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Title: Critical Factors Affecting Construction Project Cost and Schedule Adherence in Sub-Saharan Africa: A Systematic Review

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Abstract :

This systematic review examines critical factors causing time and cost overruns in Sub-Saharan African construction projects. Analyzing 32 articles using the PRISMA approach, the study identifies seven key factors: financial, contractual/legal, project planning/management, design/scope, external, resource, and contractor-related issues. Pareto analysis prioritizes financial, contractual/legal, and project planning/management factors for intervention, addressing 80% of delays and budget issues. The study enhances understanding of construction challenges, aiding policy design for timely, cost-effective project completion. Unlike prior country-specific research, it broadens the scope to Sub-Saharan Africa.

Keywords: Project schedule; Construction project; Time overrun; Cost overrun; Sub-Saharan Africa.

***Richard Gustave Kusongwa.**

1. Introduction

The building sector is a backbone of socioeconomic growth, driving progress by improving living standards and delivering critical infrastructure such as roads, hospitals, and schools. For these benefits to be realized, Saidu and Shakantu (2017) emphasize building projects to be executed within the critical path schedule, within approved budget, and comply quality standards while meeting stakeholder expectations. However, the sector's inherent complexity often leads to significant challenges, particularly schedule and budget deviations (Abdul-Rahman *et al.*, 2013; Gashahun, 2020). These overruns frequently result in contractual disagreements, jurisdiction, appeals processes, and even project termination (Aibinu & Jagboro, 2002; Sambasivan & Soon, 2007).

Schedule and budget deviations are pervasive challenges affecting building projects globally, surpassing national economic classifications. Research by Allahaim and Liu (2012) indicates that such challenges have been documented in twenty countries across five continents, impacting nearly 90% of completed projects (Flyvbjerg *et al.*, 2004; Memon, 2013).

Studies in developed nations reveal that these overruns constitute a substantial portion of total project expenses. For instance, in the UK, approximately 33.33% of building projects encounter setbacks in timelines and financial plans (Olawale & Sun, 2010; Abdul-Rahman *et al.*, 2013). In US, nearly two-thirds of high way building projects face time and budget overruns (Ellis & Thomas 2003; Anastasopoulos *et al.*, 2014). In Canada, Odeck (2014) notes that road construction projects have frequently exceeded budgets, with some cases reaching cost overruns as high as 82%. In Portugal, building projects typically exceed budgets by at least 12% (Abdul-Rahman *et al.*, 2013). In Australia, Love *et al.*, (2013) notes 12.22% average budget overruns across 276 building projects. Similarly, Assaf and Al Hejji (2006) reports 70% of Saudi Arabian building projects exceeding their deadlines and budgets.

Similar patterns of project delays and financial excesses are observed in developing nations. infrastructure projects in Bosnia and Herzegovina, typically exceed their budgets, with new buildings averaging 6.84% over budget, and reconstruction projects seeing a higher overrun of 9.23% increase (Abdul-Rahman *et al.*, 2013). In Malaysia, Memon *et al.*, (2012) reveals 89% of construction

projects averaged 7.5% budget overruns, with 92% missing deadlines. Nigeria reports that 59% of projects exceed budgets by over 10% (Olawale & Sun, 2010), while the construction costs for South Africa's 2010 World cup stadiums surpassed initial estimates by as much as 94% (Baloyi & Bekker, 2011). In Zambia, road projects exceeded budgets by over 50% due to delays (Kaliba *et al.,* 2009), and Tanzanian road constructions averaged 44% cost and 26% time overruns (Rwakarehe & Mfinanga, 2013).

For over seven decades, industry professionals, project owners, and end-users have sought solutions to mitigate these overruns (Apolot *et al.,* 2011). Even after lots of studies we haven't found good ways to make these problems happen less often. Multiple studies have examined the underlying reasons and mechanisms behind delays and cost escalations in building projects (Daoud *et al.,* 2023; Amarkhil *et al*., 2020; Isma'il *et al.,* 2013; Love *et al.,* 2012–2014; Memon *et al.,* 2012–2013; Abdul Azis & Abdul Rahman, 2013; Mahamid & Bruland, 2011; Chileshe & Berko, 2010). The highlighted studies identify repeated factors contributing to overruns, many of which share common origins and effects.

Allahaim (2006) suggests that categorizing these causes based on their sources and impacts can enhance theoretical and practical understanding. Abusafiya and Suliman (2017) emphasize that prioritizing these factors improves risk contingency planning in budget estimations. Classification helps streamline problem-solving by grouping related causes, enabling a deeper analysis of their root drivers (Karunakaran *et al.,* 2018). This structured approach also reveals patterns and interconnections among causes, facilitating targeted policy and strategy development.

