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DIRECTORATE OF RESEARCH AND GRADUATE TRAINING

AN ASSESSMENT OF THE BARRIERS TO THE ADOPTION OF DESIGN-BUILD DELIVERY METHOD FOR ROAD PROJECTS IN UGANDA

BY

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A DISSERTATION SUBMITTED TO THE DIRECTORATE OF RESEARCH AND GRADUATE TRAINING OF KYAMBOGO UNIVERSITY IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE AWARD OF MASTER OF SCIENCE IN CONSTRUCTION TECHNOLOGY AND MANAGEMENT OF KYAMBOGO UNIVERSITY

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PRONOUNCEMENT

I, the undersigned**,** hereby affirm that the information presented herein originated from me and has never been accepted previously by Kyambogo University or any other institution for academic purposes except where due acknowledgment has been made in the report. Any errors and omissions encountered in this dissertation shall be attributed to me.

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….. September 2025

APPROVAL

We, the undersigned, affirm our thorough review and approval of the dissertation entitled *'An Assessment of the Barriers to the Adoption of Design-Build Delivery Method for Road Projects in Uganda'*. We duly recommend the work for the award of a Master of Science in Construction Technology and Management.

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September 2025

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September 2025

DEDICATION

I dedicate this work to my parents (RIP) and siblings, on whose courage I continue to build. Special dedication goes to my wife, Ms. Patience Natumanya, for the unending encouragement throughout my career.

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ABBREVIATIONS

COR	Critical Oil Roads
CVI	Content Validity Index
DB	Design-Build
Dr.	Doctor
EACOP	East African Crude Oil Pipeline
Eng.	Engineer
FGDs	Focus Group Discussions
GDP	Gross Domestic Product
ITT	Instructions to Tenderers
KII	Key Informant Interview
NDP	National Development Plan
PPP	Private Public Partnership
RFP	Request For Proposal
RFP	Request for Proposal
RoW	Right of Way
SI	Severity Index

ABSTRACT

Timely delivery, budget devotion, construction quality, and stakeholder satisfaction remain the key indicators of successful road infrastructure worldwide. In Uganda, however, the road sector continues to experience recurring cost overruns and schedule slippages, most of which are attributed to the choice of project delivery approach. The Design-Build (DB) method offers an integrated alternative that could potentially mitigate these inefficiencies, yet its adoption in Uganda has remained minimal. This study assessed the level of DB adoption, identified barriers hindering its implementation, and formulated a practical toolkit to facilitate wider adoption in Uganda's road construction industry to DB adoption in Ugandan road projects and developed a practical toolkit to address them. A mixed-methods design was applied, combining survey questionnaires, key informant interviews, and case study reviews of completed road projects. Data were obtained from 113 respondents, including contractors, consultants, design specialists, and Client Project Management Teams. SPSS version 25.0 was utilised to analyse quantitative data, whereas qualitative data were examined through content analysis. Findings revealed that DB adoption in Uganda's road sector stands at only 10%. The main identified barriers include lengthy documentation processes, delayed payments to contractors, weak stakeholder communication, and limited participation of local firms. The developed toolkit emphasises enablers such as digitalised document management, transparent payment systems, and strengthened stakeholder engagement frameworks. Adoption of these measures has the potential to improve efficiency, can improve project efficiency, reduce financial and time overruns, and improve stakeholder confidence. Ultimately, the toolkit offers a pathway to increasing DB adoption in Uganda and provides lessons applicable to other developing economies.

Keywords: Barriers, Design-Build, adoption, stakeholders, delivery method, road projects

CHAPTER ONE: INTRODUCTION

1.1 Study background

Globally, road infrastructure is a recognised wide foundation for economic development, social integration, and improved access to essential services to communities. In many countries, efficient delivery of road projects not only contributes to national competitiveness but also to regional trade and connectivity. Public authorities continue to face rising expectations to deliver infrastructure projects that are timely, economical, and of acceptable quality. To address these demands, the Design-Build (DB) delivery method is often adopted, which combines design and implementation responsibilities within a single contract. In developed economies like the USA and the UK, Design-Build has been extensively adopted, offering advantages such as reduced project timelines, improved coordination, and more effective risk allocation (Savannah & Zobel, 2018; Angbazo, 2019).

While the DB has shown significant value in developed settings, its application in less developed economies, for example, Sub-Saharan Africa, has been uneven. Adoption is often constrained by contextual challenges, including institutional capacity, limited financial resources, and weaknesses in regulatory enforcement (Ololube, 2017). The region exhibits a diverse infrastructure landscape, as some countries maintain fairly modern transport networks, while others continue to grapple with poor connectivity and underinvestment in roads (Ali and Ngwenya, 2019). Although discussions around innovative procurement models are increasing, systemic barriers such as bureaucratic

inefficiencies, policy inconsistencies, and shortages of technical expertise have slowed widespread adoption (World Bank, 2020).

Examples from selected African countries highlight both opportunities and limitations of DB. South Africa has implemented DB successfully on certain large-scale projects, while countries like Egypt and Ethiopia have experimented with the model with mixed results. In Ethiopia, for instance, weak contract management and misaligned risk-sharing arrangements constrained the anticipated benefits (Lolamo and Dinku, 2017). These experiences illustrate that while DB offers the potential to improve project performance, its success largely depends on the maturity of the legal, procurement, and construction market frameworks supporting it (Adel Hashem, 2024).

In East Africa, Uganda, Kenya, Rwanda, and Tanzania have all considered DB as a possible remedy for recurrent problems in road project delivery, such as prolonged delays, escalating costs, and disputes among stakeholders. Policy debates and regional strategies often cite DB as a viable alternative to the traditional Design–Bid–Build (DBB) model, primarily due to its potential for early contractor involvement, streamlined responsibility, and innovative design solutions (Ogutu and Opawole, 2021). Nonetheless, progress has been slow, constrained by outdated procurement regulations, weak enforcement of construction standards, and underdeveloped contractor markets (Muriuki and Ochieng, 2018).

Uganda provides a particularly relevant case for examining DB adoption. The country has significantly increased its investment in transport infrastructure, dedicating approximately 17% of the national budget to the road sector in recent years (Ggoobi et al., 2020). The Uganda National Roads Authority (UNRA) is the main agency tasked

with developing and managing the national road networks. While UNRA has delivered major projects using traditional approaches, DB remains scarcely utilised. Barriers such as lengthy procurement cycles, rigid administrative procedures, delayed contractor payments, and low participation of domestic contractors have constrained its uptake. Uganda's landlocked geography further complicates logistics and inflates project costs, making efficiency gains from DB highly desirable, yet difficult to achieve.

The Innovation Diffusion Theory (IDT) proposed by Rogers (2014) presents a valuable context for assessing DB adoption aspects in Uganda. The theory postulates adoption of new practices as influenced by their perceived advantages, compatibility levels, trialability, complexity, and observability. In Uganda, challenges such as the perceived complexity of procurement, limited observable success stories, and incompatibility with existing regulatory frameworks have slowed the diffusion of DB. Conversely, clearer demonstrations of relative advantage, such as improved timelines, better cost control, and enhanced coordination, could encourage its wider acceptance.

Against this background, the study investigates the DB adoption rate in Uganda's road sector, explores barriers to its implementation, and develops a practical toolkit to address these challenges. The findings are expected to offer insights to policymakers, agencies such as UNRA, and industry practitioners on how DB can be strategically advanced in Uganda. Furthermore, the study holds relevance for other developing economies facing similar constraints in road infrastructure.

1.2 Problem Statement

Worldwide, the Design-Build approach has gained prominence for its ability to integrate design and construction within a single contractual framework. By fostering innovation, improving coordination, and streamlining responsibilities, DB has led to reduced costs, accelerated timelines, and enhanced project outcomes. Despite these demonstrated advantages, its application within Uganda's road construction sector has been minimal.

Several interrelated challenges continue to constrain DB adoption in Uganda. Stakeholders often lack adequate awareness and understanding of the DB process, which limits informed decision-making during procurement and implementation. In addition, there is a shortage of practitioners with practical DB expertise, leading to capacity gaps in both public institutions and private firms. The complexity of contractual arrangements, difficulties in balancing risk-sharing between clients and contractors, and persistent concerns about potential loss of design autonomy further compound these barriers. Collectively, these factors not only hinder the effective use of DB but also restrict Uganda's ability to achieve greater efficiency and value for money in its road infrastructure investments.

Uganda's sustained commitment to road infrastructure reflects its importance as a foundation for regional integration, social development, and sustained economic performance. Nevertheless, delays, budget overruns, and disputes under conventional delivery methods undermine the impact of these investments. The limited adoption of DB represents a missed opportunity to address these persistent challenges and to align

infrastructure delivery with the country's broader aspirations for efficiency, competitiveness, and sustainable development.

The study, therefore, aims to identify context-specific limitations to DB adoption in Uganda's road sector and develop a context-appropriate toolkit that supports policymakers, implementing agencies, and industry actors in overcoming these challenges. By doing so, the research aims to position DB as a viable and effective alternative delivery method, capable of improving project success and enhancing transport sector performance.

1.3 Study Objectives

1.3.1 Main Objective

This study aims to assess the factors limiting the adoption of the Design-Build delivery method in Uganda's road construction sector.

1.3.2 Specific objectives

The study hinged on the following specific objectives

i) To determine the current DB adoption rate in Uganda's road projects.
ii) To identify and evaluate the barriers constraining the adoption of the DB delivery method.
iii) To develop a practical toolkit for mitigating these barriers and enhancing DB adoption in Uganda's road sector.

1.4 Research questions

i) How extensively is the DB delivery system currently employed in Uganda's road construction industry?

ii) What barriers limit the effective adoption of the DB delivery method in Uganda?

iii) What measures can be developed to mitigate these barriers and improve DB adoption for road projects in Uganda?

1.5 Justification

Timely delivery, budget adherence, and quality outputs remain central to road infrastructure projects. However, Uganda faces recurring challenges, for instance, time and cost overruns, and disputes often resulting from fragmented responsibilities and weak coordination among project stakeholders (Piroozfar, 2019). The DB's potential of integrating design and implementation functions for a single contractual entity has proven effective in many developed countries by reducing fragmentation and promoting efficiency. Despite these demonstrated benefits, its uptake in Uganda has been minimal.

This limited adoption raises important questions about the structural, institutional, and market-related barriers that constrain the diffusion of DB in Uganda's road sector. A systematic examination of these barriers is essential for identifying context-specific challenges, evaluating their severity, and proposing effective mitigation strategies. The persistence of these issues poses the risk that Uganda will be unable to realize the potential of the DB framework as a strategic mechanism for advancing efficiency,

reducing adversarial conflicts, and achieving higher performance in road infrastructure development.

The study is therefore justified on both academic and practical grounds. From an academic perspective, it contributes to the limited empirical research on DB adoption in Sub-Saharan Africa, offering insights into barriers specific to developing country contexts. From a practical standpoint, the findings will equip policymakers, implementing agencies such as UNRA, Consultants, and contractors with a mitigating toolkit to address these barriers. The anticipated benefits include improved performance of infrastructure projects, heightened stakeholder confidence, and the promotion of sustainability, all of which are critical to reinforcing Uganda's competitive advantage and achieving its long-term developmental aspirations

1.6 Significance

The study provides a substantial contribution to both practical application and the theoretical discourse on the subject. The toolkit developed provides a structured set of strategies for overcoming barriers to the entire DB Project cycle. For stakeholders in Uganda's road construction sector, such as policymakers, implementing agencies, consultants, and contractors, the toolkit offers practical guidance for improving project efficiency, strengthening coordination, and encouraging wider adoption of DB.

Academically, the study advances the body of knowledge on Design-Build methodologies by examining the unique barriers affecting their adoption within Uganda's road construction sector. By highlighting contextual challenges and proposing tailored solutions, it contributes to the growing discourse on construction

administration practices. The study findings also offer a foundation for future research, particularly for scholars seeking to refine DB adoption strategies in similar contexts.

For the researcher, this work represents a significant academic milestone towards the completion of the Master's study. The comprehensive analysis of barriers, coupled with the development of practical interventions, reflects a high level of scholarly rigor and provides a foundation for ongoing professional development, as well as meaningful contributions to the discipline of construction management.

1.7 Study Scope

1.7.1 Geographical Scope

This study examined UNRA road projects from 2012 to 2023 to assess the adoption rate, trends, and determinants of the DB method. To obtain deeper insights into barriers to adoption, the research concentrated on donor-funded Critical Oil Roads (COR) projects executed through the DB approach. These projects were selected because of their strategic importance, their role in supporting national development priorities, and their alignment with the urgent requirements of the East African Crude Oil Pipeline (EACOP).

The COR projects were of particular interest due to their stringent performance requirements, limited resource availability, and tight completion timelines imposed by the urgency of facilitating oil production anticipated to commence in 2025 (UNRA, 2023). Their inclusion provided an opportunity to examine how DB could be applied under high-stakes conditions, offering lessons applicable to future infrastructure initiatives in Uganda.

The geographical coverage of the study included districts in the Albertine Graben region, including Masindi, Buliisa, Hoima, Kikuube, and Kakumiro, where the selected road projects were concentrated, as shown in Figures 1-1 to 1-3.

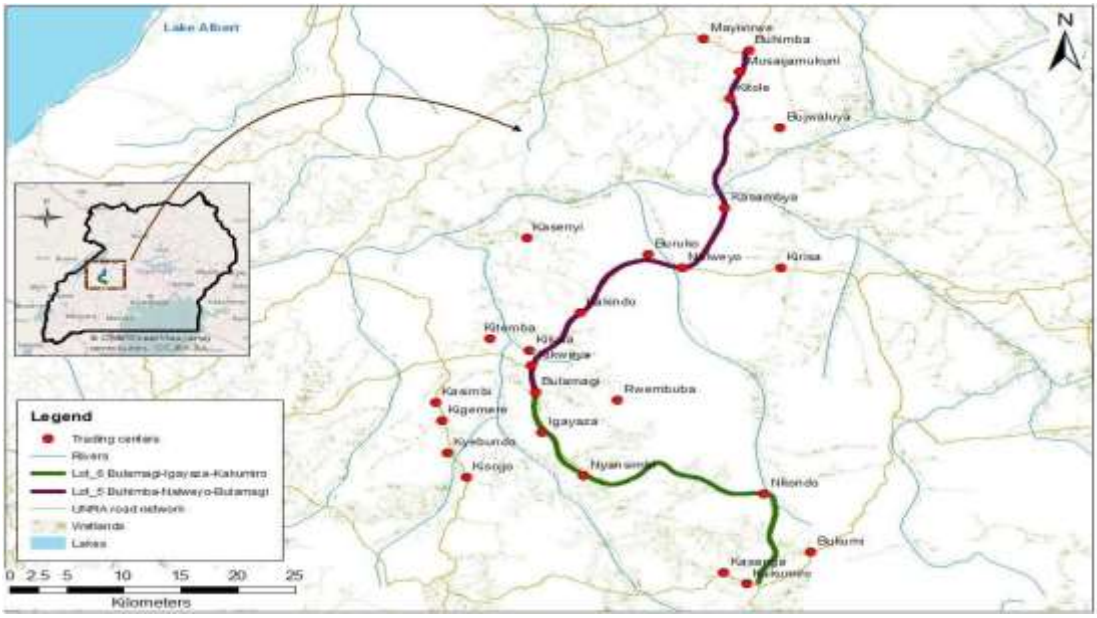

Figure 1-1: Package 3 roads Location map

Figure 1-2: Package 1 roads Location map

Figure 1-3: Package 5 roads Location map

These districts host critical infrastructure supporting the oil sector, and the road projects under review were central to enabling economic growth, regional connectivity, and the timely implementation of Uganda's petroleum development agenda

1.7.2 Content Scope

This research concentrated on reports from completed Design–Build (DB) projects undertaken between 2012 and 2023. The objective was to examine the drivers that enabled the adoption of DB, the lessons drawn, emerging patterns, and project success stories. The analysis specifically considered donor-supported critical oil roads (COR), namely: Masindi–Biiso, Hohwa–Nyarongo–Kyarusheesha–Butole, and Kabaale–Kiziranfumbi (97 km); Masindi–Kisanja–Park Junction (169 km); and Buhimba–Nalweyo–Kakumiro (93 km). Collectively, these corridors cover a total of 359 km and

were designed to provide enabling infrastructure for the East African Crude Oil Pipeline (EACOP), a facility critical for oil production projected to commence in 2025. The scope deliberately excluded other strategic oil road projects implemented under the Design–Bid–Build (DBB) model. This narrowed focus permitted a more rigorous appraisal of the barriers that were unique to DB adoption, generating context-specific insights aimed at overcoming such barriers and ensuring that project delivery timelines are met.

1.7.3 Time Scope

Data collection was undertaken once, consistent with the cross-sectional research design guiding the investigation.

1.8 Conceptual Framework

The study was structured on the linkage between the application of the DB delivery approach and the barriers encountered by stakeholders in striving for optimal project outcomes. The framework analysed how the severity of these barriers influenced the rate and effectiveness of DB adoption within Uganda's regulatory and project implementation environment. By examining the interplay between the DB model, context-specific obstacles, and external factors, the framework provided a systematic understanding of the dynamics shaping DB implementation in road construction. This integrative perspective offered a foundation for interpreting how DB interacts with project environment variables, thereby yielding insights into strategies for reducing barriers and improving project performance. Figure 1-4 presents the study's conceptual framework.

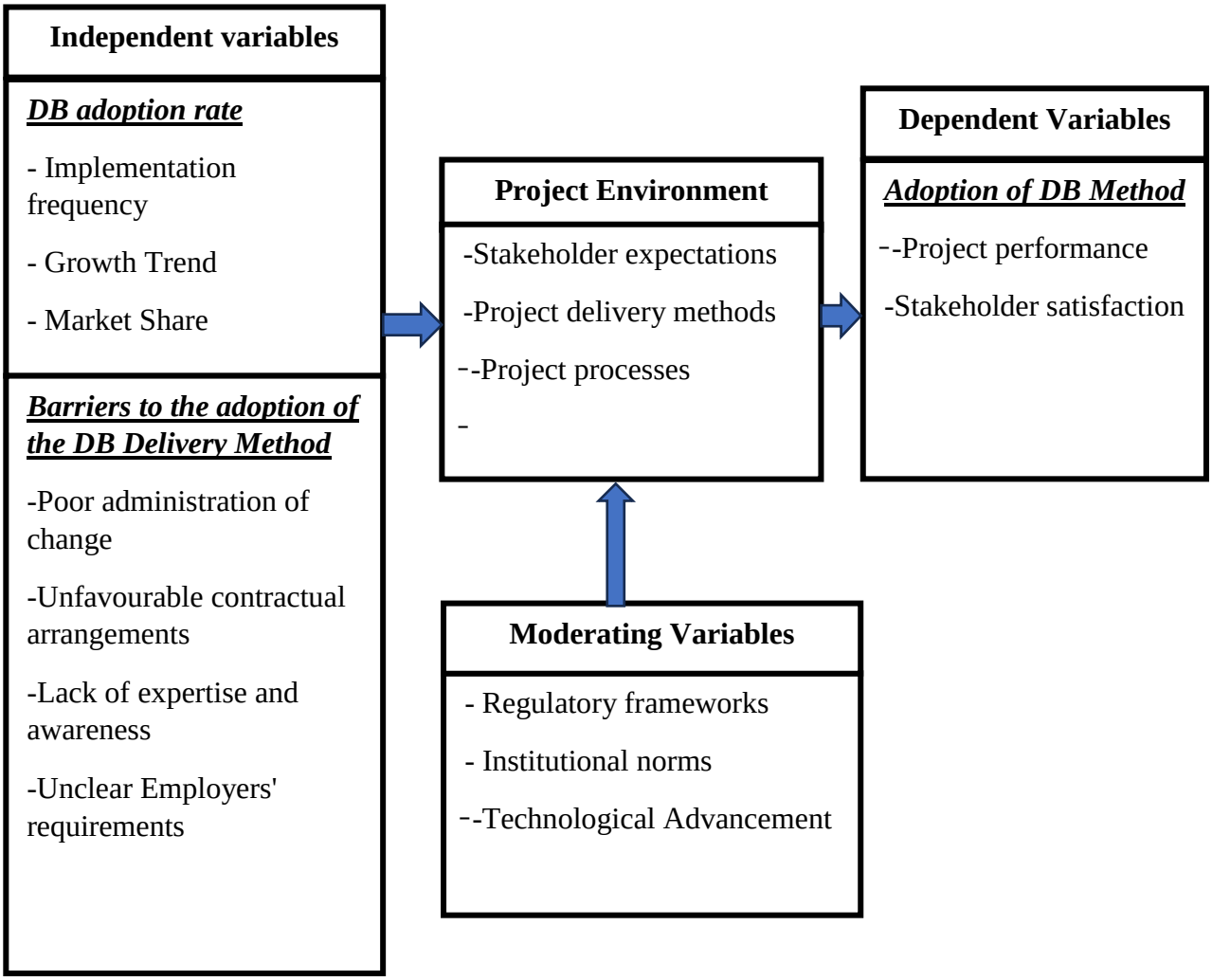

Figure 1-4: Study Conceptual Framework

1.9 Chapter Summary

This chapter offered a comprehensive introduction to the study, beginning with the context and progressing to identifying the knowledge gap articulated in the problem statement. It further presented structured questions on which the achievement of the study objectives hinged.

