MAKERERE UNIVERSITY

COLLEGE OF ENGINEERING, DESIGN, ART AND TECHNOLOGY

SCHOOL OF BUILT ENVIRONMENT

DEPARTMENT OF CONSTRUCTION ECONOMICS AND MANAGEMENT

VARIATIONS IN PUBLIC CONSTRUCTION PROJECTS IN UGANDA: CAUSES, COST IMPLICATIONS AND GOVERNANCE WEAKNESSES

BY

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A MASTERS PROJECT REPORT SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF THE MASTER OF SCIENCE IN CONSTRUCTION MANAGEMENT OF MAKERERE UNIVERSITY

JUNE 2026

DECLARATION

I, BYARUHANGA JOHN WILLIAM, declare to the best of my knowledge that this report in its originality is the product of my hard work for the award of the degree of Master of Science in Construction Management. This report has never been presented anywhere else for the award of Masters Degree in any University or Institution and can be used as reference for studies and not duplication.

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APPROVAL

This is to approve that this report has been done under my supervision. It is now ready for submission to the Department of Construction Economics and Management, College of Engineering, Design, Art and Technology, Makerere University, Kampala.

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Makerere University.

DEDICATION

This technical report is dedicated to my academic supervisor, Dr. Bwambale Andrew, whose guidance, encouragement, and scholarly support greatly contributed to the successful completion of this academic milestone. The report is also dedicated to my beloved family, relatives, lecturers, fellow course mates, and all those who tirelessly supported me throughout my academic journey. Their emotional, moral, and financial support played a significant role in enabling me to complete this programme successfully. May the Almighty God abundantly reward them for their kindness and unwavering support.

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I would like to express my sincere gratitude to the Almighty God for the gift of life, good health, protection, and strength throughout the course of my studies.

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I further extend my heartfelt appreciation to the lecturers and my fellow classmates for their encouragement, cooperation, and support throughout the duration of the programme.

In addition, I sincerely appreciate my employer, Professional Engineering Consultants [PEC] Ltd, for the unwavering support, understanding, and encouragement extended to me during the period in which I was balancing both academic obligations and professional responsibilities.

Last but not least, I extend my heartfelt gratitude to my beloved wife, children, other family members, and relatives for their enormous moral, emotional, and financial support throughout the course of this programme.

EXECUTIVE SUMMARY

Variations are a common occurrence in construction projects and constitute an integral aspect of contract administration. However, in many public construction projects in Uganda, excessive and poorly managed variations have increasingly contributed to cost overruns, delays in project completion, contractual disputes, disruption of planned implementation, and reduced value for money in the utilization of public resources. This technical report examined variations in selected public construction projects in Uganda, with particular focus on their causes, cost implications, and governance weaknesses associated with their management.

The study was grounded in the author's professional involvement in the project management and contract administration of public infrastructure projects implemented under both government and donor-funded programmes. The principal case study was the Uganda Support to Municipal Infrastructure Development - Additional Financing [USMID-AF] Project implemented in Lugazi Municipal Council under Batch 2 from June 2022 to March 2025. To enrich the analysis, additional case studies were drawn from projects implemented under the same programme in Jinja City and Kamuli Municipality during the same period of June 2022 to March 2025. Additional projects that constituted the case studies were the Ssezibwa Bridge Reconstruction Project under the Ministry of Works and Transport that was commenced in June 2024 and is still ongoing, and the KIIDP2 Batch 1B implemented in Kampala Capital City Authority [KCCA] from September 2015 to April 2019. These projects constituted the Case Studies 1, 2, 3, 4 and 5 in that order.

The study adopted a qualitative case study approach supported by documentary review, project records analysis, professional observations, and thematic analysis. Data were obtained from contract documents, variation instructions/ change orders/variation orders, extension of time claims, payment certificates, project reports, meeting minutes, and relevant literature on construction variations and governance systems including standard forms of construction contracts, academic literature, textbooks, government policies and regulatory frameworks, and institutional reports.

The findings established that inadequate design development and deficient BoQs were the primary drivers of variations. Other causes identified across the projects included technology upgrades, scope changes, inadequate project preparation, utility relocation requirements, land acquisition challenges, and time-related costs arising from extensions of time. Several projects experienced major design review adjustments shortly after commencement of

construction, indicating weaknesses in pre-contract investigations and design development processes.

The study further established that variations had significant cost implications on the selected projects. The reviewed projects experienced overall contract price increases ranging from approximately 5% to 19% above the original contract sums. The observed lower limit of approximately 5% exceeded the PPDA's regulatory threshold of 1.5%, beyond which single or cumulated variations can no longer be treated as simple change orders approved solely by the Contract Manager and the Accounting Officer. This implies that the variations were substantial in nature and therefore required formal contract amendments subject to the requisite approvals of the Entity's Contracts Committee and the Solicitor General [SG]. Furthermore, the observed upper limit of approximately 19% exceeded the PPDA's regulatory threshold of not more than 15% applicable to a single contract amendment. This further demonstrates the magnitude and significance of the variations, to the extent that processing such adjustments under a single amendment would constitute statutory non-compliance. These findings justify the conclusion that the variations, which largely originated from the implementation of design review recommendations, were indicative of deficiencies in project planning, design and overall project management processes.

In addition to direct cost increases arising from additional works, variations resulted in increased preliminary and general costs during extended implementation periods, including prolonged site establishment obligations, supervision attendance costs, traffic management expenses, and environmental, safety, health and social compliance costs. Variations also contributed to delays in project completion and disruption of implementation schedules.

The report further identified several governance weaknesses that influenced both the occurrence and management of variations. These included inadequate project preparation, delayed approvals and decision-making, weak coordination among stakeholders, delayed utility relocations, weak enforcement of regulatory requirements, funding constraints, and political interference in project implementation decisions. In some cases, approvals for variations were significantly delayed despite urgent implementation requirements, thereby contributing to additional downstream changes and project inefficiencies.

In conclusion, although variations are inevitable in construction projects, many of the variations experienced in Ugandan public construction projects arise from avoidable weaknesses in planning, design management, governance systems, and contract

administration practices. Effective mitigation of excessive variations therefore requires improvements in project preparation, design reviews, stakeholder coordination, regulatory compliance, timely decision-making, and proactive supervision throughout the project lifecycle.

The report recommends strengthening feasibility studies and detailed engineering designs before procurement, improving quality assurance during preparation of Bills of Quantities and contract documentation, enhancing coordination among implementing agencies and utility providers, enforcing regulatory approval requirements for variations, and strengthening institutional capacity in public-sector contract management. The report further recommends adoption of proactive project governance and supervision systems aimed at improving accountability, minimizing avoidable variations, and enhancing value for money in public infrastructure development.

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LIST OF ABBREVIATIONS/ ACRONYMS

Abbreviation / Acronym	Meaning
BoQ	Bills of Quantities
CCTV	Closed-Circuit Television
CRSG	China Railway Seventh Group Corporation Ltd.
DC	Design Consultant
DLP	Defects Liability Period
EoT	Extension of Time
ESHS	Environmental, Social, Health and Safety
ESIA	Environmental and Social Impact Assessment
FIDIC	International Federation of Consulting Engineers
IDA	International Development Association
IPC	Interim Payment Certificate
ITS	Intelligent Transport System
JC	Jinja City
JCC	Jinja City Council
JV	Joint Venture
KCCA	Kampala Capital City Authority
KECC	Korea Engineering Consultants Corporation Ltd.
KIIDP2	Second Kampala Institutional and Infrastructure Development Project
KMC	Kamuli Municipal Council
LMC	Lugazi Municipal Council
MLHUD	Ministry of Lands, Housing and Urban Development
MOWT	Ministry of Works and Transport
MSCM	Master of Science in Construction Management
NEC	New Engineering Contract
NDP II	Second National Development Plan
NEMA	National Environment Management Authority
NITA-U	National Information Technology Authority – Uganda
PDE	Procuring and Disposing Entity

Abbreviation / Acronym	Meaning
PEC	Professional Engineering Consultants Ltd.
PforR	Programme-for-Results
PPDA	Public Procurement and Disposal of Public Assets
QA	Quality Assurance
QC	Quality Control
QCBS	Quality and Cost-Based Selection
RC	Reinforced Concrete
ROW	Right of Way
SBD	Standard Bidding Document
SC	Supervision Consultant
SG	Solicitor General
UB	UB Consulting Engineers Ltd.
UGX	Uganda Shillings
UNRA	Uganda National Roads Authority
USD	United States Dollar
USMID	Uganda Support to Municipal Infrastructure Development
USMID-AF	Uganda Support to Municipal Infrastructure Development – Additional Financing
VAT	Value Added Tax
VO	Variation Order
WB	World Bank
WRKS	Works

1 INTRODUCTION

1.1 Background

1.1.1 General

The candidate, having undertaken a programme leading to the award of a degree of Master of Science in Construction Management [MSCM], is required [under academic supervision], to prepare, present and submit a technical report in partial fulfillment of the requirements for the award of the degree by Makerere University.

This technical report is grounded in the most recent construction project, described in detail in Section 1.4 below [presented as Case Study 1], in which the candidate has played a significant role in construction project management and contract administration. Furthermore, in accordance with the University's guidelines, the report is developed around a selected thematic area identified by the candidate as follows:

1.1.2 Theme of the technical report

The principal theme underpinning the technical report is "**Variations in Public Construction Projects in Uganda"**.

In alignment with both the report topic and the principal theme, the following sub-themes have been identified:

(i) Causes of Variations;

(ii) Cost Implications of Variations; and

(iii) Governance Weaknesses in Managing Variations.

Collectively, the main theme and its associated sub-themes constitute the overarching central focus of this technical report.

To enhance the analytical depth of the technical report, the examination of the core theme has been extended to encompass several additional recent projects in which the candidate participated. These projects are briefly outlined in Sub-section 1.4.8 below and are presented as Case Studies 2, 3, 4 and 5.

1.2 Problem Statement

Public construction projects in Uganda frequently experience variations during project implementation in the form of additions, omissions, alterations, substitutions, and

modifications to the originally contracted scope of works. Although variations are an inherent aspect of construction contract administration, excessive and poorly managed variations have increasingly undermined the performance of public infrastructure projects through cost overruns, delays in project completion, disruption of planned execution, contractual disputes, and reduced value for money in the utilization of public resources. Conversely, the inclusion of variation provisions in construction contracts provides a structured contractual framework for managing necessary modifications arising after contract execution, thereby facilitating their implementation without the need to resort to formal contractual claims or dispute resolution mechanisms.

Existing literature indicates that variations commonly arise from factors such as scope changes, design deficiencies, financial constraints, inadequate planning, delayed approvals, poor coordination, contractual ambiguities, unforeseen site conditions, and weak stakeholder coordination. Several studies further associate variations with governance weaknesses including weak procurement systems, ineffective contract administration, inadequate supervision, delayed decision-making, and weak institutional controls. However, most empirical studies on variations have been conducted outside Uganda, particularly in countries such as Nigeria, Saudi Arabia, Malaysia, Vietnam, Palestine, and Tanzania. Consequently, there remains limited context-specific evidence on how these factors manifest within Ugandan public construction projects.

The challenge is particularly significant within Uganda's public infrastructure sector, where projects are implemented within complex procurement and contract management environments characterized by multiple stakeholders, funding limitations, land acquisition challenges, utility relocation challenges, and evolving project requirements. Evidence from the projects examined in this technical report indicates that variations frequently arise from deficiencies in designs and bills of quantities, delayed approvals, scope changes, financial constraints, utility relocation challenges, and governance-related inefficiencies, with significant implications on project cost, time, and contract administration.

This technical report therefore seeks to examine variations in selected public construction projects in Uganda in which the author participated in project management and contract administration roles, with particular emphasis on their causes, cost implications, and associated governance weaknesses, in order to contribute to improved management of public construction contracts and the enhancement of value for money in infrastructure

development.

1.3 Objectives

1.3.1 Main objective

The main objective is to identify and analyze variations in public construction projects in Uganda, with particular focus on their causes, cost implications and governance weaknesses.

1.3.2 Specific objectives

In alignment with the main objective, the Specific objectives are:

i). To identify and examine the key factors causing variations in public construction projects in Uganda.

ii). To assess the impacts of variations on the overall costs of construction.

iii). To examine the governance weaknesses contributing to and/ or influencing the management of variations.

iv). To propose strategies for mitigating variations and enhancing governance in public construction projects in Uganda.

1.4 Project Description

1.4.1 General

The theme of this technical report was identified for investigation within the context of a project implemented by Lugazi Municipal Council [LMC] under the *Uganda Support to Municipal Infrastructure Development – Additional Funding [USMID-AF] Project Phase 2*. The project comprised two separate works contracts: [i] Contract Reference No. LUG788/USMID/WRKS/21-22/00001, which entailed the construction of urban road infrastructure, including 14 roads with a combined length of 10.7 km, as well as a primary urban drainage channel measuring 1.6 km; and [ii] Contract Reference No. LUG788/USMID/WRKS/21-22/00002, which involved the installation of 250 solar-powered street lights along the Kampala–Jinja Highway within the precincts of LMC.

Although the two contracts were executed by different contractors, they were administered under the supervision of a single project manager, as further elaborated in Sub-section 1.4.3 below. For the purposes of this technical report, this project is herein designated as Case Study 1; and its detailed description is presented in Sub-sections 1.4.2 through to 1.4.7 below.

1.4.2 Project background

The primary objective of enhancing the institutional performance of fourteen municipal councils, with a view to improving urban service delivery, informed the implementation of the first phase of the Uganda Support to Municipal Infrastructure Development [USMID] Programme by the Government of Uganda, through the Ministry of Lands, Housing and Urban Development [MLHUD]. This phase was executed over the financial years 2013/14 to 2017/18 as a five-year Programme-for-Results [PforR], supported by loan financing of USD 150 million from the International Development Association [IDA] of the World Bank. The programme was aligned with the Second National Development Plan [NDP II], which identified infrastructure as a key complementary sector for economic growth (Government of Uganda [MLHUD], n.d.–b). The first phase of the program was successfully completed on 31 December 2018 (Government of Uganda [MLHUD], 2019).

Subsequently, a second phase, referred to as the USMID Additional Financing [USMID-AF] Program, was implemented, supported by an additional IDA loan of USD 360 million. This phase was delivered in two batches over a five-year period spanning 2018/19 to 2022/23 and was successfully concluded on 30 June 2024. Under this phase, the number of beneficiary local government entities increased to thirty, comprising twenty-two municipalities and eight refugee-hosting districts (Government of Uganda [MLHUD], n.d.–a). Lugazi Municipal Council was among the beneficiaries of the second phase, and the project forming the subject of this technical report falls under the second batch [USMID-AF Batch 2] of this phase.

1.4.3 Summary of project details

The summaries of key project details are presented below for the two works contracts and the supervision services contract in Tables 1 through to 3.