Given these considerations, this study employs a PRISMA methodological framework to classify the key drivers for delays and cost escalations in infrastructure projects across Sub-Saharan Africa. The study aims to answer:-

i. What key factors contribute to delays and cost escalations in infrastructure projects across Sub-Saharan Africa?
ii. What are the critical implications of these factors for the region's infrastructure resilience?

A thorough analysis of these factors holds a critical value for both academic and practical purposes. Academically, it explores critical dimensions

such as project management, institutional frameworks, resource availability, and socioeconomic conditions, identifying gaps for future research. Practically, it provides actionable insights for policymakers, project managers, and stakeholders to address challenges like financial constraints, bureaucratic inefficiencies, and technological limitations. By focusing on region-specific issues, this study promotes tailored strategies to enhance project outcomes, supporting sustainable infrastructure development crucial for economic growth and poverty alleviation.

The paper is structured to present the research methodology, theoretical review, findings, policy implications, and recommendations for further study before concluding.

2. Methodolody

The study used a systematic review approach, guided by the PRISMA protocol 2020 to analyse the factors influencing construction project cost and schedule adherence in Sub-Saharan African region. The process involved identification, screening and inclussion stages to synthesize critical findings.

2.1 Identification

Identifying factors affecting construction project cost and schedule adherence is of paramount important for creating effective policies and strategies to improve efficiency, effectiveness and sustainability in the industry. To achieve this, relevant studies were identified through a thorough search of databases such as scienceDirect and Google Scholar. The search strategy followed specific inclussion and exclussion criteria, as outlined in **Table 1**

Table 1: Inclussion and Exclussion criteria

Criteria	Inclussion criteria	Exclussion criteria
Date of Publication	2014 - December, 2024	Before 2014
Publication Language	English	Non English
Study Population	Sub-Saharan Africa	Non Sub-SaharanAfrica
Nature/Type of Project	Formal Costruction Projects	Informal Construction Projects
Type of Document	Peer Reviewed Journal Articles	Conference Papers, Books and Book Chapters

The study focused on papers addressing "time overrun" or "delays" or "cost overrun"or "budget overrun" in "formal construction projects"or "building construction projects". It explored "factors" or "causes" or "reasons" or "contributing factors" related to these issues. The search included peer reviewed journal articles in English, using a search string: TITLE-ABS-KEY (cost overrun OR budget overrun OR time overrun OR delays AND building construction project OR construction project AND factors OR causes OR contributing factors). A total of 48 articles were identified with a process conducted between August 2024 and February 2025.

2.2 Screening Process

After the search strategy, identified articles were screened to align with study objectives. The process included title screening, abstruct screening and full text assessment. Initially, 423 record were identified from ScienceDirect (101) and Google Scholar (322). After removing 29 duplicates and excluding 304 ineligible records by using automation tools, 90 records were screened based on titles, abstructs and key words, leading to the exclussion of 42 irelevant articles.

The remaining 48 records underwent full text evaluation to assess their relevance for inclussion. Articles on time or cost overruns that did not specify the project type (eg. Informal projects) were excluded. Additional inclussion and exclussion criteria (**See Table 1**) led to the removal of 03 pre 2014 studies, 02 non english publications, 24 non construction studies, 35 studies outside Sub-Saharan Africa, 04 conference papers and 03 book chapters. Ultimately, 32 records were selected for review (**See Figure 1**). This meticulous approach guaranteed consistency with the study's emphasis on budget and timeline compliance in infrastructure projects, strengthening the validity and trustworthness of the systematic review results.

2.3 Information retrieval and evaluation

Relevant data were systematically extracted from the selected literature, capturing:- authorship details, study location, methodological approaches, publication dates and top three significant variables affecting building projects timelines and expenditures. Content-thematic analysis techniques were used to analyze the papers which were read multiple times to achieve the study's objectives.

Extracted data were summarized in **Table 2** to ensure consistency and accuracy. A narrative synthesis approach was adopted to identify drivers of time and cost escalations in infrastructure projects (O'Donovan *et al.*, 2019). The identified factors were systematically classified into thematic groups, including financial factors, project planning/management factors, contractual/legal factors, design/scope factors, external factors, resource factors and contractor related factors (**Refer Table 3**). Each category included factors based on their frequency of prevalence in the analyzed articles. This approach facilitated both descriptive examination and thematic interpretation of the underlaying reasons for delays and cost escalations in building projects.

