
EFFECTIVENESS OF THE DESIGN AND BUILD PROJECT DELIVERY APPROACH ON PUBLIC BUILDING CONSTRUCTION PROJECTS IN TANZANIA

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ABSTRACT

The study evaluated the effectiveness of the Design and Build (D&B) approach on public building construction projects in Tanzania. It examined schedule management, budget management on D&B and quality on D&B project execution. Utilizing Resource Dependence Theory and the Theory of Project Management, the research employed a mixed-methods approach, collecting data from 132 questionnaire respondents and 15 interview participants. Respondents were selected using a stratified random sampling technique. Data were gathered online using Kobo Toolbox, with Excel and R software (version 14.4) used for the analysis of quantitative data, while qualitative data were analysed using manual content analysis. Findings reveal that, inadequate planning and poor resource management significantly disrupt schedules and lead to budget overruns, primarily due to design issues. While the D&B approach generally meets quality standards, issues like workmanship and design changes necessitate rework. In conclusion, while the D&B approach usually maintains quality, the study reveals that enhanced planning, budget management, and quality control are essential to overcome delays, cost overruns, and rework. It recommends improvements in these areas, along with better training and feedback mechanisms. The study also suggests implementing more training and external audits to enhance project execution.

Keywords: Design and Build (D&B), Public Building, Construction, Projects.

1. INTRODUCTION

The construction industry globally plays a vital role in delivering both public and private infrastructure, including housing. It is a rapidly growing industry that significantly contributes to employment and economic expansion. Despite its importance, the construction sector faces various challenges, including financial constraints, limitations in available electrical grids, transportation issues, procurement complexities, and a shortage of skilled employees (Beirne & Kirchberger, 2021). The construction industry, as defined by the URT (2003), is an economic sector responsible for transforming resources into physical economic and social infrastructure through the construction of buildings and civil works essential for socio-economic development. The Tanzania Construction Market size is estimated at USD 5.62 billion in 2024, and is expected to reach USD 7.07 billion by 2029, growing at a CAGR of 4.67% during the forecast period (2024-2029) (www.mordorintelligence.com). Efficient management is crucial for public construction projects to ensure delivery of value for money and meet the demands of clients, competitors, and regulatory agencies. The procurement of a suitable contractor plays a pivotal role in achieving the desired project outcomes (Ershadi et al., 2021). These challenges often create a paradox that directly impacts the physical implementation of public projects, and failure to manage them effectively can

lead to problems for the entire project and the construction team (Kuitert et al., 2018). Various project delivery systems exist within the construction industry, such as traditional design-bid-build, multiple-prime contractors, construction management at risk, design, and build, Force Account, and Single Source. Each of the project delivery systems is distinguished by its specific attributes and objectives. Despite their differences, these approaches exhibit similarities aimed at expediting project completion, fostering collaboration, and potentially enhancing project results (Pastar, 2021). Design and build system has gained significant traction in both private and public sectors over the past few decades, emerging as a significant trend in contemporary design and construction (Chen et al., 2015).

Modern construction projects are characterized by high complexity and uncertainties, demanding strict performance adherence from contractors who must deliver projects with limited resources, within shorter timeframes, and to high-quality standards (Alaloul et al., 2016). The traditional design-bid-build (DBB) procurement approach has been criticized for its inability to adapt to changing client needs and the increasing complexity of technical, economic, and multi-organizational aspects in modern project execution (Kortenko et al., 2021). Many construction and engineering projects today involve significant costs, high complexity, and employ advanced materials and construction methods. Clients are increasingly dissatisfied with the traditional procurement approach, leading to a global development of new alternative methods categorized as integrated procurement systems, management-oriented procurement systems, and partnering (Kenyatta & Ajewole, 2022). D&B project delivery approach emerged as an alternative procurement method for public projects in Tanzania during the fifth regime of the Government of Tanzania due to it being a fast-track system. While this approach offers significant advantages, including faster project delivery, the sole responsibility of the contractor and the involvement and roles of clients during the initial stages are critical considerations. Challenges may arise if clients struggle to provide comprehensive briefs, especially when end-user requirements are uncertain or ambiguous. Consequently, disputes and design scope changes during the execution stage can adversely affect project performance in terms of cost and time (Saaidin et al., 2016). The fundamental idea behind the D&B project delivery approach involves assigning the entire project to a single implementation entity, which takes on the responsibilities of design, procurement, engineering, and commissioning. What sets the D&B project delivery approach apart from other procurement systems is its unique advantage of providing a single point of responsibility, a fixed timeframe and budget, streamlined communication, and a well-defined risk allocation strategy (Ruvinda & Bamunuachchige, 2020). Therefore, this study aimed to analyse the effectiveness of the D&B project delivery approach on public building construction projects as implemented by Government institutions in Tanzania, especially in Dar Es Salaam and Dodoma where public construction projects are heavily concentrated.