In addition, the discussion clarified the linkages between the study variables while underscoring the significance of the study through the identified gap, thereby establishing a coherent foundation for the progression of the research.

The next chapter presents a detailed literature review, exploring previous studies and theoretical frameworks pertinent to the research.

CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction

This chapter examines both scholarly research and practical insights related to DB adoption in road projects. It summarises the contribution of past studies towards framing of study questions and shaped the conceptual approach. The review also highlights gaps in current knowledge and practice that justify this investigation. Specifically, it explores the barriers experienced by different stakeholders in adopting DB in Uganda and examines theoretical perspectives that provide explanatory insights into the slow uptake of this approach.

2.2 Theoretical Review

The introduction of innovative project delivery approaches such as DB is rarely a straightforward technical matter; instead, it is influenced by a range of social, institutional, and organizational dynamics. To explain these complexities, this study draws on Everett Rogers' Innovation Diffusion Theory (IDT), first advanced in 1962 and refined in later editions (Rogers, 2014). The IDT provides a framework for understanding how new practices diffuse in a social system, emphasizing the roles of individual perceptions, contextual compatibility, and communication processes in shaping adoption outcomes. According to IDT, diffusion unfolds through five interrelated stages:

1. Knowledge, which is the exposure to and awareness of the innovation.

2. Persuasion, which presents the development of attitudes, either favourable or unfavourable.
3. Decision, which represents the commitment to adopt or reject.
4. Implementation, which represents the actual use in practice.
5. Confirmation, which is the reinforcement of the adoption decision through continued experience.

These stages are neither linear nor uniform across stakeholders but are influenced by perceptions and contextual realities. Rogers further outlines five key characteristics of innovations that play a critical role in influencing their adoption.

- Relative Advantage: This refers to the degree the new approach is perceived to provide superior benefits over the current system.
- Compatibility: This refers to the extent to which the innovation is compatible with the present norms, policies, and practices of the adopting system.
- Complexity: This pertains to the perceived complexity involved in understanding, implementing, and effectively utilizing the innovation.
- Trialability: This describes the degree of experimentation on a limited scale before full adoption.
- Observability: This is the degree to which the benefits of an innovation are observable, thereby increasing stakeholders' confidence and readiness to adopt it.

Application of IDT to the Ugandan DB Context

The DB method places sole responsibility for the design and implementation phases. Internationally, sole responsibility has been associated with faster delivery, cost savings, and enhanced collaboration (Ogutu and Opawole, 2021). However, Uganda's road sector has been slow in adopting DB, and the barriers can be understood through the IDT perspective:

- Relative Advantage: While DB has demonstrated clear benefits globally, its perceived superiority in Uganda is undermined by issues such as delayed payments, weak contract enforcement, and a limited pool of successful local case studies (Nuwagaba and Molokwane, 2020; Smith et al., 2021).
- Compatibility: The prevailing institutional and regulatory frameworks are designed around traditional Design–Bid–Build processes, creating systemic misalignment that reduces DB's readiness for adoption (Mutikanga et al., 2022).
- Complexity: DB contracts require advanced coordination and technical expertise, yet Uganda continues to face capacity constraints, including shortages of skilled professionals in contract management and integrated delivery (Ogutu and Opawole, 2021).
- Trialability: The absence of small-scale pilot DB projects limits opportunities for stakeholders to experiment, learn, and gradually build confidence (Smith et al., 2021).

- Observability: With only a few DB projects completed, tangible evidence of DB's benefits remains limited, reducing its visibility and attractiveness to industry actors (McCarthy et al., 2022).

Implications for this Study

By employing IDT as the guiding theory, this study:

- Interprets Uganda's slow DB adoption as reflective of stakeholders being largely concentrated in the *knowledge* and *persuasion* stages of diffusion.
- Organizes barriers within the five innovation attributes, linking technical, regulatory, and perceptual challenges into a unified explanatory framework.
- Provides direction for practical interventions, capacity building to reduce perceived complexity, regulatory reforms to enhance compatibility, pilot initiatives to improve trialability, and awareness campaigns to increase observability and relative advantage.

Conclusion of Theoretical Review

Innovation Diffusion Theory offers a robust analytical lens for assessing DB adoption in Uganda's road sector. It highlights how perceptions, systemic constraints, and contextual misalignments shape adoption outcomes beyond the purely technical domain. By applying this framework, the study seeks not only to categorize barriers but also to propose evidence-based strategies for accelerating DB diffusion. In doing so, it contributes to both academic discourse and practical policy aimed at strengthening infrastructure delivery and advancing national development priorities.

2.3 Thematic Review

2.3.1 Growth of the DB method

The DB delivery approach consolidates both design and implementation responsibilities within a single contractual arrangement, distinguishing it from the conventional Design–Bid–Build (DBB) approach. Globally, DB has gained prominence because of its demonstrated ability to shorten project schedules, reduce overall costs, and enhance collaboration among key stakeholders (Ogutu and Opawole, 2021; Al-Kasasbeh et al., 2022).

Although the institutionalization of DB delivery is commonly associated with developments in the mid-twentieth century, its conceptual roots can be traced back to the Industrial Revolution, where emphasis was placed on integrated processes to improve efficiency (McCarthy et al., 2022). In more recent studies, Lee (2022) and Kesho and Leulseged (2022) note that the increasing preference for DB is largely attributable to early contractor involvement and the merging of design and implementation stages. This integration accelerates project completion and facilitates improved distribution of risks. Robertson (2022) further argues that DB's holistic structure enhances problem-solving capacity and allows for more agile decision-making, thereby presenting a competitive advantage for clients.

The global surge in DB adoption has also been linked to rising client expectations for faster delivery and greater control over design-related complexities (Pradhananga et al., 2023; Hasanzadeh and Esmaeili, 2022). Procurement systems that emphasize qualifications-based selection and responsiveness have strengthened DB's case by

promoting transparency, efficiency, and the selection of contractors best suited for complex assignments (Al-Kasasbeh et al., 2022).

The Ugandan Context

In Uganda, the use of DB is still at an emerging stage but is gradually expanding, largely driven by the need to accelerate infrastructure development and deliver on pressing national priorities (Mutikanga et al., 2022). The method is increasingly valued for its ability to streamline project phases, reduce redundancy in procurement cycles, and limit conflicts between design and implementation teams (Nuwagaba and Molokwane, 2020). These features make DB attractive in a setting where road infrastructure is essential for economic integration and regional connectivity.

Despite this promise, Uganda's adoption of DB has been slower compared to developed economies. Key barriers include institutional rigidity, gaps in technical expertise, and limited experience with integrated contracting arrangements (Ogutu and Opawole, 2021). Nonetheless, the government has signaled growing commitment to DB delivery through policy endorsements, regulatory reforms, and targeted pilot projects (Nduhura, 2019; Mutikanga et al., 2022). The private sector also increasingly acknowledges DB's advantages, particularly in enhancing communication flows and compressing delivery timelines (Ogutu and Opawole, 2021).

However, the slow and uneven diffusion of DB in Uganda indicates persistent context-specific challenges that are not always addressed in international discourse, which typically assumes more developed and mature construction industries. This underscores a critical research gap: the need for localized studies to better understand

adoption dynamics and to identify barriers unique to Uganda's institutional and socio-economic environment.

2.3.2 Factors Influencing the Choice of Design-Build Projects

The decision to adopt the Design–Build (DB) delivery approach in Uganda, as in other contexts, is shaped by multiple project-specific and contextual considerations. Key determinants include project complexity, urgency of completion, potential for innovation, and the structure of available funding (Faraji et al., 2022; Hasanzadeh and Esmaeili, 2022). Research indicates that DB is particularly suited to projects requiring accelerated timelines, innovative technical solutions, or complex constructability arrangements, conditions commonly encountered in infrastructure development (Gransberg and Molenaar, 2019; Zhu et al., 2020).

Risk allocation is also a central factor influencing DB selection in Uganda. The method is preferred when risks can be shared fairly between the client and contractor, fostering accountability and reducing disputes (Zhu et al., 2020). Gransberg and Molenaar (2019) note that the successful adoption of DB depends on clearly defined project objectives and transparent procurement procedures. However, many Ugandan projects struggle with effective risk identification and management due to rigid regulations and limited institutional capacity, which can constrain the suitability of DB as a delivery option (Mutikanga et al., 2022). These contextual constraints highlight the need for localized empirical studies to understand how DB adoption determinants function within Uganda's unique socio-institutional environment.

2.3.3 Operational Variations in Design-Build Delivery

The Design–Build is not a uniform model; its application varies according to project characteristics, client requirements, and institutional capabilities. Literature identifies several DB variants, each with distinct contractual and managerial implications: Direct Design–Build (DDB), Design Criteria Design–Build, Preliminary Design–Build, and Bridging Design–Build (Papajohn and El Asmar, 2020; Demetracopoulou et al., 2025; Markovic, 2022).

- **Direct Design–Build (DDB):** In this model, the client assigns the DB firm the responsibility for design and implementation of the project scope. It requires substantial client engagement and expertise to manage the process effectively (Papajohn and El Asmar, 2020). While it streamlines communication and enhances control, the model assumes that the client possesses sufficient technical capacity, a condition often limited in Ugandan public-sector projects (Ogutu and Opawole, 2021).

- **Design Criteria Design–Build:** This variant relies on the client providing detailed performance criteria to guide the DB team's design solutions (Demetracopoulou et al., 2021; Hasanzadeh and Esmaeili, 2022). It helps align project outcomes with client expectations but requires precise documentation from the outset. In Uganda, inadequate scope definition frequently limits the effectiveness of this approach (Yeganeh et al., 2019).

- **Preliminary Design–Build:** Under this approach, the client presents an initial conceptual or schematic design to guide project definition before contractor selection (Zhang et al., 2019). While promoting early consensus among

stakeholders, it can restrict the contractor's flexibility and creativity, sometimes causing mismatches between design assumptions and actual construction practices (Disney et al., 2022; Faraji et al., 2022).

- **Bridging Design–Build:** This hybrid approach combines features of DB and DBB. The initial design is developed by the client's consultant, after which a DB contractor is selected for construction and final design integration (Markovic, 2022). While the method provides greater client control, it may reduce opportunities for innovation and misallocate risks, challenges particularly relevant in Uganda's risk-averse institutional culture (Shang and Migliaccio, 2020).

Although these operational models are well-documented internationally, there is limited empirical evidence on their functionality within Uganda's road sector. Specifically, studies exploring the adaptability of these variants to local regulatory frameworks, institutional capacity constraints, and project-specific demands remain scarce, signalling a critical gap in the literature.

2.4 Barriers to the adoption of the DB Delivery Method

The literature consistently recognises the Design–Build (DB) approach as a mechanism capable of enhancing infrastructure project performance through faster delivery, cost efficiencies, effective risk management, and single-point accountability. Nevertheless, DB adoption in developing countries like Uganda remains low due to a complex interplay of barriers spanning the entire project lifecycle. These obstacles can be broadly categorized into four domains: document preparation, time, cost, and scope.

Importantly, these barriers are interconnected and often amplify one another, collectively undermining the potential benefits of DB.

2.4.1 Barriers Related to Document Preparation

Document preparation is a critical stage in DB procurement as it establishes the contractual, technical, and operational framework for project execution. Deficiencies at this stage can lead to downstream inefficiencies, cost escalations, and strained client–contractor relationships.

Tender Preparation

Inadequately defined tenders are frequently cited as a significant impediment to DB adoption. Ambiguities or incomplete project scopes can create misunderstandings, trigger disputes, and erode clients and contractors' trust (Liu et al., 2016; Ajmal et al., 2022). In DB settings, where contractors assume substantial design responsibility, insufficient documentation forces them to make assumptions that may diverge from client expectations, thereby increasing risk exposure (Mengesha et al., 2023, and Osei-Kyei and Chan, 2021).

Cruz et al. (2013) highlight the need for balancing tender documentation: prescriptive elements ensure compliance with technical standards, statutory requirements, and quality expectations, while flexibility enables contractors to leverage DB's innovation potential. In practice, however, Uganda's public-sector tenders often fail to achieve this balance, oscillating between excessive rigidity, which stifles creative solutions, and vagueness, which increases uncertainty and shifts risk onto contractors (Lupton and Stellakis, 2022; Noyan, 2024).

Another recurring issue is the lack of detailed technical and financial information in tenders. Lorentziadis (2020) and Agyekum-Mensah (2019) note that incomplete documentation compels bidders to include large contingencies to hedge against uncertainty, inflating bid prices and reducing competitiveness. Empirical evidence from African infrastructure projects corroborates this, showing that poorly specified tenders can increase costs by 10–15% relative to well-defined projects (Opawole et al., 2022).

Tender Evaluation

Tender evaluation in DB procurement presents further complexity, as panels must assess both the technical viability of proposed designs and their constructability and cost efficiency (Lee et al., 2022; Gad et al., 2019). Multidisciplinary expertise, including architectural, engineering, and construction knowledge, is often lacking in evaluation committees in emerging economies (DEGEBASSA, 2024).

Fourie and Malan (2020) observe that evaluation panels without diverse expertise tend to prioritize lowest-cost bids, often neglecting innovation, lifecycle performance, and long-term value. Adamtey (2022) advocates a "best value" evaluation approach that integrates qualitative and quantitative criteria to reward design excellence and operational efficiency. However, entrenched procurement practices in many jurisdictions, including Uganda, remain focused on price minimization, generating short-term political benefits but long-term inefficiencies (Ejigu, 2021).

Freeman et al. (2020) highlight the "false economy" phenomenon, where initial savings from low-bid contracts are offset by subsequent costs from redesigns, rework, and premature deterioration. In East African DB road projects, contracts awarded

solely on price were observed to be 1.5–2 times more likely to experience cost overruns exceeding 15% (World Bank, 2022).

The literature reflects a delicate tension between prescriptiveness and flexibility in DB tendering. While excessive prescription risks reduce DB to a quasi-traditional procurement model, Mengesha et al. (2023) and Ajmal et al. (2022) maintain that in low-capacity environments such as Uganda, prescriptive documentation may be essential to mitigate misinterpretation, prevent opportunistic behaviour, and uphold minimum performance standards. A context-sensitive approach, therefore, is required: jurisdictions with strong institutional capacity may benefit from flexible documentation that encourages innovation, whereas environments with weaker capacity may necessitate more prescriptive measures to ensure legal clarity, fiscal accountability, and minimum performance thresholds.

2.4.2 *Barriers Related to Time*

Although the Design–Build (DB) delivery approach is often lauded for its ability to shorten project timelines by overlapping design and implementation activities, research indicates that these time-saving benefits are highly dependent on effective coordination, integration, and governance mechanisms (Osei-Kyei and Chan, 2021; Mengesha et al., 2023). Without such enabling structures, DB projects may experience delays comparable to, or even exceeding, those observed under DBB methods.

Integration of Design and Implementation

A core characteristic of DB is the concurrent execution of design and implementation phases, aimed at accelerating project delivery. Afzal et al. (2021) and Zhong et al.

(2022) propose that achieving this requires sophisticated coordination frameworks, efficient information management systems, and continuous communication between the design and implementation teams. In Uganda, however, these mechanisms are often underdeveloped, resulting in fragmented communication, duplicated efforts, and delays in implementing critical decisions.

Further compounding these delays are bureaucratic approval processes for design modifications, environmental permits, and regulatory compliance, which have been identified as significant contributors to schedule overruns (Faraji et al., 2022; ElZomor and Garber, n.d.). Additionally, unexpected site conditions, such as subsurface variability, conflicts with existing infrastructure, or unforeseen environmental constraints, can necessitate redesigns. Without agile change management protocols, these revisions further extend project timelines and increase resource demands (Lupton and Stellakis, 2022; Noyan, 2024).

Contextual Dependence of Time Benefits

While proponents of DB highlight parallel workflows as a key mechanism for time compression (Afzal et al., 2021; Zhong et al., 2022), empirical evidence suggests that the method's effectiveness is highly context-specific. Robinson et al. (2012) contend that in governance environments marked by slow bureaucratic procedures and fragmented institutional capacity, the theoretical scheduling advantages of DB are rarely realized.

Recent studies in sub-Saharan Africa provide empirical support for this conditionality. Mengesha et al. (2023) demonstrate that schedule compression occurs predominantly when integrated project delivery practices, digital collaboration platforms, and

streamlined approval processes are concurrently applied. In contrast, Opawole et al. (2022) report that in the absence of these enablers, DB projects often face delays related to coordination and decision-making, comparable to traditional DBB procurement. This underscores that DB's time efficiency is not intrinsic to the model but rather contingent upon institutional maturity and procedural effectiveness.

Balancing Governance and Agility

Another critical consideration is the tension between maintaining formal governance and enabling agile decision-making. Afzal et al. (2021) note that strict adherence to hierarchical approval structures can impede responsiveness, whereas overly flexible processes may compromise oversight and quality. In Uganda, where approval hierarchies are multi-layered and inter-agency coordination is weak, achieving the expected time efficiencies of DB requires a balanced approach. Such an approach must ensure regulatory compliance while supporting real-time decision-making and adaptive management (Faraji et al., 2022; Lupton and Stellakis, 2022).

In summary, while DB has the theoretical potential to accelerate project delivery, this advantage is highly dependent on the presence of integrated coordination systems, robust governance frameworks, and agile procedural mechanisms. Absent these contextual enablers, DB projects in Uganda may fail to achieve schedule reductions, highlighting the critical importance of aligning the delivery method with the institutional and procedural capacity of the project environment.

2.4.3 Barriers Related to Cost

Cost-efficiency is widely regarded as a key advantage of DB, primarily because integrating design and implementation under a single contract theoretically reduces duplication, optimises resource utilisation, and minimises project delays (Osei-Kyei and Chan, 2021; Mengesha et al., 2023). However, evidence from developing-country contexts, including Uganda, indicates that both procurement and execution stages can introduce cost-related obstacles that limit the realisation of these benefits.

Tender Preparation

A major cost-related challenge arises from incomplete or ambiguous tender documentation. Lorentziadis (2020) and Agyekum-Mensah (2019) note that insufficient technical and financial detail compels contractors to inflate contingencies to mitigate risk. This results in higher initial bids, undermining competitive advantage. Evidence from African infrastructure projects indicates that unclear tender specifications can increase bid prices by 8–15% compared to projects with comprehensive documentation (Opawole et al., 2022). In DB contracts, where contractors assume significant design responsibility, uncertainties in the tender phase have amplified financial implications (Lupton and Stellakis, 2022).

Tender Evaluation

Procurement evaluation also affects cost efficiency. Freeman et al. (2020) describe the phenomenon of "false economies," where selecting the lowest-priced bid may appear fiscally prudent initially but frequently results in downstream expenditures from rework, remedial interventions, or disputes. In Uganda, entrenched procurement

traditions, political influence, and donor-driven budget cycles often prioritise low-cost selection over value for money, reinforcing these challenges (Ejigu, 2020; Marzouk and El-Said, 2021).

Design and Implementation Combination

Cost challenges extend into project execution. Liu et al. (2020) highlight that rigid preliminary designs, often mandated by risk-averse clients, limit opportunities for design optimisation and innovative solutions. Deviations from initial assumptions on-site necessitate costly modifications, undermining DB's potential for integrated cost savings. Similarly, Noyan (2024) notes that weak contractor–client collaboration and insufficient iterative cost management exacerbate overruns in projects requiring frequent design adjustments.

Short-Term vs. Long-Term Cost Considerations

The literature reveals a tension between immediate cost control and long-term value optimisation. Advocates of strict upfront cost management reason that competitive bidding and prescriptive tendering enforce fiscal discipline, reduce opportunistic behaviour, and maintain accountability (Lorentziadis, 2020; Agyekum-Mensah, 2019). Under this perspective, clear documentation and rigorous evaluation criteria mitigate inflated contingencies, achieving short-term savings.

Conversely, proponents of whole-life costing emphasise that DB's true cost-efficiency emerges only when projects are assessed over their operational lifecycle, considering maintenance, adaptability, and sustainability (Lee et al., 2022; Lupton and Stellakis, 2022). Over-reliance on lowest-price selection risks "false economies," where short-

term savings are offset by downstream costs, such as rework, early repairs, or legal disputes (Freeman et al., 2020; Opawole et al., 2022). Evidence from African infrastructure projects indicates that contracts awarded purely on cost criteria are 1.5–2 times more likely to experience overruns exceeding 15%, underscoring the need for qualitative assessment criteria (World Bank, 2022; Mengesha et al., 2023).

Institutional Context and Procurement Strategy

In low-capacity environments like Uganda, prescriptive procurement measures, detailed technical requirements, mandatory contingency allowances, and strict cost caps are essential to mitigate misinterpretation and opportunistic practices (Ajmal et al., 2022; Mengesha et al., 2023). However, excessive rigidity can suppress innovation, limit contractor-led optimisation, and diminish DB's inherent cost-saving potential. Therefore, a context-sensitive approach is necessary: mature institutional settings benefit from flexibility and innovation, whereas weaker governance contexts require prescriptive safeguards to ensure fiscal prudence and performance compliance.