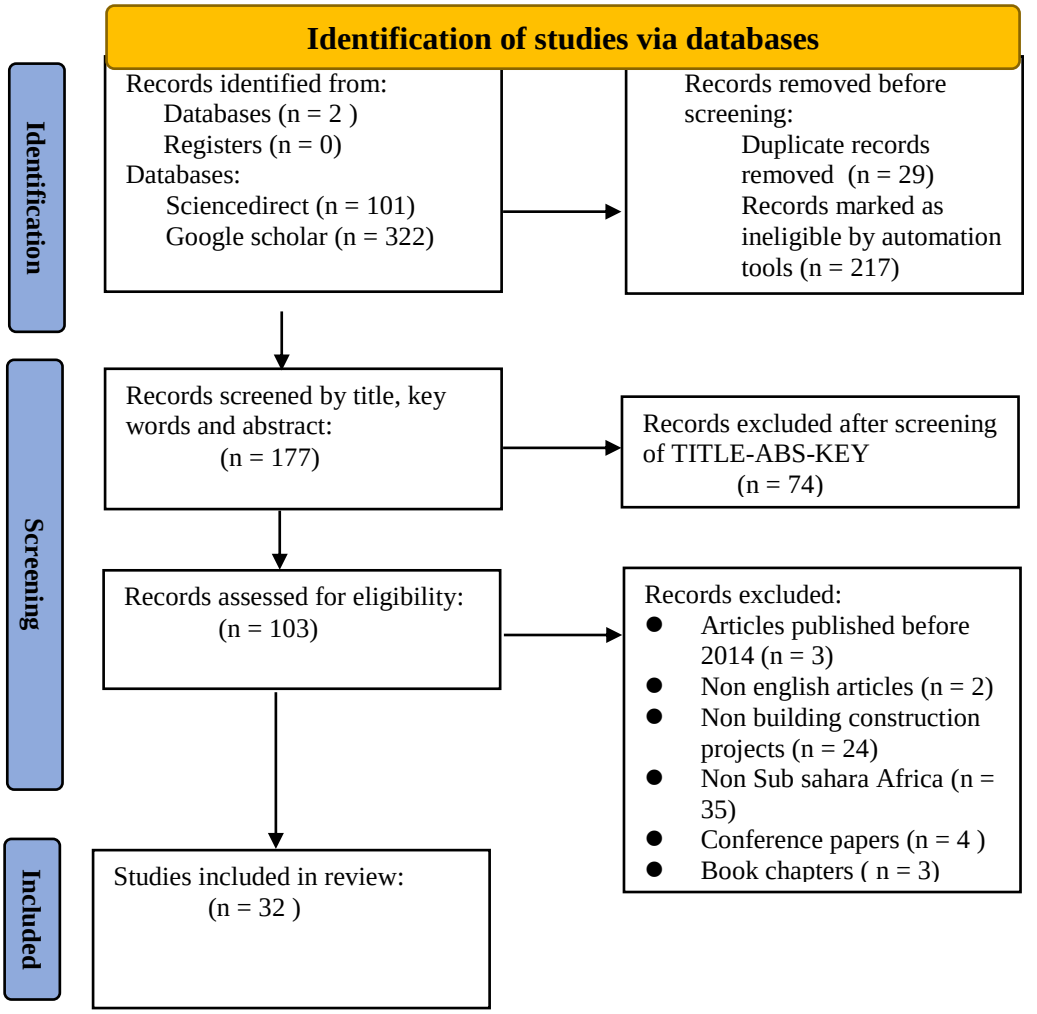


Figure 1: PRISMA 2020 flow diagram for systematic reviews.

Adopted from Page *et al.,* (2021)

2.4 Theoretical Review

This study's theoretical framework examines key factors influencing construction project cost and schedule adherence, drawing on established theories to analyze challenges in resource-constrained regions like Sub-Saharan Africa.

2.4.1 Resource Based View (RBV) Theory

Resource availability, including skilled labor, materials, and equipment is critical for project success. Supply chain inefficiencies and import dependencies often worsen shortages, leading to delays and budget overruns (Ahady *et al.,* 2008). RBV theory (Penrose, 1959; Barney, 1991) highlights how strategic resource management impacts project outcomes. In Sub-Saharan Africa, where resources are scarce, ineffective allocation or shortages can significantly disrupt building projects.

2.4.2 Institutional Theory

Institutional frameworks heavily influence construction project performance. Bureaucratic delays, corruption, and weak contract enforcement frequently hinder progress (Ofori, 2012). Institutional theory (DiMaggio & Powell, 1983) explains how regulatory inefficiencies, cultural norms, and governance weaknesses affect project delivery. In Sub-Saharan Africa, poor institutional structures often lead to timeline disruptions and increased costs.