1.1 Problem Statement

Construction industry stakeholders in Tanzania and globally have been emphasizing improved performance in construction projects concerning cost, time, and quality. However, a persistent issue over decades has been the subpar performance of many public construction projects, (CAG - Technical Audit Report on cost control, 2023). The audited public institutions implementing public projects include the National Housing Corporation (NHC), Tanzania Buildings Agency

(TBA), National Social Security Fund (NSSF), Dar Es Salaam Water Supply and Sanitation Authority (DAWASA) and Public Service Pension Fund (PSPF). The audit report shows that many of the implemented projects suffered from cost overruns, delays, and to some extent low quality work. Existing literature and past researchers indicate that the choice of project delivery approach is one of the factors contributing to this poor performance (Doloi, 2013). Selecting a competent contractor presents a complex and challenging task for clients and project managers within the construction industry, with potential repercussions for both profitability and project quality. Therefore, it is crucial to identify the underlying causes of these challenges to inform efforts towards developing effective solutions (Daoud et al., 2023). During the fifth regime of the Government of Tanzania (2015-2020), there was a notable encouragement to use the D&B project delivery approach in the implementation of public projects involving Government institutions. At that time, the FIDIC standard of tendering documents was utilized, as the Tanzania Procurement Regulatory Authority had not yet established own document. Subsequently, in the year 2020, the authority introduced the document to guide procuring entities in the procurement of contractors under the D&B procurement method. Previous research works in developed countries indicate that the D&B approach has shown superior performance in terms of quality, time, and cost. Therefore, this dissertation analyses the effectiveness of the D&B project delivery approach for public building construction projects implemented by Government institutions in Tanzania to determine if time, cost, quality and value for money was achieved by oversighting on team collaboration, risk management, value engineering, continuous improvement, and stakeholders' involvement.

1.2 Specific Objectives

- i. To assess the effectiveness of schedule management in D&B project execution.
- ii. To examine the effectiveness of cost management on D&B project execution.
- iii. To evaluate the effectiveness of quality management on D&B project execution

2. LITERATURE REVIEW

2.1 Theoretical Review

The study was based on the Resource dependence theory and the Theory of Project Management

2.1.1 Resource dependence theory

In 1978, (Pfeffer & Salancik, 1978) introduced the resource dependence theory (RDT). The theory explains how the behaviour of organizations is shaped by external resources such as raw materials, production strategies, contract structure, finance, and organizational strategy. The fundamental premise is that an organization, or more specifically a manager, seeks to ensure organizational survival. According to the RDT, the crucial factor for organizational survival lies in the organization's ability to obtain and retain resources (Pfeffer & Salancik, 1978), as well as negotiating with their external environment to secure access to the necessary resources for survival. This suggests that a firm's competitive edge hinges on its ability to manage external resources effectively. Van Weele, (2018) argues that this aspect is even more crucial than managing internal resources. Since procuring external resources is essential for both strategic and tactical management, the RDT has several implications, such as determining the optimal

organizational structure, recruiting board members and staff, developing production strategies, structuring contracts, establishing external organizational links, and other strategic elements. The RDT was used to analyse how financial resources (operating costs) and value for money affect the effectiveness of the D&B project delivery approach. Specifically, it explores how external resources like operating costs and value for money influence the schedule performance of the D&B approach in public building construction projects in Tanzania, particularly within public institutions.