In conclusion, DB cost efficiency depends not only on procurement processes and contract design but also on institutional capacity, governance quality, and the integration of lifecycle cost considerations. By addressing these cost-related barriers through tailored tendering, evaluation, and execution strategies, Uganda's DB projects can achieve their intended financial benefits while minimising the risk of cost overruns and inefficiencies.

2.4.4 Barriers Related to Scope

Effective scope management is widely acknowledged as a critical determinant of project success in Design–Build (DB) delivery. Poorly defined or evolving project scopes can significantly compromise DB's benefits, including cost control, timely completion, and quality outcomes. In developing contexts such as Uganda, these challenges are further exacerbated by limited client technical capacity, shifting project requirements, and weak change management mechanisms (Mossad et al., 2022; Abdul Nabi et al., 2020).

Client Requirements and Scope Definition

Inadequately articulated client requirements are a major source of scope-related difficulties. Studies by Mossad et al. (2022) and Olatokun (2017) indicate that incomplete or ambiguous project briefs frequently lead to scope creep, disputes, and operational inefficiencies. Vahabi (2018) and Yeganeh et al. (2019) observe that mid-project changes, arising from evolving client needs or unforeseen technical challenges, often disrupt schedules and increase costs. In Uganda, Abdul Nabi et al. (2020) highlight that clients limited technical expertise and reliance on external consultants amplify the risk of misalignment between project intentions and actual outcomes.

Tender Preparation

Scope-related challenges are also entrenched during tender preparation. Ajmal et al. (2022) and Liu et al. (2016) contend that poorly defined scopes in tender documents create difficulties during execution by constraining contractors' planning, innovation, and resource allocation. Insufficient detail increases the potential for misinterpretation,

disputes, and subsequent cost or schedule overruns, particularly in DB projects where contractors bear both design and implementation responsibilities. Empirical studies from African infrastructure projects indicate that projects with weakly defined tender scopes experience 12–18% more scope changes during execution (Mengesha et al., 2023, and Opawole et al., 2022).

Design and implementation Integration

During execution, scope changes are often unavoidable due to site-specific conditions, regulatory updates, or emerging stakeholder requirements. Koc and Gurgun (2022) and Robinson et al. (2012) emphasise that without effective change management and communication protocols, these modifications can create conflicts among stakeholders, delay approvals, and inflate costs. Smith et al. (2021) further note that mistrust in DB frameworks may prompt clients to impose restrictive oversight measures, limiting contractors' ability to adapt designs or respond to unforeseen circumstances. In Uganda, weak institutional capacity and governance structures intensify these challenges.

Balancing Scope Clarity and Flexibility

The literature reveals a nuanced tension between the need for clear, stable scopes and the potential benefits of adaptive flexibility. According to Mossad et al. (2022) and Abdul Nabi et al. (2020), clearly defining the project scope is critical in institutional contexts with limited capacity to avoid misinterpretation, conflicts, and opportunistic behavior. In contrast, Koc and Gurgun (2022) and Mengesha et al. (2023) argue that moderate flexibility can foster innovation, enabling contractors to implement value-

engineering solutions, adapt to site-specific realities, and respond efficiently to evolving project requirements.

This debate highlights a contextual trade-off: excessive flexibility in weak governance environments may encourage inefficiency and opportunism, whereas overly rigid scopes can stifle creativity, limit innovation, and compromise project outcomes. African case studies indicate that a structured approach to "controlled adaptability", combining clear contractual boundaries, transparent change management, and robust monitoring, represents an optimal compromise. This approach maintains accountability while leveraging DB's integrated design–construction benefits (Opawole et al., 2022; Lupton and Stellakis, 2022).

In conclusion, managing project scope in DB delivery is both a technical and strategic governance challenge. The ideal level of scope flexibility depends on client expertise, institutional capacity, and the robustness of oversight mechanisms, highlighting the importance of balancing clarity with adaptive innovation to optimise project performance.

2.5 Gap Identification

Although the global literature extensively examines the theoretical foundations, operational models, and potential benefits of the DB approach, a notable lack of research that addresses contextual barriers and realities of DB adoption exists in Uganda. Most existing studies extrapolate insights from developed countries, which operate within mature institutional frameworks and highly regulated construction markets. Such generalizations fail to account for Uganda's unique socio-political,

economic, and technical landscape, where institutional capacity, regulatory enforcement, and resource constraints differ significantly.

The review highlights several critical empirical gaps:

- The actual adoption rate of DB in Uganda, and the influence of institutional, regulatory, and capacity constraints on its uptake.
- Local stakeholders' perceptions and experiences regarding DB's relative advantages, practical challenges, and operational barriers.
- The absence of tailored strategies, frameworks, or toolkits designed to address Uganda-specific impediments to DB adoption.

Filling these gaps is essential to enable Uganda's road construction sector to harness DB's full potential, including accelerated project delivery, efficient resource utilization, and enhanced stakeholder satisfaction. Context-specific insights will also support policymakers, clients, and practitioners in designing interventions that are both practical and effective within the Ugandan infrastructure landscape.

2.6 Summary of Literature

This chapter has critically examined global and Ugandan studies concerning the emergence, operational variations, and DB adoption, with particular attention to barriers impacting the success of road projects. It has highlighted key themes, including DB's benefits, its diverse operational models, and the interplay of contextual factors influencing adoption.

The review further identified significant gaps, most notably the scarcity of empirical studies focused on Uganda and the lack of contextually tailored strategies to mitigate adoption barriers. These knowledge gaps underscore the need for a focused empirical investigation to generate evidence-based insights, inform policy, and guide practical interventions.

The subsequent chapter presents the research methodology designed to address these gaps through a systematic, empirical study that evaluates DB adoption, stakeholder experiences, and context-specific mitigation strategies within Uganda's road construction sector.

CHAPTER THREE: RESEARCH METHODOLOGY

3.1 Introduction

This chapter outlines the methodological context employed to achieve the study's objectives. It describes the research design, population, and sample size, data sources, data collection instruments, and measures undertaken to ensure data validity and reliability. Ethical protocols observed are discussed, alongside strategies for disseminating results and identification of study limitations with corresponding mitigation measures.

3.2 Research design

Due to the study's multidimensional nature, a mixed-methods research design was employed. Structured questionnaires were distributed to key project stakeholders, including contractors, supervision consultants, and concept designers, while semi-structured interviews were conducted with client project management teams. This approach facilitated an in-depth exploration of stakeholder experiences with the DB delivery method in Uganda's road sector.

Additionally, a descriptive design was utilised to capture perspectives for individual, organizational, and industry levels, enabling comprehensive analysis of project barriers and DB adoption trends. This approach aligns with the guidance of Creswell and Plano Clark (2017) and Mulisa (2022). Data were collected once over four weeks, ensuring detailed responses to study questions.

3.3 Research Approach

A mixed methods strategy was employed to address the research questions. This allowed triangulation of findings, ensuring robustness, completeness, and verification of results (Patton, 2015; Johnson and Onwuegbuzie, 2004).

The study also involved a systematic review of available reports on completed DB road projects under UNRA. Combining qualitative and quantitative methods enabled the research to capture stakeholders' experiences and quantify the severity of barriers encountered. Such an approach strengthened the dependability and rationality of the findings, consistent with recommendations by Bryman (2016).

3.4 Population and Sample Size

3.4.1 Population

The work focused on responents directly engaged in key oil road projects implemented using the Design-Build delivery method under UNRA. These projects included: Project I: Masindi-Kisanja Park Junction (169 km); Project II**:** Buhimba-Nalweyo-Kakumiro (93 km); Project III**:** Masindi-Biiso, Hohwa-Nyarongo-Kyarusheesha-Butole, Kabaale-Kiziranfumbi (97 km)

The total combined length of the roads studied was 359 km. Key stakeholders included project management staff, procurement officers, Contractors, Concept Designers, subcontractors, Supervision Consultants, and other relevant personnel with expertise across project phases. An overview of the study projects' information is presented in Table 3-1:

Table 3-1: Overview of the Selected Road Projects

Description **Duration: 3 Years**	**Project I** **Masindi-Kisanja Park Junction**	**Project II** **Buhimba-Nalweyo-Kakumiro**	**Project III** **Masindi-Biiso, Hohwa-Nyarongo**
Funder	GoU, and Exim Bank of China	GoU, and Exim Bank of China	GoU
Contractor	China Communications Construction Company Ltd	China Wu Yi Co. Ltd	China Railway Seventh Group Company Ltd
Design Consultant	COWI Uganda Ltd	LEA Associates Ltd	LEA Associates Ltd
Concept Designers	UNRA IN-HOUSE TEAM	UNRA IN-HOUSE TEAM	UNRA IN-HOUSE TEAM
Subcontractors	1. RODO Contractors 2. Mukoda Engineering Works Ltd 3. Greystone Investments Ltd 4. Town to Town Ltd	1. Rarlon Equipment Ltd 2. Wim Services Ltd 3. Armpass Technical Services Ltd 4. Selective Services Ltd	1. STC East Africa Investments Ltd 2. Volcom Technical Services Ltd 3. Rizik Construction Company Ltd 4. Bygon Enterprises Ltd
Key Stakeholders	Masindi, Pakwach, District Local Government Technical staff, Audit staff, land acquisition staff, procurement staff, project accountants	Kikuube District, Kakumiro District Local Government Technical staff, Audit staff, land acquisition staff, procurement staff, project accountants	Masindi, Hoima, Kikuube District Local Government Technical staff, Audit staff, land acquisition staff, procurement staff, project accountants
Supervision Consultant	PROME Consultants Ltd	Kagga and Partners Ltd	Net Consult Consulting engineers and Architects Plc. in Joint Venture with Stadia Engineering Works Consultant Plc. and KKATT Consult Ltd

The respondents were grouped based on their area of expertise rather than experience or nationality. Specialist categories included Resident Engineers, Highway Engineers, Surveyors, Materials Engineers, Measurement Engineers, Contract Managers, Graduate Engineers, Accountants, Design Teams, Procurement Staff, and Client Project Management Teams. This ensured that the study captured diverse perspectives related to DB challenges and operational dynamics. Table 3-2 illustrates the population structure across the three projects:

Table 3-2: Distribution of respondents across the three selected projects

Expertise	**Project I**	**Project II**	**Project III**	**Population**
Project Management Team	10	10	10	30
Procurement Staff	5	5	5	15
Contractors	8	8	9	25
Concept Designers	5	5	5	15
Subcontractors	8	8	9	25
Supervision Consultants	8	8	9	25
Key Stakeholders	10	10	5	25
TOTAL	**54**	**54**	**52**	**160**

This structured population framework enabled a comprehensive examination of the barriers, experiences, and perspectives related to DB road projects in Uganda, ensuring the study addressed the research objectives with appropriate depth and rigor.

3.4.2 Sample size

Sampling entails picking a subset of respondents from a larger population to reflect the group's characteristics and diversity, allowing the researcher to draw valid inferences and conclusions (Ahmad et al., 2023). This study utilised purposive and random sampling methods to gather insights and perspectives from individuals directly involved in the execution of Uganda's Design-Build projects.

The combined population across the three selected projects comprised 160 individuals. Following the guidelines of Krejcie and Morgan (1970), an initial sample of 152 respondents was determined across all respondent categories (Appendix 6). However, for a finite population of 160, the statistically recommended sample size is 113. To reconcile this difference while maintaining proportional representation across respondent categories, the sample was adjusted using proportionate stratified allocation. A scaling factor of $113 \div 152 = 0.743$ was applied to each category to determine the adjusted sample. For example, a category initially allocated 28 respondents was scaled to $0.743 \times 28 \approx 21$, while another with 14 respondents became $0.743 \times 14 \approx 10$. This ensured equitable representation across all stakeholder groups.

The final sample of 113 respondents was considered sufficient to capture the perceptions, experiences, and insights of key stakeholders involved in DB road projects, providing a robust basis for analysis of both qualitative and quantitative data.

Table 3-3 presents the adjusted sample distribution across respondent categories. This sampling approach ensured comprehensive coverage of all relevant professional roles and project experiences, providing a representative and credible dataset.

Table 3-3: Sample distribution of respondents

Category	**Population**	**Morgan's Sample**	**Adjusted Sample**	**Respondents' project (I, II, III)**	**Selection Criteria**
Project Management Team	30	28	21	7,7,7	21 Project management staff were selected by Purposive sampling from the Client's Project Management Team
Procurement Staff	15	14	10	3,3,4	10 Procurement staff selected by Purposive sampling from those who handled the procurement of DB Projects
Contractors	25	24	18	6,6,6	18 Contractors' staff selected by Purposive sampling from those involved in DB Projects
Concept Designers	15	14	10	3,3,4	10 Concept Designers selected by Purposive sampling from client staff and consultants involved in DB Projects
Subcontractors	25	24	18	6,6,6	18 Subcontractors; staff were selected by Purposive sampling from those involved in DB Projects
Supervision Consultants	25	24	18	6,6,6	18 Consultants' staff were selected by Purposive sampling from those involved in DB Projects
Key Stakeholders	25	24	18	7,7,4	18 Key stakeholders (Adjudicators, Auditors, Accountants, Land acquisition team) were selected by Random sampling from those involved in DB Projects
Total	**160**	*152*	**113**		

3.5 Sampling strategies

The study employed a purposive sampling technique to ensure the choice of respondents with high-quality and pertinent information. This approach facilitated the deliberate inclusion of individuals with the expertise necessary to contribute meaningfully to the investigation of Design–Build (DB) road projects in Uganda. Key respondents selected through this method included project management personnel, procurement staff, contractors, concept designers, subcontractors, supervision consultants, and other relevant stakeholders directly involved in DB projects. The purposive approach ensured that the data collected reflected informed perspectives on project implementation, barriers, and best practices.

In addition, the study adopted random sampling to select respondents from local district administrations within the project areas. This strategy ensured that stakeholders representing different geographic locations and administrative units were incorporated into the study, providing a balanced and representative understanding of local perspectives on DB project delivery. By combining purposive and systematic random sampling, the research captured both expert insights and community-level experiences, enhancing data dependability, diversity, and comprehensiveness.

3.6 Data sources

The study utilised primary and secondary sources to thoroughly address the research objectives. Primary data included direct insights, perceptions, and experiences obtained from the selected respondents regarding the adoption of the DB delivery method, associated barriers, facilitating factors, and potential strategies for enhancing

project performance. The data were obtained using structured questionnaires, key informant interviews, and a review of project completion reports from DB road projects.

Secondary data were obtained from an extensive literature review and industry sources. These included academic journal articles, conference proceedings, construction publications, project reports, technical magazines, and unpublished research materials. By integrating primary and secondary sources, the study synthesized both practical experiences from stakeholders and theoretical insights from literature, providing a holistic understanding of the threats, opportunities, best practices, and enablers.

3.7 Achievement of objectives

To address research questions, multiple data collection tools tailored to different respondent categories were employed. These included analysis of project reports to capture success stories from completed Design–Build (DB) critical oil road projects, questionnaires, KIIs, and FDGs, as detailed in Appendices 1–3. Combining these methods enabled the gathering of rich insights, perceptions, and opinions on barriers to DB adoption, factors influencing project performance, and potential mitigation measures. This multi-method approach facilitated an understanding of the challenges relating to DB adoption for road projects in Uganda.

3.7.1 Specific Objective One: To establish the current DB adoption rate for Uganda's road projects

To determine the current adoption rate of the DB delivery method in Uganda's road sector, the study commenced with an extensive literature review related to DB implementation in the road sector. This review encompassed scholarly articles, construction reports, case studies, and industry publications, particularly focusing on DB adoption in developing countries. This information established a foundation of factors inducing DB utilization, highlighting key trends applicable to Uganda.

Following the literature review, official project documents, bidding records, and contracts from the Uganda National Roads Authority (UNRA) covering the period 2012–2023 were examined. These documents provided essential project-specific information, including location, financial value, funding sources, type of project (new construction or rehabilitation), and implementation strategies. The use of open government data, as recommended by the World Bank (2014), was integral to this analysis.

The study was centred on identifying the prevalence of DB projects, the rationale for selecting DB over traditional methods, and the perceived benefits of DB implementation. This approach aligns with Borgman (2010), who emphasized that industry publications and news archives are valuable sources for understanding completed infrastructure projects.

Data analysis was conducted through the following steps:

1. **Descriptive Statistics:** Calculated the proportion of DB projects relative to those executed using traditional Design–Bid–Build methods.
2. **Data Dissection:** Examined DB projects by project value, type (new construction or rehabilitation), and geographic distribution to identify patterns and trends.
3. **Content Analysis:** Assessed recurring themes in project documentation, such as reasons for choosing DB, observed benefits, encountered challenges, and industry opinions regarding DB practices in Uganda.
4. **Data Triangulation:** Cross-verified findings from project documents with information from government reports to ensure accuracy and a comprehensive understanding of DB adoption patterns, following Mulisa (2022), who emphasized the importance of multiple data sources for research reliability.
5. **Case Studies:** Analysed key success stories to provide detailed insights into effective DB implementation in Uganda's road projects.

Finally, quantitative findings were complemented with qualitative insights, which explored participants' experiences with DB projects, perceived advantages and limitations, and suggestions for enhancing DB adoption. Integrating these perspectives with document-based data ensured that the research conclusions were both statistically robust and grounded in the practical realities of practitioners and local communities. This holistic approach strengthened the practical relevance and credibility of the study findings for informed decision-making in Uganda's road sector.

3.7.2 Specific Objective Two: To evaluate the barriers to the adoption of the DB delivery method

To achieve this objective, questionnaire surveys, interview guides, and FGD guides. These tools captured both the depth of stakeholder experiences and the measurable severity of identified barriers.

- **Questionnaire**

Structured questionnaires formed a key instrument for obtaining practical data from selected respondents, allowing for standardized and confidential responses. Closed-ended questions were primarily used to ensure efficiency, particularly given the relatively large sample size. Each respondent received an identical set of questions to minimize bias and ensure consistency in data collection.

The questionnaire was organized to address barriers to DB adoption across multiple project stages, including concept design, tender preparation, evaluation, contract award, detailed design, and construction.

To assess the magnitude of each barrier, the Severity Index (SI) was applied, which quantifies the relative severity of identified challenges as a percentage. Barriers with an SI above 60% were considered significant, consistent with Wuni and Shen (2020).

$$SI(\%) = \Sigma A \left(\frac{F}{N}\right)\% * \frac{100}{5} \qquad \text{(Equation 3-1)}$$

Where *A* represents the constant weighting assigned to each response (ranging from 1 to 5), *F* denotes the frequency of responses, and *N* denotes the total number of responses. The barriers with a Severity Index (SI) greater than 60% were considered.

- **Interview guide**

A structured interview guide provided a framework to obtain detailed insights into barriers affecting DB adoption, their severity, and prevalence among key stakeholders. Interviews explored participants' experiences with DB projects, perceived benefits, and the challenges encountered at different project stages.

Key focus areas included:

1. **Experience with DB Projects:** Participants described practical experiences, highlighting successes and difficulties encountered.
2. **Benefits of DB Method:** Insights were obtained on perceived advantages, such as faster delivery, cost efficiency, and enhanced collaboration.
3. **Barriers to Adoption:** Respondents elaborated on challenges, including regulatory constraints, procurement complexities, and resistance to change.
4. **Severity and Prevalence:** Interviews assessed which barriers were most significant and widespread among stakeholders.
5. **Recommendations for Improvement:** Participants suggested measures to enhance DB adoption, including policy adjustments, capacity-building initiatives, and improved stakeholder engagement.

Interviews were documented through detailed note-taking and supplemented with Zoom voice recordings to ensure accuracy and completeness.

- **Focus Group Discussions guide**

FGDs were conducted using structured prompts to elicit discussion and collective insights regarding DB adoption barriers. Participants shared experiences, identified challenges, and proposed solutions related to DB road projects. Discussions covered:

- **Experiences with DB Projects:** Successes, challenges, and lessons learned.
- **Perceived Benefits:** Speed, cost efficiency, quality, and risk management advantages.
- **Barriers to Adoption:** Challenges such as institutional constraints, lack of stakeholder buy-in, limited technical expertise, and resource limitations.
- **Recommendations:** Policy reforms, training initiatives, enhanced stakeholder coordination, and other interventions.
- **Future Research Areas:** Suggestions for further exploration of DB practices, long-term impacts, or lessons from other contexts.

Sessions were recorded via Zoom to ensure that all insights were captured for detailed analysis.

Application of the Severity Index

The Severity Index scale (60–100%) was applied to categorize barriers as highly significant. This allowed focus on the most critical barriers, ensuring that resources and mitigation efforts were directed toward challenges that posed the greatest risk to DB project success. Insights from this assessment informed the development of a

toolkit aimed at addressing barriers and enhancing the adoption and implementation of DB delivery methods in Uganda's road projects.

By systematically identifying and prioritizing barriers based on severity, the study provided a structured basis for designing targeted strategies to improve DB adoption and overall project performance.

3.7.3 Specific Objective 3: To develop a toolkit for enabling the mitigation of the barriers to the adoption of the DB delivery method for road projects in Uganda

A toolkit is a systematically organized collection of validated instruments, guidelines, and procedures, designed to help practitioners address specific challenges within projects or sectors. In this study, the toolkit was developed to mitigate barriers to DB adoption, using a structured, evidence-based, and participatory approach. The aim was to ensure both theoretical rigor and practical applicability in Uganda's road construction context.