2.4.3 Systems Theory

Effective planning, risk management, and monitoring are crucial to preventing overruns (Mengesh & Amaru, 2019). Additionally, technological gaps in construction methods limit efficiency (Agyekum *et al.,* 2020). Systems theory (Bertalanffy, 1968) views projects as interconnected systems where resources, stakeholders, and regulations interact. Disruptions in one area (e.g., technology) can cascade into delays and budget overruns.

2.4.4 Contingency Theory

Socioeconomic and political instability such as inflation, currency fluctuations, and governance issues further complicate project execution (Windapo, 2013). Contingency theory (Fiedler, 1968) argues that project success depends on adapting strategies to specific conditions. In Sub-Saharan Africa's volatile environment, flexible management approaches are essential.

These theories collectively emphasize the interplay between resources, governance, planning, and external factors, offering insights into mitigating delays and cost overruns in Sub-Saharan Africa.

2.4.5 Empirical Review

To determine the key factors influencing construction project cost and schedule adherence in Sub-Saharan Africa, a systematic review of prior studies conducted in the region was carried out, and the findings were summarized in **Table 2**

Table 2: Selected prior studies in Sub-SaharanAfrica and major findings

SN	Author (s)	Country	Methodology	Top 3 contributing factors revealed per Article
1	Xegwana *et al.,* (2024)	South Africa	Descriptive Analysis	Ineffective communication, Suboptimal procurement process and Deficient stakeholder management
2	Asiedua and Mkansi, (2023)	Ghana	Exploratory factor analysis and structural equation modelling	Poor contract management, Inaccurate time and cost estimate and Inadequate planning and scheduling
3	Frederic *et al.,* (2023)	Rwanda	Quantitative approach (Linear regression analysis)	Changes in labour costs, Poor site financial control and Finacial difficulties encountered by contractor
4	Gaston and Tembo, (2023)	Rwanda	Quantitative analysis (Descriptive analysis)	Inadequate designs, Contractor's financial muscles and Late payments
5	Mtana *et al.,* (2023)	Tanzania	Qualitative approach	Shortage of resources, Change in design and Poor planning
6	Baila *et al.,* (2023)	Mauritania	Quantitave approach (Descriptive and regression analysis)	Poor site financial control, Poor contract management and Governments's unstable economic conditions
7	Ammar *et al.,* (2022)	Ethiopia	Descriptive analysis and Relative Importance Index (RII) analysis	Inacurate cost estimates, Design modifications and Variation orders
8	Belayneh and Tsegaye, (2022)	Ethiopia	Relative Importance Index (RII) analysis	Human resource capability, Improper project communication and Project constructability

9	Kulaya *et al.,* (2022)	Tanzania	Qualitative thematic review	Failure of the client to pay contractor timely, contractors financial difficulties and Poor site management
10	Negesa, (2022)	Ethiopia	Quantitative approach (Descriptive analysis)	Reluctance among consultants, Inadequate estimation of contract duration and Delay in approvals
11	Flepisi and Mlambo, (2021)	South Africa	Relative Importance Index (RII) analysis	Failure to update construction programmes, Late delivery of contractor supplied materials and Corruption
12	Kassa, (2020)	Ethiopia	Descriptive statistics and RII	Incomplete study before project approval, Poor project management and Inacurate forecasting of the schedule
13	Ndunguru *et al.,* (2020)	Tanzania	Quantitative approach (Descriptive analysis)	Unexpected inflation, Adverse effect of wealther and Lack of proper communication
14	Aderemi and Kagiso, (2019)	Botswana	Relative Importance Index (RII) analysis	Cost of building materials, Incorrect project planning and Frequent design changes
15	Anigbogu *et al.,* (2019)	Nigeria	Descriptive statistics (measure of discrepancy and RII	Inflation, Fluctuation of prices and Changes in policies
16	Eboh *et al.,* (2019)	Nigeria	Relative Importance Index (RII) analysis	Poor contract management, Deficiency in prepared cost estimate and Incomplete design
17	Jongo *et al.,* (2019)	Tanzania	Quantitative approach (descriptive analysis)	Underestimation, Delay of payments and Scope change
18	Kuhil and Seif, (2019)	Ethiopia	Relative Importance Index (RII) analysis	Difficult in project financing, Poor project management system and delay in issuance of design
19	Luvara *et al.,* (2018)	Tanzania	Quantitative approach (descrptive analysis)	Delay in decission making, Incomplete design and Improvement of drawing during construction stage
20	Mwaitenda and Mohamed, (2018)	Tanzania	Factor analysis of Principal Component Analysis (PCA)	Change in the contract terms, Financial conditions of the owner and Unforeseeable ground conditions
21	Belachew *et al.,* (2017)	Ethiopia	Descriptive analysis	Mataerial price fluctuation, Cost underestimation and Delay in supply of raw materials
22	Famiyeh *et al.,* (2017)	Ghana	Relative Importance Index	Financial problems, Unrealistic contract durations imposed by