2.1.2 Theory of Project Management

The Project Management theory identifies and addresses critical aspects of project management, categorizing them into ten knowledge areas. The Project Management Institute PMI (2017). delineates crucial control elements, providing a theoretical framework essential for successful project management. This theory outlines project management guidelines, defines key concepts, and elucidates the project management lifecycle alongside its associated processes. Widely acknowledged as a universal theory, it is applicable across diverse fields and project types. Moreover, Liviu et al. (2010) elaborate that these knowledge areas stem from best practices observed in project case studies, representing pivotal elements in project management. Additionally, Gomes et al. (2021) argues that while each knowledge area consists of multiple processes, there exist variations in the specifics of project management knowledge areas across various project types, including discrepancies in success criteria, requirement management, information management, and performance management. The components of this theory include Planning and Scheduling, Contracts Management, Financial Flow, and their integration culminates in effective Project Management.

2.2 Empirical Reviews

Ruvinda & Bamunuachchige (2020) wrote that construction sector is a crucial part of the Sri Lankan economy, and while various procurement approaches are available, the D&B approach is noted for its innovative qualities. It is particularly valued for features such as single-point responsibility, shorter project timelines, and predictable costs. This previous study outlines the primary benefits of the D&B approach. A study undertaken by Saaidin et al. (2016) explored the contemporary utilization of the D&B procurement process in Malaysia. The research investigated the increasing prominence of the D&B project delivery method as an alternative to conventional approaches within the public sector.

Agbaxode et al. (2024) in Ghana notes that while past research has primarily concentrated on comparing project quality between different methods, the critical aspect of performance quality has frequently been neglected. This paper fills that gap by exploring construction professionals' views on the effectiveness of D&B approach. Lee, Rahman and Doh (2020), various procurement methods are utilized in the construction industry, each exhibiting different rates of success. The D&B method has gained global popularity due to its unique feature of integrating design and construction, effectively addressing the challenges inherent in the traditional DBB method. This previous research in Malaysia has mainly focused on establishing a D&B strategy, identifying its challenges and risks, and outlining a broader scope for its implementation in public projects. The

study conducted by Yip (2019), examined the different elements that affect the timely completion of construction projects, which is vital for the country's economic and market development. Key factors include clients, contractors, consultants, and both internal and external techniques that impact project completion within the available resources in Manila. A study undertaken by Salla (2020), DBB and D&B are two widely used construction project delivery methods across the globe. Existing research often compares these methods primarily in terms of project quality, but frequently overlooks performance quality, a crucial aspect. This study seeks to assess construction professionals' perceptions of the performance quality of DBB compared to D&B.

3. MATERIALS AND METHODS

The study was conducted at Dar-es-Salaam and Dodoma, Tanzania where the TBA head and sub-head offices and where numerous government construction projects were underway. These projects were being executed using the D&B project delivery approach. The researcher employed a pragmatism philosophy, integrating both quantitative and qualitative methods (Kaushik & Walsh, 2019). Pragmatism in research focuses on achieving practical outcomes and assessing how theories or concepts can effectively address real-world problems. The study followed a research design as outlined by Kothari (2014), which provides a conceptual framework for conducting research, including data collection, measurement, and analysis. The research began with an exploratory phase, utilizing interviews and discussions to identify various factors contributing to delays in completion time, cost overruns, and unsatisfactory quality of work. The study employed a mixed-methods approach, blending quantitative and qualitative techniques (Almalki, 2016). Surveys for quantitative data analysis with comprehensive interviews for qualitative insights, the research provided an in-depth understanding of the complexities in public building construction projects. The target population was 244 technical employees of the Tanzania Buildings Agency (TBA). This group included architects, structural engineers, quantity surveyors, procurement officers, and real estate officers, specifically within the Directorates of Consultancy, Construction, and Real Estates. The sample size of 151 was calculated using a formula adapted from Kothari, (2004). Sampling involved stratified and random sampling techniques. A stratified random sampling method was employed to ensure accurate representation across different categories of technical staff and procurement officers within TBA. These strata included professionals such as architects, structural engineers, services engineers, quantity surveyors, real estate officers, and procurement officers involved in public building construction projects. The questionnaire and interview were facilitated by the Kobo toolbox. Analysis of quantitative data were analysed using the R-Software Packages (version 14.4) and analysis of qualitative data were analysed using manual contents. Two approaches or techniques were used in the quantitative data analysis procedure, parametric tests (one-sample t-tests) and tests of descriptive statistics (measurements of central trends and frequency analysis).