Table 1: Project details for Works Contract ref. LUG788/USMID/WRKS/21-22/00001 [Case Study 1]

Project Title:	Uganda Support to Municipal Infrastructure Development – Additional Funding [USMID-AF] Project
Contract Title:	Construction of Selected Road Infrastructure under Batch 2 including Ntenga road [1.425Km], Station road [0.937Km], Hassan Zirabamuzaale road [0.18Km], Sempala road [0.753Km], Church road [0.37KM], Gitta road [0.313Km],

	Adventist road [0.72Km], Cathedral 1 road [1.31Km], Cathedral 2 road [0.216Km], UMEA road [0.16Km], Kinyoro 2 road [0.386Km], Nalule Miyodi road [0.104Km], Namengo-Kibubu road [2.373Km], Line Murefu road [1.509Km], and Lugazi Main Drainage Channel [1.596Km].
Type of Contract:	Admeasurement Contract
Employer:	Lugazi Municipal Council
Contract Manager:	Eng. Daniel Kamya/ Municipal Engineer
Project Manager:	M/s Professional Engineering Consultants Ltd. in Joint Venture with UB Consulting Engineers Ltd.
Project Manager's Representative:	Eng. John William Byaruhanga
Contractor:	M/S Zhongmei Engineering Group Limited
Contract Start Date:	13th June 2022
Initial Intended Completion Date	12 months from Start Date; i.e., by 13th June 2023
Time Extension	Total 9.60 months [292 Calendar Days], awarded on 4 occasions i.e., 4.6 months [140 days], 1.41 months [43 days], 0.59 months [18 days] and 2.99 months [91 days] respectively.
Revised Completion Date	31st March 2024
Defects Liability Period:	365 days [12 months]/ expiring on 30th March 2025
Initial [Accepted] Contract Price:	UGX 27,103,215,731 VAT Exclusive
Variation	UGX 1,417,574,930 [5.23%]
Revised [Final] Contract Price	UGX 28,520,790,661
Reasons for Variation	Design review revealed grave inadequacies in the designs and BoQs which were harmonized and the scope of works varied accordingly. The other cause was Time-related items during EoT of 4.6 months. The solar street lighting specification was upgraded leading to increased unit rate thereof.

Table 2: Project Details for the Works Contract ref. LUG788/USMID/WRKS/21-22/00002 [Case Study 1]

Project Title:	Uganda Support To Municipal Infrastructure Development – Additional Funding [USMID-AF] Project
Contract Title:	Supply and Installation of 250 Solar Street Lights to Lugazi Municipal Council
Type of Contract:	Admeasurement Contract
Employer:	Lugazi Municipal Council
Contract Manager:	Eng. Daniel Kamya/ Municipal Engineer
Project Manager:	M/s Professional Engineering Consultants Ltd. in Joint Venture with UB Consulting Engineers Ltd.
Project Manager's Representative:	Eng. John William Byaruhanga
Contractor:	M/s Reliefline Uganda Limited
Contract Start Date:	13th June 2022
Intended Completion Date	12 months from Start Date; i.e., by 13th June 2023
Time Extension	1.5 months
Revised intended completion date	28th July 2023
Practical Completion Date	24th October 2023
Defects Liability Period:	365 days [12 months], ending on 23rd October 2024
Initial (Accepted) Contract Price:	UGX 1,825,000,000 VAT Exclusive
Variation of Contract Price	UGX – 1,900,000 [-0.104%]
Final Contract Sum	UGX 1,823,100,000
Reasons for Variation	The solar street lighting specification was upgraded leading to increased unit rate thereof from UGX 7,300,000 to UGX 8,850,000. The total number of street lights installed under this

	contract was accordingly reduced from 250 to 206 and, at the new unit rate, this led to the reduced final contract sum.

Table 3: Project Details for the Supervision Services Contract ref. LUG788/ SRVCS/21-22/00011 [Case Study 1]

Contract Title:	Consultancy Services for Design Review and Construction Supervision of Civil Works for Infrastructure Sub-projects under Batch 2 – Cluster 4 – Lugazi Municipal Council
Client:	Lugazi Municipal Council
Consultant (Project Manager):	M/s Professional Engineering Consultants Ltd. in Joint Venture with UB Consulting Engineers Ltd.
Member in Charge:	Lead Consultant - M/s Professional Engineering Consultants Ltd [PEC]
Authorized Representative:	Client: Town Clerk, Lugazi Municipal Council; Consultant: Mr. Bonnie Kalanzi Nsambu
Project Manager's Representative	Eng. John William Byaruhanga
Commencement Date:	19th May 2022
Completion Date:	12 months Design Review and Construction Supervision + 12 months Defects Liability Period [DLP]
Type of Contract:	LUMPSUM
Contract Amount:	UGX 978,912,000

1.4.4 Scope of works

As indicated in Sub-section 1.4.1 above, the scope of works under Contract No. LUG788/USMID/WRKS/21–22/00001 [the main project], executed by M/S Zhongmei Engineering Group Limited, entailed the reconstruction and upgrading of fourteen [14] urban roads with a combined length of approximately 10.7 km. The works executed under this contract comprised the following components:

- Mobilization and establishment on site [facilities installed/ constructed at the workers' camp comprised: Sanitation facilities, offices, accommodation for expatriate personnel, stores, workshops, material storage areas, casting yard, materials testing laboratory, and asphalt plant];

- Services relocation [water, electricity, telecom] including the required ducting;
- Materials sourcing, opening up and restoration of borrow pits;
- Earthworks including cut and fill;
- Widening of existing carriage way and embankment;
- Pavement layers and surfacing: gravel sub-base, crushed stone-base and asphalt concrete surfacing;
- Longitudinal drainage works consisting of concrete kerbing and gutters, interlocking block-paved raised sidewalks, concrete-lined open channels, covered concrete drains, reinforced concrete pipe culverts and reinforced concrete manholes;
- Cross drainage consisting of concrete pipe culverts and reinforced concrete box culverts;
- Longitudinal and cross service ducts;
- Ancillary works comprising road marking, traffic signs, marker posts, guardrails, landscaping [topsoiling, grassing and tree planting], and solar street lighting;
- Safe accommodation of traffic during construction;
- Implementation of Health & Safety, Social and Environmental safeguards plans;
- Primary drainage channel works: Reinforced concrete box culverts [4 locations], reinforced concrete bedding with upstand, stone masonry vertical walling, covered rectangular sections, and reinforced concrete retaining wall.

The Photographic illustrations of this project are presented in Appendix 1.

1.4.5 Author's involvement on the project

On this project, the author was engaged by the Project Manager, M/s Professional Engineering Consultants in joint venture with M/s UB Consulting Engineers, in the capacity of Project Manager's Representative/Resident Engineer and Team Leader. Figure 1 below presents the organogram of the project manager. The author oversaw the mobilization and assignment of the Consultants design review and supervision teams.

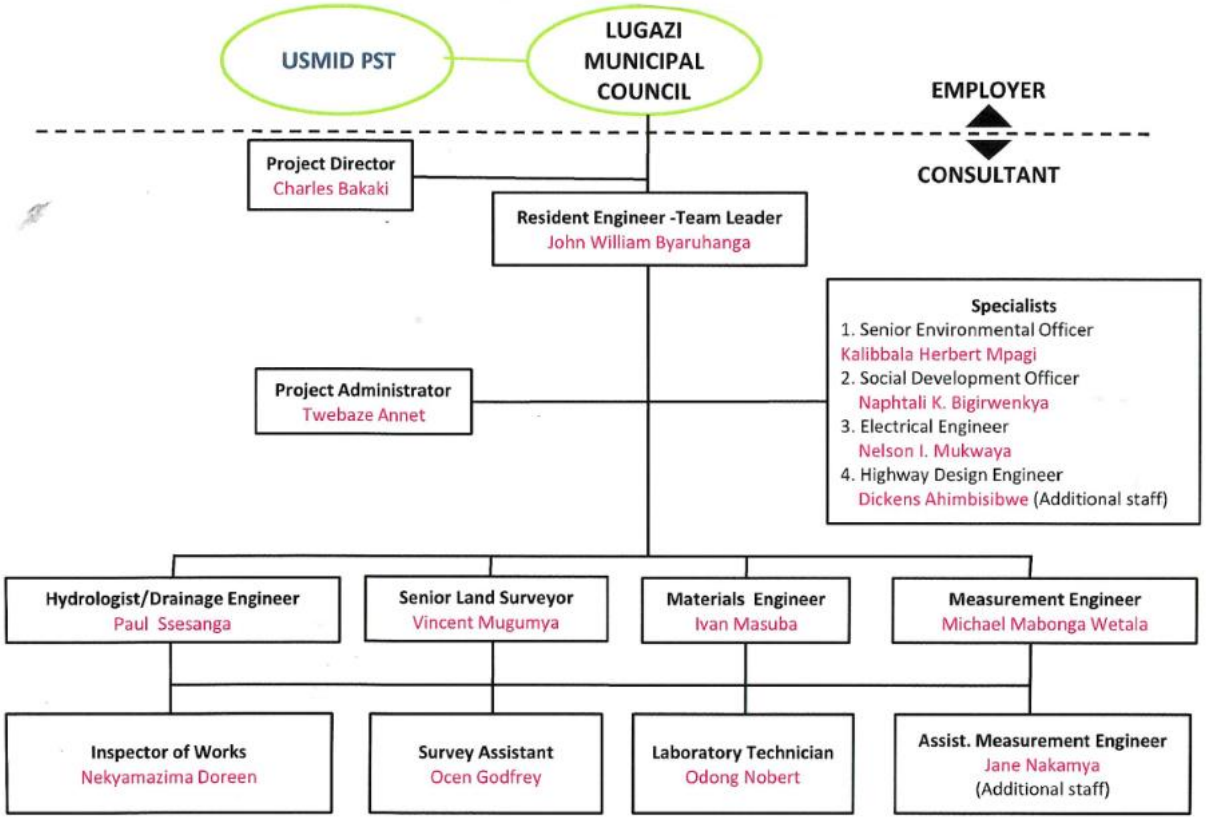


Figure 1: Project Manager's Organogram

In accordance with the provisions of the Consultancy Services Contract, the Project Manager's obligations and responsibilities comprised the discharge of the functions assigned to the Project Manager under the Works Contract, including contract administration and the supervision of construction activities on behalf of the Client throughout both the construction period and the defects liability period. In accordance with the terms of this appointment, the author undertook key roles on the project in dual capacities, namely as the Client's Agent and as an Independent Certifier/Independent Professional, as further elaborated in the subsequent paragraphs.

Roles performed in the Project Manager's capacity as a Client's Agent:

In this capacity, the author effectively discharged the following roles:

- ***Advising the Client***: The author provided structured and formal advice to the Client on a wide range of project-related matters, communicated through written correspondence and during formal forums such as site meetings, technical meetings, and management meetings. Key areas of advisory input included: timely grant of site possession; prompt issuance of contractual documents to the Contractor; rectification

of inconsistencies within contract documentation, including alignment with applicable standard specifications; recommendations for design modifications [notably in relation to solar street lighting systems, influenced by technological advancements]; assessment of funding adequacy following design reviews; interpretation of the implications of the Contractor's contractual notices; identification of delays attributable to the Employer; evaluation of the necessity and implications of variations; and assessment of the consequences of unrectified defects or snags, including their valuation, particularly in anticipation of the expiry of the Defects Liability Period [DLP].

- ***Providing information to the Contractor***: In fulfilment of this role, the author ensured the timely and systematic dissemination of essential project information to the Contractor. This included, inter alia: copies of contract documents; standardized templates for quality control [QC] and quality assurance [QA]; technical clarifications; formats for interim payment certificates; setting-out data; construction drawings; revised Bills of Quantities following design review; approved meeting minutes; introductory correspondence to utility authorities; formal responses to the Contractor's submissions [including approvals and rejections, as appropriate]; reminders regarding contractual milestones and obligations; and guidance on compliance with Environmental, Social, Health, and Safety [ESHS] safeguards.
- ***Issuance of instructions to the Contractor***: The author consistently issued formal instructions to the Contractor throughout both the construction phase and the DLP. These instructions encompassed, among other matters: detailed construction requirements; rectification of non-compliant works; stakeholder engagement directives; requests for submission of quotations; extension of performance guarantees and other securities and policies; removal of personnel from site on grounds of misconduct; submission and updating of work programmes; reinstatement of damaged properties; and rectification of defects and snags.
- ***Supervision and Inspection***: The author established and maintained robust quality assurance and quality control procedures, ensuring that the Project Manager's personnel effectively executed their supervisory functions. These activities, often undertaken collaboratively with the Contractor's team, included: approval of material sources through testing; routine sampling and testing of materials delivered to site;

development and verification of mix designs; verification of setting-out works; inspections conducted before, during, and after completion of construction activities to facilitate approval prior to cover-up; surveys to confirm compliance with specified construction tolerances; testing of completed works; management of changes; monitoring of construction progress and facilitation of progress review meetings; oversight of compliance with Environmental, Social, Health, and Safety [ESHS] requirements and issuance of corrective instructions; and capacity building through training of the Client's graduate trainees. Other supervision aspects included management of communications involving the Employer, the Project Manager, the Contractor, and the stakeholders; management of the stakeholders including consultative meetings and follow-ups; change management including initiation, evaluation and approval processing; value engineering and value management; management of procurement of utility services relocation providers; risk management through monthly assessment of the risk register and monitoring of the planned mitigation measures' effectiveness.

- ***Quantity surveying function***: In this role, the author ensured that the Project Manager's team adequately fulfilled all obligations associated with the admeasurement contract. Core responsibilities included: preparation of accurate quantity take-offs based on design review drawings to evaluate the adequacy of the contract Bills of Quantities; implementation of measurement and cost control procedures; review and verification of the Contractor's interim payment applications and preparation of Interim Payment Certificates [IPCs]; and continuous valuation and financial assessment to facilitate the determination and updating of the final contract price estimate for monthly reporting.

Roles performed in the Project Manager's capacity as an Independent Professional/ Independent Certifier:

In this capacity, the Project Manager is required to exercise impartial judgment and make determinations independent of the Client's influence. In this regard, the author effectively discharged the following roles:

- ***Certification***: In accordance with the provisions of the works contracts, the author undertook the preparation and issuance of contractual certificates, utilizing formats developed and formally communicated to the Contractor as applicable. These included:

- Interim Payment Certificates [IPCs]: During the construction period spanning June 2022 to March 2024, the author certified nine [9] IPCs. A further two [2] IPCs were certified during the DLP. These certificates covered the valuation of executed works, materials delivered to site, and compliance with general contractual obligations.
- Certificates recording contractual events: The author issued certificates evidencing significant contractual milestones, including: [i] a *Certificate of Completion* dated 14th May 2024, certifying that substantial completion was achieved on 31st March 2024. This certification effected the Employer's takeover of the works, marked the commencement of the DLP, and entitled the Contractor to release of the first 50% of retention, as well as the remaining 50% subject to the provision of an appropriate bank guarantee; and [ii] a *Defects Liability Certificate* dated 18th December 2025, certifying that all notified defects had been satisfactorily remedied as of 30th June 2025.
- Final Certificate: The *Final Account* [Final Certificate], dated 28th July 2025, was issued to confirm the total amount due to the Contractor under the contract, incorporating all payments related to the execution of the works and the rectification of defects.

- ***Claims management***: The author evaluated four [4] claims submitted by the Contractor for extensions of time, granting appropriate extensions following detailed assessment of the supporting particulars. The delays giving rise to these claims were attributable to multiple factors, including: delayed relocation of utility services; adverse weather conditions characterized by abnormal rainfall; inefficiencies on the part of contractor's subcontractors; delays in procurement of construction materials; generally slow progress due to failure to achieve planned productivity rates, even in unencumbered work sections; and delayed mobilization of the asphalt plant and associated equipment.