Integration and Triangulation of Empirical Findings

The development process began with synthesizing empirical findings. Quantitative data from Objective One established the current state of DB adoption, while the Severity Index analysis from Objective Two identified the most critical barriers to implementation. The results were triangulated with qualitative insights, offering a nuanced understanding of the context, underlying causes, and respondents'

perspectives for each barrier. This triangulation strengthened both the validity and depth of the findings (Mulisa, 2022; Patton, 2015).

Only barriers with a Severity Index (SI) above 60%, indicating high or very high severity, were prioritized for inclusion, in line with construction research best practices (Wuni and Shen, 2020).

Thematic Categorization and Framework Development

The identified barriers were grouped thematically by project lifecycle stages, i.e., procurement, design, and construction, and mapped to relevant stakeholder groups, including clients, contractors, and regulators. This structured framework enabled the creation of targeted, phase-specific mitigation strategies reflecting the multi-stakeholder complexity inherent in DB projects (Elzomor and Garber, n.d.; Hasanzadeh and Esmaeili, 2022).

Formulation of Practical Mitigation Strategies

For each thematic cluster, mitigation strategies were developed through a combination of literature review and stakeholder input. International best practices, including AIA Design-Build Documents and FIDIC guidelines, informed these strategies, which were then adapted to Uganda's regulatory, institutional, and operational environment.

Key measures included:

- **Checklists for client requirements:** Ensuring clear, unambiguous briefs to prevent scope creep;

- **Transparent tender frameworks:** Balancing fairness and innovation during preparation and evaluation;
- **Standardized communication protocols:** Enhancing coordination between design and implementation teams;
- **Risk management and change control tools:** Addressing scope modifications, design conflicts, and unforeseen challenges.

These strategies are consistent with evidence demonstrating improved project outcomes and stakeholder satisfaction in similar contexts (Adamtey, 2022; Fourie and Malan, 2020).

Stakeholder Engagement and Rigorous Validation

A draft toolkit was validated by a purposively selected panel of industry experts, including representatives from UNRA, contractors, consultants, project managers, and academics. Evaluation focused on relevance, clarity, sequence, usability, and adaptability. A mixed-methods approach was employed:

- **Quantitative Likert-scale ratings:** Assessing each toolkit section from "very poor" to "excellent";
- **Qualitative feedback:** Capturing detailed suggestions for improvement.

This evaluation process aligns with established frameworks for tool validation in construction management research (Myakala and Sabavath, 2024).

Iterative Refinement Process

Toolkit components receiving more than 40% “poor” or lower ratings were revised. Revisions focused on clarifying content, expanding explanations, enhancing procedural guidance, and adding practical examples. Iterations continued until consensus was reached that the toolkit effectively addressed priority barriers and provided actionable guidance. This participatory co-creation approach ensures higher adoption and sustainability of the toolkit (Adamtey, 2022; Fourie and Malan, 2020).

Final Toolkit Structure and Future-Proofing

The final toolkit was organized into a modular, user-friendly format:

- **Introduction:** Rationale, objectives, and target users;
- **Phase-wise guidelines:** Procedures aligned with typical project stages in Uganda’s road sector;
- **Templates and checklists:** Supporting documentation, risk assessment, and communication;
- **Capacity building recommendations:** Ensuring long-term institutional strengthening;
- **Feedback mechanisms:** Facilitating continuous updates and adaptation to evolving construction practices.

This design ensures the toolkit remains relevant and effective over time, supporting sustainable improvements in DB project delivery within Uganda.

3.8 Validity and Reliability

3.8.1 Validity

Ensuring validity is essential for accurately measuring the intended variables and effectively addressing the research objectives. The study implemented multiple measures to ensure the validity:

i. **Literature review and expert input:** A comprehensive review of relevant literature on Design-Build (DB) delivery methods and survey design was conducted. This ensured the instrument was grounded in existing knowledge and best practices. In addition, input was sought from a construction management expert (supervisor) to confirm that the instrument covered all relevant concepts and ideas.

ii. **Conceptual clarity and suitability:** The questionnaire was carefully structured with clear wording and appropriate concepts to ensure respondents could easily understand and respond accurately. This minimized ambiguity and enhanced the suitability of the instrument for the study context.

iii. **Pretesting:** A pre-test was conducted with five key respondents, including clients, contractors, and concept designers. This pretest helped identify and resolve potential issues with the instrument, ensuring it was effective and reliable for collecting data from the main study sample.

iv. **Content validity:** This evaluated the effectiveness of the instrument in addressing each research objective. Table 3-4 presents the content validity index (CVI) results, which demonstrate high validity for all sections of the instrument.

v. **Acceptable content validity:** The average CVI of 0.921 was obtained across all

sections, exceeding the minimum acceptable threshold recommended by Yusoff (2019). This confirms that the questionnaire reliably captured the information necessary to meet the research objectives.

In summary, the rigorous validation process, including literature review, expert consultation, pretesting, and content validity assessment, ensured that the study instrument was valid and capable of producing reliable data.

Table 3-4: Content Validity

Parameter	**CVI**
Respondent Profile	0.920
Project Characteristics	1.00
Factors that favour DB choice	0.900
Barriers at the Procurement stage	0.917
Barriers at the Execution Stage	0.947
Average CVI	**0.921**

The average CVI of 0.921 confirms a high level of content validity, surpassing the minimum acceptable standard of 0.780 as indicated by previous studies (Gilbert and Susan, 2016; Karageorgopoulos, 2014).

3.8.2 Reliability

Reliability ensures that a research instrument produces precise and accurate measurements consistently. Several methods exist, including Cronbach's alpha method, test-retest, parallel forms, and inter-rater. This study utilised **Cronbach's alpha** because it requires only one data set.

The reliability analysis for each questionnaire section is presented in Table 3-6. Values for factors that favour DB choice, procurement barriers, and execution barriers ranged from 0.833 to 0.854, with an **average alpha of 0.847**, indicating good reliability and internal consistency. These results exceed the acceptable threshold of 0.70, consistent with the study by Bougie and Sekaran (2010).

Table 3-5: Questionnaire reliability analysis using Cronbach's Alpha

Parameter	**Cronbach's Alpha**
Factors that favour DB choice	0.854
Barriers at the Procurement stage	0.833
Barriers at the Execution Stage	0.853
Average Cronbach alpha value	**0.847**

In conclusion, the questionnaire demonstrated high reliability and internal consistency, confirming its suitability for accurately measuring the intended variables and collecting dependable data from the study population

3.9 Research procedure

The research procedure for this study was carefully designed to ensure a systematic, rigorous approach while adhering to ethical standards and accounting for potential study limitations. Following the guidelines outlined by Mengist et al. (2020), the research procedure followed the following sequential steps:

i. **Obtaining official approval:** The researcher first secured formal approval from the Kyambogo University Directorate of Research and Graduate Training. This

approval letter was presented to the targeted organizations, granting permission to engage with their staff for data collection. The letter served as formal validation of the research and facilitated institutional acceptance.

ii. **Ethical considerations**: Before engaging participants, ethical principles were strictly observed. Participants were informed of the study's purpose, anticipated benefits, voluntary participation, and confidentiality of their responses and identities. This ensured transparency and adherence to ethical research standards.

iii. **Baseline study:** A preliminary baseline study was conducted to gather initial insights and information, which informed the refinement and updating of the data collection instruments. This step helped ensure clarity of questions, relevance, and alignment with the study objectives.

iv. **Pretesting:** Before initiating full-scale data collection, the instruments were pretested with a small sample of five participants. This pretesting assessed the clarity, completeness, and overall effectiveness of the questionnaires, interview guides, and focus group discussion prompts. Feedback from this pretest guided necessary revisions to the instruments, ensuring they were suitable for the main study.

v. **Data Collection**: After pretesting, data collection commenced with the selected participants and organizations. Structured questionnaires, interviews, and focus group discussions were employed. Participants were encouraged to provide candid and thorough responses, ensuring the reliability of the collected data.

Through this structured research procedure, the study upheld methodological rigor, ensured ethical compliance, and minimized potential limitations.

3.10 Data analysis

3.10.1 Quantitative Analysis

This included systematically organizing, coding, and examining numerical information. SPSS version 25.0 was employed to facilitate analysis. To assess the severity of barriers to the adoption of the DB delivery method, the study utilized the Severity Index (SI), as defined by Myakala and Sabavath (2024) and Wuni and Shen (2020).

Barriers identified as highly severe through this analysis were subsequently used to develop a practical toolkit designed to mitigate challenges in DB project delivery. By targeting the most critical barriers, the toolkit aims to enhance DB adoption rates for road projects in Uganda.

Regression Analysis

To examine the relationship between identified barriers to DB adoption, multiple regression analysis was applied. This technique enabled assessment of how each barrier influenced the extent of DB adoption while controlling for other variables, offering predictive insights and determining the relative importance of multiple factors (Creswell, 2014).

i) Model Specification

The dependent variable (DB adoption), measured as a percentage of projects executed using the DB method relative to the total number of road projects implemented. Independent variables included barriers identified from literature, preliminary

interviews, and the Severity Index (SI) calculated from questionnaire responses. These barriers were categorized into key dimensions:

- **Regulatory and Policy Barriers:** e.g., approval delays, complex procurement procedures, challenges in acquiring rights-of-way.
- **Financial Barriers:** e.g., high upfront costs, funding uncertainties, limited access to multilateral financing.
- **Technical and Capacity Barriers:** e.g., limited contractor expertise, insufficient local capacity, complex project design requirements.
- **Project Management Barriers:** e.g., poor coordination, schedule overruns, inefficient risk management.

ii) Data Preparation

Before conducting regression analysis, the dataset was pre-processed as follows

- **Normalization:** Severity Index scores were scaled to a 0–1 range to standardize variables.
- **Multicollinearity Check:** Correlation matrices and Variance Inflation Factor (VIF) tests ensured independent variables were not highly correlated.
- **Outlier Detection:** Extreme values were identified and addressed to prevent undue influence on the regression results.

iii) Regression Procedure

The regression analysis was conducted using the following steps:

- **Descriptive Analysis:** Mean, standard deviation, and distribution patterns of DB adoption and barrier variables were examined.
- **Model Estimation:** Multiple linear regression using Ordinary Least Squares (OLS) was performed to estimate coefficients for each barrier.
- **Significance Testing:** Coefficients were evaluated at a 95% confidence level; significant variables indicated a strong influence on DB adoption.
- **Goodness-of-Fit:** R^2 and adj R^2 measured the proportion of variance in DB adoption clarified by identified barriers.
- **Residual Analysis:** Residual plots and tests for normality and homoscedasticity were conducted to validate model assumptions.

iv) Interpretation of Results

- **Negative coefficients:** Indicated that greater barrier severity corresponded to lower DB adoption rates.
- **Positive coefficient:** Suggested that higher attention to certain barriers could correlate with increased adoption, potentially reflecting targeted mitigation efforts.

This regression approach allowed for both ranking barriers by severity and evaluating their statistical influence, offering a solid empirical foundation for designing the mitigation toolkit.

v) Software and Tools

SPSS v25 facilitated data cleaning, normalization, regression analysis, and visualization, including scatter plots, correlation matrices, and residual diagnostics, supporting a robust and transparent quantitative analysis.

3.10.2 Qualitative Analysis

This focused on interpreting information collected from interview transcripts and FGDs. Content analysis, as recommended by Patton (2015), was adopted, which provides a systematic, transparent, and reproducible approach to examining textual data.

Content analysis allowed the researcher to organize large volumes of textual information into meaningful categories using clear coding rules, identifying emerging themes, patterns, and relationships within the data, regarding the barriers affecting the adoption of the DB method for road projects in Uganda.

Through a careful examination of the transcripts and notes from focus groups, the researcher was able to extract recurring viewpoints, stakeholder experiences, and insights on obstacles encountered at different stages of DB project implementation. This approach enabled a comprehensive understanding of how regulatory, financial, technical, and project management challenges influence DB adoption.

The qualitative analysis complemented the quantitative findings by providing contextual depth and explanatory insights. This ensured a holistic understanding of the barriers to DB delivery in Uganda's road construction sector, enhancing the reliability and richness of the study conclusions.

3.11 Research Ethics

Research ethics are essential to safeguard, welfare and dignity of respondents, as emphasized by Brittain et al. (2020). The following measures were implemented:

i. **Informed Consent:** All participants received detailed explanations regarding the study objectives, potential risks, and their right to voluntarily participate. Written consent was obtained, ensuring participants could make an informed decision about their involvement.

ii. **Confidentiality and Privacy:** Strict measures were employed to maintain participant confidentiality. Data were anonymized, securely stored, and identifiers were removed to prevent the identification of individual responses without prior consent.

iii. **Respect for Participants:** Participants' autonomy and dignity were upheld throughout the research. Permission was obtained before recording interviews or taking photographs, and participants were treated with respect during all interactions.

iv. **Voluntary Participation:** Participants were informed that failing to participate would not result in any adverse consequences or affect their relationship with the researcher or affiliated organizations.

v. **Accurate Reporting and Dissemination:** Research findings were reported truthfully and presented without distortion. Dissemination was conducted in a manner that maintained confidentiality and accurately reflected participants' contributions.

3.12 Chapter Summary

This chapter detailed the methodology utilised to achieve the study objectives, including the research design, sample, data sources, and collection and analysis procedures.

The structured approach presented in this chapter served as a roadmap guiding the study from conceptualization through data collection, analysis, and interpretation. By systematically applying these methods, the research aimed to ensure robust, reliable, and valid findings.

The results derived from implementing this methodology are presented in the subsequent chapter. These findings provide insights into the barriers to DB adoption for road projects in Uganda and offer potential strategies for mitigation.

CHAPTER FOUR: RESULTS PRESENTATION AND DISCUSSION

4.1 Introduction

This chapter details the findings on the barriers to DB adoption in Uganda's road projects. The findings are drawn from analysis of quantitative and qualitative data collected through structured questionnaires, KIIs, and FGDs.

To provide context to the qualitative findings, the demographic profile of the participants is presented, illustrating their experience and expertise within Uganda's road construction sector. The chapter integrates data analysis and interpretation in alignment with the study objectives:

1. To determine the current rate of DB adoption in road projects in Uganda.
2. To identify and evaluate the barriers to DB adoption.
3. To develop a practical toolkit for mitigating these barriers in road project implementation.

4.2 Quantitative Results

4.2.1 Response rate

In total, 113 questionnaires were disseminated to stakeholders directly involved in UNRA-supervised road projects, including project management staff, procurement personnel, contractors, concept designers, subcontractors, supervision consultants, and

other key stakeholders. Out of these, 100 completed questionnaires were returned, yielding an overall response of 88% (Table 4-1).

Table 4-1: Distribution and rate of questionnaire responses

Category	**questionnaires**	**Responses**	**Rate**
Project Management Staff	21	20	95%
Procurement Staff	10	10	100%
Contractors	18	15	83%
Concept Designers	10	10	100%
Subcontractors	18	15	83%
Supervision Consultants	18	15	83%
Key Stakeholders	18	15	83%
Total/Average	**113**	**100**	**88%**

The achieved response rate exceeds the 80% benchmark typically recommended for studies with smaller sample sizes (Doyle et al., 2023). Such a high participation rate minimizes non-response bias and reflects strong engagement from stakeholders within the sector. This level of engagement reinforces reliability, rationality, and representativeness of findings (Creswell and Creswell, 2017).

4.2.2 Respondent Characteristics

Understanding respondent characteristics is essential for contextualizing the study findings and assessing their reliability and applicability. Respondent characteristics

were analysed in terms of road sector experience, the number of Design-Build (DB) road projects undertaken, age, and gender.

Experience in the road sector

The distribution of respondents' experience in the road sector is presented in Table 4-1. A significant proportion, 35%, reported having 11–15 years of experience, while 28% had over 15 years. Additionally, 26% had between 6–10 years, and 11% reported 1–5 years.

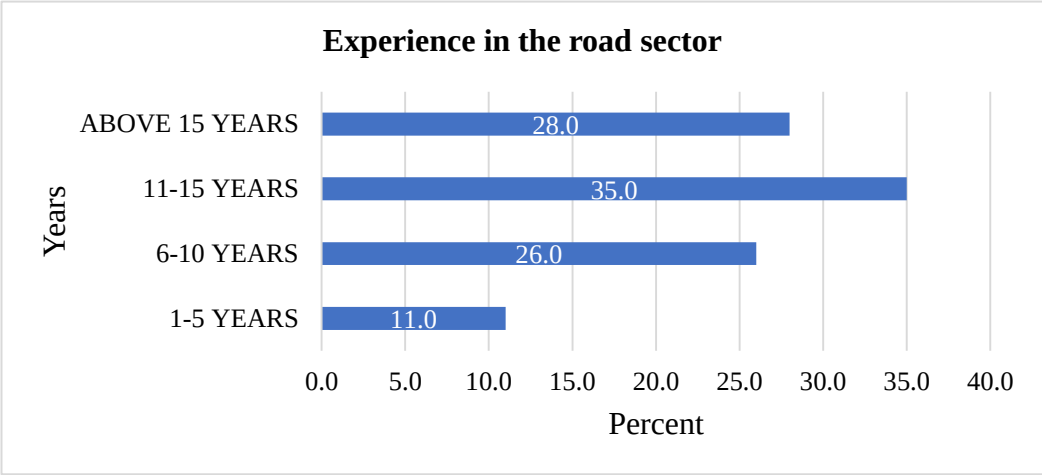

Figure 4-1: Road sector experience of respondents

These findings indicate that 89% of respondents possessed over six years of experience, demonstrating a substantial level of expertise. Such extensive experience is critical for providing practical insights into barriers and facilitators affecting DB project delivery, enhancing the credibility of the data collected (Creswell and Creswell, 2017; Jiménez, 2020). Leveraging experienced practitioners ensures that study outcomes are grounded in practical realities, consistent with Mulisa's (2022) recommendations for infrastructure research. Moreover, engaging seasoned

professionals strengthens stakeholder confidence in the research findings and supports the translation of insights into operational and policy improvements (Patton, 2015).

Number of Design-Build Road projects undertaken

The respondents' involvement in DB projects reflects their practical exposure to this project delivery method. Figure 4-2 presents the distribution, showing that most respondents had participated in 11–15 DB projects (35%), followed by over 15 projects (28%). Those involved in 6–10 projects accounted for 26%, while only 11% had participated in 1–5 projects.

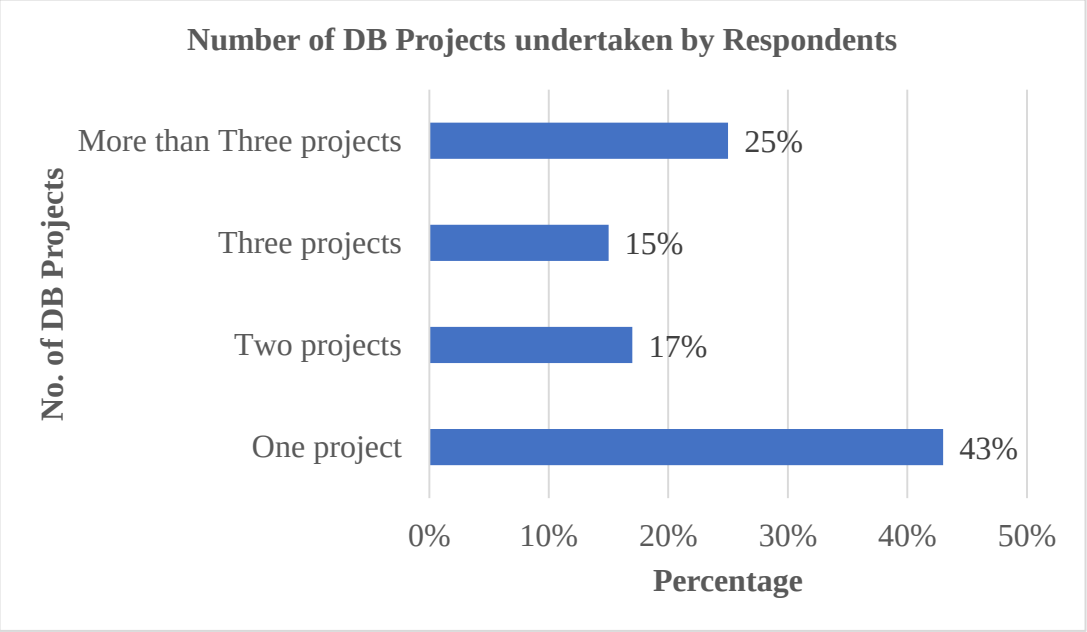

Figure 4-2: Number of Design-Build Road projects undertaken

This distribution demonstrates that nearly 90% of participants had considerable hands-on experience with DB projects, enhancing the reliability and relevance of their perspectives. Practitioners with experience are better equipped to evaluate the challenges, opportunities, and mitigation strategies related to Design-Build road

projects, thereby enhancing the study's practical contributions (Creswell and Creswell, 2017; Mulisa, 2022)

Respondents' Age

From Figure 4-3, 92% of respondents were aged 30 years and above, with only 8% below 30. The age profile indicates that most participants had substantial professional and life experience, which is crucial for evaluating complex delivery methods like DB.