4. FINDINGS

4.1 Response rate

The response rate was computed and the table 1.1 shows the results.

Table 1.1: Respondents' Response rate

Na	Category of Respondents	Expected Respondents	Actual Respondents	Actual Percentages
1	Architects	55	55	41.67%
2	Civil/Structural engineers	33	31	23.48%
3	Quantity Surveyors	32	23	17.42%
4	Service Engineers	20	18	13.64
5	Procurement officers	4	2	1.52%
6	Town Planner officers	3	1	0.76%
7	Real Estate officers	4	2	1.52%
Total		151	132	87.42

According to the table 1.1 the actual respondent response was 132. The study found this response satisfactory since the respondents were distributed in the stratum as envisaged and as recommended by Kothari, (2014).

4.2 Demographic Information

4.2.1 Sex

During the data collection phase, respondents were asked to specify their gender to help the researcher accurately describe the characteristics of the population. The results showed that out of the 132 participants, 111 were male, representing 84.09% of the sample, while 21 were female, accounting for 15.91%. This suggests that male respondents were more actively involved in the activities within the surveyed organization. The respondents' characteristics are displayed in Table 1.2.

Table 1.2: Social-demographic characteristics of the study population.

Variable	Category	Frequency	
		n	%
Sex	Female	21	15.91 %
	Male	111	84.09 %

4.2.2 Age of respondents

Understanding the age ranges of the respondents was vital for a comprehensive analysis of the employees at the Tanzania Buildings Agency (TBA). The depiction reveals that most respondents were between 36-50 years old, comprising 61.36% of the sample, 20-35 years old, comprising 28.79% of the sample, 51 and above years comprising 9.85%. This implies that the age distribution of respondents at TBA shows that the majority are more experienced or senior professionals. With 61.36% of employees in the 36-50 age range, there is a considerable number of experienced

individuals who likely possess valuable knowledge and skills. The presence of 28.79% of respondents aged 20-35 indicates a younger workforce that could benefit from mentorship and professional development opportunities to enhance their skills and prepare for future leadership positions. The smaller segment of employees aged 51 and above (9.85%) underscores the importance of succession planning to retain essential skills and knowledge as this group transitions out of the organization. Overall, understanding these age dynamics will help TBA develop focused strategies for talent development, retention, and succession planning, ultimately improving organizational effectiveness. This information is detailed in Table 1.3.

Table 1.3: Age of respondents.

Variable	Category	Frequency	
		n	%
Age	20 – 35 years' old	38	28.79 %
	36 – 50 years' old	82	61.36 %
	51 and above	12	9.85 %

4.2.3 Education level

The study examined the highest educational qualifications achieved by respondents. The findings revealed that most respondents (65.91%) had completed a Bachelor's degree as their highest level of education. This was followed by 32.58% who had earned a Master's degree, with only a small fraction holding a PhD or other advanced degrees. The findings regarding the educational qualifications of respondents carry significant implications for TBA. With 65.91% of participants holding a Bachelor's degree, the workforce has a solid educational foundation, indicating a need for further professional development to enhance specialized skills and knowledge. The presence of 32.58% of respondents with Master's degrees suggests that a notable portion of employees has pursued advanced education, potentially leading to better project outcomes and innovation within the agency. However, the small number of individuals with PhDs or other advanced degrees indicates a gap in high-level expertise, which could hinder research capabilities and advanced problem-solving within the organization. These findings highlight the importance of TBA investing in ongoing training and education programs that encourage further academic advancement and professional growth. By doing so, the agency can cultivate a more skilled workforce capable of tackling complex challenges and promoting organizational development. Additionally, collaborating with educational institutions could create continuous learning opportunities and foster a culture of lifelong education within TBA.

Table 1.4: Education level of respondents.