  Applying the principle of concurrent delay, the author determined that the delays were partly attributable to both the Employer and the Contractor. Consequently, extensions of time were granted on a "no-cost" basis, resulting in the revision of the contractual completion date from 13th June 2023 to 31st March 2024.

1.4.6 Challenges and mitigation measures

The implementation of the Project encountered several technical, contractual, and implementation challenges during both the Design Review and Construction Supervision phases.

The design review phase challenges mainly comprised the following:

- ***Inadequacies in the original design***: At the commencement of the design review, it became evident that the designs prepared by the Design Consultant [DC] contained significant technical deficiencies and could not be updated to an acceptable standard to facilitate construction. Consequently, the Supervision Consultant [SC] undertook fresh topographical surveys and completely redesigned the affected project components at no additional cost to the Employer, thereby ensuring that technically sound and constructible designs were available for implementation.
- ***Deficiencies in the Bills of Quantities***: The design review also revealed substantial deficiencies in the Bills of Quantities [BoQs], including significant underestimation of quantities, omission of several work items [most notably longitudinal drainage works], and other measurement inaccuracies. To mitigate the potential financial implications of these shortcomings, the SC comprehensively identified, quantified and documented all deficiencies, assessed their cost implications, and advised the Employer on an appropriate revision of the project scope to align the proposed works with the available budget.
- ***Escalation of Construction Cost***: As a consequence of the revised designs and corrected quantities, the reviewed construction cost increased from UGX 277,103,215,731 to UGX 37,621,071,719, representing a cost increase of UGX 10,517,855,988 [38.81%]. Owing to budgetary constraints, the Employer was unable to finance the entire increase. Acting on the advice of the Project Manager, the Employer reprioritized the project components and approved a revised scope of works by omitting selected infrastructure elements. Consequently, the revised Contract Sum was established at UGX 28,604,416,084, representing a net increase of UGX 1,501,200,353 [5.54%] above the original Contract Sum.
- ***Delay in completion of the Design Review***: The Design Review was originally programmed for completion within the first two months of the twelve-month

Construction Supervision period, that is, by 13th August 2022. However, the extensive redesign activities and associated scope revisions extended the Design Review period, culminating in submission of the final Design Review Report on 2nd December 2022, approximately three months beyond the planned completion date. To prevent any consequential delay to the commencement and progress of the Works, the SC proactively prepared and, following agreement with the Employer's Contract Manager, issued approved construction drawings progressively to the Contractor before formal completion of the Design Review. This approach ensured uninterrupted construction activities despite the delayed completion of the design review process.

Besides, the Works implementation phase challenges comprised mainly the following:

- ***Delayed relocation of utility services***: Relocation of existing utility services experienced considerable delays arising from the need to identify utility owners, prepare and approve relocation schemes, procure relocation contractors through competitive bidding, and execute the relocation works. Although the Project Manager actively coordinated stakeholder engagements to expedite the process, delays in utility relocation remained the principal contributor to the extension of the Contract Time.
- ***Adverse Weather***: The Project experienced prolonged periods of abnormally high rainfall, which adversely affected earthworks and other weather-sensitive construction activities, thereby contributing to delays in the overall programme.
- ***Delayed access to Sections of the Site***: Possession of certain sections of the Site was impeded by Right-of-Way (ROW) constraints, for which the Contractor duly issued the required contractual notices. Resolution of these encumbrances required active intervention by the Employer through stakeholder negotiations, compensation processes, and, where necessary, enforcement actions involving the removal of illegally erected structures. As a mitigation measure, the Contractor was instructed to re-sequence the works by first progressing in accessible areas while the affected sections were being cleared. Nevertheless, these constraints significantly contributed to the overall time overrun.
- ***Contractor Performance Challenges:*** Throughout the implementation period, the Contractor experienced several performance-related challenges, including slow progress, persistent cash flow constraints, delays in procurement of construction

materials, high labour turnover, and poor performance of local-content subcontractors. During assessment of the Contractor's requests for Extension of Time [EoT], these Contractor-attributable delays were evaluated alongside Employer-risk events using the principle of concurrent delay. Consequently, while appropriate extensions of time were granted where justified, entitlement to prolongation costs attributable to concurrent Contractor delays was not recognized, thereby shielding the Employer from avoidable additional financial liability.

1.4.7 Lessons learned

The lessons learned from the experiences of this project throughout the design review and implementation phases consist of the following:

- Engineering designs and Bills of Quantities should undergo independent technical review and quality assurance, and possibly audits, before procurement to ensure completeness, constructability and consistency with site conditions;
- Comprehensive topographical, geotechnical, hydrological and utility investigations should be completed before commencement of detailed design to minimize unforeseen conditions during construction;
- Utility identification, costing, approvals and relocation should preferably be completed before commencement of civil works, rather than leaving the process to the contractor during construction which results in delays/ works progress disruption;
- Design optimization during project preparation provides better value for money than implementing extensive variations during construction;
- Prompt contractual decisions and effective communication among stakeholders significantly reduce implementation delays;
- Construction supervision teams should comprise competent multidisciplinary professionals with sufficient flexibility to respond to changing project requirements;
- Proper documentation, timely contractual correspondence and strict adherence to contract provisions greatly reduce disputes and facilitate successful project completion;
- Project implementation plans should incorporate realistic contingencies for

technical, financial, environmental and contractual risks to improve resilience and minimize schedule disruptions.

1.4.8 Overview of other projects included in this technical report

An overview of additional projects undertaken by the author is presented below, designated as Case Study 2, Case Study 3, Case Study 4, and Case Study 5. These, together with Case Study 1 described in detail above, provided the requisite data and insights necessary to comprehensively address the central theme of this technical report.

Case Study 2: USMID-AF Batch 2, Jinja City [June 2022 to March 2024]

Table 4: Project details for Works Contract ref. JC854/USMID/WRKS/21-22/00057 [Case Study 2]

Project Title:	Uganda Support to Municipal Infrastructure Development – Additional Funding [USMID-AF] Project
Contract Title:	Rehabilitation of Clive and Clerk roads [1.891km], Bell Avenue East & West [1.466km], Completion of Busoga Avenue [0.75km], Traffic signalling [2No.] and Drainage Works [1.782km]
Contract Type.:	Admeasurement Contract
Employer:	Jinja City
Contract Manager:	David Ereemye/ City Engineer
Project Manager:	M/s Professional Engineering Consultants Ltd. in Joint Venture with UB Consulting Engineers Ltd.
Project Manager's Representative:	Eng. John William Byaruhanga
Contractor:	M/s Zhongmei Engineering Group Limited
Contract Start Date:	13th June 2022
Initial Intended Completion Date	12 months from Start Date; i.e., by 13th June 2023
Time of Extension	Total 9.60 months [292 Calendar Days], awarded on 4 occasions i.e., 4.60 months [140 days], 1.41 months [43 days], 0.59 months [18 days] and 2.99 months [91 days] respectively.
Revised Intended	31st March 2024

Completion Date	
Defects Liability Period:	365 days [12 months]/ expiring on 30th March 2025
Initial [Accepted] Contract Price:	UGX 16,536,240,976 VAT Exclusive
Variation of Contract Price	UGX 2,592,078,920 [15.68%]
Revised Contract Price	UGX 19,128,319,896 VAT Exclusive
Reasons for VOs	Design review revealed grave inadequacies in the designs and BoQs which were harmonized and the scope of works varied accordingly. The other cause was Time-related items during EoT of 4.6 months. Besides, toward the end of construction, the Employer realised some additional funds for the Project.

Case Study 3: USMID-AF Batch 2, Kamuli Municipality [June 2022 to March 2024]

Table 5: Project details for Works Contract ref. KMC789/USMID-AF/WRKS/2021-22/00007 [Case Study 3]

Project Title:	Uganda Support to Municipal Infrastructure Development – Additional Funding (USMID-AF) Project
Contract Title:	Construction of Selected Road Infrastructure in Kamuli Municipal Council under Batch 2 Cluster 4 involving Nadiope Road [0.412Km], Babubhai Road[0.181Km], Badaza Road [0.317Km], Muwanga Road [0.369Km], Ben Lubaale Road [0.47Km], Commercial Road [0.635Km], Lubaga Road [1.094Km], Kadhuba Road [1.272Km] and Hajjat Watongola Road [0.265Km].
Employer:	Kamuli Municipal Council
Contract Manager:	Eng. Yosia Denga/ Municipal Engineer
Project Manager:	M/s Professional Engineering Consultants Ltd. in Joint Venture with UB Consulting Engineers Ltd.
Project Manager's Representative:	Eng. John William Byaruhanga
Contractor:	M/s Zhongmei Engineering Group Limited
Contract Start Date:	13th June 2022

Intended Completion Date	12 months from Start Date; i.e., by 13th June 2023
Time Extension	Total 9.60 months [292 Calendar Days], awarded on 4 occasions i.e., 4.6 months [140 days], 1.4 months [43 days], 0.59 months [18 days] and 2.99 months [91 days] respectively
Revised Intended Completion Date:	31st March 2024
Defects Liability Period:	365 days [12 months]
Initial [Accepted] Contract Price:	UGX 14,921,485,018 VAT Exclusive
Amount of Variation:	1,602,765,744 [10.74%].
Revised Contract Price:	UGX 16,524,250,762 VAT Exclusive
Reasons for Variations	• Design review revealed grave inadequacies in the designs and BoQs; • The length of Babubhai road increased by 109m and that of Hajjat Watongola Road increased by 174m. In total, the overall road length increased by 250m; • Underestimation of costs for relocation of existing utility services, mainly water and electricity; • Omission, by the DC in the tender BoQs, of the designed box culverts along Commercial road and Kadhuba road; • Upgrade of the street lighting design/ specification; • Additional work for excavation of the drain and installation of associated access culverts along the road link between Badaza road and Muwanga road to get rid of the side drainage problem on the newly constructed Badaza road; • Additional work for excavation and stone pitching works and installation of associated access culverts for the side drain along Abdallah Bagoth road to which storm water from parts of Nadiope road, Badaza road, Muwanga road and Ben Lubaale road discharges, in order to get rid of the drainage problem on these newly constructed roads;

	• Time-related items in Bill No.1 executed during EoT of 4.6 months.

Case Study 4: Ssezibwa Bridge Reconstruction, MOWT [June 2024; ongoing]

Table 6: Project details for Works Contract ref. UNRA/WRKS/2023-2024/00001 [Case Study 4]

Contract/Project Title	Emergency Reconstruction of Ssezibwa Bridge [1.6Km] along Kalagi – Kayunga Road under Design and Build
Procurement Type	Lump Sum
Employer	Ministry of Works and Transport
Contract Manager	Eng. Yasin Kayemba
Engineer [Consultant]	Professional Engineering Consultants Ltd.
Engineer's Representative/ Resident Engineer	Eng. James Walyemwa
Assistant Resident Engineer	Eng. John William Byaruhanga
Contractor	Dynaco Limited [Local Contractor]
Commencement Date	20th June 2024
Initial Expected Completion Date	20th December, 2025
Time of Extension	410 Calendar Days (13.48 months)
Revised Expected Completion Date	03rd February 2027
Contract Price	UGX 54,051,617,179.99 incl. 3% Employer's Contingency 2.5% discount on Civil Works and 18% VAT

Case Study 5: KIIDP 2, KCCA [September 2015 to April 2019]

Table 7: Project details for Works Contract ref. KCCA/KIIDP2/RDS-1 [Case Study 5]

Project Name	Second Kampala Institutional and Infrastructure Development Project [KIIDP2]
Contract Title	Road Upgrading and Junction Improvement Works, Batch 1A
Contract Type	Admeasurement
Employer/Employer	Kampala Capital City Authority [KCCA]

Engineer [Consultant]	Korea Engineering Consultants Corporation Ltd [KECC]
Team Leader/ Resident Engineer	Eng. John William Byaruhanga
Contractor	China Railway Seventh Group Corporation Ltd. [CRSG]
Contract Price	UGX 88,585,529,217
Revised Contract Price	UGX 99,159,571,437
Start Date [per Section]:	
Fairway Junction Section	7th September 2015, confirmed by Order to Commence
Kira Road and Kabira Junction Section	7th September 2015, confirmed by Order to Commence
Mambule Road and Bwaise Junction Section	8th January 2016, confirmed by Order to Commence
Makerere Hill Road Section	12th February 2016, confirmed by Order to Commence
Bakuli-Nakulabye-Kasubi Section	6th May 2016, confirmed by Order to Commence
Time for Completion [per Section]:	
Fairway Junction Section	Original: 8 Months. 1st Revision to 11.98 Months. 2nd Revision to 15.93 Months. 3rd Revision to 18.26 Months. (3rd Revised Completion Date: 15th March 2017).
Kira Road and Kabira Junction Section	Original: 8 Months. 1st Revision to 11.98 Months. 2nd Revision to 15.93 Months. 3rd Revision to 18.89 Months. (3rd Revised Completion Date: 03rd April 2017).
Mambule Road and Bwaise Junction Section	Original: 6 Months. 1st Revision to 10.21 Months. 2nd Revision to 13.66 Months. 3rd Revision to 16.59 Months. 4th Revision to 18.20 Months [4th Revised Completion Date: 13th July 2017; Actual Completion: 11th August 2017].
Makerere Hill Road Section	Original: 12 Months. 1st Revision to 19.96 Months. 2nd Revision to 21.77 Months. 3rd Revision to 23.09. 4th revision to 23.98 months [4th Revised Completion Date: 05th January

	2018].
Bakuli-Nakulabye-Kasubi Section	Original: 12 Months. Revised to 23.01 Months. Revised to 25.02 Months. Revised to 25.81 months [Revised Completion Date: 30th April 2018].
Entire Project Section	Original: 18 Months. Revised to 29.01 Months. Revised to 31.02 Months. Revised to 31.81 months [Revised Completion Date: 30th April 2018].
Defects Liability Period [DLP]	12 Months

1.5 Structure of this Technical Report

This technical report is organized into six chapters.

Chapter One presents the introduction, including the background to the study, problem statement, objectives, and project description. Particularly, this chapter presents a detailed account of the author's involvement in the project in a key project management and contract administration role, thereby demonstrating the practical application of project management principles throughout the project lifecycle. The chapter further documents the principal challenges encountered during design review and project construction phases, together with the corresponding mitigation measures developed and implemented to address them.

Chapter Two presents the literature review relating to variations in construction projects, their causes, cost implications, and governance weaknesses in variation management.

Chapter Three describes the methodology adopted, including the case study approach and methods of data collection and analysis.

Chapter Four presents the findings and analysis of the selected case studies.

Chapter Five discusses the findings in relation to existing literature and the study objectives.

Finally, Chapter Six presents the conclusions, lessons learned, and recommendations arising from the study.

2 LITERATURE REVIEW

2.1 Introduction

This chapter presents the literature review relevant to the technical report theme of "*Variations in Public Construction Projects in Uganda*." The review is structured around the selected sub-themes, namely; Causes of Variations, Cost Implications of Variations, and Governance Weaknesses in Managing Variations. It examines scholarly literature, institutional publications, standard forms of construction contracts, and regulatory frameworks relating to the management of variations in construction projects, also referred to in certain jurisdictions as change orders, variation orders, or contract amendments. The purpose of the review is to establish the existing body of knowledge on the topic, identify prevailing knowledge gaps, and provide a foundation for the analysis and discussion of the selected case studies.