			(RII) analysis	clients and Poorly defined project scope
23	Ikechukwu *et al.*, (2017)	Nigeria	Quantitative (descriptive analysis)	Underestimation of actual cost, Inflation and Difficult in obtaining construction materials
24	Murithi *et al.*, (2017)	Kenya	Quantitative approach (Multiple regression analysis)	Shortage of resources, Poor project management and Poor leadership
25	Nyoni and Bonga, (2017)	Zimbabwe	Quantitative approach (Descriptive analysis)	Delay in payment by owner, Difficulties in financing project and change of orders
26	Teye Amoatey and Anson, (2017)	Ghana	Quantitative approach (Descriptive analysis)	Client changes, Unforeseen risks and Unclear scope
27	Oguya and Muturi, (2016)	Kenya	Quantitative approach (Analysis of variance, ANOVA and regressions)	Contractor's competency, Construction party's financial management and Timely availability of construction materials
28	Abdulkadir *et al.*, (2015)	Nigeria	Quantitative approach (Spearman correlation for test of agreement)	Design changes, Inadequate experience and Delay in payments for completed work
29	Akanni *et al.*, (2015)	Nigeria	Quantitative (Descriptivr and correlation analysis)	Civil conflicts/Disturbance, Unexpected prices raises for raw materials and Climatic condition/wealther
30	Alfen and Asiedu, (2015)	Ghana	Quantitative (Descriptive and correlation analysis)	Delayed payments, Recurrent default of interim payment by the government and Corruption
31	Aigbavboa *et al.*, (2014)	Zambia	Quantitative approach (Descriptive analysis)	Delay in payments, Difficulties in financing projects by contractor and delay in approving changes
32	Muhwezi *et al.*, (2014)	Uganda	Quantitative (Relative Importance Index (RII)) analysis	Delay in approving changes, Financia indescipline and Inadequate experience

Source: Systematic Literature Review, (2024)

3. Synthesis of findings

3.1 Descriptive overview of included studies

This part synthesizes the outcomes derived from the systematic literature review, which examined key factors leading to schedule and budget overruns in Sub-Saharan African infrastructure projects. The final analytical sample comprised 32 empirical studies that satisfied all predetermined inclusion requirements. The synthesized evidence demonstrate that the articles came from 12 Sub-Saharan African countries, with the highest number published in 2017 (6 articles) followed by 2019 and 2023 (5 each). Ethioipia and Tanzania contributed the most studies (6 each), while Nigeria and Ghana followed with 5 and 4 articles respectively (**See Table 3**)

Table 3: Characteristics of the included studies

Study Location	**Frequency**	**Percent**
Maurtania	1	3.1
Tanzania	6	18.8
Rwanda	2	6.2
Ethiopia	6	18.8
Kenya	2	6.2
Zimbabwe	1	3.1
Nigeria	5	15.6
Ghana	4	12.5
Botswana	1	3.1
South Africa	2	6.2
Uganda	1	3.1
Zambia	1	3.1
Total	**32**	**100.0**
Year of Publication		
2014	2	6.2
2015	3	9.4
2016	1	3.1
2017	6	18.8
2018	2	6.2
2019	5	15.6

2020	2	6.2
2021	1	3.1
2022	4	12.5
2023	5	15.6
2024	1	3.1
Total	**32**	**100.0**

3.2 Key factors contributing to schedule and budget overruns in building projects

The study prioritized analysis of the three most prevalent causes of schedule and budget overruns in Sub-Saharan African construction projects (**Table 2**), with results categorized and summarized in **Table 3.** Financial related factors , such as financial difficulties, payment delays, poor financial site control and material price fluctuation were found to be the most significant contributors. Among these, Financial difficulties was the most critical factor. In contrast, resource and contract related factors had a relatively minor impact on project delays and budget overruns (**See Table 4**)

Table 4: Key factors contributing to schedule and budget overruns in building projects

Key factors contributing to delays and budget overruns	Frequency	Percent of Cases
Financial Factors		
Financial Difficulties	10	31.2%
Delay in Payments	7	21.9%
Poor Site Financial Control	5	15.6%
Material price fluctuation	4	12.5%
Unexpected Inflation	3	9.4%
Changes in Labour costs	1	3.1%
	30	**93.7%**
Contractual /Legal Factors		
Inaccurate estimation of contract duration and cost	9	28.1%
Poor Contract Management	5	15.6%
Change orders	3	9.4%