Variable	Category	Frequency	
		n	%
Education level	Bachelor degree	87	65.91 %
	Master degree	43	32.58 %

Other	1	0.76 %
PhD	1	0.76 %

4.2.4 Year of the Firm in Operations

Table 1.5 provides details on the duration of firm operations as reported by respondents. According to the data, 76.52% of respondents indicated that the firm has been in operation for over 10 years, with 101 instances reflecting this duration. In contrast, 21.21% of respondents noted that the firm has been operating for 5 to 10 years, corresponding to 28 instances, while 2.27% reported that the firm has been active for less than 5 years, representing 3 instances. This analysis suggests that the firm has extensive experience in the building industry since it has more than 10years of working experience, having managed a variety of projects over a significant period. The findings on the duration of firm operations have significant implications for TBA. With 76.52% of respondents indicating over 10 years of operation, the firm demonstrates substantial experience and stability, enabling effective management of diverse projects. Additionally, 21.21% of respondents report 5 to 10 years of operation, suggesting a younger workforce that can introduce fresh ideas, while only 2.27% have been active for less than 5 years, indicating potential challenges in integrating new employees. Overall, these findings underscore the importance of leveraging the firm's experience and fostering knowledge sharing to enhance collaboration and innovation, contributing to the organization's growth in the building industry.

Table 1.5: Year of the firm in operations.

Variable	Category	Frequency	
		n	%
Years of operation	5 – 10 years	28	21.21 %
	Less than 5 years	3	2.27 %
	More than 10 years	101	76.52 %

4.2.5 Working Experience Level of Respondents in the Company

Table 1.6 details the working experience of the respondents. The data reveals that 60.61% of employees have between 3 and 10 years of experience, 33.33% have over 10 years of experience, 4.55% have between 1 and 3 years of experience, and 1.52% have less than 1 year of experience. This indicates that most respondents possess considerable work experience, either between 3 and 10 years or exceeding 10 years. The findings on the working experience of respondents highlight important implications for TBA. With 60.61% of employees having between 3 and 10 years of experience and 33.33% with over 10 years, the organization benefits from a knowledgeable workforce that enhances project execution and decision-making. Additionally, the low turnover rate indicated by only 4.55% of respondents having 1 to 3 years of experience and just 1.52% with less than 1 year promotes a stable environment conducive to mentorship and professional development. Overall, these insights emphasize the need for TBA to leverage existing experience while implementing ongoing training programs to keep all employees engaged and skilled.

Table 1.6: Working experience of respondents.

Variable	Category	Frequency	
		n	%
Year of working	1 – 3 years	6	4.55 %
	3-10 years	80	60.61 %
	Less than 1 year	2	1.52 %
	More than 10 years	44	33.33 %

4.2.6 Role of the Respondents in the Company

The professional roles in the company are quite diverse. Architects are the most common, comprising 41.67% of the group. Civil/Structural Engineers make up 23.48%, and Quantity surveyors account for 17.42%. Service engineers represent 13.64%, while Procurement staff and real estate professionals each constitute 1.52%. Town Planners are the least represented, with just 0.76%. This distribution shows a strong representation of architects, engineers, and quantity surveyors reflecting a broad array of roles within the construction industry. Details are provided in Table 1.7.

Table 1.7: Role of the respondents in the company.

Variable	Category	Frequency	
		n	%
Role	Architect	55	41.67 %
	Civil/Structural Engineer	31	23.48 %
	Procurement staff	2	1.52 %
	Quantity surveyor	23	17.42 %
	Real estates	2	1.52 %
	Service Engineer	18	13.64 %
	Town Planner	1	0.76 %

4.2.7 Type of Projects Executed by the Company

The data presented in Table 1.8 reveals that the company's primary focus is on office buildings (38.11%) and residential properties (27.36%), indicating a strong presence in both the commercial and residential sectors. The notable share of mixed-use buildings (20.20%) reflects a growing interest in multifunctional developments. However, the smaller proportions of factories (5.21%), hotels (3.26%), and other project types (5.86%) suggest that the company has less involvement in industrial, hospitality, or specialized projects. This trend shows that the company is mainly concentrating on office and residential construction, with mixed-use projects emerging as a key growth area. To further expand, the company might consider diversifying its portfolio into less-

represented sectors, such as industrial or hospitality, to reduce its dependence on its current focus areas.

