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MODERATING ROLE OF PROJECT ENVIRONMENT ON THE RELATIONSHIP BETWEEN FINANCIAL MANAGEMENT PRACTICES AND SAFETY OF ROAD CONSTRUCTION PROJECTS IN KENYA

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ABSTRACT

Objective: To examine the moderating role of the project environment in the relationship between financial management practices and safety outcomes in road construction projects in Kenya.

Theoretical Framework: The main underpinning concepts and theories are Construction Management Theory (CMT), Wreckers Financial Distress Theory (WFDT), Principal-Agent Theory (PAT) and Control Theory (CT), models, which provide a better understanding on the interplay of the study variables

Method: The research employs a pragmatic paradigm, mixed-methods approach and cross-sectional survey design to obtain and analyze data from a randomly sampled 191 respondents in road construction projects within Nairobi County using interviews, questionnaires and observations.

Results and Discussion: From the findings, effective financial planning and assessment positively influences safety (regression results: β=0.812, $p<0.01$; β=0.909, $p<0.01$) moderated by project environment (regression results: β=0.452, $p<0.01$). Therefore, the variables significantly influence safety, while project environment plays a critical role. The study suggests a robust financial management, combined with a project environment, which enhances safety in road construction. The study focused on Nairobi County, hence limit generalizability beyond Kenya.

Research Implications: The established integrated model helps organizations and project managers match financial management techniques to environmental conditions to improve safety and assist policymakers in financial control and road safety.

Originality/Value: The study contributes to literature by addressing knowledge gaps and underexplored areas of prior research on road construction, project environment and safety. Mixed methods approach provides data triangulation and utilizes larger and diverse sample to improve generalizability compared to single methodologies and limited data sources in prior studies.

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PAPEL MODERADOR DO AMBIENTE DO PROJETO NA RELAÇÃO ENTRE AS PRÁTICAS DE GESTÃO FINANCEIRA E A SEGURANÇA DOS PROJETOS DE CONSTRUÇÃO RODOVIÁRIA NO QUÉNIA

RESUMO

Objetivo: Analisar o papel moderador do ambiente do projeto na relação entre as práticas de gestão financeira e os resultados de segurança em projetos de construção de estradas no Quénia.

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Estrutura Teórica: Os principais conceitos e teorias subjacentes são a Teoria de Gestão da Construção (CMT), a Teoria dos Desastres Financeiros (WFDT), a Teoria do Agente Principal (PAT) e a Teoria de Controle (CT), modelos que fornecem uma melhor compreensão sobre a interação das variáveis do estudo
Método: A pesquisa emprega um paradigma pragmático, abordagem de métodos mistos e design de pesquisa transversal para obter e analisar dados de uma amostra aleatória de 191 entrevistados em projetos de construção de estradas no condado de Nairobi usando entrevistas, questionários e observações.
Resultados e Discussão: A partir das constatações, o planejamento e a avaliação financeira efetivos influenciam positivamente a segurança (resultados de regressão: β=0.812, p<0,01; β=0.909, p<0,01) moderada por ambiente de projeto (resultados de regressão: β=0.452, p<0,01). Portanto, as variáveis influenciam significativamente a segurança, enquanto o ambiente do projeto desempenha um papel fundamental. O estudo sugere uma gestão financeira robusta, combinada com um ambiente de projeto, que aumenta a segurança na construção de estradas. O estudo se concentrou no condado de Nairóbi, limitando assim a generalização para além do Quênia.
Implicações da Pesquisa: o modelo integrado estabelecido ajuda as organizações e os gerentes de projeto a adequar as técnicas de gestão financeira às condições ambientais para melhorar a segurança e auxiliar os formuladores de políticas no controle financeiro e na segurança rodoviária.
Originalidade/Valor: O estudo contribui para a literatura, abordando lacunas de conhecimento e áreas subexploradas de pesquisas anteriores sobre construção de estradas, ambiente de projetos e segurança. A abordagem de métodos mistos fornece triangulação de dados e utiliza amostras maiores e diversificadas para melhorar a generalização em comparação a metodologias únicas e fontes de dados limitadas em estudos anteriores.