Therefore, in alignment with the selected themes, the literature review was purposely focused on the concept of variations in both the international and local context, causes of variations, cost implications of variations, and governance weaknesses in managing variations. These are discussed in depth in the Sections 2.2 through to 2.5 below.

2.2 The Concept of Variations in Construction Projects

In public-sector construction contracts, a variation is generally understood as a formal modification to the originally agreed scope of works or contract obligations. Although no universally accepted definition exists [the concept is shaped by the applicable jurisdiction and the specific form of contract] there is broad consensus on its essential characteristics, that is, variations typically encompass additions, omissions, substitutions or alterations to the works, including changes to materials, design, or methods of works execution, and are ordinarily accompanied by consequential implications for project cost, time and quality.

It is very rare that all project requirements are completely known prior to contract signing and, for this reason, projects become progressively elaborate downstream across their evolution stages of conception, planning, design and construction. According to Uff (2009), it is a common feature of construction contracts that the design of work contracted may require variation downstream during implementation. To be able to bind the contractor to any changes to be made subsequent to contract signing [i.e., additions, substitutions, alterations, etc.], construction contracts incorporate clauses for variations (Hughes, Champion, &

Murdoch, 2015).

The general principle in contract law is that, irrespective of whether a contract contains an express clause prescribing limits on the extent of permissible variations, any variation that goes to the root of the contract [causing fundamental change of the contract] is not permissible (Hughes et al., 2015).

2.2.1 Variations in the international context

In the JCT Standard Building Contract, the term "*variations*" encompasses alterations to the design, modifications to the materials specification, the removal of work already properly executed, and changes to construction methods (Hughes et al., 2015). The authority to instruct variations is vested in the contract administrator. However, the contractor retains the right to object to a proposed variation on reasonable grounds, such as where it entails a change in construction methodology. This form of contract also provides for sanctioning of contractor-initiated variations by the contract administrator. With respect to their valuation, the JCT SBC prescribes that variations may be assessed through one of the following approaches: [i] Negotiation between the parties [the employer and the contractor], [ii] derivation by the contract administrator in strict accordance with the contractual provisions, [iii] derivation and submission by the contractor, likewise in accordance with the contract terms.

Unlike in the JCT, in the NEC Engineering and Construction Contract framework there are no express provisions addressing "variations" as a distinct contractual concept. This form of contract instead has provisions that treat variation instructions issued by the contract administrator as compensation events, thereby integrating such changes within the contract's broader risk and cost management framework (Hughes et al., 2015).

In the FIDIC contract suites, a variation is defined as "a means of change to the Works, which is instructed as a variation under Clause 13 [*Variations and Adjustments*]" (International Federation of Consulting Engineers [FIDIC], 2017a, p. 7; 2017b, p. 7; 2017c, p. 7). The variations procedure slightly varies across the various FIDIC forms of contract [the Red Book, the Silver Book and the Yellow Book]. According to the Red Book which applies to construction works designed by the Employer, a variation may comprise changes to quantities, quality, levels or positions and/or dimensions of any part of the work, omissions of any work, additional work or plant or materials, sequence or timing of the execution of works (International Federation of Consulting Engineers [FIDIC], 2017b). The variation provisions

prohibit assigning any work omitted to be executed by the employer or others. The authority to instruct variations is vested in the engineer, however, this form of contract lays down three approaches by which a variation can be instructed as follows: [i] the engineer may issue instructions and notice of variation to the contractor following which the contractor commences and proceeds with the varied work and prepares and submits, for the Engineer's approval, details of the varied works, impact on the works programme and cost implication, [ii] the engineer may request the contractor to submit a proposal before instructing the variation, [iii] the contractor may submit a value engineering proposal which must demonstrate benefit to the employer in form of accelerated completion, cost reduction without negatively impacting quality or functionality, and improved efficiency and value. This contractual variation process also confers upon the contractor the right to object to a variation basing upon reasonable grounds like [i] unforeseeable work, [ii] difficulty in obtaining the goods for the variation, [iii] adverse impact on the contractor's ability to comply with environmental and safety safeguards. The variation clauses also prescribe procedures for determining, by the engineer, time extension and additional costs emanating from the variations.

2.2.2 Variations in the local context

Legal/ Regulatory Framework

In the Ugandan context, a variation is defined as "an instruction given by the Project Manager which varies the works"(PPDA Uganda, 2025, p. 94).

Under the PPDA [Contracts] Regulations (2023), variations are categorized as "Change Orders" and "Contract Amendments [Variation Orders]" according to the set regulatory requirements pertaining to the limits on the scope of the variations. On one hand, Change Orders are limited to ≤1.0% per single change and ≤1.5% cumulatively and are in the powers and authority of the contract manager to issue them upon approval by the accounting officer. On the other hand, the regulation requires that change[s] which is [are] beyond the Change Order must be made in the form of Contract Amendment which is also constrained to ≤15% for a single amendment and ≤25% cumulatively subject to requisite funding commitment by the Accounting Officer, approval of the PDE's Contracts Committee and approval of the Attorney General [Solicitor General] (Republic of Uganda, 2023).

PPDA Construction contracts

The Conditions of Contract under Clauses 49 and 50 of the PPDA SBD for Works prescribe the procedures for managing variations in construction contracts, including the instruction of variations, incorporation of variations into the works programme or activity schedule, and payment for variations (PPDA Uganda, 2025). These procedures are elaborated separately for both Admeasurement and Lump Sum contracts within the PPDA works contract framework.

Under this framework, the Project Manager is empowered to instruct variations whenever the need arises during contract implementation. Before issuing a variation, the Project Manager may require the Contractor to submit a quotation for assessment and valuation. The valuation of such quotations may be based on assessed new rates where the variation constitutes entirely new work outside the original contract scope, or on the approved contract unit rates where the varied work corresponds to items already included in the Bills of Quantities (BoQ). However, where a variation results in an increase in the quantity of a particular BoQ item by more than 25%, and where such increase also exceeds 1% of the initial contract price, amended or reduced rates should be applied.

The contract framework further provides that where the Contractor's quotation is considered unreasonable in the opinion of the Project Manager, the Project Manager may proceed to instruct the variation and independently determine the corresponding adjustment to the contract price. In the case of emergency works, the normal variation procedures may be waived, and the Project Manager is authorized to treat such works as a compensation event.

2.3 Causes of Variations in Public Construction Projects

In construction projects, the sources of variations are multifaceted and arise from a range of project, contractual, and external factors. Hughes et al (2015) identify several key sources, including; changes in client's requirements, incomplete designs and specifications at the time of contract execution, Changes in legislation and other external factors, contractor design assumptions forming part of the contract, discrepancies within contract documents, and instructions for utilization of provisional sums.

The reviewed literature from several studies demonstrates strong consensus that variations in construction projects arise from multiple interconnected causes rather than from isolated technical issues alone. Across the studies, common causes repeatedly identified include scope changes, design deficiencies, financial constraints, inadequate planning, delayed approvals, poor coordination, contractual ambiguities, and unforeseen site conditions.

However, the literature differs regarding the relative significance of these causes. Tayo Adu, Ekung and Lashinde (2020) found that change of plans or scope of work constituted the dominant cause of variation orders in Nigerian public projects, followed by client financial difficulties and inadequate working drawings. Similarly, Mohammad and Hamzah (2019) established that client-induced scope changes were the most significant source of variations in Malaysian construction projects. These findings contrast with Enshassi, Arain and Al-Raee (2010) who identified consultant-related factors such as design changes, design errors, and inadequate consultant knowledge as the most significant contributors to variations in the Gaza Strip.

Likewise, Saki and Yeom (2022) found that financial problems, weather conditions, differing site conditions, and design modifications were the leading causes of variations in Tanzanian road projects. Their findings differ from Nguyen and Do (2023) , who emphasized management and communication failures, ambiguous scope definitions, delayed approvals, and poor supervision as the dominant drivers of variation orders.

These differences in findings suggest that although certain causes of variations are universal, their relative significance depends heavily on project type, procurement systems, governance structures, socio-economic conditions, and institutional capacities prevailing within specific jurisdictions.

2.3.1 Design-related causes

Design-related causes emerged as one of the most consistently emphasized sources of variations across all reviewed studies. The literature strongly links variations to design errors, omissions, inadequate working drawings, inaccurate bills of quantities, ambiguous specifications, poor design reviews, and conflicts among contract documents.

Tayo Adu et al (2020) identified inadequate working drawings and design errors among the most dominant causes of variation orders in Nigerian public projects. Similarly, Ismaeil and Sobaih (2024) found that deficiencies in design documents, inaccurate BOQs, ambiguous design details, and consultant design changes were major drivers of excessive variation orders in Saudi public construction projects.

The findings of Enshassi et al (2010) strongly reinforce this position. Their study established that consultant-related factors constituted the principal contributors to variations, particularly through design changes, inadequate specifications, lack of consultant knowledge of local

materials, and conflicts between contract documents. In contrast, Nguyen and Do (2023) placed greater emphasis on design/scope problems and ambiguous project definitions, arguing that poor communication and inadequate strategic planning significantly exacerbate design-related changes.

Saki and Yeom (2022) similarly linked variations to poor site investigations, unsatisfactory designs, inaccurate estimations, and design modifications in Tanzanian road projects. However, unlike other studies, their findings placed greater emphasis on the interaction between inadequate investigations and subsequent design changes.

Overall, the literature demonstrates substantial agreement that weak design management systems constitute one of the principal underlying causes of variations in public construction projects.

2.3.2 Employer-related causes

Employer-related causes are prominently discussed throughout the reviewed literature, particularly in relation to scope changes, financial constraints, delayed decision-making, unclear project objectives, and inadequate project planning.

Mohammad and Hamzah (2019) identified client-induced scope changes as the single most significant cause of variation orders in Malaysian construction projects. Similarly, Tayo Adu et al (2020) found that change of plans or scope of work and client financial difficulties were among the most dominant causes of variations in Nigerian public projects.

Saki and Yeom (2022) reinforced these findings by establishing that financial problems ranked first among causes of variations in Tanzanian road projects. However, their study differed from the Nigerian and Malaysian studies by placing stronger emphasis on budgeting inadequacies, delayed utility relocation, and poor pretender investigations as major contributors to employer-related variations.

Nguyen and Do (2023) approached employer-related causes from a governance and decision-making perspective, arguing that impedimental decision-making processes, delayed approvals, weak communication systems, and ineffective owner responsiveness significantly worsen project performance and increase variations. Similarly, Alsulami (2024) emphasized bureaucratic delays, weak planning systems, unclear project requirements, and ineffective change management procedures within public institutions.

Although the literature differs regarding the relative importance of specific employer-related

factors, there is broad consensus that owners and public-sector institutions frequently constitute the principal contributors to variations through scope changes, delayed approvals, financial constraints, and weak project governance systems.

2.3.3 Contractor-related causes

Compared to employer-related and design-related causes, contractor-related causes received relatively less emphasis in most reviewed studies. Nevertheless, several studies identified contractor deficiencies as contributing factors to variation orders.

Tayo Adu et al (2020) identified defective workmanship, contractor financial difficulties, and lack of contractor involvement during the design stage among causes of variation orders. Similarly, Ismaeil and Sobaih (2024) identified contractor performance problems, shortages of skilled labour, and substitution of materials or procedures as contributors to variations.

Nguyen and Do (2023) placed greater emphasis on poor supervision, poor site management, inadequate communication, and weak construction methods as contractor-related causes affecting project performance. In contrast, Saki and Yeom (2022) emphasized scarcity of contractor knowledge, shortage of skilled workforce, impractical completion periods, and poor scheduling practices within road construction projects.

Despite identifying contractor-related deficiencies, most studies concluded that contractors were not the principal contributors to variations. Instead, owners and consultants were generally perceived as bearing greater responsibility for variations due to weaknesses in planning, design management, and decision-making systems.

2.3.4 External causes

The reviewed literature also recognizes the importance of external and uncontrollable factors in generating variations. These include weather conditions, unforeseen site conditions, force majeure, political interference, government regulations, utility relocation issues, economic conditions, and socio-cultural factors.

Saki and Yeom (2022) identified weather conditions and differing site conditions among the most significant causes of variation orders in Tanzanian road projects. Their findings are consistent with Alsulami (2024) , who identified unforeseen site conditions, force majeure, socio-economic conditions, and legal regulations as major contributors to change orders in Saudi public projects.

Similarly, Enshassi et al (2010) highlighted political instability, donor constraints, material shortages, and external environmental factors as significant causes of variations in the Gaza Strip. Unlike other studies, however, their findings were heavily shaped by the unique political and economic conditions prevailing within the Gaza Strip construction environment.

Nguyen and Do (2023) also identified government intervention and regulatory changes as major external factors affecting project implementation and stakeholder performance. The reviewed literature therefore demonstrates that while some external causes are universal, others are highly context-specific and influenced by prevailing political, environmental, economic, and regulatory conditions.

2.4 Cost Implications of Variations

The literature unanimously agrees that variations significantly affect project cost performance, although the magnitude of impacts varies across studies and project contexts. Common cost implications identified include cost overruns, schedule overruns, rework, claims, disputes, litigation, productivity losses, increased overheads, procurement delays, and disruptions to project cash flow.

Tayo Adu et al (2020) found that variations increase project costs, delay completion, generate disputes, and adversely affect project performance. Similarly, Mohammad and Hamzah (2019) established that variations increase project time and cost while impairing work progress and construction performance.

Ismaeil and Sobaih (2024) provided more quantitative evidence by establishing that total variation changes across sampled Saudi projects amounted to 7.13% of original contract values. Their findings further revealed that quantity increases and new items constituted major contributors to cost escalation. By contrast, Saki and Yeom (2022) reported significantly higher cost impacts within Tanzanian road projects, where 95% of projects experienced cost variations ranging from 19% to 216% of original contract sums. This suggests that infrastructure projects, particularly road projects in developing countries, may experience more severe cost impacts from variations than building projects.

Nguyen and Do (2023) estimated that project cost overruns due to variations commonly range between 10% and 20%, while time overruns range between 11% and 15%. Meanwhile, Alsulami (2024) found that schedule overruns ranged from 22% to 200% and cost increases ranged from 2.67% to 42.86% in Saudi public projects.

Although the reported magnitudes vary considerably, the literature consistently demonstrates that poorly managed variations substantially undermine value for money and project delivery efficiency.

2.5 Governance Weaknesses in Variations Management

Governance weaknesses emerged as one of the strongest recurring themes across the reviewed literature. Most studies link excessive variations not merely to technical deficiencies but to broader institutional, managerial, procurement, and administrative weaknesses.

Tayo Adu et al (2020) strongly associated variations with weak project planning systems, poor procurement processes, delayed decision-making, weak coordination structures, and ineffective management systems. Similarly, Ismaeil and Sobaih (2024) identified poor tender documentation, inaccurate BOQs, weak contract administration, ineffective communication structures, and absence of formalized variation management systems as major governance deficiencies.

Nguyen and Do (2023) emphasized weak owner/consultant responsiveness, ineffective information management systems, poor communication, and delayed approvals as critical governance shortcomings affecting project performance. Likewise, Saki and Yeom (2022) highlighted inadequate pretender planning, poor stakeholder integration, weak utility coordination systems, and inadequate budgeting mechanisms within public road projects.