Table 1.8: Type of Projects executed by the company.

Variable	Category	Frequency	
		n	%
Type of project	Office building	117	38.11%
	Factories	16	5.21%
	Mixed use building	62	20.20%
	Residential houses	84	27.36%
	Hotels	10	3.26%
	Others	18	5.86%

4.3 Effectiveness of schedule management in D&B project execution.

This was the first objective of the study and focused on schedule management. The Table 1.9 shows the results.

Table 1.9: Schedule management in D&B projects execution.

Statement	Mean score	SD	t-test =3.5)	(μ sig(2-tailed)
Inadequately planning of the work schedule result in project delays	4.73	0.49	28.83	<.001
Project be delayed due to the improper implementation or absence of a resource calendar	4.50	0.67	17.12	<.001
Project delays result from the improper handling or absence of a stakeholders register	3.86	0.96	4.34	<.001
Inadequate preparation of a procurement plan for acquiring materials and labor result in project delays	4.73	0.46	30.84	<.001
Delays in paying the contractor's certified certificates lead to project delays	4.55	0.72	16.58	<.001
Insufficiently design lead to project delays	4.55	0.78	15.49	<.001
Financial limitations on the client's part result in project delays	4.64	0.62	21.22	<.001
Project delays might happen due to clients taking longer to respond	4.42	0.81	13.09	<.001
A project team lacking the necessary skills cause delays in	4.42	0.83	12.70	<.001

Statement	Mean score	SD	t-test =3.5)	(μ sig(2-tailed)
project completion				
Inadequate leadership can result in project delays	4.36	0.80	12.35	<.001
Delays in making timely decisions can result in project delays	4.58	0.64	19.21	<.041
Inadequate allocation of risks can cause project delays	4.19	0.81	9.76	<.001
Inadequate supervision may result in project delays.	4.55	0.66	18.25	<.001
Ineffective communication to disseminate project information can cause project delays	4.41	0.76	13.72	<.001
The schedule adapts to accommodate changes or delays	3.88	0.89	4.88	<.001
If change requests are not managed properly, they can cause delays in the project	4.49	0.64	17.93	<.001
Effective utilization of Organizational Process Assets (OPA) help reduces project delays	4.13	0.83	8.68	<.001
lack of a lessons learned register result in project delays	3.89	0.95	4.69	<.001

The results in Table 1.9, the mean values were high, showed the respondents agreed with the statement on schedule management affected project delivery. The t-value and a p-value of less than 0.001 confirm the statistical significance of the relationship between statement of D&B and public building project execution. During an interview with one of the managers from the consultancy department at TBA, when asked about the elements that, if not properly managed in D&B project execution, could lead to delays, their responses were as follows:

“Improper definition of scope activities and inadequate planning of essential resources—such as funds, materials, labor, plants, and machinery—can significantly impact a project's success. If these elements are not thoroughly addressed and managed, they can lead to project delays, increased costs, and overall project failure”.

During the interview with the director of the consultancy department, TBA responded that change requests related to D&B projects can lead to project delays in the following ways:

“Incomplete requirements, design flaws, unforeseen site conditions, and client-driven changes frequently require adjustments to the project schedule. Additionally, factors such as technological advancements, coordination challenges, budget limitations, regulatory compliance issues, external influences, and unforeseen risks can also lead to change requests. These change requests, in turn, have the potential to cause delays in the project”

4.4 Effectiveness of budget management on D&B project execution

The second objective focused on effectiveness of budget management on D&B project execution. The findings are shown in Table 1.10.