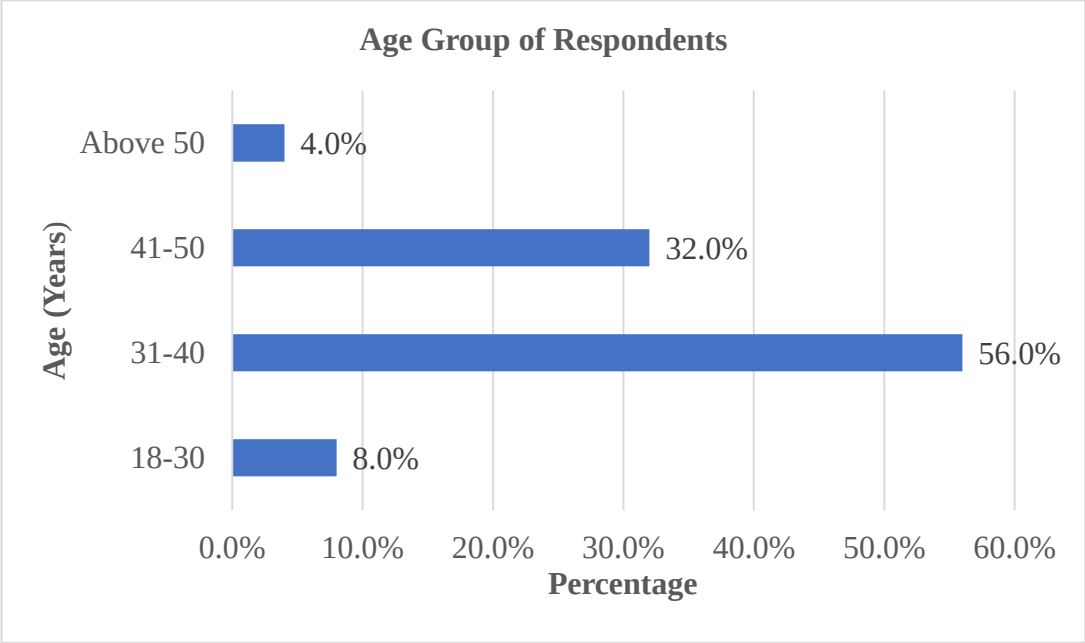

Figure 4-3: Respondents' age distribution

Mature respondents are more likely to exhibit critical thinking, reflective judgment, and informed decision-making, which enriches the assessment of barriers, risks, and management strategies in road projects (Mulisa, 2022; Jiménez, 2020). Their accumulated expertise also enhances stakeholder engagement and decision-making processes, reinforcing the validity and contextual relevance of the study findings (Nieminen et al., 2020).

Respondent's Gender

From Figure 4-4, 92% of respondents were male, while only 8% were female. This disparity reflects the global underrepresentation of women in the construction and infrastructure sectors (International Labour Organization, 2019).

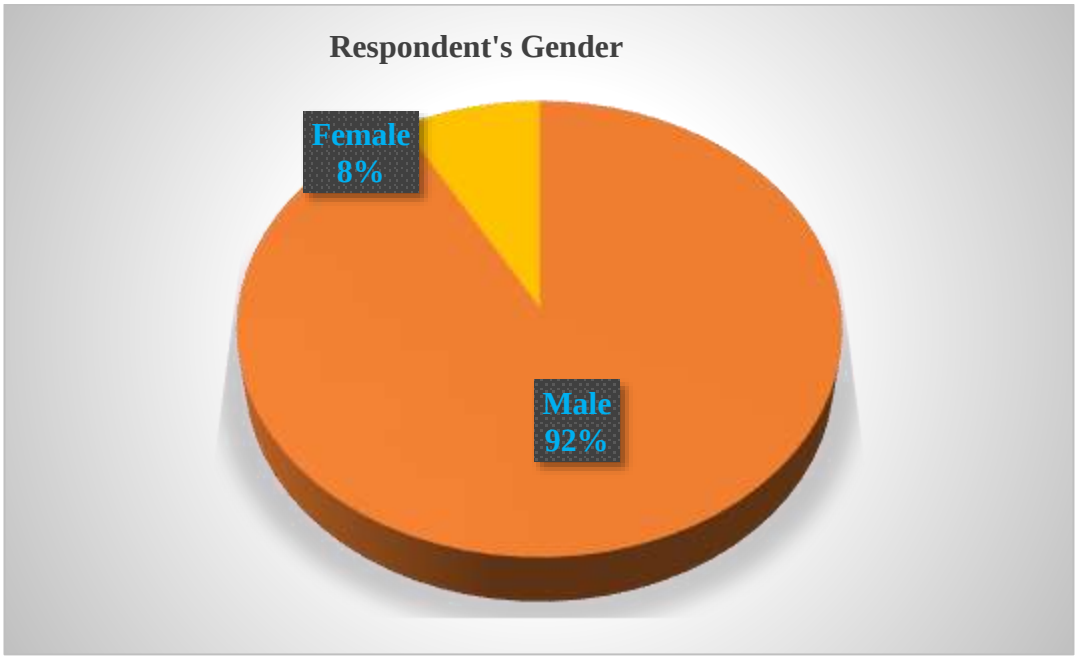

Figure 4-4: Respondents' gender distribution

Limited female participation may constrain the diversity of perspectives necessary for innovation, problem-solving, and community-sensitive engagement (Mehan, 2024; Maron et al., 2019). In Uganda's road sector, women contribute uniquely to areas such as community relations, land acquisition, and compensation processes, which enhance project acceptance and stakeholder cooperation.

The findings stress the need for deliberate policies promoting gender diversity in the road sector. Increasing women's participation not only fosters equity but also

strengthens the effectiveness, societal impact, and sustainability of road project delivery, aligning with ILO (2019) recommendations.

4.3 Establishment of DB Adoption rate for road projects in Uganda

This presents findings from analysis of secondary data, including news archives, industry publications, and official project documentation, on the adoption of the DB method in Ugandan road projects carried out between 2012 and 2023.

4.3.1 Trends in DB adoption

The analysis revealed a gradual increase in DB adoption, reflecting broader trends observed in developing countries. Globally, DB is increasingly preferred due to its integration of design and implementation phases, which reduces project timelines and minimizes disputes between stakeholders (Ng et al., 2007; Choi et al., 2020).

In contrast, the DBB approach, due to sequential and fragmented project phases, has often been associated with delays and cost overruns (Gómez-Cabrera et al., 2024). Findings from this study corroborate prior research by Rajbahak (2025), which demonstrated that the concurrent workflow of DB enhances efficiency by enabling overlapping project activities, leading to faster project delivery and more effective resource utilization.

Additionally, government policy in Uganda explicitly supports the use of DB for high-value and complex road projects, as outlined in the National Infrastructure Development Plan (2018). This aligns with international best practices, where DB is endorsed to expedite the delivery of critical infrastructure (Akintola and Al-Hashimi,

2020). Nonetheless, higher upfront costs of DB projects, as reported by UNRA (2021) and confirmed by Ng et al. (2022), highlight the cost-time trade-off inherent in DB contracting.

4.3.2 DB adoption rate and scale

A review of official project reports and contracts obtained from UNRA revealed that between 2012 and 2023, UNRA implemented 107 road construction projects (Appendix 4). Among these, 11 projects were procured using the DB method as presented in Table 4-2 below.

Table 4-2: List of Design-Build projects in Uganda between 2012 and 2023

No.	FY	Project Name	Length (KM)	Cost (Million USD)	Source of Funding	Type
1	2013/14	Mbarara-Kikagati - Murungo Bridge	74	100	GoU	Upgrading
2	2017/18	Kampala-Entebbe Express way	57	476	China Exim Bank	Upgrading
3	2017/18	Munyoyo Spur	11	40	China Exim Bank	Upgrading
4	2019/20	Mubende-Kakumiro-Kagadi Rd	107	129	GoU	Upgrading
5	2021/22	Package 3: Buhimba – Nalweyo –Bulamagi & Bulamagi – Igayaza –Kakumiro	93	138	Exim Bank/GOU	Upgrading
6	2021/22	Package 1: Masindi Park Junction and Tangi Junction- Para-Bulisa	159	219	Exim Bank/GoU	Upgrading
7	2021/22	Package 5: Masindi-Biiso, Hohwa – Nyairongo – Kyarusheesha – Butoole, And Kabaale – Kiziranfumbi (97km)	97	134	Exim Bank/GoU	Upgrading
8	2022/23	Kira-Matugga Road and improvement of 5 No. junctions	21	53	GOU	Upgrading
9	2022/23	Najjanakumbi – Busabala and Service Roads	28	69	GOU	Upgrading
10	2022/23	Emergency Reconstruction of Saka Crossing under Design and Build	1	20	GOU	Upgrading
11	2014/15	Mukono-Kalagi-Kayunga-Bukolooto-Njeru	92	62	GOU	Upgrading

As shown in Figure 4-2, the rate of adoption is 10%, obtained as a quotient of the number of executed Design-Build projects and the total number of projects implemented between 2012 and 2023, and then multiplying by 100%.

$$Adoption\ rate\ = \frac{11}{107} \times 100\% \cong 10\%$$

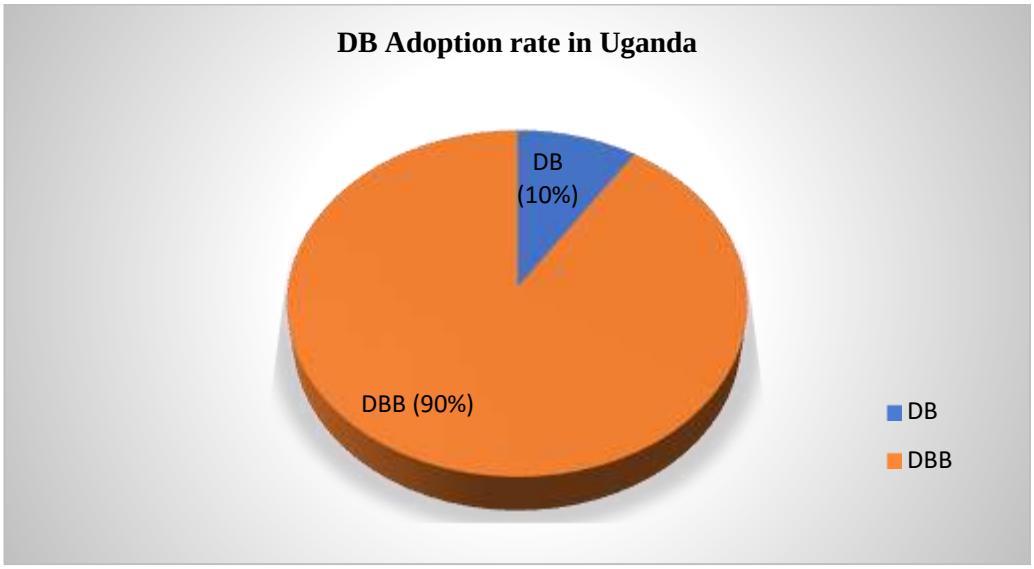

Figure 4-5: Trends in Design-Build road projects, 2012–2023

The resulting DB adoption rate of 10% is modest but consistent with findings by Akintola and Al-Hashimi (2020), who note that DB adoption in developing countries tends to be selective rather than widespread. The predominance of the DBB approach (90%) indicates that traditional procurement methods remain preferred, likely due to institutional familiarity, existing regulatory frameworks, and perceived risk profiles associated with DB projects (Nguyen and Kim, 2022).

4.3.3 Detailed Account of Reviewed Reports

Project Identification and Funding Reports

The study undertook a thorough review of documentation for road projects implemented by UNRA from 2012-2023. The aim was to determine the procurement methods employed, particularly distinguishing between DB and DBB approaches. Primary sources included official UNRA project reports, signed contracts, and supporting government publications.

These documents provided detailed information on project scope, including route length, type of project (new construction or rehabilitation), and intended outcomes. They also contained cost estimates and funding sources, which comprised government allocations, international donor contributions, and multilateral financing from institutions such as the African Development Bank.

Annual UNRA reports for the period 2012–2023 offered critical insights into project planning, approval processes, and execution trends. Notably, projects such as the Mbarara–Kikagati Road Upgrade and the Entebbe–Kampala Expressway were identified as DB projects, reflecting their technical complexity, substantial funding requirements, and the need for integrated design and implementation responsibilities.

A pattern emerged from the review: high-value projects (typically exceeding USD 100 million) with complex engineering requirements were preferentially delivered through the DB method, while smaller rehabilitation or maintenance projects were predominantly executed under DBB, maintaining the traditional separation of design and implementation tasks.

Project Completion Reports

Project completion and handover reports were examined to assess performance against key metrics, including adherence to timelines, cost variations, and quality standards. Challenges encountered during execution, such as delays due to regulatory approvals, weather disruptions, or contractor performance issues, were documented.

DB projects consistently demonstrated performance advantages over DBB projects. For instance, the Kampala–Entebbe Expressway, completed in 2018, achieved timely

delivery, maintained high-quality standards, and realized cost efficiencies. The DB approach facilitated integrated project management, reduced delays stemming from design-construction coordination issues, and ensured single-point accountability for outcomes.

Other projects, including the Masindi–Kisanja Park Road, demonstrated similar benefits, where DB delivery enabled more responsive decision-making, improved risk management, and smoother procurement of specialized materials, processes that are often more cumbersome under DBB arrangements.

Feasibility and Design Reports

Feasibility studies and detailed design reports were reviewed to evaluate project complexity, risk profiles, and suitability for DB adoption. Projects involving high technical complexity, such as large bridges, dual carriageways, and expressways, were more likely to be delivered under DB to ensure seamless integration of design and implementation activities.

For example, the Buhimba–Nalweyo–Kakumiro Road project required comprehensive geotechnical and hydrological assessments, making DB the most appropriate procurement approach. Similarly, high-value projects exceeding USD 100 million, such as the Najjanankumbi–Bussabala Road project, were considered suitable for DB due to the need to coordinate multiple contractors, manage environmental and social risks, and adhere to international quality standards.

Feasibility reports frequently recommended DB for projects requiring accelerated timelines, integrated risk management, and extensive stakeholder coordination. These

recommendations guided procurement strategies and underscored the increasing adoption of DB for technically demanding and high-stakes road projects.

Funding and Financial Analysis Reports

Funding and financial analysis reports from UNRA, African Development Bank, and World Bank were reviewed to understand budget allocations, funding sources, and financial risk mitigation strategies.

DB projects generally require higher upfront financial commitments compared to DBB projects due to the integration of design with construction responsibilities. However, they often achieve better cost control during execution by minimizing design changes, preventing claims and disputes, and reducing time-related expenditures.

For instance, the Kampala–Entebbe Expressway had a total budget of approximately USD 476 million, financed through government contributions and loans from China Exim Bank alongside international funding sources. Although the initial cost was substantial, structured payment milestones, performance bonds, and comprehensive contract management mitigated financial risk.

Financial analyses indicated that access to multi-lateral funding and structured financial planning facilitates the adoption of DB for large-scale projects by providing financial security to contractors and government agencies.

Summary of Observations from Reviewed Reports

Observation	Implication for DB Adoption
DB projects were predominantly high-value (>USD 100 million) and technically complex.	Indicates a preference for DB in projects requiring sophisticated engineering and integrated management
New construction projects favored DB.	Suggests DB offers greater flexibility and enhanced risk mitigation for projects without existing infrastructure
Funding sources included government allocations and international donors	Demonstrates that multi-lateral financing supports DB adoption
Completion reports highlighted faster delivery and quality assurance	Confirms the efficiency and effectiveness advantages of DB over DBB
Identified barriers included high upfront costs, limited local contractor capacity, and regulatory challenges.	Highlights the need for policy support, contractor capacity-building, and streamlined regulatory frameworks for wider DB adoption.

4.3.4 Project Type Preferences and Associated Risk Profiles

Analysis of project types indicated that the Design-Build (DB) procurement method was predominantly applied to new road construction projects, accounting for 100% of

DB projects, while rehabilitation projects did not utilize DB (0%), as presented in Table 4-2. This exclusive use of DB for new construction reflects patterns observed in other contexts, such as China, where the method's integrated design and implementation framework and flexible risk allocation are particularly advantageous for entirely new projects (Liu et al., 2022).

In contrast, rehabilitation projects inherently involve higher levels of uncertainty, including unforeseen subsurface conditions, environmental constraints, and legacy design issues. These uncertainties complicate DB contracting because of the challenges in defining and sharing risk between the client and contractor (Vo et al., 2025). Consequently, such delineation leverages the need for tailoring procurement strategies to project context and associated risk profiles, ensuring that the benefits of DB, such as schedule compression, integrated project management, and streamlined decision-making, are realized where most feasible.

4.3.5 Analysis of Trend Patterns

Figure 4-6 illustrates that between 2012 and 2023, the adoption of DB in Uganda's road sector followed an exponential growth pattern, which can be modelled by the equation $y=0.1543e^{0.324x}$ with projections suggesting continued acceleration through 2032.

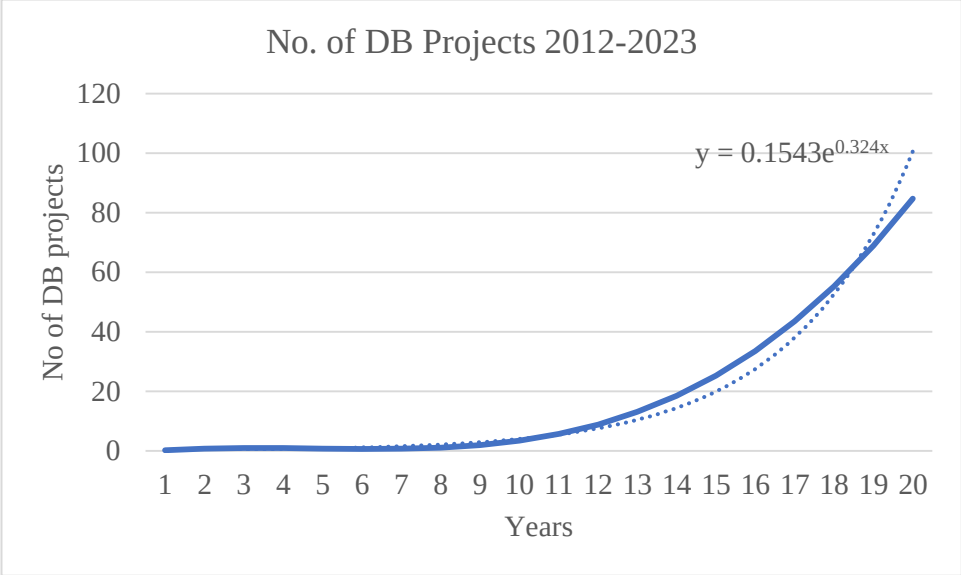

Figure 4-6: Adoption Trends of DB Delivery over time

This trajectory closely aligns with the innovation diffusion S-curve described by Rogers et al. (2014), in which adoption begins slowly with pilot initiatives, progresses through gradual uptake, and eventually accelerates as institutional familiarity, technical capacity, and policy support improve (Ali et al., 2009). In the Ugandan context, early stagnation in DB adoption was influenced by persistent reliance on the Design-Bid-Build (DBB) approach, limited contractor capacity, and regulatory gaps, consistent with barriers documented in prior studies (Saad et al., 2023).

Subsequent growth in DB adoption appears to have been driven by procurement reforms, donor-supported capacity-building initiatives, and increased confidence from demonstrated project successes. This is consistent with the findings by Lee et al. (2023), who highlighted the need for leadership and practical demonstration in promoting procurement innovation

Despite these gains, the observed lag in actual adoption relative to projections highlights ongoing challenges, including skills shortages, unclear risk allocation mechanisms, and limited contractor experience. These findings reinforce calls for continuous capacity development, regulatory framework strengthening, and adaptive procurement strategies to support broader DB implementation in Uganda's road sector (Saad et al., 2023; Akintola and Al-Hashimi, 2020).

4.3.6 Factors Influencing DB Adoption

The DB adoption in Uganda's road sector is influenced by several key factors. Among these, project size and technical complexity, cost-effectiveness, and time efficiency were most prominent. Large-scale and complex projects benefit from DB's integrated management approach and single-point accountability, which reduces coordination failures, enhances decision-making efficiency, and ensures clear allocation of responsibilities (Gómez-Cabrera et al., 2024; Rajbahak, 2025).

Cost-effectiveness emerged as a critical motivator for DB adoption, primarily due to reductions in change orders, improved communication between stakeholders, and minimized design-construction conflicts. These findings align with Choi et al. (2020), who reported that Design-Build projects can realize up to 8% savings in both time and cost compared to traditional Design-Bid-Build (DBB) projects. Likewise, Ibrahim et al. (2020) emphasized the superior performance of the DB regarding schedule adherence, quality assurance, and change management.

Despite these advantages, certain barriers continue to impede DB adoption. These include limited awareness of the DB approach, high upfront financial requirements,

and resistance to organizational and procedural change. Such challenges align with common obstacles reported in infrastructure innovation studies, particularly in developing economies (Akintola and Al-Hashimi, 2020; Rattmann, 2023). The observed gradual decline in the frequency and severity of these barriers suggests that capacity-building initiatives, procurement reforms, and increased exposure to successful DB projects are gradually facilitating broader acceptance of the method.