Enshassi et al (2010) further emphasized political interference, donor-related funding constraints, poor procurement systems, and inadequate consultant knowledge as governance-related contributors to variations. Meanwhile, Alsulami (2024) focused more on systemic inefficiencies, bureaucratic delays, weak monitoring systems, and absence of proactive planning frameworks within public institutions.

The literature therefore collectively demonstrates that governance weaknesses constitute a central underlying factor in the occurrence and ineffective management of variations in public construction projects.

2.6 Knowledge Gaps

Despite the extensive body of literature on variations in construction projects, several knowledge gaps are evident. First, most reviewed studies were conducted outside Uganda, particularly in Nigeria, Saudi Arabia, Malaysia, Vietnam, Palestine, and Tanzania.

Consequently, there remains limited empirical evidence specifically addressing variations within Ugandan public construction projects.

Second, although many studies extensively identify causes and impacts of variations, relatively fewer studies critically examine the interaction between variations and governance systems.

Lastly, although several studies quantify cost and schedule impacts of variations, limited literature exists examining how governance weaknesses such as political interference, procurement inefficiencies, delayed approvals, and institutional accountability directly contribute to variation occurrence and cost escalation in public infrastructure projects.

2.7 Summary of Literature Review

The reviewed literature demonstrates that variations constitute a significant and recurring challenge in construction projects globally. Although the studies differ in emphasis and analytical approaches, there is broad consensus that variations arise primarily from deficiencies in project planning, design management, financial preparedness, stakeholder coordination, and institutional governance systems.

The literature consistently identifies scope changes, design deficiencies, delayed approvals, inadequate working drawings, poor coordination, financial constraints, and unforeseen site conditions as dominant causes of variations. However, differences emerge regarding the principal contributors to variations. While studies such as Tayo Adu et al (2020), Mohammad and Hamzah (2019), and Saki and Yeom (2022) emphasize employer-related causes, Enshassi et al (2010) place greater responsibility on consultants and design-related deficiencies.

The reviewed studies further demonstrate that variations significantly contribute to cost overruns, time overruns, reduced productivity, disputes, claims, and weakened project performance. Although the magnitude of impacts varies across studies, all authors agree that poorly managed variations adversely affect project delivery efficiency and value for money.

Importantly, the literature strongly links variations to governance deficiencies such as weak procurement systems, inadequate project preparation, poor contract administration, delayed decision-making, ineffective communication systems, bureaucratic inefficiencies, and poor stakeholder coordination. However, limited empirical literature exists specifically addressing these issues within Ugandan public construction projects. The author therefore recommends

that future studies should be conducted to bridging this contextual and governance-related knowledge gap by examining variations in public construction projects in Uganda with emphasis on causes, cost implications, and governance weaknesses.

3 METHODOLOGY

3.1 Approach

This technical report adopted case study approach, focusing on selected construction projects in which the author was directly involved in a project management and contract administration capacity. The case study approach was considered appropriate because it facilitated an in-depth examination of real-life project situations and enabled detailed analysis of the occurrence, management, and implications of variations in the projects.

The principal case study [Case Study 1] comprised the Uganda Support to Municipal Infrastructure Development – Additional Funding [USMID-AF] Project Phase 2 implemented in Lugazi Municipal Council. This project included two works contracts involving road infrastructure development and installation of solar street lighting.

To enrich the analysis and enhance the robustness of findings, additional projects undertaken by the author since the year 2015 were incorporated as Case Study 2, Case Study 3, Case Study 4, and Case Study 5, providing comparative insights across different project environments and contractual contexts.

3.2 Sources of Data and Information

The data and information used in this technical report were obtained from both primary and secondary sources.

Primary data sources largely arose from the author's direct professional involvement in the selected projects. These included contract administration records, variation instructions and approvals, variation orders, change orders, contract amendments, payment certificates, site meeting minutes, progress reports, completion reports, and official correspondence exchanged among the Employer, Contractor, and Project Manager [Engineer]. These records provided first-hand practical insights into the causes, administration processes, governance challenges, and cost implications associated with variations in public construction projects.

Secondary sources comprised standard forms of construction contracts, including FIDIC, NEC, JCT, and PPDA Uganda documents. Other secondary sources included academic literature, textbooks on construction project management, government policies and regulatory frameworks relating to public procurement in Uganda, and institutional reports such as audit and monitoring reports. These sources supported the theoretical grounding and comparative analysis of variation management practices.

3.3 Data Collection Methods

Data for this technical report were collected using a combination of document review, observational insights, comparative analysis, and structured data logging techniques.

A systematic review of project documentation was undertaken to identify the nature, causes, governance implications, and cost effects of variations. The reviewed documents included contract documents, variation instructions, variation orders, change orders, contract amendments, payment records, meeting minutes, and project progress and completion reports. This document review process enabled verification of events and facilitated detailed assessment of how variations were initiated, processed, approved, and implemented within the selected projects.

The report also benefited from observational insights obtained through the author's direct participation in project supervision and contract administration activities. Such involvement provided practical understanding of the institutional, technical, and managerial challenges associated with variation management in public construction projects.

In addition, comparative analysis was undertaken across the selected case studies in order to identify patterns and divergences.

To facilitate systematic collection and organization of information, data logs were designed and utilized by the author to capture relevant information relating to causes of variations, cost increases or reductions, and governance weaknesses on the selected projects. Samples of the data logs used are included in Appendix 2 of this report.

3.4 Data Analysis Techniques

The collected data were analyzed using both qualitative and quantitative analytical techniques.

Thematic analysis of qualitative data was undertaken across the selected case studies to identify recurring themes related to causes of variations and governance challenges. Besides, quantitative data relating to the financial implications of variations were analyzed using descriptive statistical techniques majorly focusing on assessing cost increases, cost reductions, and overall financial impact on project delivery.

3.5 Justification of the Methodology

The selected methodology was considered appropriate for the technical report for several

reasons. First, the case study approach enabled an in-depth examination of complex and real-world construction project environments, thereby facilitating comprehensive analysis of the issues surrounding variations. Secondly, the qualitative approach enabled exploration of governance and institutional factors that are not easily quantifiable. Third, the inclusion of multiple case studies facilitated broadening the findings in relation to the selected theme. Lastly, the author's direct professional involvement in the projects enhanced access to detailed, reliable, and first-hand project data, which improved the credibility and richness of the analysis.

3.6 Limitations

Several limitations are noted. First, the findings are based on a limited number of case studies, which does not statistically represent all public construction projects in Uganda. Secondly, reliance on the author's direct involvement in the selected projects may introduce some degree of subjectivity; however, this limitation was mitigated through reliance on documented project records and verifiable contractual documentation. Lastly, disclosure of some project data was restricted owing to confidentiality aspects.

4 FINDINGS AND DATA ANALYSIS

4.1 Case Study 1 Findings [USMID-AF Batch 2, Lugazi Municipality]

4.1.1 Particulars and causes of the variations

This study established that only one [1] variation occurred on the project. The variation arose from the design review undertaken by the Supervision Consultant at the commencement of the construction works in June 2022, which was concluded in December 2022. Subsequently, the parties executed a formal Variation Order [VO] dated 06th June 2023, incorporating a reduction in the project scope as follows:

- Elimination of 2.9Km of road length out of the total 10.7Km [i.e., 27.1%];
- Elimination of 308 solar street lights out of the total 408 [i.e.75.5%].

The major cause of this variation was attributed to design deficiencies, which became evident following the design review undertaken at the commencement of the construction works. The review identified several inadequacies in the original design, which had significant implications on the project scope and were anticipated to substantially impact the project budget. The key design inadequacies that required to be rectified before constructing the works included inter alia the following:

- The Design Consultant's [DC's] report included longitudinal pipes under walkways but corresponding items of work for drainage pipes and manholes were missed out in the BoQ for all roads;
- Due to technological upgrades there was need to re-specify the street lighting specification [Lamp specification changed from "40W/450lm" to "60W/12V/8000lm" and battery specification changed from "GEL Battery System of 250AH installed underground" to "LiPO4 Battery System of 150AH/12V installed on pole"];
- An improvement was done in consultation with the Employer to provide parking lanes in the first 500m segment of Ntenga Road and the entire 274m length of Church road;
- Box Culverts were designed but missed out from the BoQs for Cathedral 1 road, Cathedral 2 road, Namengo – Kibubu road, Line Murefu road and the Lugazi Main Drainage Channel.

The design review revealed that implementation of the proposed design and BoQ modifications would result in a substantial cost overrun of UGX 10,517,855,988, increasing

the Contract Price from UGX 27,103,215,731 to UGX 37,621,071,719, representing a 38.81% increase over the original contract amount. However, the Employer did not have sufficient budgetary provisions to accommodate the additional costs. Furthermore, the resultant variation would exceed the applicable regulatory thresholds governing contract variations, namely 15% for a single variation and 25% for cumulative variations. Consequently, the Employer resolved to reduce the scope of works to align the project implementation with the available funding and regulatory requirements.

The variation causes identified on this project, including design deficiencies, defective Bills of Quantities [BoQs], technological upgrades, and Employer-initiated scope changes, constituted the immediate causes of the variations experienced during project implementation. These immediate causes were in turn attributable to underlying root causes such as institutional capacity weaknesses in the supervision and management of design consultants, which contributed to inadequate site surveys and investigations, as well as substandard design outputs and inaccurate BoQs.

Furthermore, variation causes such as design deficiencies and defective BoQs constituted avoidable variations that could reasonably have been prevented through adequate project preparation, proper planning, comprehensive site investigations, and effective design coordination and review processes. Such variations are generally undesirable because they often result in cost escalation, implementation delays, disruption of construction progress, contractual claims and disputes, and reduced value for money in project delivery.

Conversely, some of the variations identified on the project, including the upgrading of the street lighting specifications and the Employer-instructed introduction of parking lanes on selected roads, constituted beneficial variations. These changes were introduced with the objective of enhancing the project's functionality, safety, quality, durability, operational efficiency, and overall service value. Although such variations resulted in adjustments to the original contract scope and contract price, they were justified on the basis of improved project performance and long-term infrastructure benefits.

4.1.2 Cost implications

The single variation approved under the project increased the Contract Price by UGX 1,501,200,353, representing a 5.54% increase from UGX 27,103,215,731 to UGX 28,604,416,084. However, it subsequently emerged that the Employer did not have sufficient funds to fully finance the revised contract amount. Consequently, the final scope of works

was proactively managed through the project's cost control mechanisms to remain within the limited available budget of UGX 28,520,790,662. As a result, the final contract price exceeded the original contract price by UGX 1,417,574,931, equivalent to a net increase of 5.23%.

4.1.3 Governance weaknesses

This study established that the project's variation management processes were significantly affected by several governance-related issues, which included the following:

- ***Inadequate project preparation***: The design was incomplete and the BoQs contained substantial deficiencies, which necessitated extensive revisions during the design review undertaken at the commencement of construction. These revisions rendered the original project budget inadequate, consequently compelling the Employer to formally reduce the scope of works through a VO.
- ***Inadequacy of contract management and oversight***: There was a significant delay by the Employer in approving the variation proposals contained in the Draft Design Review Report dated 02nd December 2022, with the VO only being formally executed on 06th June 2023.
- ***Weak regulatory enforcement***: The single VO dated 06th June 2023, which increased the Contract Price by 5.54% [significantly exceeding the statutory threshold of 1.5% beyond which the Solicitor General's approval is legally required] was executed without obtaining the requisite approval from the Solicitor General. This irregularity may have been attributable to the Employer's challenges in processing the necessary approvals within the required timelines.
- ***Political interference***: Decisions regarding the project components to be excluded under the Variation Order [VO] were influenced predominantly by the political leadership of the Municipality rather than being guided by technical planning considerations.

4.2 Case Study 2 Findings [USMID-AF Batch 2, Jinja City]

4.2.1 Particulars and causes of the variations

This study established that two [2] variations arose during the implementation of the project. However, in both instances, the variation management process was not concluded to the stage

of formal execution of VOs by the contracting parties, potentially due to the Employer's challenges in securing and processing the requisite approvals.

The first variation, which emanated from the design review completed in January 2023, involved a reduction in the scope of works as follows:

- ❖ Excluding from the Project, the Street Lighting Works along all project roads, comprising a total of 236 No. solar street lighting units;
- ❖ Excluding from the Project, the Traffic Signalization Works at the two proposed junctions, namely: [i] Eng. Zikusooka Way/Main Street Junction; and [ii] Main Street/Clive East Road Junction;
- ❖ Excluding from the Project three [3] standalone drainage channels, namely Nyanza Channel, CPC Channel, and Agro Way Channel. Consequently, only two drainage channels, namely Nafiri Channel and Kamagara Channel, were ultimately constructed.

The principal cause of this variation was deficiencies in the original design, which became evident following the design review undertaken by the Supervision Consultant at the commencement of construction works. The design review identified several inadequacies and omissions with significant cost implications to the Project, including the following:

- Relocation of existing utility services, principally water supply lines, electricity infrastructure, and NITA-U facilities, whose scope and associated costs had been substantially underestimated at tender stage;
- Significant underestimation by the Design Consultant of quantities for numerous Bill of Quantities [BoQ] items, coupled with omission of several essential pay items from the tender BoQ;
- Provision of additional drainage works at the downstream end of Busoga Avenue to facilitate conveyance of storm water runoff to Nafiri Channel through Oboja Road and Nile Crescent;
- Provision of additional drainage works at the downstream end of Bell Avenue West to safely discharge storm water into the existing longitudinal drainage system along Bridge Street;
- Raising of the road formation along Clerk Road within the swamp section near the

Prisons area, from Km 1+300 to Km 1+897, together with installation of relief drainage structures comprising two locations of twin 1200 mm diameter pipes and one location of a twin-cell 2.0 m × 1.5 m reinforced concrete box culvert;

- Omission by the Design Consultant from the tender BoQ of critical earthworks items, including G7 fill material, rockfill works for Clerk Road, and roadbed preparation and compaction works; and
- Due to technological upgrades, there was need re-specify the street lighting specification [Lamp specification changed from "40W/450lm" to "60W/12V/8000lm" and battery specification changed from "GEL Battery System of 250AH installed underground" to "LiPO4 Battery System of 150AH/12V installed on pole"].

The design review established that implementation of the proposed design revisions and corresponding BoQ adjustments would result in a substantial cost escalation of UGX 5,808,742,517, thereby increasing the Contract Price from UGX 16,536,240,976 to UGX 22,344,983,493, representing a 35.13% increase over the original Contract Price. However, the Employer did not have adequate budgetary provision to accommodate the additional costs. Furthermore, the proposed variation exceeded the applicable regulatory thresholds governing contract variations, namely 15% for a single variation and 25% for cumulative variations. Consequently, the Employer resolved to reduce the scope of works to align the Project with the available funding envelope and regulatory requirements.

The second variation, which was instructed by the Employer following commitment of additional funding in May 2024 during the Defects Liability Period [DLP], comprised the following additional works:

- ❖ Installation of 158 No. solar street lights, forming part of the 236 No. solar street lights that had previously been omitted under the first variation.

The Employer had been notified by the Ministry of Lands, Housing and Urban Development [MLHUD] of the availability of supplementary funding under the existing financing arrangement and subsequently reached agreement with the Contractor for execution of the additional works during the DLP.