Suboptimal procurement processes	2	6.2%
Change in Policies	1	3.1%
	20	**62.4%**
Project Planning /Management Factors		
Poor planning	5	15.6%
Delay in Decision Making	4	12.5%
Ineffective Communication among parties	4	12.5%
Poor Project Management	3	9.4%
Poor Leadership	1	3.1%
	17	**53.1%**
Design and Scope Factors		
Change in Design	8	25.0%
Change in Scope	4	12.5%
	12	**37.5%**
External Factors		
Unforeseen Risks	4	12.5%
Corruption	2	6.2%
Civil conflicts	1	3.1%
	07	**21.8%**
Resource Related Factors		
Shortage of Resources	2	6.2%
Delay in supply of raw materials	3	9.4%
	05	**15.6%**
Contractor Related Factors		
Contractor's Competency	5	15.6%
	05	**15.6%**
Total	**96**	**300.0%**

3.3 Policy implications and priority action areas

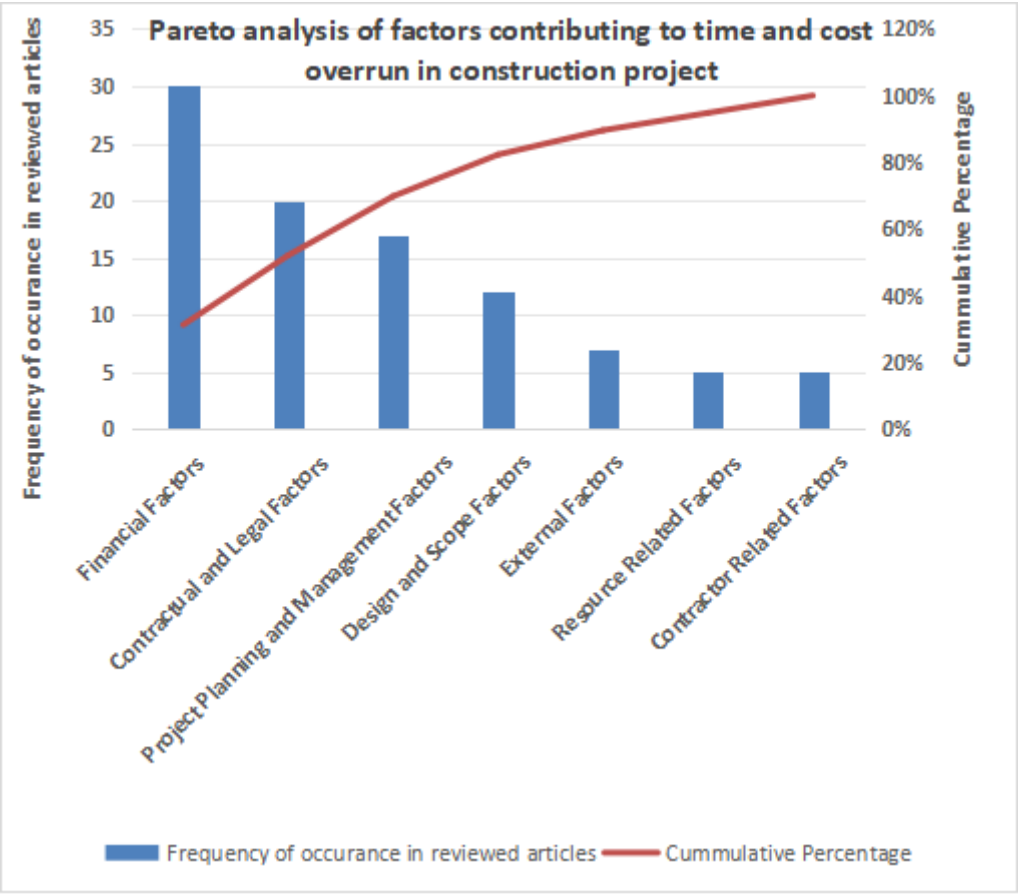
To diagnostically evaluate and prioritize intervention targets for reducing schedule and budget deviations in Sub-Saharan African infrastructure projects, a pareto analysis (the 80/20 rule) was applied. The findings highlight financial, contractual/legal and project planning/management related factors as the most critical drivers of delays and budget overruns (**See Figure 2**). According to the pareto principle, addressing these high-impact factors ("the vital few") could resolve approximately 80% of schedule and cost adherence issues, while the remaining factors like design and scope challenges, external influences, resource

constraints and contractor related inefficiencies account for only 20% of the problem.