4.3.7 DB Success Stories as Catalysts for Broader Adoption

Empirical evidence from successful DB projects in Uganda demonstrates that the method can achieve timely completion, high-quality standards, and cost savings, notwithstanding challenges such as delayed payments and right-of-way acquisition. These successful implementations serve as demonstrative cases, encouraging further adoption of DB by showcasing its practical benefits.

A notable example is the Kampala–Entebbe Expressway, which illustrates the effectiveness of DB in delivering large-scale infrastructure efficiently. The project's timely completion, high construction quality, and improved connectivity reflect findings from international studies, where well-executed DB projects function as exemplars that accelerate diffusion by providing clear evidence of tangible advantages (Choi et al., 2020).

However, persistent procedural challenges, particularly delays in payments and complexities in right-of-way acquisition, highlight the need for targeted policy interventions. Addressing these bottlenecks is critical for fully realizing the potential of DB adoption, ensuring that the benefits of integrated project delivery can be

consistently achieved across Uganda's road sector and comparable developing-country contexts (Akintola and Al-Hashimi, 2020).

4.4 Assessment of Barriers to DB adoption

A questionnaire approach was employed to solicit insights and opinions of respondents regarding the barriers to DB adoption for road projects in Uganda.

4.4.1 Barriers to document preparation

Respondents were asked to evaluate challenges associated with documentation processes in DB projects. The findings shown in Table 4-3 indicate that procedural inefficiencies are the most significant barrier. Specifically, lengthy document processing cycles received the highest Severity Index (SI = 0.748), emphasizing administrative delays as a critical constraint in DB implementation, consistent with findings by Liu et al. (2016).

The second most significant barrier was the delayed provision of constructability advice from contractors (SI = 0.726). This emphasizes the critical role of early contractor involvement in achieving feasible, practical, and cost-effective designs, a factor noted in studies by Chan et al. (2010) and Choi et al. (2020).

Additional barriers identified include communication gaps (SI = 0.666), weak collaboration among project teams (SI = 0.648), and challenges in interpreting unclear client requirements (SI = 0.648). These outcomes align with the research of Chakra and Ashi (2019) and Nguyen and Kim (2022), which demonstrated that poor stakeholder integration, ambiguous requirements, and ineffective communication compromise DB project performance.

The findings collectively highlight that effective document management, clear client directives, and early collaborative engagement are crucial for realizing the efficiency and integration advantages of DB projects. Failure to address these barriers can undermine project outcomes, as procedural bottlenecks and communication breakdowns impede timely execution and coordinated decision-making.

Table 4-3: Document preparation barriers – descriptive analysis

Barriers to document preparation	SA	A	N	D	SD	Mean	SD	SI	SIG	Rank
High Document process cycle time requirement	11	62	17	10	0	2.260	0.787	0.748	0.006	1
Delays due to the contractor's late constructability advice	19	46	17	16	1	2.333	1.015	0.726	0.038	2
Communication gaps lead to problems	10	44	18	26	1	2.636	0.924	0.666	0.004	3
Barriers to team collaboration	7	38	29	25	0	2.727	1.086	0.648	0.043	4
Difficulties Interpreting Unclear Client Requirements	12	37	18	30	2	2.727	1.044	0.648	0.024	4
Lack of transparency in decision processes	7	30	25	33	4	2.970	1.000	0.600	0.006	6

These results emphasize that the success of DB adoption is highly contingent upon streamlined documentation processes, timely contractor input, and effective team collaboration. Addressing these barriers is pivotal for optimizing DB implementation in Uganda’s road sector

4.4.2 Barriers to time

Respondents were asked to evaluate time-related challenges associated with adopting the Design-Build (DB) delivery method for road projects. Analysis using mean scores, standard deviations, and Severity Indices (SI) revealed that delays in acquiring the right-of-way after design approval constituted the most critical temporal barrier (SI = 0.918), as shown in Table 4-4. These delays were largely attributed to the protracted process of compensating affected landowners and stakeholders.

Following closely were delays in utility relocation caused by third-party providers (SI = 0.874) and late contractor payments (SI = 0.856). Both of these factors disrupt project schedules, delay cash flow, and hinder continuous construction activities. The findings concur with earlier studies, which stress RoW acquisition and utility coordination as common factors delaying infrastructure project timelines in developing countries (Tesfaye, 2019; Elong, 2020; Smith & Odera, 2023).

Additionally, delayed payments negatively affect contractor motivation, increase costs, and create cascading effects for subcontractors and suppliers (Chadee et al., 2023; Ikediashi and Okolie, 2022).

Other barriers included underestimated time for design and statutory approvals (SI = 0.780), unrealistic scheduling due to designers' misinterpretation of construction requirements (SI = 0.710), and failure to conduct thorough brief reviews at the project outset (SI = 0.602). These factors collectively highlight the importance of realistic scheduling, proactive planning, and early engagement of all relevant parties in mitigating time-related risks in DB projects.

Overall, the results underscore the necessity for streamlined institutional procedures, timely financial management, and enhanced coordination with utility providers.

Table 4-4: Time barriers – descriptive analysis

Barriers to time	SA	A	N	D	Mean	SD	SI	SIG	Rank
Acquisition of the right-of-way after design is slow due to lengthy compensation processes	66	31	1	1	1.364	0.562	0.918	0.006	1
Third parties holding up relocation slow down construction	49	42	8	1	1.586	0.639	0.874	0.010	2
Late payments stall progress	45	44	7	3	1.677	0.740	0.856	0.002	3
Underestimated time needed for design and statutory approvals	23	56	9	12	2.100	0.893	0.780	0.029	4
Unrealistic schedules due to the designer's misunderstanding of construction needs	15	45	22	17	2.414	0.948	0.710	0.003	5
Skipping a thorough brief review leads to problems down the line	6	30	26	36	2.960	0.979	0.602	0.007	6

4.4.3 Barriers to cost

Respondents evaluated the cost-related obstacles associated with DB adoption for road projects. Analysis findings revealed that issues related to right-of-way (RoW) acquisition constituted the most critical cost barrier (SI = 0.886). This was primarily due to unforeseen expenses incurred in securing land and compensating affected parties, as presented in Table 4-5 below.

Table 4-5: Cost barriers – descriptive analysis

Barriers to cost	SA	A	N	D	Mean	SD	SI	SIG	Rank
RoW issues are causing cost overruns	50	47	1	1	1.525	0.578	0.886	0.008	1
Vague utility plans mean the project goes over budget	38	52	3	6	1.768	0.780	0.838	0.005	2
Contractor claims design flaws to hide cost-cutting issues	23	46	21	9	2.190	0.929	0.762	0.010	3
Clients passing on risks easily manage themselves	15	55	18	10	2.263	0.876	0.740	0.009	4
High cost of disputes due to adversarial relationships	16	43	27	12	2.384	0.934	0.716	0.010	5

Overall, the results underscore the need for comprehensive early-stage planning, clear utility coordination, and cooperative stakeholder engagement to mitigate cost-related risks and enhance the financial efficiency of DB projects

Closely following this, unclear utility relocation plans (SI = 0.838) frequently resulted in budget overruns during project execution. Contractor claims linked to alleged design flaws (SI = 0.762) were also significant, often reflecting attempts to justify cost escalations or mask inefficiencies. Additional barriers included clients transferring risks to contractors and high costs arising from disputes or adversarial relationships

(SI ≥ 0.716), which collectively impact project financial management and predictability.

These findings are consistent with previous research identifying right-of-way complications and incomplete utility assessments as major contributors to unforeseen budget increases in infrastructure projects (Tesfaye, 2019; Elong, 2020; Gómez-Cabrera et al., 2021). Moreover, adversarial relationships and dispute-related expenses highlight the importance of collaborative contract management, transparent risk allocation, and proactive dispute resolution mechanisms to safeguard project finances (Elhag et al., 2020).

4.4.4 Barriers to the scope

Participants evaluated scope-related challenges affecting the DB adoption. Analysis of the responses using mean scores, standard deviations, and Severity Indices (SI) revealed that the most critical barriers included difficulties in introducing, evaluating, and managing scope changes (SI = 0.746), balancing clear project requirements with room for contractor creativity (SI = 0.744), and confusion between scope changes and design development modifications (SI = 0.742).

Other notable challenges included contractors compromising design standards to reduce costs and designers facing conflicting demands between regulatory compliance and contractor expectations (SI ≥ 0.740). Table 4-6 presents descriptive statistics for barriers to scope.

Table 4-6: Scope barriers – descriptive analysis

Barriers to the scope	Mean	SD	SI	SIG	Rank
Difficulty introducing, evaluating, and administering change	2.232	0.819	0.746	0.009	1
Striking a balance between clear instructions and room for contractor creativity is tough	2.242	1.001	0.744	0.007	2
Contracting parties confuse the scope change with the design development change	2.253	0.873	0.742	0.006	3
Contractor skimps on design to save money	2.263	0.921	0.740	0.010	4
Designers are caught between following the rules and pleasing contractors	2.495	1.128	0.691	0.028	5
Contract design does not satisfy clients' expectations	2.515	1.110	0.690	0.009	6
Lack of client involvement in technical discussion	3.040	1.253	0.585	0.019	7

These results align with prior studies emphasizing that poorly defined scopes, ambiguous roles, and compromises in quality can undermine the success of DB projects (Chakra and Ashi, 2019; Nguyen and Kim, 2022; Gómez-Cabrera et al., 2021). Interestingly, limited client participation in technical discussions was perceived as less critical (SI = 0.585), indicating that effective coordination among core design and implementation teams has a greater impact on DB project outcomes (Chan et al., 2010).

Overall, the findings highlight the importance of implementing robust scope definition frameworks, establishing clear contractual distinctions between scope changes and design development modifications, and promoting collaborative practices that balance contractor innovation with quality assurance. Effectively addressing these scope-related barriers is essential to realizing the full benefits of DB in delivering timely, cost-efficient, and high-quality road infrastructure in Uganda.

4.5 Regression Analysis and Enablers for Adoption of the DB Method

Regression analysis is used to assess the strength and nature of relationships between independent and dependent variables. It was applied to quantify the impact of identified barriers on DB adoption in Uganda's road projects. This approach allowed for data-driven prioritization and informed interventions to address key obstacles to DB adoption.

4.5.1 Regression Analysis and Enablers for Adoption of the DB Method

After multiple iterations, a regression model with statistically significant predictors ($p < 0.05$) was obtained. Variables with p-values exceeding 0.05 were excluded as they did not demonstrate a significant influence on DB adoption. Excluded factors included prolonged document processing cycles, delayed constructability input from contractors, insufficient stakeholder communication, delays in right-of-way acquisition after design approval, late contractor payments, cost-saving pressures causing design-related claims, and right-of-way acquisition-related cost prolongation.

The resulting regression model is presented in Table 4-7.

Table 4-7: Regression model – barriers to DB adoption

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	1.300	0.625		1.957	0.020
High Document process cycle time requirement	0.374	0.139	0.188	1.514	0.014
Delayed payment of the contractors' invoices reduces cash flows	0.313	0.147	0.151	1.723	0.019
Lack of communication with end users and stakeholders	0.242	0.113	0.144	1.222	0.024
Acquisition of right-of-way upon design approval	0.18	0.222	0.065	1.311	0.038
Late input of constructability advice from the contractor results in delays	0.177	0.111	0.192	1.324	0.031
Cost-saving pressures are leading to claims from the contractor	0.128	0.165	0.107	1.196	0.033
The RoW acquisition problem leads to prolonged costs	0.014	0.226	0.009	1.372	0.048
a. Dependent Variable: Parameters that limit the adoption of the DB Method					

The regression equation derived from the analysis is presented as Equation 4-1:

ADOPTION=1.300+0.374HD+0.313DP+0.242LO+0.180AO+0.177LI+0.128CS+ 0.014RoW (Equation 4-1)

Where:

- **ADOPTION** = Dependent variable representing the adoption of the DB delivery method
- **HD** = High document process cycle time requirement
- **LI** = Late input of constructability advice from contractors
- **LO** = Lack of communication with end users and stakeholders
- **AO** = Acquisition of right-of-way upon design approval, causing execution delays
- **DP** = Delayed payment of contractors' invoices, reducing cash flow and production rate
- **RoW** = Right-of-way acquisition problems leading to prolonged costs
- **CS** = Cost-saving pressures prompting contractor claims regarding design issues

The variables above were measured on a Likert scale to capture respondents' perceptions of each factor's influence on the adoption of the Design-Build approach. The model established high explanatory power (adjusted $R^2 = 0.8015$), demonstrating that the examined barriers collectively exert a substantial effect on DB adoption in Uganda, in line with findings from similar infrastructure contexts (Mutikanga et al., 2022)

High document processing times emerged as the most critical barrier, corroborating previous studies (Liu et al., 2016; Abbasova, 2020) that highlight procedural delays as major inhibitors to DB adoption. Delayed contractor payments were also identified as

a major barrier, highlighting the importance of effective cash flow management to maintain project cost and contractor engagement (Chadee et al., 2023; Ikediashi & Okolie, 2022)

Lack of communication with stakeholders underscores the socio-organizational dimension of DB adoption. Effective engagement channels are essential to mitigate resistance, foster collaboration, and support integrated project delivery (Osobajo et al., 2023; Chakra and Ashi, 2019).

Other statistically significant barriers, including right-of-way acquisition delays, late contractor constructability input, and cost-saving pressures leading to claims, are well-documented in developing country literature (Tesfaye, 2019; Elong, 2020; Wuni and Shen, 2020). The regression coefficients quantitatively confirm that these factors negatively affect the adoption of DB, emphasizing the need for tailored interventions to enhance adoption rates.

4.5.2 Model Analysis

The regression equation (Equation 4-1) illustrates the relationship between DB adoption and adoption barriers in road projects in Uganda. The model quantifies the effect of each factor on DB adoption while holding other variables constant. The regression coefficients indicate the magnitude and direction of influence for each barrier.

From the model, high document process cycle time requirements (HD) emerged as the most significant negative factor affecting DB adoption. Specifically, a unit increase in HD corresponds to a 0.374 unit reduction in DB adoption.

Following HD, delayed payment of contractors' invoices (DP) showed a substantial negative impact, with a coefficient of -0.313. This implies that increased delays in contractor payments reduce adoption rates by 0.313 units. Likewise, lack of communication with end users and stakeholders (LO) showed a coefficient of -0.242, indicating a negative impact on adoption; specifically, an increase in LO corresponds to a 0.242-unit decrease in DB adoption

Other notable negative factors included cost-saving pressures (CS) (-0.148), acquisition of right-of-way upon design approval (AO) (-0.142), and late input of constructability advice from contractors (LI) (-0.134). These findings demonstrate that both administrative and procedural inefficiencies, as well as financial and communication-related challenges, substantially hinder the uptake of DB methods in Ugandan road projects.

The prominence of high document processing times, delayed constructability advice, and poor stakeholder communication is consistent with the research by Abbasova (2020); Osobajo et al. (2023), and Wuni and Shen (2020). Bureaucratic delays in documentation are frequently identified as key obstacles to innovative procurement in road projects (Liu et al., 2016; Zhong et al., 2022). Similarly, late contractor involvement, which limits timely input, heightens the potential risk of time and cost overruns (Chan et al., 2010; Wuni & Shen, 2020). Communication gaps are widely recognized as root causes of project disputes and resistance to adopting integrated delivery methods (Osobajo et al., 2023).

Additional challenges, including delayed compensation payments, cost-saving pressures leading to design disputes, and ineffective change management, further

corroborate the literature on infrastructure project risks in developing countries (Tesfaye, 2019; Mutikanga et al., 2022). These barriers highlight systemic inefficiencies and the complexities of multi-stakeholder environments, emphasizing the need for targeted interventions to facilitate broader DB adoption in Uganda's road sector.

4.5.3 Model Verification

The F-test measures the overall regression model fit by determining the extent to which the independent variables, as a group, significantly improve the explanation of the dependent variable compared to a restricted baseline model. In this study, it compares the intercept-only model, which assumes no effect of barriers on DB adoption, with the full regression model incorporating the identified independent variables. The aim is to confirm whether these factors meaningfully influence DB adoption in Ugandan road construction projects.

In the intercept-only model, all regression coefficients are set to zero, implying that the independent variables do not affect DB adoption. The full model, however, includes variables representing barriers such as high document processing time, delayed payments, and lack of stakeholder communication, among others.

Following standard procedures (Kellie & Lemeshow, 2006), the model's goodness-of-fit was evaluated by comparing the calculated F-statistic with the critical F-value from the F-distribution table at a 5% significance level with 9 degrees of freedom, yielding a critical value of 1.833 (see Appendix 7). The calculated F-value from the regression analysis was 7.206 (Table 4-8), which exceeds the critical threshold.

The ANOVA summary in Table 4-8 confirms that the identified barriers account for a significant portion of DB adoption. Therefore, it can be inferred that barriers such as administrative delays, delayed contractor payments, communication gaps, and right-of-way acquisition challenges pose a measurable and significant impact on DB adoption in Uganda's road sector.

Table 4-8: Regression model – verification

ANOVA[a]						
Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	12.804	9	1.423	7.206	.002[b]
	Residual	133.701	89	1.502		
	Total	146.505	98			
a. Dependent Variable: Parameters that Govern the Choice of the DB Method						
b. Predictors: (Constant)						

4.5.4 Model fitness test

The suitability of the regression model was assessed using R^2, which explains the proportion of variance in DB adoption that is explained by the identified barriers. Both predicted R^2 and adjusted R^2 values were evaluated to ensure the model's reliability and predictive capability.

Table 4-9 presents the model summary. It can be confirmed that approximately 80.55% of the variance in DB adoption is explained by the studied barriers, leaving only 19.45% attributable to other unexamined factors. With an adjusted R^2 of 0.8015, the

model demonstrates strong robustness, as this statistic compensates for the number of predictors and provides a more conservative yet reliable estimate of model fit (Kim and Lee, 2019)

Table 4-9: Model Summary

Model Summary									
Model	R	R Square	Adjusted R Square	Std. The error in the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	0.8234[a]	0.8055	0.8015	1.760	0.055	1.367	9	94	0.025
a. Predictors: (Constant)									

High R^2 values demonstrate that the identified barriers significantly influence the adoption of the DB method. The model's robustness is further validated by the F-test results, which indicate that the identified barriers collectively have a significant effect on DB adoption. The unexplained variance (approximately 19.45%) may be due to additional contextual or institutional factors not captured in this study.

Using regression analysis in this context aligns with established methodologies in construction management and infrastructure research (Johnson and Wang, 2018; Kim and Lee, 2019).

Furthermore, employing SPSS for model estimation and validation facilitates rigorous statistical testing, thereby strengthening the reliability and credibility of the results

(Karupiah, 2022). By iteratively refining the regression model and excluding variables with non-significant p-values, the final model achieves both parsimony and explanatory strength, making it suitable for practical application in policy and project planning.

4.5.5 Model Validation

The regression model evaluating barriers to DB adoption was validated using a split-sample approach ratio of 7:3. This method assessed the model's robustness, predictive accuracy, and adherence to statistical assumptions, including normality and control of overfitting.

Consistency between the R^2 values of the actual model and the predicted outputs from the testing set was assessed, as shown in Table 4-10. Small differences between these values indicate strong predictive reliability.

Table 4-10: Regression model – split-sample validation

Actual R^2	**Pred R^2**	**Actual R^2– Pred R^2**	**Remarks**
0.8055	0.8660	0.0605	Close
Actual Adj R^2	**Pred Adj R^2**	**Actual Adj R^2– Adj Pred R^2**	**Remarks**
0.8015	0.8089	0.0074	Very close to zero

The results demonstrate agreement between the actual and predicted models, confirming the model's validity. This level of concordance supports its practical

application for guiding stakeholders in implementing the DB for Uganda's road projects. Therefore, the developed model can be adopted for identifying and addressing barriers to DB adoption while recognizing inherent limitations.

Key barriers identified as statistically significant, such as prolonged document processing cycles, delayed contractor constructability input, and poor communication with stakeholders, align with findings from previous studies (Abbasova, 2020; Osobajo et al., 2023; Wuni and Shen, 2020). Procedural delays in documentation are consistently identified as a major barrier to the adoption of innovative procurement in road projects (Liu et al., 2016; Zhong et al., 2022).

Late involvement of contractors, which limits timely input on constructability, is also recognized as a risk factor accounting for schedule slippages and cost overruns (Chan et al., 2010; Wuni and Shen, 2020). Similarly, communication gaps with stakeholders were identified as a major source of conflicts and resistance to new project delivery approaches (Osobajo et al., 2023).

Other barriers, including delays in compensation payments, cost-saving pressures, and inadequate change management, mirror challenges observed in developing-country infrastructure contexts (Tesfaye, 2019; Mutikanga et al., 2022). Collectively, these findings reveal systemic inefficiencies and the intricate dynamics of multi-stakeholder environments in Uganda, underscoring the importance of coordinated policy measures and managerial interventions to promote DB adoption.

4.6 Qualitative results

4.6.1 Demographic Profile of Qualitative Respondents

A total of twelve key informants were purposively selected for in-depth interviews. These participants represented UNRA Project Management Teams, contracting firms, supervision consultants, MoWT, and design consultancies. Selection criteria focused on individuals with direct involvement in project implementation, technical oversight, and policy development, ensuring comprehensive insights across the spectrum of road project stakeholders.