The variation causes identified on this project, including design deficiencies, drainage scope changes, defective Bills of Quantities [BoQs], and technological upgrades, constituted the

immediate causes of the variations experienced during project implementation. These immediate causes were in turn attributable to underlying root causes such as institutional capacity weaknesses in the supervision and management of design consultants, which contributed to inadequate site surveys and investigations, as well as substandard design outputs and inaccurate BoQs.

Furthermore, variation causes such as design deficiencies and defective BoQs constituted avoidable variations, the impact and possible preventive measures of which have been discussed in Sub-section 4.1.1 above.

Conversely, some of the variations identified on the project, including the upgrading of the street lighting specifications and drainage scope changes, constituted beneficial variations. These changes were introduced with the objective of enhancing the project's functionality, safety, quality, durability, operational efficiency, and overall service value. Although such variations resulted in adjustments to the original contract scope and contract price, they were justified on the basis of improved project performance and long-term infrastructure benefits.

4.2.2 Cost implications

The first variation increased the Contract Price by UGX 1,691,710,601, representing a 10.23% increase, from UGX 16,536,240,976 to UGX 18,227,951,577. However, in approving this variation, the Employer did not confirm firm commitment of the requisite additional funding, instead deferring the matter for subsequent consideration pending further implementation monitoring and financial advice from the project management teams.

The second variation further increased the original Contract Price by UGX 1,396,581,396, equivalent to an 8.45% increase, thereby raising the revised Contract Price from UGX 18,227,951,577 to UGX 19,624,532,973.

The cumulative effect of the two variations was an increase in the Contract Price of UGX 3,088,291,997, representing an aggregate increase of 18.68% over the original Contract Price. However, it subsequently became evident that the Employer lacked sufficient budgetary provision to fully finance the revised contract sum. Consequently, the final scope of works implemented was proactively rationalized and managed under the Project's cost control mechanisms to align with the limited available budget of UGX 19,128,319,896. Accordingly, the final Contract Price exceeded the original Contract Price by UGX 2,592,078,920, representing an overall increase of 15.68%.

4.2.3 Governance weaknesses

This study established that several governance-related weaknesses adversely affected the management of variations on the Project, including the following:

- ***Inadequate project preparation***: The original design was incomplete, and the BoQs contained substantial inaccuracies and omissions, which necessitated extensive revisions during the design review undertaken at the commencement of construction. These deficiencies rendered the original project budget inadequate, consequently compelling the Employer to reduce the scope of works through a Variation Instruction in order to align the Project with the available funding envelope.
- ***Inadequacy of contract management and oversight***: There was significant delay by the Employer in reviewing and approving the variation proposals contained in the Draft Design Review Report dated 27th January 2023, with approval only being granted on 19th April 2023. This delayed decision-making adversely affected timely processing and implementation of the required variations.
- ***Weak regulatory enforcement:*** The two variations, which cumulatively increased the Contract Price by 18.68% [comprising individual increases of 10.23% and 8.45%, respectively], were implemented without obtaining the requisite approval of the SG, notwithstanding that the variations exceeded the statutory approval thresholds of 1% for a single variation and 1.5% for cumulative variations. This non-compliance may have been attributable to the Employer's challenges to efficiently process the necessary approvals within the required timelines.

4.3 Case Study 3 Findings [USMID-AF Batch 2, Kamuli Municipality]

4.3.1 Particulars and causes of the variations

This study established that only one [1] variation occurred on the Project. The variation arose from the design review undertaken by the Supervision Consultant at the commencement of construction works in June 2022 and concluded in December 2022. Subsequently, a formal Change Order dated 08th June 2023 was executed by the parties to revise the Contract Price and incorporate the approved design review recommendations into the Contract scope.

The principal cause of this variation was deficiencies in the original design, which became evident during the design review process undertaken at commencement of the construction works. The design review identified several inadequacies and omissions with significant cost

implications to the Project, including the following:

- Increase in the length of the four-lane Babubhai Road by 109m, from 181m to 290m, in order to rectify a design error;
- Increase in the length of the two-lane Hajjat Watongola Road by 174m, from 265m to 439m, to incorporate an additional spur road as directed by the Employer at the commencement of the design review;
- Relocation of existing utility services, principally water supply and electricity infrastructure;
- Significant underestimation by the Design Consultant [DC] of quantities relating to side drainage works;
- Omission by the Design Consultant from the tender Bills of Quantities [BoQs] of the designed box culverts along Commercial Road and Kadhuba Road;
- Omission by the Design Consultant from the tender BoQs of critical earthworks items, including G7 fill material, rockfill works for Commercial Road, and roadbed preparation and compaction works;
- Due to technological upgrades there was need re-specify the street lighting specification [Lamp specification changed from "40W/450lm" to "60W/12V/8000lm" and battery specification changed from "GEL Battery System of 250AH installed underground" to "LiPO4 Battery System of 150AH/12V installed on pole"].

In addition, while approving the design review recommendations, the Employer expressly instructed the following scope modifications:

- Replacement of concrete-lined open drains with stone-pitched drains; and
- Reduction of the asphalt concrete surfacing thickness from 50mm to 40mm.

The variation causes identified on this project, including design deficiencies, defective Bills of Quantities [BoQs], Employer-instructed scope changes, and technological upgrades, constituted the immediate causes of the variations experienced during project implementation. These immediate causes were in turn attributable to underlying root causes such as institutional capacity weaknesses in the supervision and management of design consultants, which contributed to inadequate site surveys and investigations, as well as substandard design outputs and inaccurate BoQs.

Furthermore, variation causes such as design deficiencies and defective BoQs constituted avoidable variations, the impact and possible preventive measures of which have been discussed in Sub-section 4.1.1 above.

Conversely, some of the variations identified on the project, including the upgrading of the street lighting specifications and addition of a road spur, constituted beneficial variations. These changes were introduced with the objective of enhancing the project's functionality, safety, quality, durability, operational efficiency, and overall service value. Although such variations resulted in adjustments to the original contract scope and contract price, they were justified on the basis of improved project performance and long-term infrastructure benefits.

4.3.2 Cost implications

The single variation approved on the Project increased the Contract Price by UGX 2,634,584,836, representing a 17.66% increase, from UGX 14,921,485,018 to UGX 17,556,069,854.

However, it subsequently became evident that the Employer did not have sufficient budgetary provision to fully finance the revised contract sum. Consequently, the final scope of works implemented was proactively rationalized and managed under the Project's cost control mechanisms to align with the limited available budget of UGX 16,524,250,762. Accordingly, the final Contract Price exceeded the original Contract Price by UGX 1,602,765,744, representing an overall increase of 10.74%.

4.3.3 Governance weaknesses

This study established that several governance-related weaknesses manifested in the management of variations on the Project, including the following:

- ***Inadequate project preparation***: The original design was incomplete, and the BoQs contained substantial inaccuracies and omissions, which necessitated extensive revisions during the design review undertaken at the commencement of construction. These deficiencies rendered the original project budget inadequate. Consequently, following confirmation by the Employer with the Ministry of Lands, Housing and Urban Development [MLHUD] regarding the availability of additional funding, the Employer proceeded to approve the design review recommendations and revise the Contract Price accordingly.
- ***Inadequacy of contract management and oversight***: There was significant delay by

the Employer in reviewing and approving the variation proposals contained in the Draft Design Review Report dated 19th December 2022, with approval only being granted on 05th April 2023. This delayed decision-making adversely affected timely processing and implementation of the required variations.

- ***Weak regulatory enforcement***: The single VO dated 08th June 2023 increased the Contract Price by 17.66%, which was significantly above both the statutory threshold of 1.0% above which the SG approval is legally required and the maximum regulatory limit of 15% permissible for a single variation. Notwithstanding these requirements, the VO was executed without obtaining the requisite SG approval, a situation that may have been attributable to the Employer's challenges to efficiently process the necessary approvals within the desired timelines.

4.4 Case Study 4 Findings [Ssezibwa Bridge Reconstruction, MOWT]

4.4.1 Particulars and causes of the variations

This Design-Build project has been under implementation since June 2024 and, as at the time of preparation of this technical report, no variations had been experienced on the Project.

4.4.2 Cost implications

None, as no variations had been recorded on the Project at the time of this study.

4.4.3 Governance weaknesses

None, as no variations had been recorded on the Project at the time of this study.

4.5 Case Study 5 Findings [KIIDP2 Batch 1A, KCCA]

4.5.1 Particulars and causes of the variations

This study established that four [4] variations occurred on the Project. However, for all these variations, the process was not concluded to the stage of formal execution of Variation Orders [VOs] by the parties, which may have been attributable to the Employer's challenges in efficiently processing the requisite approvals.

The first variation arose from the design review undertaken by the Supervision Consultant at the commencement of the Design Review and Construction Supervision Services in June 2015, which was concluded in October 2015.

The principal cause of this variation was deficiencies in the original design, which became evident during the design review conducted at the commencement of construction works. The

review identified several inadequacies and scope modifications with significant cost implications to the Project, including the following:

- Technological advancement: Comprehensive upgrading of the traffic signalization design to an Intelligent Transportation System [ITS], including: [i] introduction of CCTV surveillance cameras at the signalized intersections; and [ii] establishment of a central traffic control centre at the Employer's offices;
- Change of the street lighting system from conventional hydropower-based lighting to a solar-powered lighting system, as instructed by the Employer;
- Change in the material specification for traffic sign plates from steel plates to aluminium composite panels in order to mitigate rampant vandalism, as directed by the Employer;
- Enhanced landscaping and urban beautification requirements introduced by the Employer;
- Introduction of rockfill works at Bwaise Junction and its approach legs;
- Correction of underestimated quantities and inclusion of omitted items in the BoQs;
- Expansion of the scope of works to incorporate emergency drainage interventions along Kiwunya Road, including asphalt surfacing works on the road section;
- Increased costs associated with relocation of existing utility services, including water, electricity, and telecommunications infrastructure;
- Reconstruction of boundary walls and other affected structures belonging to Project Affected Persons [PAPs]; and
- Escalation of time-related preliminaries under Bill No. 1 [General Items] arising from extension of the completion period from 07th March 2017 to 04th February 2018.

The second variation arose from Right of Way [ROW] challenges affecting the terminal section of the Bakuli–Nakulabye–Kasubi Road Section. The Employer's efforts to relocate vendors operating within Kasubi Market were unsuccessful, thereby preventing timely access to that part of the site and commencement of construction works for the proposed Kasubi Signalised Intersection. Consequently, in January 2018, the Employer resolved to reduce the scope of works, following which the Engineer issued a Variation Instruction to:

- Exclude from the Contract a 244m section of the Bakuli–Nakulabye–Kasubi Road

extending from Km 2+230 to Km 2+474, together with the three associated minor junction legs.

The third variation was triggered by the preceding Employer-instructed variation involving the exclusion of the Kasubi Signalised Intersection, which consequently created surplus funds within the Contract Budget. Similar to the first variation, this variation principally arose from deficiencies in the original design. Specifically, the design had not adequately provided for the safe conveyance and downstream discharge of storm water runoff from the road drainage system into the natural streams and drainage channels serving the surrounding low-lying areas. Furthermore, this design deficiency had not been identified and addressed during the design review process, as it had been assumed that the drainage systems on adjacent roads were either adequate or would be improved under subsequent interventions.

Consequently, the Engineer issued a Variation Instruction dated 02nd February 2018 for execution of the following additional works:

- Nsalo Road [0.35Km]: Reconstruction of the road to asphalt-paved standard, installation of 1200mm diameter concrete pipe culvert [CPC] longitudinal storm water drainage, and construction of paved walkways. The scope was subsequently expanded by the Employer to include installation of solar street lighting;
- Coronation Road [0.22Km]: Installation of 1200mm diameter CPC longitudinal storm water drainage pipes. The scope was later expanded by the Employer to incorporate paved walkways and solar street lighting; and
- Kyadondo Road [0.41Km]: Installation of 900mm diameter and 1200mm diameter CPC longitudinal storm water drainage pipes. The scope was subsequently expanded by the Employer to include reconstruction of the road to asphalt-paved standard together with construction of paved sidewalks.

The fourth variation arose from the Employer's directive to modify the cross-sectional design of Mambule Road [0.62 km] in order to enhance road safety, following observations made during a World Bank Mission site inspection. Consequently, the Engineer issued a Variation Instruction dated 25th August 2017 directing implementation of the following modifications to the already completed road works:

- Revision of the road cross-section from the original configuration comprising two 3.0m traffic lanes and two 2.0m shoulders, to a revised configuration incorporating a

1.5m wide level sidewalk on the left-hand side [LHS] and two widened traffic lanes of 3.8m each;

- ❖ Installation of a handrail along the LHS side drain to provide protection for pedestrians using the sidewalk;
- ❖ Installation of a barrier kerb separating the level sidewalk from the carriageway in order to segregate pedestrian and vehicular traffic; and
- ❖ Installation of a barrier kerb along the right-hand side [RHS] trapezoidal side drain to protect vehicles from inadvertently veering into the deep drainage channel.

The variation causes identified on this project, including design deficiencies, defective Bills of Quantities [BoQs], Employer-instructed scope changes, technological upgrades, and change of drainage work scope, constituted the immediate causes of the variations experienced during project implementation. These immediate causes were in turn attributable to underlying root causes such as institutional capacity weaknesses in the supervision and management of design consultants, which contributed to inadequate site surveys and investigations, as well as substandard design outputs and inaccurate BoQs.

Furthermore, variation causes such as design deficiencies and defective BoQs constituted avoidable variations, the impact and possible preventive measures of which have been discussed in Sub-section 4.1.1 above.

Conversely, some of the variations identified on the project, including the upgrading of the traffic signals specifications, change of street lighting specification, change of traffic sign plates, introduction of rockfill at Bwaise Junction, re-design of safety works for Mambule Road, and addition of new roads, constituted beneficial variations. These changes were introduced with the objective of enhancing the project's functionality, safety, quality, durability, operational efficiency, and overall service value. Although such variations resulted in adjustments to the original contract scope and contract price, they were justified on the basis of improved project performance and long-term infrastructure benefits.

4.5.2 Cost implications

The first variation increased the Contract Price by UGX 10,574,042,220, representing an 11.94% increase, from UGX 88,585,529,217 to UGX 99,159,571,437.

The second, third, and fourth variations were valued at UGX -4,188,231,185 [-4.73%], UGX

5,050,496,414 [5.70%], and UGX 193,499,362 [0.22%], respectively.

The cumulative effect of the four variations was an increase in the Contract Price of UGX 11,629,806,811, equivalent to an aggregate increase of 13.13%, thereby revising the Contract Price from UGX 88,585,529,217 to UGX 100,215,336,028. However, no formal Variation Orders [VOs] were executed by the parties. Consequently, the final scope of works implemented was proactively rationalized and managed under the Project's cost control mechanisms to align with the limited available budget of UGX 99,159,571,437. Accordingly, the final Contract Price exceeded the original Contract Price by UGX 10,574,042,220, representing an overall increase of 11.94%.

