respondents which direct and stakeholders of the project and the data collected were analyzed using descriptive and inferential statistics to address the study each study objective and test each study hypotheses.

The study findings showed that the delays in the initiation phase significantly increased land acquisition costs, supporting the first hypothesis and rejecting H0. This means that all Respondents indicated that conflicts from land ownership, delays in land surveys and bureaucratic delays in compensation were the most critical factor indicators, with mean scores ranging from 3.75 to 3.92 this confirmed that delays in initiation phase have significant effect on land acquisition cost overruns.

On the second objective of the study, findings showed that delays in the planning phase significantly increased labor costs which confirmed the second hypothesis of the study and rejected H0₂. All respondents indicated that delays in obtaining necessary permits, ineffective resource allocation, frequent plan revisions, and insufficient feasibility studies were identified as critical contributors, with mean scores ranging from 3.88 to 4.06, and where the study indicated that the highest being delays in obtaining permits (M =

4.06.). Findings also on this objective indicated that regression and t-test analyses demonstrated that there is a significant effect of planning delays on labor cost overruns.

On the third objective the study, findings indicated that delays in the implementation phase can significantly increase material costs and confirming the third hypothesis of the and rejected H0₃. All Respondents indicated that poor contractor performance, delayed delivery of materials with inadequate timeline management and subcontractor inefficiencies were the major contributors, with mean scores ranging from 3.83 to 4.02, and indicated that poor contractor performance rated highest (M = 4.02). After that regression analysis and correlation results showed that there is positive significant effect of implementation delays on material cost overruns which impacted the increase overall project costs.

The study found that cumulative delays across all project phases had a positive significant effect on overall cost overruns risk. Mean scores ranged from 3.81 to 4.00, indicating strong agreement among respondents. In the ANOVA analysis the results indicated that F = 493.122 with P-Value less than 0.001.

From the Above findings the study confirms that project delays in initiation phases, planning phase and implementation phases have a positive significant effect on cost overruns risk in large-scale infrastructure projects. The finding result of the study indicated and confirmed that project delays at all phases like initiation, planning, and implementation have a positive and significant effect on cost overruns in large-scale infrastructure projects in

Rwanda focusing on Bugesera International Airport as a case study. This means that the delays in the initiation phase of project have significantly increase land acquisition costs secondary research findings confirmed that delays in Planning phase directly escalated labor costs finally the study findings results showed that delays in implementation-phase increased material costs the researcher concluded that the Cumulative delays across all phases increase overall project costs.

5.2. Recommendations

1. From the findings results which indicated that delays significantly increased land acquisition costs. The researcher recommended that the project managers must conduct comprehensive and clear land surveys, engage communities early and documentation processes to reduce delays at the initiation phase of the project and preventing cost escalations.
2. As per findings results confirmed that delays in Planning-phase significantly influenced labor cost overruns. The researcher recommended that the project designers must Clearly conduct risk assessments during project planning phase to minimize labor-related delays and associated costs.
3. The study findings result as per confirmation indicated that delays in Implementation phase significantly increased material costs. The researcher recommended must clearly Strengthening contractor selection and improving stakeholder communication to reduce delays in implementation phase and control costs.

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