Table 4-11: Demographics of Key Informants

Characteristic	**Category**	**Freq**	**%**
Gender	Male	7	58.4
	Female	5	41.6
Professional Role	Government official	5	41.7
	Contractor	4	33.3
	Consultant	3	25.0
Years of Experience	< 5 years	2	16.6
	5–10 years	4	33.3
	> 10 years	6	50.0
Involvement in DB Projects	Direct project management	7	58.4
	Policy/regulatory oversight	3	25.0
	Advisory/Monitoring	2	16.6

The data indicates that the majority of respondents have over ten years of professional experience, demonstrating considerable exposure to road project management. This

enables grounding of qualitative findings in practical expertise and informed judgment. These results align with recommendations by Patton (2015) and Saunders et al. (2019), emphasizing that inclusion of highly experienced stakeholders in qualitative studies enhances both the credibility and depth of insights.

4.6.2 Focus Group Discussions

Two FGDs were organized to obtain broader perspectives. The first FGD was held in Kampala, including central government engineers, procurement officers, and major contractors. The second was conducted in Hoima, engaging district engineers and local contracting representatives. Each focus group discussion (FGD) comprised 6–8 participants, totaling 14 participants across both groups. Table 4-12 presents the demographic characteristics of the FGD participants

Table 4-12: Focus group participants – demographics

Characteristic	**Category**	**Freq.**	**%**
Gender	Male	9	64.3
	Female	5	35.7
Professional Role	Engineer/project manager	6	42.9
	Contractor representative	5	35.7
	Procurement specialist	3	21.4
Years of Experience	< 5 yrs	4	28.6
	5–10 yrs	4	28.6
	>10 yrs	6	42.8
Prior DB Project Exposure	Yes	5	35.7
	No	9	64.3

While most participants possessed considerable professional experience, a majority (64.3%) had no prior direct involvement in DB projects. This mix of experienced DB practitioners and participants with limited exposure provided a rich balance of perspectives, revealing both informed insights and potential misconceptions. Existing research suggests that incorporating participants with varying levels of prior exposure is valuable for uncovering knowledge gaps and identifying barriers to adoption that might otherwise remain unnoticed (Bryman, 2016; Osobajo et al., 2023).

4.6.3 Significance of the Participant Profile

The qualitative sample for this study comprised 26 participants representing a range of professional backgrounds and varying levels of Design-Build (DB) experience. This diversity facilitated the collection of insights across multiple layers of project delivery, including policy formulation, strategic management, and operational implementation. It also enriched the analysis by revealing a spectrum of perspectives on procedural, systemic, and perceptual barriers to DB adoption.

Such diversity has been shown to strengthen the credibility, transferability, and analytical depth of qualitative research in construction and infrastructure management (Alamos-Concha et al., 2024). By incorporating perspectives from both experienced experts and emerging practitioners, the study offered a comprehensive knowledge of the barriers and enablers to Uganda's DB implementation.

4.7 Qualitative Findings and Discussion

Building on the demographic diversity described above, qualitative data obtained from KIIs and FGDs revealed several consistent themes related to barriers, enablers, and stakeholder perceptions of DB adoption in Uganda's road sector.

The thematic findings are presented according to the prominence and frequency of participant responses. Each theme is discussed in relation to existing empirical and theoretical literature, highlighting areas of convergence and divergence. This approach not only contextualizes the findings within the broader research landscape but also demonstrates the practical implications for policy, project management, and the operational deployment of DB methods in Uganda.

4.7.1 Barriers to DB Adoption

Prolonged Documentation and Approval Processes

Participants consistently identified extended bureaucratic procedures and slow approval cycles as a significant constraint on DB adoption. These delays often undermined the intended "fast-track" advantages of DB projects. One UNRA official explained, "*By the time a DB contract is awarded, we've spent so much time on approvals that the 'fast-track' advantage is lost*." These findings align with Memon et al. (2018), who highlight that cumbersome administrative processes in developing countries undermine the efficiency benefits of integrated delivery methods. Similarly, Tessema (2023) highlights that delays in documentation and approvals directly affect project schedules and stakeholder satisfaction.

Delayed Contractor Payments

Payment delays were reported as a major barrier, disrupting cash flow and weakening trust between clients and contractors. A participant in the Kampala FGD noted, "*You cannot expect contractors to commit to compressed timelines if they are not paid for work done.*" Ofori (2015) similarly observes that delayed payments in sub-Saharan Africa reduce contractor participation, particularly among small and medium enterprises, which in turn limits competition and diminishes innovation in construction delivery.

Limited Stakeholder Awareness and Misconceptions

Misunderstandings about the DB approach, including concerns about potential contractor opportunism and perceived project risks, were frequently mentioned. An academic expert noted, "*Many people think DB means the contractor can cut corners. That's a misconception that kills its adoption*." Dzitouo (2024) also identifies stakeholder misperceptions as a major inhibitor in emerging economies, emphasizing the need for awareness campaigns and targeted training to improve adoption rates.

Policy and Regulatory Constraints

Although DB is legally permitted in Uganda, participants reported that the absence of practical, operational guidelines limits its implementation. One FGD participant from Hoima explained, "*The law says you can do DB, but it doesn't say how to do it effectively*." Research from Kullaya et al. (2022) and Tola (2024) shows that inconsistent or inadequate regulatory frameworks in East African countries such as Kenya and Tanzania have led to delays, disputes, and inconsistent project outcomes.

Mutikanga et al. (2022) further argue that clear and enforceable policy frameworks are vital for institutionalizing DB adoption.

Capacity and Skills Gaps

Limited experience with integrated design–construction methods was highlighted as a key barrier. Many government engineers lacked exposure to design management, and contractors were unfamiliar with the complexities of shared risk mechanisms. As one participant observed, "*Many players are used to traditional methods; they lack skills in integrated design and implementation management required for DB*." Chan et al. (2010) emphasize that capacity building and technical training are critical for successful DB implementation, as skills gaps exacerbate risks and reduce confidence in innovative project delivery methods.

4.7.2 Enablers and Good Practices

Participants identified several key enablers that can effectively promote the adoption of the Design-Build (DB) delivery method while aligning local practices with global standards.

Digital Document Management Systems

The use of digital platforms for document management was repeatedly emphasized as a practical tool to streamline approval processes, improve traceability, and reduce administrative delays. Such systems help maintain clear records, minimize human error, and facilitate real-time collaboration among project stakeholders. These observations are consistent with findings by Abbasova (2020) and Habibzadeh et al.

(2019), who highlight digital solutions as critical for enhancing efficiency in integrated project delivery.

Prompt Payment Mechanisms

Ensuring timely payment to contractors was highlighted as a crucial enabler for maintaining healthy cash flows, fostering trust, and sustaining productivity. Payment delays were cited as a key barrier, and participants noted that reliable financial processes significantly enhance contractor willingness to engage in DB projects. These insights resonate with Tang and Nandy (2023) and Koch (2019), who emphasize that prompt financial management underpins successful project execution.

Targeted Capacity Building

Participants underscored the importance of structured training programs focusing on DB-specific risk allocation, integrated design–construction coordination, and performance monitoring. Such capacity-building initiatives equip project participants with the technical knowledge and managerial abilities for navigating the complexities of DB projects. This aligns with Akintola and Al-Hashimi (2020), who argue that enhancing technical competence is fundamental to increasing confidence in innovative delivery methods.

Pilot DB Projects

The implementation of pilot DB projects was seen as a practical approach to demonstrate feasibility, build institutional confidence, and encourage gradual

adoption. One contractor noted, "*Show them it works; one or two well-executed DB projects will change the whole conversation*." (KII, Contractor). These findings align with Zhong et al. (2022), who advocate for pilot initiatives to effectively demonstrate the benefits of Design-Build and provide a model for broader implementation.

Overall, these enablers collectively offer a practical roadmap to address adoption barriers, improve stakeholder confidence, and strengthen the institutional and technical foundations for successful DB implementation in Uganda's road sector.

4.7.3 Risks and Perceived Trade-offs

Participants identified several risks intrinsic to the Design-Build (DB) delivery method that can significantly affect project outcomes.

Limited Flexibility for Design Changes

One frequently mentioned risk was the restricted ability to implement design changes once the project is underway. Because DB integrates design and implementation phases, modifications requested late in the process can result in additional costs or delays. Participants noted that evolving client requirements often exacerbate this challenge. These findings correspond with Love et al. (2011), who emphasize that integrated delivery approaches require careful upfront planning to balance innovation with constructability and ensure schedule adherence.

Potential for Cost Overruns

Cost overruns were also identified as a major concern, especially in projects where the scope is not clearly defined. Ambiguous or incomplete project specifications may lead

contractors to underestimate resource needs, timelines, or material requirements, triggering claims and escalating budgets. “This is consistent with the findings by Mayer et al. (2022), who contend that accurate and comprehensive documentation is essential in Design-Build projects to minimize disputes and maintain financial control.

Concentration of Contractor Risk

Participants emphasized that DB inherently consolidates both design and implementation responsibilities onto the contractor, which concentrates financial and performance risk. While this integration can increase accountability and efficiency, it may also deter smaller or less experienced contractors from participating, particularly in countries like Uganda, where DB experience is limited.

Mitigation Strategies

To address these risks, participants recommended implementing clear performance specifications, adopting balanced contract frameworks, and ensuring proactive oversight by clients throughout the project lifecycle. Such measures help clarify expectations, distribute risks equitably, and identify potential challenges early, thereby improving the likelihood of successful DB adoption (Mayer et al., 2022).

Overall, understanding such risks and perceived trade-offs is essential for tailoring DB practices to local contexts, enhancing stakeholder confidence, and promoting sustainable adoption in Uganda’s road sector

4.7.4 Barriers by Category

The qualitative analysis revealed that barriers to DB adoption in Uganda can be grouped into several distinct categories, each affecting project performance in unique ways:

Scope-Related Barriers

Poorly defined project scopes were frequently cited as a source of disputes and misalignment between clients and contractors. Ambiguities in scope often lead to claims, rework, and delays. These are consistent with the results reported by Elhag et al. (2020), who emphasize that precise scope definition is critical to minimizing conflicts in DB projects.

Time-Related Barriers

Delays in acquiring Right-of-Way (RoW) and compensating affected stakeholders were consistently reported as major obstacles to fast-tracked project execution. Participants noted that prolonged RoW procedures stall construction activities, eroding the inherent schedule advantages of DB delivery (Tesfaye, 2019).

Cost-Related Barriers

Unclear scope definitions coupled with financial pressures often resulted in contractual disputes, affecting cash flow and overall project timelines. This supports global findings that unresolved cost uncertainties can inhibit DB adoption unless effectively addressed.

Procurement and Regulatory Constraints

The lack of DB-specific procurement guidelines and operational regulations was highlighted as a systemic challenge. Participants observed that general procurement rules fail to accommodate the integrated nature of DB, creating inefficiencies, approval delays, and inconsistent project outcomes (Hassan and Mustaffa, 2022; Moran et al., 2022).

Capacity and Skills Gaps

Limited expertise in integrated design–construction management among both government officials and contractors was a recurring theme. This skills deficit hampers effective risk allocation, coordination, and innovation, supporting Chan et al. (2010), who argue that capacity building is vital for successful DB adoption in emerging markets.

Awareness and Perception

Misconceptions regarding DB, such as concerns over contractor opportunism or perceived project risk, were common. Stakeholders unfamiliar with the approach often see it as riskier or cost-cutting, consistent with Ling et al. (2004), who note that perception and awareness strongly influence adoption in developing economies.

Risk Perception

Participants emphasized that apprehensions about cost overruns, ambiguous contractual obligations, and inadequate communication reduce willingness to adopt DB. These insights highlight the need for structured risk management, clear

contractual frameworks, and transparent communication to foster confidence and uptake (Tang and Nandy, 2023).

In summary, these categories demonstrate that DB adoption in Uganda is influenced by interrelated structural, procedural, and perceptual barriers, suggesting that effective interventions must address multiple dimensions simultaneously.

4.7.5 Successful DB Projects and Enablers

The study highlighted several critical factors that enabled the successful adoption of DB delivery in Uganda. Prominent among these were early contractor involvement, clearly defined project scopes, committed leadership, and robust communication and collaboration among stakeholders. These elements collectively facilitated smoother project execution, minimized disputes, and improved overall efficiency.

One contractor remarked:

"The few successful DB projects had active collaboration from all parties, early input from contractors, and government support with streamlined approvals." (KII, Contractor)

This qualitative insight aligns well with the findings of Abbasova (2020) and Zhong et al. (2022), who argue that involving contractors early in design and planning, along with continuous stakeholder engagement, is crucial for fostering innovation, reducing rework, and enhancing project outcomes. Implementing these practices creates a collaborative environment, addresses barriers such as scope ambiguity and procedural delays, and strengthens risk management, thereby increasing the probability of successful DB project delivery.

Proposed Measures to Overcome Barriers

Drawing on insights from the qualitative findings and regression analysis, the study recommends targeted interventions to address the primary barriers to DB adoption in Uganda:

- **Establish Clear DB-Specific Policies and Procurement Frameworks:** Regulatory and procurement ambiguities were identified as major impediments to DB adoption. Developing policies and procurement guidelines tailored specifically for DB projects can reduce procedural inefficiencies, provide a structured framework for approvals, and enhance institutional support for DB implementation (Mutikanga et al., 2022).
- **Implement Targeted Capacity-Building Programs:** Skills gaps among stakeholders were frequently cited as a limiting factor. Structured training programs focusing on DB risk allocation, integrated design coordination, and performance monitoring can equip project teams to manage the complexities of DB delivery effectively, strengthening competence and confidence in adopting the method (Wuni and Shen, 2020).
- **Strengthen Stakeholder Engagement and Communication Platforms:** Limited awareness, misconceptions, and perceived risks were recurrent barriers. Developing participatory communication mechanisms, regular feedback channels, and continuous stakeholder consultations can foster understanding, align expectations, and promote collaboration across project teams (Osobajo et al., 2023).

- **Ensure Early Contractor Involvement in Design Phases:** Lack of constructability input and poorly defined scopes contribute to disputes, cost overruns, and schedule delays. Engaging contractors early in the design process enables practical input, reduces rework, and fosters shared ownership of project outcomes (Chan et al., 2010).

- **Adopt Digital Tools for Document and Process Management:** Prolonged documentation cycles and complex approval procedures were identified as significant bottlenecks. Implementing digital document management systems enhances traceability, streamlines approvals, and accelerates project processes, thereby improving overall efficiency (Abbasova, 2020; Habibzadeh et al., 2019).

- **Streamline Right-of-Way (RoW) Acquisition and Compensation Procedures:** Delays in acquiring RoW and compensating affected stakeholders were highlighted as critical time-related barriers. Efficient land acquisition procedures and timely compensation mechanisms help minimize construction delays and support fast-tracked project delivery (Tesfaye, 2019).

By directly linking these interventions to the identified barriers, the proposed framework offers a practical, evidence-based roadmap for policymakers, project managers, and stakeholders to facilitate the effective adoption of DB methods in Uganda's road infrastructure projects.

4.7.6 Government's Role

Government leadership plays a pivotal role in fostering DB adoption by establishing the requisite policy, regulatory, and institutional frameworks for effective implementation. Participants emphasized that clear guidelines, dedicated funding, and proactive advocacy are crucial for minimizing stakeholder resistance and ensuring standardized processes across DB projects. As one participant noted: *"Government must champion DB through clear guidelines, funding support, and advocacy to reduce resistance and standardize processes."*

These insights align with the quantitative findings, which identified regulatory ambiguities and procedural inefficiencies as major obstacles to DB adoption. By providing clear policies, robust enforcement mechanisms, and streamlined approval processes, the government can mitigate these challenges, ensuring timely compensation for Right-of-Way (RoW) acquisitions and enhancing adherence to contractual obligations.

The role of government support is further reinforced by Nuwagaba and Molokwane (2020), who argue that institutional backing is crucial for scaling innovative project delivery methods in emerging economies. The qualitative evidence from this study suggests that strong government leadership can also facilitate other enabling factors, such as capacity-building programs, early contractor engagement, and the implementation of digital document management systems, by coordinating stakeholders and promoting best practices.

In summary, proactive government involvement not only addresses structural and procedural barriers but also fosters collaboration and trust among project participants.

This supportive environment is vital for successfully integrating DB delivery methods into Uganda's road sector and ensuring efficient, timely project execution within budget.

4.7.7 Importance of Collaboration and Partnerships

Government leadership remains a cornerstone in promoting the adoption of the Design-Build (DB) delivery method, providing essential guidance through policy formulation, regulatory enforcement, and advocacy. Participants emphasized the need for proactive government involvement: *"Government must champion DB through clear guidelines, funding support, and advocacy to reduce resistance and standardize processes."* Such institutional support establishes the framework necessary to scale innovative project delivery approaches, consistent with the observations of Nuwagaba and Molokwane (2020).

In addition to government efforts, collaboration among stakeholders was identified as a key enabler for successful DB adoption. Strategic partnerships, particularly between local and international firms, facilitate knowledge sharing, skills development, and exposure to global best practices. These collaborative arrangements strengthen trust, enhance institutional capacity, and build stakeholder confidence in implementing DB projects. This finding supports Osobajo et al. (2023), who stress the role of partnerships in promoting innovation and improving project delivery outcomes.

Overall, the combination of strong government leadership and effective stakeholder collaboration creates a supportive ecosystem that encourages DB adoption. Such an environment not only tackles structural and procedural challenges but also establishes

a foundation for implementing practical mitigation strategies, including the toolkit developed in this study, to improve project success within Uganda's road sector.

4.8 Discussion of Qualitative Results

The qualitative findings offer an in-depth knowledge of the root causes of the identified barriers, offering rich insights into the challenges and enablers of DB adoption in Uganda. Key observations include:

- **Scope Ambiguity and Procedural Delays:** Persistent uncertainties in project scope, coupled with prolonged Right-of-Way (RoW) acquisition and delayed contractor payments, emerged as significant impediments to efficient DB implementation. Regulatory constraints and limited technical capacity further exacerbated these challenges, highlighting structural and systemic issues that restrict project effectiveness.
- **Risk Perception and Stakeholder Misconceptions:** Misunderstandings regarding DB, including perceived contractor opportunism and project risk, emphasized the need for clear communication, stakeholder engagement, and structured change management processes to build confidence in DB delivery.
- **Enablers for Successful Adoption:** Early contractor involvement, collaborative practices among stakeholders, and pilot DB projects were identified as critical mechanisms to enhance integration, innovation, and institutional readiness. These practices support knowledge transfer, reduce conflicts, and improve the overall quality and timeliness of project execution.

- **Government Leadership and Policy Support:** Active government involvement through clear policies, regulatory guidance, and institutional backing was repeatedly highlighted as foundational. Such leadership establishes a supportive environment, ensures consistency across projects, and promotes adherence to DB frameworks.

Together, these findings substantiate the mitigation toolkit developed in this study and provide practical strategies for overcoming barriers to DB adoption. By combining empirical evidence from Uganda with international best practices, the study findings are consistent with the recommendations by Mutikanga et al. (2022), Abbasova (2020), and Zhong et al. (2022), providing a comprehensive framework for both theoretical insights and practical strategies to enhance Design-Build project delivery.

4.8.1 Toolkit for Mitigating Barriers to DB Adoption

Development and Theoretical Basis

The mitigation toolkit is a structured, stage-oriented framework designed to support stakeholders in overcoming barriers and achieving successful adoption of the Design-Build (DB) delivery method. Its implementation begins with the systematic identification of key obstacles, such as delays in documentation, late constructability input, payment bottlenecks, poor communication, and cost-related disputes. These barriers are drawn from the study's integrated quantitative and qualitative findings. Stakeholders subsequently evaluate the potential impact of each barrier across key project stages, from pre-award planning and design development to construction execution and project handover.

The toolkit provides context-specific interventions to address each identified barrier. For instance, protracted document processing cycles can be mitigated by implementing digital document management systems, which streamline approvals and improve traceability (Abbasova, 2020; Habibzadeh et al., 2019). Late constructability input is addressed by ensuring early contractor involvement in the design phases, enhancing integration, and minimizing rework (Chan et al., 2010; Zhong et al., 2022). Delays in contractor payments are countered through prompt and transparent financial mechanisms that sustain cash flow and incentivize timely performance (Tang and Nandy, 2023; Koch, 2019). Similarly, challenges related to stakeholder communication and misconceptions are mitigated through structured engagement platforms, targeted training, and capacity-building initiatives (Wuni and Shen, 2020; Osobajo et al., 2023).

A key feature of the toolkit emphasis on continuous monitoring, evaluation, and feedback. Project progress, risk mitigation effectiveness, and stakeholder satisfaction are regularly reviewed, while lessons learned are documented to inform subsequent DB projects. This iterative approach reflects adaptive project management principles, ensuring that interventions remain responsive to evolving project conditions (Cobb, 2023).

By linking identified barriers to actionable, evidence-based solutions within a stage-specific framework, the mitigation toolkit provides a practical guide for road project practitioners in Uganda. Additionally, it serves as a policy-oriented instrument for government agencies aiming to institutionalize the DB delivery method, aligning local

practice with global best practices in DB adoption (Mutikanga et al., 2022; Abbasova, 2020).