4.5.3 Governance weaknesses

- ***Inadequate project preparation***: The design was incomplete, and the BoQs contained substantial deficiencies, resulting in extensive revisions during the design review undertaken at the commencement of the Design Review and Construction Supervision Services. Consequently, the original project budget became inadequate, necessitating a prolonged consultation process between the Employer and the World Bank to secure approval of the design review recommendations and the corresponding adjustment to the contract price. Furthermore, certain design inadequacies, including deficiencies in road safety provisions and the safe conveyance and discharge of storm water at selected culvert outfalls, were only addressed through subsequent variations issued well after completion of the design review phase.
- ***Inadequacy of contract management and oversight***: There was a substantial delay by the Employer in approving the variation proposals contained in the Draft Design Review Report dated 15th October 2015. As a consequence of this delay, by the time the Employer secured the World Bank's No Objection to the amendment of the contract price on 19th January 2018, additional project developments giving rise to further substantial variations had already materialized. The most significant of these was the exclusion of the Kasubi Signalized Intersection from the project scope. These subsequent developments necessitated significant further revisions to the Bills of Quantities [BoQ]. Consequently, the Employer did not proceed with the formalization and execution of a Variation Order [VO] with the Contractor.
- ***Weak regulatory enforcement***: The first variation, which resulted in an increase of the contract price by 11.94% [substantially exceeding the statutory approval threshold

of 1.0% above which the Solicitor General's approval was required] was instructed prior to obtaining the requisite approval from the Solicitor General. This arose from the Employer's challenges in efficiently processing and securing the necessary approvals within the desired timeframe.

- ***Political interference***: The issue relating to the relocation of vendors at Kasubi Market became politicized, resulting in the vendors' refusal to temporarily vacate the area to facilitate execution of the road construction works associated with the Kasubi Junction signalization. Thus, the Employer took decision to instruct a variation to exclude the encumbered road segment.

4.6 Data Analysis

4.6.1 Causes of variations

Table 8 below presents the results of the thematic analysis of the causes of variations identified across the selected Case Studies 1, 2, 3, 4, and 5.

Table 8: Thematic Analysis of Causes of Variations

		Causes of Variations in:				
Broader theme	**Theme**	**Case Study 1**	**Case Study 2**	**Case Study 3**	**Case Study 4**	**Case Study 5**
Design-related causes	Incomplete design	✓	✓	✓	Ongoing project; no variations yet	×
	Design deficiencies	✓	✓	×		✓
	Deficiencies in BoQ preparation	✓	✓	✓		✓
Employer-related causes	Changes in Employer's requirements	✓	×	✓		✓
	Financial constraints	✓	✓	×		×
Contractor-related causes		×	×	×		×
Other/ External causes	Funding uncertainties	×	✓	×		✓
	Land acquisition challenges	×	×	×		✓
	Other public institution weakness	×	✓	✓		✓
	Poor stakeholder coordination	×	✓	✓		✓
	Technological advancement	✓	✓	✓		✓

From this analysis, it was observed that design-related, Employer-related, and other/external

categories of variations were the most dominant across the selected case studies. In contrast, no Contractor-related causes of variations were identified.

The most prevalent causes of variations, occurring across all the selected Case Studies 1, 2, 3, and 5, were deficiencies in Bills of Quantities [BoQ] preparation and technological advancements. These were followed by incomplete designs, design deficiencies, changes in the Employer's requirements, weaknesses within other public institutions, and poor stakeholder coordination, each of which occurred in three of the four projects. The least prevalent causes of variations were financial constraints and funding uncertainties, which were identified in only two of the four projects.

4.6.2 Cost implications

Table 9 below presents the results of the analysis of the overall cost implications of variations on the contract price across the selected Case Studies 1, 2, 3, and 5, while Figure 2 further below provides a graphical representation of the findings.

Table 9: Analysis of Cost Implication of Variations

Case Study	**Case Study 1**	**Case Study 2**	**Case Study 3**	**Case Study 5**
Original Contract Price [UGX]	27,103,215,731	16,536,240,976	14,921,485,018	88,585,529,217
Overall Cost Implication of Variations [UGX]	1,501,200,353	3,088,291,997	2,634,584,836	11,629,806,811
Overall Cost Implication of Variations [%]	5.54%	18.68%	17.66%	13.13%

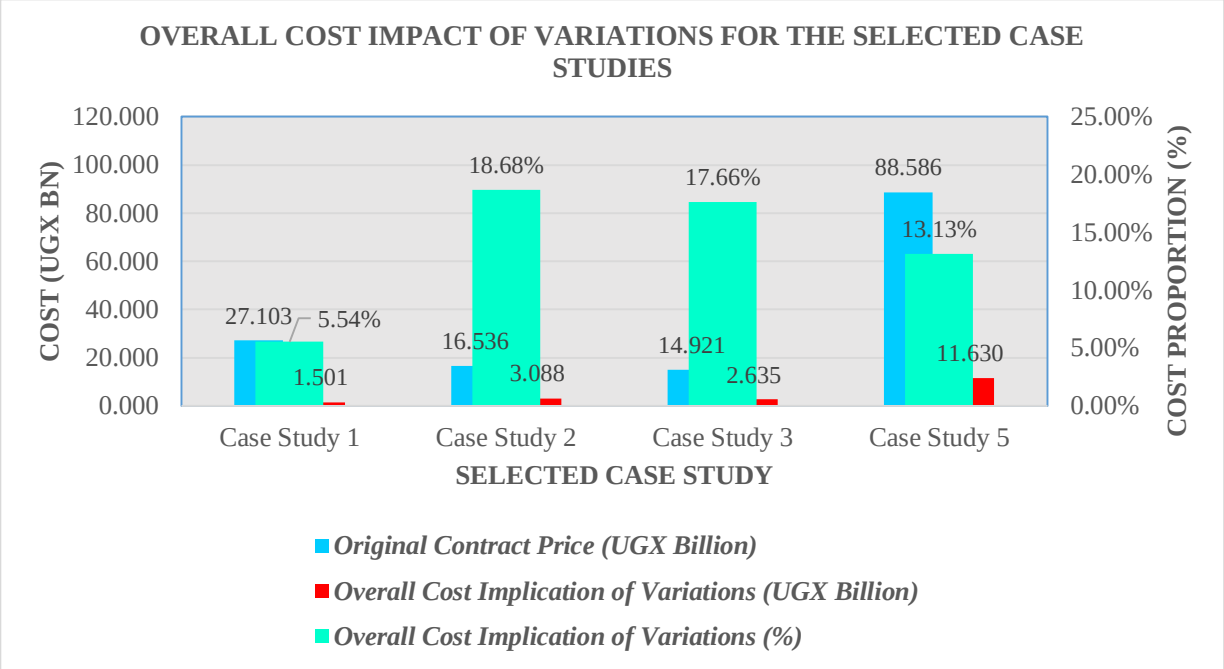


Figure 2: Graphical Presentation of Overall Cost Implication of Variations

The analysis of the cost implications of variations revealed that all the selected Case Studies 1, 2, 3, and 5 experienced overall increases in contract prices attributable to variations. The magnitude of the increases above the original contract prices ranged between 5.54% and 18.68%, with a mean increase of 13.75% and a standard deviation of 15.88%.

4.6.3 Governance weaknesses

Table 10 below presents the results of the thematic analysis of the governance weaknesses observed across the selected Case Studies 1, 2, 3, 4, and 5.

Table 10: Thematic Analysis of Governance Weaknesses

		Factor of Governance Weakness in:				
Broader theme	**Theme**	**Case Study 1**	**Case Study 2**	**Case Study 3**	**Case Study 4**	**Case Study 5**
Governance Weakness	Delayed approvals	✓	✓	✓	Ongoing project; no variations yet	✓
	Delayed decision making	✓	✓	✓		✓
	Inadequate project preparation	✓	✓	✓		✓
	Political interference	✓	×	×		✓
	Weak regulatory enforcement	✓	✓	×		×

The findings of the analysis indicate that delayed approvals, delayed decision-making, and

inadequate project preparation constituted the predominant governance weaknesses affecting the management of variations across the selected case studies. Political interference and weak regulatory enforcement were also identified, although these manifested in only two of the four projects.

5 DISCUSSION

5.1 General

This chapter discusses the findings presented in Chapter Four in relation to the study objectives and the literature reviewed in Chapter Two. The discussion is organized according to the selected sub-themes of the technical report, namely: causes of variations, cost implications of variations, and governance weaknesses in managing variations. The findings from the selected case studies are analyzed in relation to existing literature in order to establish areas of convergence and contextual relevance to public construction projects in Uganda.

5.2 Causes of Variations in Public Construction Projects

The findings from the selected case studies indicate that variations in public construction projects in Uganda arise from multiple interrelated technical, managerial, financial, and institutional factors. Notably, these findings demonstrate that inadequate design development and deficient BoQs are the primary drivers of variations. Other causes identified across the projects included technology upgrades, scope changes, inadequate project preparation, utility relocation requirements, land acquisition challenges, and time-related costs arising from extensions of time.

The findings strongly support the literature reviewed in Chapter Two, which identified design-related deficiencies as a major contributor to variations in construction projects. Consistent with the findings of Enshassi et al (2010), Tayo Adu et al (2020), and Ismaeil and Sobaih (2024), this analysis of the selected case studies established that incomplete designs and inaccurate BoQs were among the principal causes of variations in several projects. In Case Studies 1, 2, 3, and 5, post-contract design reviews revealed significant inadequacies in the original designs and tender documentation, thereby necessitating major adjustments to project scope, quantities, and technical specifications.

The study further established that inadequate project preparation prior to procurement significantly contributed to the occurrence of variations. Several projects commenced for instance before completion of utility mapping and design coordination activities. This finding aligns with Saki and Yeom (2022), who associated variations with inadequate pretender investigations and unsatisfactory designs. Within the Ugandan public-sector context, this demonstrates persistent weaknesses in project planning and design management systems.

Employer-related factors also emerged prominently in the selected case studies. These included changes in project priorities, delayed approvals, financial limitations, and additional scope requirements identified during implementation. In Case Study 2, realization of additional funding during the later stages of implementation resulted in further scope modifications. Similarly, Case Study 5 experienced additional requirements relating to road safety, drainage, and traffic management, which substantially altered the project scope and associated costs. These findings are consistent with Mohammad and Hamzah (2019), who identified client-induced scope changes as a major cause of variation orders.

Utility relocation was also established as a significant source of variations in urban road infrastructure projects. Underestimation of the complexity and costs associated with relocation of water, electricity, and telecommunications infrastructure contributed to additional quantities, delays, and cost increases in Case Studies 2, 3 and 5. This finding reinforces the observations of Saki and Yeom (2022), who identified utility relocation challenges as a major contributor to variations in road construction projects.

Technology-related changes additionally contributed to variations in the selected projects. In Case Studies 1, 2 and 3, solar street lighting specifications were upgraded during implementation in order to accommodate improved technologies and revised operational requirements. Besides, in Case Study 5, traffic signals specifications were similarly upgraded during implementation. Although such changes enhanced project functionality and service delivery, they nevertheless resulted in revisions to quantities and unit rates and led to cost escalations.

The study further established that time-related costs arising from extensions of time significantly contributed to variations in contract prices. In Case Studies 1, 2, 3, and 5, prolonged implementation periods resulted in additional costs associated with preliminary and general items, including site establishment, performance securities and insurances, supervision attendance, traffic management, and environmental, health, safety, and social [EHSS] management requirements. This finding demonstrates the strong relationship between project delays and cost escalation in public construction projects.

In general, the case study findings demonstrate that variations in Ugandan public construction projects do not arise from isolated technical causes alone, but rather from a combination of design deficiencies, weak project preparation, delayed decision-making, institutional inefficiencies, evolving project requirements, and external implementation challenges.

5.3 Cost Implications of Variations

The findings from the selected case studies demonstrate that variations have significant implications on the overall costs of public construction projects. The analysis presented in Chapter Four revealed that variations generally resulted in substantial increases in contract prices across most of the projects studied.

The results showed that projects experienced overall cost increases attributable to variations ranging from 5.54% to 18.68% above the initial contract sums. The observed lower threshold of approximately 5% exceeded the PPDA's regulatory limit of 1.5%, beyond which single or cumulated variations can no longer be treated as simple change orders approved solely by the Contract Manager and the Accounting Officer. This implies that the variations were substantial in nature and therefore required formal contract amendments subject to the requisite approvals of the Entity's Contracts Committee and the Solicitor General [SG]. Furthermore, the observed upper threshold of approximately 19% exceeded the PPDA's regulatory limit of 15% applicable to a single contract amendment. This further demonstrates the magnitude and significance of the variations, to the extent that processing such adjustments under a single amendment would constitute statutory non-compliance. These findings justify the conclusion that the variations, which largely originated from the implementation of design review recommendations, were indicative of deficiencies in project planning, design and overall project management processes.

In some projects, however, projected cost increases identified during design reviews were substantially higher, as far as 38.81%, before scope rationalization measures were undertaken. These findings confirm that variations constitute a major contributor to cost escalation in public construction projects.

The findings are consistent with the literature reviewed in Chapter Two, which generally acknowledges that variations adversely affect project cost performance. Similar to the findings of Mohammad and Hamzah (2019), Nguyen and Do (2023), and Alsulami (2024), this study established that variations increase project costs, prolong implementation periods, and negatively affect project delivery efficiency.

The study also revealed that public-sector employers frequently resorted to scope reduction measures in order to maintain projects within available budget ceilings and statutory variation thresholds. In several case studies, proposed design review adjustments were rationalized through omission of certain project components, deferment of works, or phased

implementation approaches. This demonstrates the financial pressures faced by public-sector institutions when managing substantial variations under constrained funding conditions.

Furthermore, the findings established that cost increases did not arise solely from additional work quantities, but also from revised specifications, additional drainage works, utility relocation requirements, road safety improvements, prolonged project durations, and implementation of previously omitted components.

The findings additionally revealed that delayed approval of variations contributed to further cost escalation. In several case studies, considerable time elapsed between completion of design reviews and approval or execution of formal variation orders. During this period, additional project requirements continued to emerge while implementation proceeded under uncertain financial and contractual conditions. This finding supports Nguyen and Do (2023), who associated delayed approvals and weak decision-making systems with increased project cost overruns.

The study further established that some projects were proactively managed through strict cost control mechanisms aimed at preventing exceedance of available budgets and statutory variation limits. Although these measures assisted in maintaining financial compliance, they occasionally resulted in exclusion or deferment of certain project components, potentially affecting the overall completeness and long-term functionality of the projects.

In general, the case study findings confirm that variations undermine value for money in public construction projects through cost escalation, prolonged implementation periods, disruption of project planning, and increased contractual and administrative complexities.

5.4 Governance Weaknesses in Managing Variations

One of the most significant findings of this study is that governance weaknesses constituted a major underlying factor contributing both to the occurrence of variations and to ineffective management of the variation process in public construction projects.

The study established that delayed approvals, delayed decision-making, inadequate project preparation, weak regulatory enforcement, political interference, ineffective contract administration, and poor stakeholder coordination were among the dominant governance weaknesses that manifested across the selected case studies.

Notably, the findings from the case studies demonstrate that the PPDA's variation approval framework, which prescribes a threshold of not more than 1.5% beyond which a variation can

only be effected through a formal contract amendment, tends to constrain project implementation efficiency in pursuit of enhanced accountability and regulatory control. In this regard, the study established that the processing of formal contract amendments and variation orders was frequently characterized by significant delays. These delays often resulted in situations where the proposed variation processes were either abandoned altogether because subsequent project developments largely altered the original variation requirements before completion of the approval process, or where Employers proceeded to authorize implementation of the variations prior to conclusion of the formal approval procedures in order to mitigate costly delays associated with the time extensions arising from late issuance of instructions to the Contractors.