Table 1.10. budget management on D&B project execution

Statement	Mean score	SD	t-test($\mu = 3.5$)	sig(2-tailed)
Can alterations in design cause the project to exceed its budget?	4.48	0.76	14.96	<.001
Inadequate development of the design can result in exceeding the budget?	4.55	0.66	18.25	<.001
Lack of adequate information during the design phase and cost estimates can result in exceeding the budget.	4.68	0.54	25.00	<.001
Time extension can lead to over budget?	4.32	0.77	12.13	<.001
If the project is not insured, could accidents on the site lead to exceeding the budget?	4.16	0.93	8.13	<.035
Could equipment and machinery problems lead to over budget?	4.06	0.99	6.53	<.001
Could delays in paying certified certificates result in exceeding the budget?	4.31	0.84	11.10	<.043
Could fluctuations in prices result in exceeding the budget?	4.51	0.76	15.30	<.001
Could fluctuations in currency exchange rates result in exceeding the budget?	4.38	0.82	12.25	<.024
Could inefficiencies within the procurement team result in exceeding the budget?	4.41	0.79	13.21	<.001
Poor management of the cost baseline during implementation can lead to exceeding the budget?	4.61	0.55	23.36	<.001
Could an inadequate feasibility study result in exceeding the budget?	4.52	0.64	18.49	<.001
Could the absence of an environmental impact assessment lead to exceeding the budget?	4.26	0.87	10.00	<.019

Statement	Mean score	SD	t-test($\mu = 3.5$)	sig(2-tailed)
Could the lack of a geotechnical soil investigation report result in exceeding the budget?	4.58	0.64	19.37	<.001
Could the absence of a procurement plan to guide procurement result in exceeding the budget?	4.28	0.77	11.57	<.001
Could the lack of a schedule for materials and labor lead to exceeding the budget?	4.21	0.87	9.36	<.018
Could the need for rework in some activities result in exceeding the budget?	4.34	0.86	11.19	<.001
Could adding scope beyond the original scope result in exceeding the budget?	4.73	0.53	26.83	<.001

The results in Table 1.10, the mean values were high, showed the respondents agreed with the statement on schedule management affected project delivery. The t-value and a p-value of less than 0.001 confirm the statistical significance of the relationship between the statements of D&B and public building project execution. During interviews with senior officers at TBA regarding the factors that contribute to budget overruns in D&B projects, the responses were as follows:

“Factors contributing to cost overruns in a D&B project include inaccurate cost estimates, scope creep, design errors, and ineffective project management. Additionally, changes in design, incorrect technical specifications, and delays in decision-making by the client can further exacerbate financial challenges. These elements collectively lead to increased expenses and can disrupt the project's financial stability”.

During interviews with TBA technical experts involved in project management, when asked about weaknesses in managing subcontractors and material suppliers during D&B project execution that can lead to cost overruns, the details of their responses are outlined below:

“Weaknesses in managing subcontractors and material suppliers that can lead to budget overruns include inadequate definitions of the scope of work, poorly drafted contract specifications, and a lack of clear terms of reference. Additionally, disputes and claims, issues with payments, and ineffective communication between parties can exacerbate financial inefficiencies. These problems collectively hinder smooth project execution and contribute to exceeding the budget”.

Effectiveness of quality on D&B project execution.

The third objective investigated effectiveness of quality on D&B project execution. The results were shown in Table 1.11.

Table 1.11: Quality Evaluation in D&B Project Execution.

Variable	Category	Frequency	
		n	%
Frequency of Testing and Inspections	Daily	22	16.67 %
	Monthly	27	20.45 %
	Other	21	15.91 %
	Weekly	62	46.97 %
Responsibility for Testing and Inspections	External Quality Control Team	12	9.09 %
	Internal Quality Control Team	109	82.58 %
	Other	11	8.33 %
Documentation of Testing and Inspection Results	No	27	20.45 %
	Partially	6	4.55 %
	Yes	99	75 %
Frequency of Rework	Frequently	5	3.79 %
	Occasionally	48	36.36 %
	Rarely	79	59.85 %
	Design Changes	41	31.06 %
Primary Reasons for Rework	Material Defects	24	18.18 %
	Other	6	4.55 %
	Poor Workmanship	61	46.21 %
Management and Tracking of Rework	Documented in project reports	86	65.15 %
	Other	5	3.79 %
	Recorded in a log	41	31.06 %
Addressing Issues Identified Through Testing, Inspections, and Rework	Continuous improvement initiatives	15	11.36 %
	Immediate corrective actions	99	75 %
	Other	2	1.52 %
	Root cause analysis	16	12.12 %
Incorporation of Lessons Learned	No	2	1.52 %
	Partially	16	12.12 %
	Yes	114	86.36 %
Ongoing Training for Quality Improvement	No	37	28.03 %
	Partially	32	24.24 %
	Yes	63	47.73 %
Feedback on Quality Management Practices	No	29	21.97 %
	Partially	28	21.21 %