4.8.2 Operation of the Toolkit

The mitigation toolkit is designed to guide stakeholders through a series of structured, adaptive stages, each aimed at promoting the effective adoption of the Design-Build (DB) delivery method. The operational stages are as follows:

1. Identification of Critical Barriers and Risks: Stakeholders begin by systematically evaluating the primary obstacles affecting DB project performance. Key factors include extended document processing cycles, delayed constructability input, payment bottlenecks, communication inefficiencies, and cost-related disputes. This initial assessment establishes a clear focus for targeted interventions.

2. Understanding DB Processes, Benefits, and Pitfalls: Stakeholders are provided with a contextualized understanding of DB delivery, including its advantages and potential challenges within Uganda's road sector. This stage ensures informed decision-making and realistic expectations regarding project execution.

3. Planning Procurement and Execution Strategies: Projects are developed within an enabling policy and regulatory framework, ensuring alignment with government guidelines, stakeholder capacities, and institutional requirements. Effective planning at this stage facilitates smoother implementation and reduces procedural delays.

4. Feasibility Assessment and Continuous Auditing: The toolkit incorporates ongoing evaluation mechanisms to monitor progress, verify the suitability of the selected DB approach, and adapt strategies in response to emerging risks or challenges.

Continuous auditing promotes organizational learning and ensures proactive management of project uncertainties.

This sequential, adaptive framework reflects globally recognized project management practices, emphasizing iterative learning, stakeholder engagement, and evidence-based decision-making as critical enablers of successful DB adoption (Alemu, 2025).

4.8.3 Drivers and Selection Considerations

Within the context of Uganda's road projects, the primary factors hindering DB adoption correspond closely to the barriers identified by stakeholders. As illustrated in Table 4-12, respondents highlighted several critical factors: 68% identified prolonged costs associated with Right-of-Way (RoW) acquisition as a significant obstacle, 80% pointed to delays in RoW acquisition, and 89% cited delayed payment of contractor invoices. Other notable barriers included poor change management (70%), inadequate scope definition (72%), and high document processing cycle times (97%). Additionally, 84% of respondents indicated a lack of effective communication, 82% emphasized contractual claims arising from cost-saving pressures, and 74% identified late constructability input from contractors as key impediments to DB adoption.

These results underscore the multifaceted challenges affecting DB implementation and highlight the need for focused interventions in addressing the barriers. Factors such as project cost implications, innovation potential, risk management, and flexibility in handling change reflect the complex decision-making considerations inherent in adopting the DB approach (Elhag et al., 2020; Mayer et al., 2022). This level of agreement among respondents (ranging from 70% to 97%) aligns with international

evidence suggesting that DB can deliver projects more rapidly, cost-effectively, and innovatively when barriers are adequately managed (Mutikanga et al., 2022; Kim and Lee, 2019).

Furthermore, practical considerations, such as operational and maintenance requirements, prior project success, and financing arrangements, reinforce the importance of contextual suitability in selecting the appropriate DB variant, echoing the frameworks proposed by Zhong et al. (2022). Collectively, these findings emphasize that successful DB adoption requires a balanced approach, integrating stakeholder insights with rigorous evaluation of project-specific drivers and constraints.

i. The process

The process of adopting the Design-Build (DB) approach begins with selecting DB as the preferred project delivery method. According to Table 4-12, 92% of respondents indicated that the anticipated impact on project cost is a decisive factor, while 88% emphasized the importance of the level of innovation required to achieve creative solutions. Additionally, 80% highlighted improved risk management, 84% noted the effect on dispute reduction, and 90% recognized the flexibility in managing changes as key considerations supporting the choice of DB for road projects in Uganda.

Beyond selecting DB as a delivery method, the process also involves determining the most suitable DB mechanism or variation for a specific project under particular conditions. As reported in Table 4-12, 97% of respondents identified operational and maintenance requirements as crucial in selecting the appropriate DB mechanism. Similarly, 92% considered the success of previously executed facilities, and 95%

highlighted financing arrangements through strategic alliances as important selection criteria.

These results illustrate that both the choice of DB as a delivery method and the selection of the specific DB mechanism require careful consideration of multiple interrelated factors. Addressing these dimensions systematically is essential to optimizing project performance, reducing risks, and ensuring successful implementation within Uganda's road construction sector.

ii. Planning

The planning phase of a Design-Build (DB) project encompasses initial contractor selection and the framework for project management. As shown in Table 4-12, 90% of respondents highlighted the preparation of clear and comprehensive preliminary design documents as a fundamental factor for DB success. Similarly, 91% emphasized the importance of well-defined risk management strategies, while 84% agreed on the need for standardized procedures and milestones to review, evaluate, and approve concept designs during development.

Stakeholder engagement was also identified as critical: 93% of respondents stressed involving all relevant parties in defining client requirements, and 98% emphasized clear articulation of scope and client expectations to prevent misunderstandings or misinterpretation. Additionally, 90% of respondents indicated that skills development and capacity-building initiatives are essential for sustaining DB project success, and 88% noted that early contractor involvement during planning enhances constructability and maintainability outcomes.

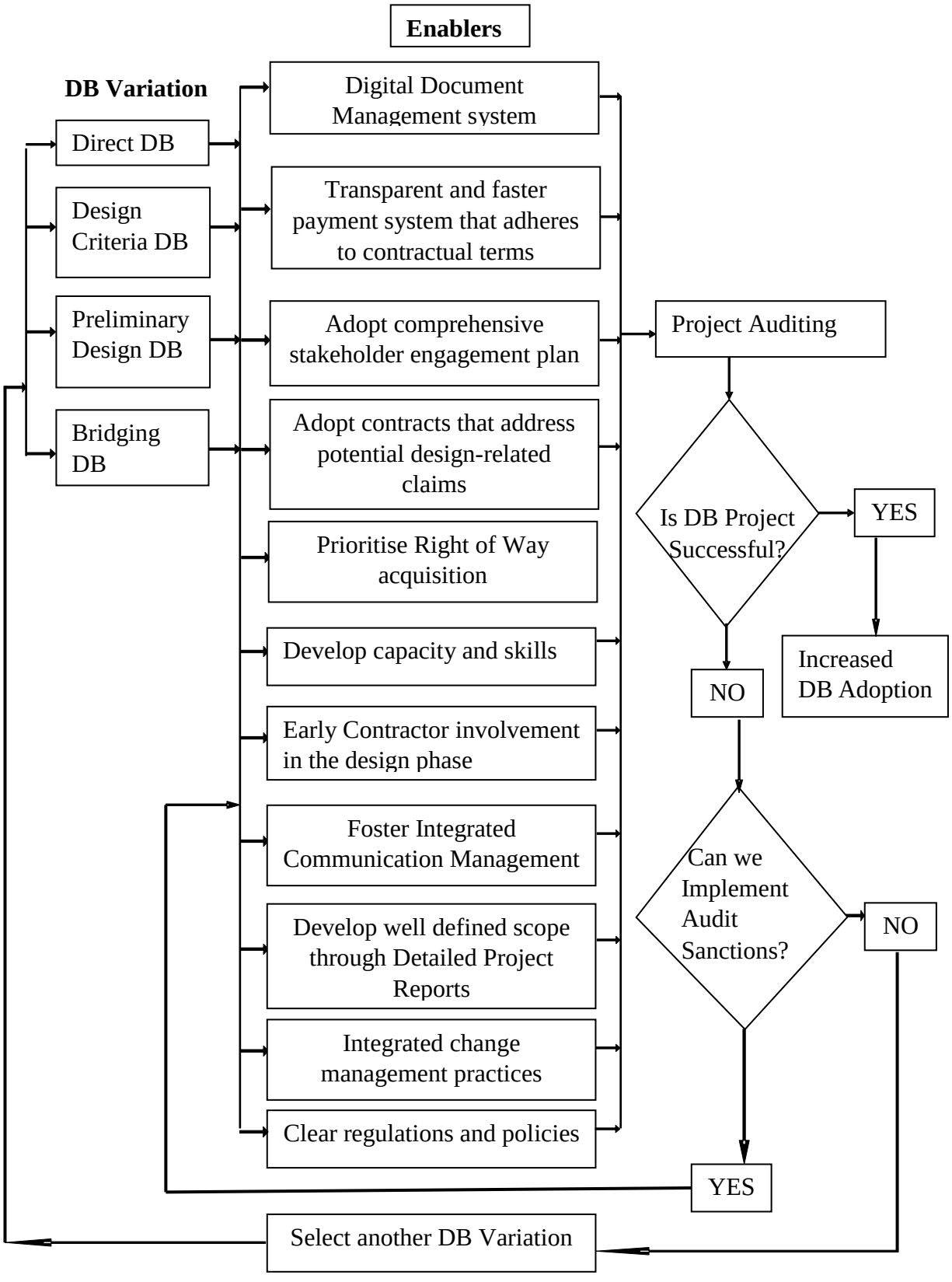

Figure 4-7: Toolkit model developed

These findings highlight the need for structured, thorough planning in DB projects, underscoring comprehensive documentation, proactive risk mitigation, active stakeholder participation, and precise definition of project scope and requirements. The emphasis on preliminary design clarity, risk management, and stakeholder collaboration aligns with established project management best practices (PMI, 2021; Kerzner, 2017). Furthermore, the strong consensus on skills development and early contractor engagement reinforces literature advocating for integrated capacity-building initiatives and collaborative teamwork to enhance DB project performance (Akintola and Al-Hashimi, 2020; Wuni and Shen, 2020).

Overall, these insights affirm that successful DB adoption in emerging economies like Uganda requires not only technical innovation but also strategic investment in human capital and collaborative project planning (Mutikanga et al., 2022).

iii. Conducive Environment for DB Delivery Method

A supportive project environment is critical for the successful DB implementation. Key environmental factors identified in this study include strong stakeholder commitment to project objectives, endorsed by 95% of respondents, robust performance management systems (90%), effective communication management (92%), and the presence of clear regulations and policies (90%). Additionally, prioritizing Right-of-Way (RoW) acquisition and timely payment of contractor invoices was highlighted by 90% and 95% of respondents, respectively. Proper stakeholder management (93%), integrated change management (90%), and enforcement mechanisms such as audit sanctions (82%) were also identified as essential for DB project success.

These results emphasize that creating a conducive environment requires coordinated efforts across multiple dimensions, including commitment from all project actors, well-defined performance oversight, structured communication channels, and regulatory clarity. The importance of stakeholder engagement, performance, and communication management, and clear policies aligns with systemic enablers necessary for sustainable DB implementation in emerging economies (Nuwagaba and Molokwane, 2020; Osobajo et al., 2023). Furthermore, prioritizing RoW acquisition and contractor payments addresses institutional and procedural challenges commonly documented in infrastructure governance literature (Tesfaye, 2019; Smith and Odera, 2023).

The findings confirm that technological solutions or process optimizations alone cannot guarantee the success of a DB project. A supportive institutional and regulatory environment is equally critical, consistent with observations from procurement reform studies, which emphasize that enabling frameworks are indispensable for the effective adoption of innovative delivery methods (Mutikanga et al., 2022).

iv. The Outcomes

The primary motivation for DB adoption is its potential for shorter project durations, as agreed by 96% of respondents. Other key incentives include the opportunity for innovative solutions (88%), cost reductions associated with accelerated schedules (90%), and a perceived competitive advantage over alternative delivery methods (82%). Importantly, 98% of respondents emphasized that a supportive project environment directly contributes to the achievement of project objectives, thereby enhancing stakeholder satisfaction (Table 4-13).

These results underscore the multiple benefits that drive DB adoption, including improved efficiency, increased innovation, cost optimization, and strategic positioning within the construction industry. The recognition of shorter project timelines, innovation potential, and cost advantages as primary motivators aligns with documented benefits of DB in developed and emerging economies (Elhag et al., 2020; Johnson and Wang, 2018). Collectively, these outcomes highlight the relevance of the DB method for addressing Uganda's infrastructure delivery challenges while reinforcing its potential to generate measurable value for project stakeholders

Table 4-13: Toolkit model – respondents' feedback

Model variables	Respondents			
	Yes	%	No	%
Drivers for low adoption				
1. Prolonged Cost	68	68	32	32
2. Delayed RoW acquisition	80	80	20	20
3. Delayed payment of Invoices	89	89	11	11
4. Poor management of change	70	70	30	30
5. Poor scope definition	72	72	28	28
6. High document cycle time	97	97	3	3
7. Lack of Communication	84	84	1	1
8. Cost-Saving Pressures on Projects	82	82	1	1
9. Late input of contractor advice	74	74	2	2
The process				
Choice of DB as a delivery method				
1. Impact on project cost	92	92		
2. Level of innovation required	88	88		
3. Risk management strategies	80	80	1	1
4. Impact on disputes	84	84	8	8
5. Change management flexibility	90	90	0	0
Choice of DB Mechanism				
1. Operation and Maintenance needs	97	97	0	0
2. Financing requirements	92	92	2	2
3. Success of previous projects	95	95	1	1
Planning				
1. Sufficient preliminary design	95	95	0	0
2. Risk management strategies	91	91	3	3
3. Set standard milestones	84	84	6	6
4. Sufficient stakeholder engagement	93	93	1	1
5. Clear scope definition	98	98	0	0
6. Develop skills and capacity	90	90	3	3
7. Involve the contractor early enough	88	88	8	8
Conducive environment				
1. Level of commitment to the project	95	95	0	0
2. Proper communication management	92	92	2	2
3. Clear regulations and policies	90	90	5	5
4. Degree of performance	90	90	3	3
5. Prioritise RoW Acquisition	95	95	0	0
6. Prioritize payment of the Contractor				
7. Proper stakeholder engagement	93	93	1	1
8. Integrated change management	90	90	5	5
9. Implement Audit sanctions	82	82	6	6
The outcome of the DB Delivery Method				
1. Reduced project duration	96	96	0	0
2. Reduced project cost	90	90	3	3
3. High degree of innovative solutions	88	88	8	8
4. Increased competitive advantage	82	82	6	6
5. Increased stakeholder satisfaction	98	98	0	0

4.8.4 Validation and practical relevance of the toolkit

The validation of the toolkit aimed to ensure its fidelity to real-world scenarios. This validation process involved rating the toolkit based on criteria such as practical relevance, clarity, logical structure, and applicability in construction management. The same participants in the questionnaire survey were enlisted to rate the toolkit's quality, using categories ranging from "very poor" to "excellent."

The ratings revealed a positive perception of the toolkit's quality from the majority of respondents: 38% for "excellent," 35% for "good." Additionally, 18% of respondents considered it "average," with smaller proportions rating it as "poor" (6%) or "very poor" (3%). Overall, 73% of respondents expressed a favourable opinion of the toolkit, while 27% found it to be average, as presented in Figure 4-7.

These findings reveal that while the toolkit generally received positive feedback, there are areas where improvement may be needed to address the concerns of users who rated it as average or below average. The toolkit’s positive reception by practitioners, i.e.,73% rating it “good” or “excellent,” indicates practical resonance with the target audience, a key measure of external validity in applied research (Kerzner, 2017). However, recognition of areas requiring improvement reflects the need for continued feedback loops for refinement.

This participatory validation approach is consistent with user-centered design principles increasingly adopted in construction management research (Bingi, 2021).

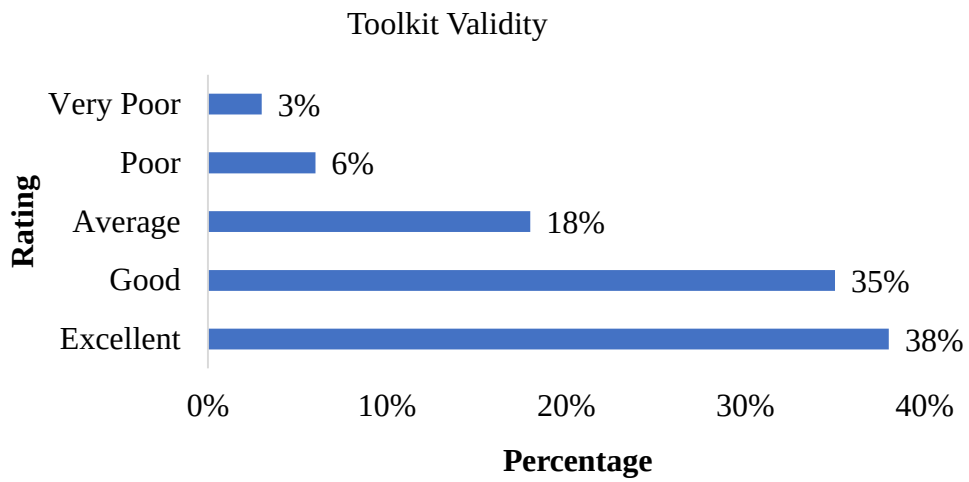

Figure 4-8: Toolkit Validity

4.9 Chapter Summary

This chapter presented a detailed analysis and interpretation of the findings concerning the barriers affecting Design-Build adoption in Uganda's road projects. In addition, it introduced a practical mitigation toolkit designed to address these challenges, linking empirical insights with actionable strategies.

The next chapter will synthesize the overall research findings, provide a comprehensive discussion, draw conclusions, and offer evidence-based recommendations. It will also highlight areas where further investigation could enhance understanding and support the continued development of DB project delivery in Uganda.

CHAPTER FIVE: CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This chapter summarizes the key conclusions of the study, reflecting on the findings related to Design-Build adoption in Uganda's road construction sector. Based on these conclusions, practical recommendations are presented to guide policymakers, project managers, and other stakeholders in improving DB adoption. The chapter further highlights areas for future research aimed at building upon the insights generated by the study.

5.2 Study Conclusion

The main objective of the study was to assess the barriers limiting Design-Build adoption in Uganda's road projects, assess their impact, and recommend targeted mitigation strategies. The study revealed that although the DB method is being applied in some large-scale, time-sensitive projects, its overall uptake remains limited across the road construction sector. Critical obstacles identified include prolonged document processing cycles, delayed contractor payments, and inadequate communication among stakeholders. These barriers were consistently highlighted in both the quantitative analysis and qualitative interviews, confirming their significant influence on DB adoption.

The research further demonstrated that the mitigation toolkit developed in this study, which directly addresses these barriers, can enhance project performance, reduce delays, and improve efficiency. Implementing the toolkit has the potential to foster

broader acceptance of DB, resulting in more effective and sustainable road infrastructure outcomes in Uganda.

5.3 Study Recommendations

Drawing on the findings and conclusions of the study, the following recommendations are proposed:

1. **Adoption and Implementation of the Mitigation Toolkit:** Stakeholders should utilize the comprehensive toolkit, focusing on interventions such as digital document management systems to reduce approval delays, prompt and transparent payment processes, and structured communication strategies to strengthen collaboration among project participants.
2. **Enhancing Communication and Collaboration:** Project managers and implementing agencies should prioritize open, continuous communication among all stakeholders to build trust, clarify project requirements, and enable timely decision-making.
3. **Institutionalizing Clear Policies and Guidelines:** The government and regulatory bodies should establish well-defined policies and procedural guidelines specific to DB projects. This includes standardized workflows, payment schedules, dispute resolution mechanisms, and regulatory oversight to create an enabling environment for DB adoption.
4. **Capacity Building and Training:** Targeted programs should be introduced to equip government officials, project teams, and contractors with the necessary knowledge and skills for managing DB projects. Addressing skills gaps is

crucial to effective risk management, integrated planning, and project execution.

Implementing these recommendations will help decision-makers overcome barriers to DB adoption, promoting more efficient, innovative, and sustainable road infrastructure development in Uganda.

5.4 Recommendation for further study

To support the continuous improvement of DB project delivery, future research should focus on:

1. **Streamlining the Legal and Regulatory Framework:** Explore current legal and policy constraints affecting DB adoption and propose reforms to improve procurement processes, contract enforcement, and risk allocation.
2. **Leveraging Emerging Technologies:** Investigate how Artificial Intelligence (AI) and digital project management tools can improve cost control, planning accuracy, predictive maintenance, and overall innovation in DB projects.

Future research in these areas can provide policymakers and practitioners with evidence-based guidance for modernizing DB delivery methods and enhancing their effectiveness.

5.5 Implications of the study

Practical Implications: The study offers actionable guidance for project managers, contractors, and other stakeholders in identifying projects suitable for DB delivery and systematically addressing barriers. The mitigation toolkit provides a structured

approach for managing regulatory, financial, technical, and operational challenges, supporting timely and high-quality project execution. For instance, large-scale, high-value road projects may benefit most from DB adoption, while medium-sized projects can be supported through targeted risk mitigation and capacity-building strategies.

Policy Implications: The findings underscore the importance of streamlined regulatory processes, clearer procurement guidelines, and flexible financing mechanisms, including public-private partnerships and multi-source funding. Additionally, structured stakeholder engagement is essential for ensuring the smooth implementation of projects.

Future Research Implications: The study identifies opportunities for further investigation, including evaluating legal and regulatory reforms, enhancing capacity-building initiatives, and integrating emerging technologies in DB delivery.

Overall, this study provides a comprehensive framework for improving DB adoption in Uganda, offering practical solutions, informing policy decisions, advancing theoretical understanding, and contributing to sustainable development outcomes in the road sector.

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