Given these insights, policy makers and industry stakeholders in Su-Sahara Africa, should prioritize interventions in three key areas. First, Strengthening financial controls, improving access to project financing and mitigating risks such as payment delays and material price fluctuations. Second, Enhancing contract enforcement, revising ambiguous or unfair contract terms and ensuring robust legal safeguard to minimize disputes. Third, Implementing structural planning processes, deploying effective project management tools and techniques including Critical Path Method (CPM) and establishing real time performance monitoring systems.

By concentrating efforts on these strategic areas, governments, developers and contractors shall significantly reduce the pervasive nature of schedule and budget performance shortfalls in infrastructure projects.

Figure 2: Pareto-based prioritization of the critical factors for transition programme



4. Discussion of findings

4.1 Geographical scope of the reviewed studies

The analyzed studies reveals that delays and budget exceedances in infrastructure projects frequently occur in many Sub-Saharan African countries, particularly in Tanzania, Ethiopia, Nigeria and Ghana, which account for 65% of the analyzed research. This high prevalence suggests significant challenges in these nations likely stemming from resource shortages, weak institutional systems, poor project management and socioeconomic instability. The findings emphasize the need for focused interventions in these heavily affected areas to enhance efficiency and project performance.

Ahady *et al.*, (2017) and Gashahun, (2020) further confirm the frequency of delays and budget exceedances in Sub-Saharan Africa , linking them to resource limitations and institutional weaknesses. These studies align with the current findings, highlighting how regulatory, institutional and resource related barriers consistently hinder projects timeline and budgets, especially in the named

countries.

By consolidating these results, this study not only confirms the widespread nature of schedule and budget overruns but also stresses the importance of tailored and localized solutions to improve building project success in the region. The urgency of addressing these challenges through context specific strategies is clear, given their persistent impact on project delivery in Sub-Saharan Africa.

4.2 Factors contributing to schedule and budget overruns in Sub-Saharan African infrastructure projects

4.2.1 Financial factors

The findings from literature review highlights that financial issues such as funding difficulties, delayed payments and poor financial control are major contributors to time and cost overruns in construction projects. Nyoni and Bonga (2017), Baila *et al.,* (2023) and Mtana et al., (2023) emphasize that financial constraints disrupt cashflows, leading to payment disputes and procurement delays. When projects faces funding shortages, key activities like material procurement, hiring and contractor payments are affected, ultimately causing schedule and budget overruns. Additionally, inadequate financial management on site results in overspending, inefficient resource use and cost escalations (Negesa, 2022; Kulaya *et al.,* 2022).

Notably, financial factors account for 93.7% of the causes of overruns, underscoring their dominance role in construction projects inefficiences. This suggests that improving financial planning, ensuring timely payments and implementing stricter budget monitoring shall significantly reduce delays and cost overruns. Addressing these financial challenges is crucial for enhancing project performance and ensuring successful delivery.

4.2.2 Contractual/legal factors

Contractual/Legal issues are the second most significant contributors to time and cost overruns in building construction projects, following financial factors. Key problems include inaccurate cost and duration estimates, poor contract management, frequent change orders, inefficient procurement and shifting policies. Among these, inaccurate estimations and poor contract management were the most prevalent both at 43.7% of contractual/legal related overruns. Some contractors deliberately underestimate project cost and timelines to secure contracts, only to face financial strain later, leading to significant cost escalations (Ikechukwu *et al.,* 2017; Jongo *et al.,* 2019).

Effective contract management is essential to ensure compliance with agreed terms and prevent disputes (Mwaitenda and Mohamed, 2018; Eboh *et al.*, 2019). Weak management often results in misunderstandings, conflicts and delays, exacerbating time and budget overruns. These findings underscore the importance of accurate initial estimates, strong contract administration and flexible yet controlled procurement processes. Proactively addressing these contractual risks shall minimize delays, control costs and enhance project success rates.

4.2.3 Project planning/management factors

Project planning/management related factors such as poor planning, delayed decision making, poor communication among stakeholders, inefficient project management and weak leadership contribute to delays and budget overruns in construction projects. Among these factors, poor project planning was the most common, contributing to 16.5% of the cases. This finding align with the research by Alghonamy (2015), Agyekum-Mensah and Knight (2017) and Abeysinghe and Jayathilaka (2022) who found that improper planning negatively impacts project costs, often causing budgets to be exceeded and delaying completion.

These results imply that stakeholders must prioritize critical activities during the initial planning phase, as neglecting them shall result in project delays and subsequent budget overruns.