These findings strongly align with the literature reviewed in Chapter Two. Similar to the observations of Tayo Adu et al (2020), Ismaeil and Sobaih (2024), and Nguyen and Do (2023), this study established that weak planning systems, delayed approvals, poor coordination, and ineffective management structures significantly contributed to variations and associated project inefficiencies.

A particularly significant governance weakness identified in this study was inadequate project preparation prior to procurement. In several projects, tender documentation contained major design deficiencies, omitted items and inaccurate quantities. This indicates weaknesses within the planning, design review, and procurement processes preceding contract award.

The findings further revealed that delays in processing approvals for variation proposals significantly affected project implementation. In some projects, considerable periods elapsed between submission of design review findings and approval of corresponding variation orders. Such delays created uncertainty during implementation and contributed to additional downstream variations and financial adjustments. This finding reinforces the conclusions of Nguyen and Do (2023), who associated delayed approvals and ineffective decision-making systems with poor project performance.

The study also identified instances of weak regulatory enforcement in variation management. In certain projects, variations exceeding statutory approval thresholds were implemented before completion of all requisite approvals. This suggests weaknesses in compliance enforcement within public procurement and contract administration systems.

Political interference additionally emerged as an important governance issue in some projects. In certain instances, decisions relating to scope exclusions and prioritization of

project components were influenced more by political considerations than by technical planning principles. This finding is consistent with Enshassi et al (2010), who identified political influences as a contributor to ineffective project governance and variations.

Weak stakeholder coordination was also evident, particularly among utility agencies. Delayed relocation of utilities and inadequate coordination among stakeholders contributed to implementation delays and additional variation requirements.

Despite these governance challenges, the findings further indicate that proactive supervision, continuous design review, and active cost control mechanisms played an important role in mitigating excessive cost escalation in some projects. The involvement of experienced supervision and project management teams assisted in identifying design deficiencies early and implementing corrective measures during project execution.

In general, the case study findings demonstrate that governance weaknesses are not merely secondary administrative challenges, but rather constitute fundamental underlying drivers of variations in public construction projects in Uganda.

6 CONCLUSION

6.1 Conclusion

This technical report examines variations in public construction projects in Uganda, with particular focus on their causes, cost implications, and governance weaknesses. The study adopted a case study approach involving five selected public infrastructure projects in which the author directly participated in project management and contract administration roles.

The findings established that variations were a common and significant feature in the projects subjected to the study. Across the selected case studies, the dominant causes of variations included design deficiencies, defective Bills of Quantities (BoQs), technology upgrades, scope changes, inadequate project preparation, utility relocation requirements, land acquisition challenges, and time-related costs arising from extensions of time.

The study further established that variations have substantial cost implications. In most of the selected projects, variations resulted in significant increases in contract prices, prolonged project implementation periods, and increased financial and administrative pressures on project stakeholders.

Importantly, the study established that governance weaknesses constitute a major underlying contributor to both the occurrence and ineffective management of variations in public construction projects. The dominant governance weaknesses identified included delayed approvals, delayed decision-making, inadequate project preparation, weak regulatory enforcement, political interference, ineffective stakeholder coordination, and weaknesses in contract administration systems.

The findings therefore demonstrate that variations in Ugandan public construction projects are not solely technical phenomena, but are strongly linked to broader institutional and governance challenges within project planning, procurement, contract administration, and decision-making systems.

In general, the study concludes that improving the management of variations in public construction projects in Uganda requires strengthening project preparation processes, enhancing design management systems, improving regulatory compliance and approval efficiency, and strengthening institutional governance frameworks within public-sector construction project delivery systems.

6.2 Lessons Learned

The selected case studies provided several important lessons relevant to the management of public construction projects in Uganda.

Firstly, comprehensive project preparation prior to procurement is critical in minimizing variations during construction. Adequate utility mapping, design reviews, scope appraisals, verification of Bills of Quantities and Right of Way assessments, among others, should be completed before commencement of procurement processes.

Secondly, design reviews undertaken at the commencement of construction can play a significant role in identifying deficiencies in contract documentation before extensive physical works are executed. Early identification of design inadequacies assists in mitigating downstream disputes, delays, and excessive cost escalation.

Thirdly, timely decision-making and efficient approval processes are essential for effective variation management. Delayed approvals create uncertainty, disrupt project implementation, and may contribute to additional variations and cost increases.

Fourthly, effective coordination among stakeholders, particularly utility agencies, contractors, consultants, and public authorities, is necessary for successful implementation of urban infrastructure projects. Poor coordination significantly contributes to delays, scope changes, and additional costs.

Fifthly, strong contract administration and proactive supervision are essential in managing variations and controlling project costs. Continuous monitoring, accurate measurement/ quantity take-offs, timely certification, and active cost control mechanisms assist in mitigating excessive financial exposure.

Lastly, governance and institutional systems significantly influence project outcomes. Weak procurement systems, political interference, weak regulatory enforcement, and delayed approvals/ decision-making undermine efficient project delivery and increase the occurrence of or exacerbate variations impacts.

6.3 Recommendations

The findings of the study revealed the occurrence of avoidable variation causes across the analyzed case studies, particularly design deficiencies and defective Bills of Quantities [BoQs]. These variation causes were largely attributable to inadequate project preparation,

insufficient design coordination, and weaknesses in pre-contract planning processes. In order to minimize the occurrence of such avoidable and undesirable variations in future public construction projects, the following recommendations are proposed:

(i) ***Strengthening Project Preparation:*** Public-sector employers should strengthen project preparation processes prior to commencement of procurement by ensuring the undertaking of adequate feasibility studies, detailed engineering designs, utility mapping, hydraulic assessments, comprehensive reviews of BoQs and technical specifications, as well as Right of Way [ROW] assessments. This intervention would facilitate completion of coordinated and technically sound designs together with accurate and comprehensive BOQs and other contract documentation prior to contractor engagement.

(ii) ***Undertaking independent design audits prior to tendering:*** Procuring and Disposing Entities [PDEs] should institutionalize mandatory independent design audits before initiation of procurement for major public infrastructure projects in order to minimize design-related variations during project implementation. Where audit findings identify deficiencies, appropriate design reviews should be undertaken at the pre-procurement stage to rectify design inadequacies and correct errors, omissions, and inconsistencies in the BoQs and specifications.

(iii) ***Strengthening risk analysis and management:*** Comprehensive risk analysis should be undertaken during project planning and prior to tendering in order to identify potential sources and causes of variations. Appropriate mitigation measures should subsequently be instituted to prevent avoidable variations while optimizing the cost and functional benefits associated with beneficial or unavoidable variations.

(iv) ***Enhancing stakeholder coordination:*** Improved stakeholder coordination frameworks should be established, particularly for urban infrastructure projects involving multiple utility agencies and government institutions. Such coordination should facilitate assessment of the impacts of proposed infrastructure works on existing utility services and enable accurate estimation of utility relocation costs for inclusion in the works contracts. In addition, this coordination mechanism would provide a platform for informing utility service providers of planned infrastructure developments so as to prevent installation of utilities within designated construction corridors, thereby minimizing unforeseen utility relocation costs during project

implementation.

Furthermore, the findings of the study revealed the occurrence of governance weaknesses including delayed approvals, delayed decision-making, inadequate project preparation, weak regulatory enforcement, political interference, ineffective contract administration, and poor stakeholder coordination. These governance deficiencies constituted significant underlying factors contributing both to the occurrence of variations and to ineffective management of the variation process in public construction projects. In order to strengthen institutional governance and improve variation management practices in public construction projects, the following recommendations are proposed:

(i) ***Improving Efficiency of Approval Processes:*** Government institutions responsible for approval of variations should improve the efficiency and timeliness of approval processes in order to minimize delays in project implementation and the associated cost escalation arising from prolonged contract durations.

(ii) ***Strengthening Contract Administration Capacity:*** Public-sector institutions should strengthen institutional capacity in contract administration through continuous professional training in project management, construction contract administration, procurement management, and cost control practices.

(iii) ***Promoting Transparency and Technical Independence in Decision-Making:*** Transparency, accountability, and technical independence in project decision-making processes should be strengthened in order to minimize political interference and non-technical influence in project implementation and variation management.

Finally, this study recommends that future research should be undertaken on variations in public construction projects in Uganda using broader project samples and quantitative research approaches in order to generate wider empirical evidence on the causes of variations, their cost implications, and the relationship between governance systems and effective variation management.

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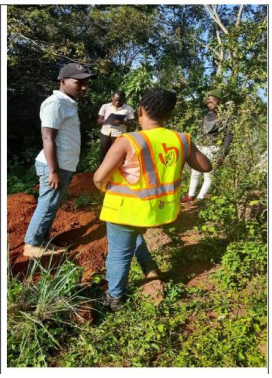
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APPENDICES

APPENDIX 1: PROJECT PHOTOGRAPHS

APPENDIX: PHOTOGRAPHS REPRESENTING DIFFERENT ACTIVITIES EXECUTED ON THE PROJECT (Complementing Section 1.4.4 of this technical report)

TYPICAL PHOTOGRAPHS FROM CASE STUDY 1 PROJECT	
 Asphalt plant installed at the Workers' Camp	 Site laboratory at the Camp
 Contractor's site offices at the Camp	 Site stores at the Camp
 Services Relocation – Ntenga Rd	  Borrow materials sourcing - Kasininya
 Earthworks Cut – Kinyoro 2 Rd	 Earthworks – road widening – Cathedral 1 Rd

TYPICAL PHOTOGRAPHS FROM CASE STUDY 1 PROJECT



Rockfill – Cathedral 1 road



Subgrade layer – Kinyoro 2 Rd



G30 Subbase layer – Kinyoro 2 rd



CRR Base layer – Cathedral 2 Rd



Priming – Kinyoro 2 Rd



Asphalt concrete – Kinyoro 2 Rd



Longitudinal Drainage – Church Rd



Lined Open Drain – Cathedral 1 Rd

TYPICAL PHOTOGRAPHS FROM CASE STUDY 1 PROJECT



Closed rectangular drain – section of the main drainage channel



Cross culvert – Ntenga Rd



Box culvert -Cathedral 2 Rd



Box culvert – Cathedral 1 Rd



Box culvert – Cathedral 1 Rd



Service Duct – Nalule-Miyodi Rd



Church road



Cathedral 1 road

TYPICAL PHOTOGRAPHS FROM CASE STUDY 1 PROJECT



Adventist road



Lugazi Main Drainage Channel



Lugazi Main Drainage Channel



Lugazi Main Drainage Channel





ESHS: Gender Engagement Meeting



ESHS: Air quality assessment





ESHS: Waste management



ESHS: Sample of Safety devices

APPENDIX 2: SAMPLE DATA LOG SHEETS

MSCM TECHNICAL REPORT BY BYARUHANGA JOHN WILLIAM
TITLE: VARIATIONS IN PUBLIC CONSTRUCTION PROJECTS IN UGANDA: CAUSES, COST IMPLICATIONS AND GOVERNANCE WEAKNESSES

DATA LOG TEMPLATE

PROJECT: CASE STUDY 1:

1.0	**General**			
1.1	Project Title:		Evidence	
1.2	Contract Title:		Evidence	
1.3	Duration:		Evidence	
1.4	Currency:		Evidence	
1.5	Initial Contract Price:		Evidence	
1.6	Final Contract Price:		Evidence	
1.7	Cost Overrun		Evidence	
1.8	Cost Overrun (%)		Evidence	
1.9	Form of Contract:		Evidence	
1.10	Clauses aplicable to Variations:		Evidence	
2.0	**First Variation**			
2.1	Particulars of the Variation:		Evidence	
2.2	Initiator:		Evidence	
2.3	Causes			
2.3.1			Evidence	
2.3.2			Evidence	
2.3.3			Evidence	
2.3.4			Evidence	

2.3.5			Evidence	
2.4	**Cost Implication**			
2.4.1	Cost of Variation		Evidence	
2.4.2	Percentage of Contract Price		Evidence	
2.4.3				
2.4.4				
2.4.5				
2.5	**Governance issues**			
2.5.1	Adequacy of project preparation (initiation, feasibility studies, detailed design, tendering, contract documentation)		Evidence	
2.5.2	Adequacy of contract management and oversight (tracking, timely approvals, enforcement of contract provoisions)		Evidence	
2.5.3	Poor coordination between Employer, PM and Contractor (delayed decision-making, conflicting instructions, disputed variations)		Evidence	
2.5.4	Weak regulatory enforcement (non-compliance with established procedures)		Evidence	
2.5.5	Political interference and patronage		Evidence	
2.5.6	Corruption and lack of transparency (unjustified variations, inflated valuations, compromised quality of work)		Evidence	
3.0	**Second Variation**			
3.1	Particulars of the Variation:		Evidence	
3.2	Initiator:		Evidence	
3.3	Causes			
3.3.1			Evidence	
3.3.2			Evidence	
3.3.3			Evidence	
3.3.4			Evidence	
3.3.5			Evidence	
3.4	**Cost Implication**			

3.4.1	Cost of Variation		Evidence	
3.4.2	Percentage of Contract Price		Evidence	
3.4.3			Evidence	
3.4.4				
3.4.5				
3.5	**Governance issues**			
3.5.1	Adequacy of project preparation (initiation, feasibility studies, detailed design, tendering, contract documentation)		Evidence	
3.5.2	Adequacy of contract management and oversight (tracking, timely approvals, enforcement of contract provoisions)		Evidence	
3.5.3	Poor coordination between Employer, PM and Contractor (delayed decision-making, conflicting instructions, disputed variations)		Evidence	
3.5.4	Weak regulatory enforcement (non-compliance with established procedures)		Evidence	
3.5.5	Political interference and patronage		Evidence	
3.5.6	Corruption and lack of transparency (unjustified variations, inflated valuations, compromised quality of work)		Evidence	
4.0	**Third Variation**			
4.1	Particulars of the Variation:		Evidence	
4.2	Initiator:		Evidence	
4.3	Causes			
4.3.1			Evidence	
4.3.2			Evidence	
4.3.3			Evidence	
4.3.4			Evidence	
4.3.5			Evidence	
4.4	**Cost Implication**			
4.4.1	Cost of Variation		Evidence	

4.4.2	Percentage of Contract Price		Evidence	
4.4.3			Evidence	
4.4.4				
4.4.5				
4.5	**Governance issues**			
4.5.1	Adequacy of project preparation (initiation, feasibility studies, detailed design, tendering, contract documentation)		Evidence	
4.5.2	Adequacy of contract management and oversight (tracking, timely approvals, enforcement of contract provoisions)		Evidence	
4.5.3	Poor coordination between Employer, PM and Contractor (delayed decision-making, conflicting instructions, disputed variations)		Evidence	
4.5.4	Weak regulatory enforcement (non-compliance with established procedures)		Evidence	
4.5.5	Political interference and patronage		Evidence	
4.5.6	Corruption and lack of transparency (unjustified variations, inflated valuations, compromised quality of work)		Evidence	
5.0	**Overall Cost Implication od Variations**			
5.1	Cost of Variation		Evidence	
5.2	Percentage of Contract Price		Evidence	
5.3			Evidence	
5.4				
5.5				