Variable	Category	Frequency	
Evaluation of Quality Management Effectiveness	Yes	75	56.82 %
	Annually	17	12.88 %
	Other	24	18.18 %
	Quarterly	91	68.94 %
Achievement of Required Quality	No	5	3.79 %
	Partially	18	13.64 %
	Yes	109	82.58 %

The results in Table 1.11 shows that, quality evaluation increased project execution as depicted by the high percentages when the quality evaluation is quality. During the interview with senior officers at TBA, who are involved in project design, supervision, and construction, the following responses were provided when questioned about factors leading to a project's failure to meet quality standards in D&B execution

“The failures to meet project quality standards were attributed to several key issues: inadequate material specifications, which led to the use of substandard or inappropriate materials; insufficient testing instruments, resulting in inadequate assessment of material quality and performance; and ineffective supervision, which allowed for lapses in adherence to quality standards and project requirements”

During the interview with senior officers at TBA involved in project design, supervision, and construction, when inquired about the main factors leading to rework or the need for redoing tasks that undermine quality standards in D&B project execution, their responses were as follows:

“The issues contributing to reworks or redo and compromised quality standards were contributed by employing inexperienced project team for project execution, which often results in mistakes and oversight; having insufficiently detailed drawings and specifications, leading to misunderstandings and errors during construction; and improper sequencing of activities, which disrupts workflow and coordination, causing delays and quality issues”.

5.3 Conclusion

The analysis of projects execution using the D&B approach reveals critical factors affecting project success. Schedule management issues are primarily driven by inadequate planning and poor procurement practices, necessitating improvements in these areas, along with better risk management and communication. Budget overruns stem from scope changes, poor cost baseline management, and inadequate design details, highlighting the need for rigorous scope management, accurate design documentation, and effective cost control. Quality management practices for the executed project meets standards, even though there is potential for more improvement through better training, improved feedback mechanisms, and external evaluations. Addressing these issues will optimize project execution using the D&B delivery approach by improving scheduling, budget control, and quality outcomes in all public building projects executed by public institutions in Tanzania.

5.4 Recommendations

Based on the results, the following recommendations are suggested to improve schedule, budget, and quality management in the execution of projects in Tanzania using the D&B delivery approach.

5.4.1 Effective schedule management

Develop comprehensive planning processes that include detailed timelines and resource allocations to prevent delays and implement advanced planning tools and methodologies to address potential issues proactively. Strengthen procurement strategies by adopting best practices and ensuring timely procurement to avoid delays as well as regularly review procurement processes to ensure efficiency and effectiveness. Establish clear communication channels and decision-making protocols to ensure timely responses and reduce delays and use project management software to facilitate real-time updates and decision tracking. Integrate risk management strategies into project planning to identify and mitigate potential delays and regularly update risk assessments and contingency plans. Improve the management of resources and stakeholder registers to ensure that all project components are efficiently utilized and aligned with project goals.

5.4.2 Effective cost management

Implement a rigorous change management process to control scope changes and prevent budget overruns. Also ensure all scope changes are thoroughly evaluated and approved before implementation. Establish and maintain a detailed cost baseline to be used to monitor and control expenditures. Regularly review and adjust the cost baseline as needed to reflect actual project conditions. Ensure that design information is accurate and complete from the outset. Engage in thorough design reviews and validation processes to prevent costly revisions. Mitigate risks such as price fluctuations and time extensions by conducting detailed feasibility studies and including contingency budgets to handle unforeseen expenses. Develop a comprehensive procurement plan and streamline payment processes to avoid delays and inefficiencies.

5.4.3 Effective quality management

Expand training programs for project teams to enhance skills in quality management and continuous improvement. Develop more robust feedback systems to gather and act on inputs from all stakeholders. Use feedback to drive continuous improvement and address quality issues promptly. Ensure comprehensive documentation of testing, inspections, and rework activities. Implement formal procedures for root cause analysis and continuous improvement to minimize rework and improve quality. Conduct regular quality assessments and audits to ensure compliance with standards.

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