4.2.4 Design and Scope factors

Design/scope related factors, particularly design changes and scope modifications, significantly contribute to schedule and budget overruns in building projects. Among these, design changes were the most frequent, accounting for 25% of occurrences. Alterations in design often require reworking or adjusting completed tasks to meet new specifications, leading to delays and higher expenses. Research conducted by Abusafiya and Suliman (2017), Basak *et al.* (2019) and Ahmad *et al*. (2019) reached similar conclusions, highlighting design and scope issues as key factors behind construction projects overruns.

To mitigate these challenges, thorough initial planning, precise design processes and effective stakeholder communication are essential. Implementing structured change management systems will help reduce unnecessary modifications. Furthermore, early stakeholder involvement and detailed feasibility studies can minimize late stage design and scope adjustments. By addressing these

factors, project managers can enhance adherence to schedule and budgets, improving overall project efficiency and success.

4.2.5 External factors

External factors, including unforeseen risks, corruption and civil conflicts influence schedule and budget overruns in infrastructure projects. Among these, unforeseen risks were the most prevalent, accounting for 12.5% of delays and budget increases. These risks such as natural disasters, unexpected site conditions, technological failures and adverse weather conditions disrupt schedules and raise costs by forcing activity postponements. However, Ibrahim and Elshwadfy (2021) found that unforeseen risks had a relatively minor influence on overruns in some cases.

Civil conflicts, though less frequent (impacting 1% of projects), still pose significant risks, particularly in politically unstable regions like Sub-Saharan Africa. These findings underscore the need for thorough risk assessments and contingency planning when operating in volatile areas. Effective risk management strategies during project planning can help to mitigate these external challenges, reducing their impact on timelines and budgets. Addressing such factors proactively enhances project resilience and success.

4.3 Study limitations and future research directions

4.3.1 Study limitations

This study synthesizes literature on schedule and budget overruns in Sub-Saharan African infrastructure projects, but several limitations were identified. First, the findings may be biased or less generalizable due to the limited availability and varying quality of included articles. Additionally, the predominance of quantitative studies (30 out of 32) and differences in geographical contexts could affect result comparability. As with any secondary data review, the analysis relies on the accuracy of primary sources, which may not always be comprehensive.

While efforts were made to include multi-language studies, relevant non-English publications may have been overlooked, introducing potential language bias. Despite these constraints, the review offers valuable insights into the drivers of project delays and budget overruns, serving as a useful reference for future research and policy development in the region.

4.3.2 Future research directions

This study identifies three key areas for further investigation. First, comparative study should explore the impact of regional, cultural and regulatory

differences on construction projects delays and budget overruns, especially when comparing developed and developing countries. These investigations could provide context-specific insights to guide policy and strategy development. Second, research should be conducted to evaluate the effectiveness of advanced planning and scheduling techniques like Building Information Modelling (BIM), Critical Path Method (CPM) and Lean construction in minimizing project delays and budget overruns. Assessing these methodologies could offer actionable strategies for project managers, encourage wider adoption of innovative tools, and improve overall industry performance. Third, In-depth case studies of projects completed on time and within budget should be analyzed to identify best practices. A mixed method approach (combining quantitative and qualitative analysis) could uncover the social, organizational and technical factors contributing to success outcomes. The findings could help reduce overruns, improve stakeholder satisfaction and promote more efficient and sustainable project delivery.

5. Conclusion

This study confirms that schedule and budget overruns are prevalent in Sub-Saharan Africa's construction sector, particularly in Tanzania, Ethiopia, Nigeria, and Ghana. The primary causes include financial constraints (93.7%), contractual/legal issues (62.4%), and poor planning/management (53.1%). Financial instability underscores the need for better fiscal controls and timely payments, while contractual weaknesses such as inaccurate estimates, poor procurement, and policy shifts, highlight the necessity of precise contracts and stable regulations.

Inefficient planning and delayed decision-making further exacerbate overruns, emphasizing the importance of strong leadership and clear communication. Design changes (37.5%) and external risks (21.8%) also contribute significantly, necessitating thorough design reviews and proactive risk management. Though less frequent (15.6% each), resource shortages and contractor inefficiencies demand improved resource allocation and stricter contractor selection.

A holistic approach, combining robust financial management, efficient contract administration, strategic planning, and risk mitigation, is essential to minimize overruns. Implementing these measures will enhance project success rates and support sustainable growth in Sub-Saharan Africa's construction industry and beyond.

Authorship contributions

Richard Kusongwa led the initial manuscript preparation, designed the methodology, performed formal analysis, handled data management and contributed to conceptual framework. **Obedi Ngaleson** assisted in manuscript revisions, visualization, validation, supervision and conceptual dvelopment. **Hussein Kiende** supported manuscript editing, investigation, visualization and validation

Competing interests

The researchers declare no conflict of interest concerning this publication

Data availability

No external data was used in this research

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