Palavras-chave: Planejamento Financeiro, Avaliação, Segurança, Projetos de Construção Rodoviária, Meio Ambiente.

MODERACIÓN DEL ENTORNO DE LOS PROYECTOS SOBRE LA RELACIÓN ENTRE LAS PRÁCTICAS DE GESTIÓN FINANCIERA Y LA SEGURIDAD DE LOS PROYECTOS DE CONSTRUCCIÓN DE CARRETERAS EN KENYA

RESUMEN
Objetivo: Examinar el papel moderador del entorno de los proyectos en la relación entre las prácticas de gestión financiera y los resultados de seguridad en los proyectos de construcción de carreteras en Kenya.
Marco Teórico: Los principales conceptos y teorías son la teoría de la gestión de la construcción (CMT), la teoría de la aflicción financiera de los saboteadores (WFDT), la teoría del agente principal (PAT) y la teoría de control (CT), modelos que proporcionan una mejor comprensión de la interacción de las variables de estudio
Método: La investigación emplea un paradigma pragmático, un enfoque de métodos mixtos y un diseño de encuesta transversal para obtener y analizar datos de una muestra aleatoria de 191 encuestados en proyectos de construcción de carreteras en el condado de Nairobi utilizando entrevistas, cuestionarios y observaciones.
Resultados y Discusión: A partir de los hallazgos, una planificación y evaluación financiera efectiva influye positivamente en la seguridad (resultados de regresión: =0,812, p<0,01; =0,909, p<0,01) moderado por entorno de proyecto (resultados de regresión: =0,452, p<0,01). Por lo tanto, las variables influyen significativamente en la seguridad, mientras que el entorno del proyecto juega un papel crítico. El estudio sugiere una sólida gestión financiera, combinada con un entorno de proyecto, que aumenta la seguridad en la construcción de carreteras. El estudio se centró en el condado de Nairobi, por lo que limita la generalización más allá de Kenya.
Implicaciones de la Investigación: El modelo integrado establecido ayuda a las organizaciones y a los directores de proyectos a adaptar las técnicas de gestión financiera a las condiciones ambientales para mejorar la seguridad y ayudar a los encargados de formular políticas en materia de control financiero y seguridad vial.
Originalidad/Valor: El estudio contribuye a la bibliografía al abordar las lagunas de conocimientos y las esferas de la investigación previa insuficientemente exploradas sobre la construcción de carreteras, el medio ambiente y la seguridad de los proyectos. El enfoque de métodos mixtos proporciona triangulación de datos y utiliza muestras más grandes y diversas para mejorar la generalización en comparación con metodologías individuales y fuentes de datos limitadas en estudios anteriores.

Palabras clave: Planificación Financiera, Evaluación, Seguridad, Proyectos de Construcción de Carreteras, Medio Ambiente.

1 INTRODUCTION

In Kenya, road construction is pivotal for enhancing economic growth and development (Kinyumu & Mungai, 2022). However, road projects frequently encounter substantial safety challenges, which jeopardize lives and the overall quality of infrastructure. Inadequate financial planning and budgeting may result in insufficient funds to address safety measures, and poor forecasting can lead to delays that increase the risk of accidents. Moreover, projects suffering from financial instability may require costly remedial work, further straining resources and impacting project outcomes (Phalanndwa, 2018). Robust financial planning and assessment enhance overall project performance by mitigating risks. However, the specific relationship between financial management and safety in road construction remains underexplored (Singh & Ahuja, 2014). The project environment encompasses various external and internal factors that can affect project performance, such as regulatory conditions, environmental factors, and stakeholder influences. Despite the recognition of the project environment's importance, there is limited research integrating this factor into the analysis of financial management practices and safety outcomes (Hanisch & Wald, 2017). Addressing this gap will contribute to more effective policies and practices aimed at enhancing safety and performance in road construction projects. Therefore, the purpose of this article is to examine the moderating role of project environment on the relationship between financial management practices and safety of road construction projects in Kenya.

1.1 OBJECTIVES OF THE STUDY

1. To establish the extent to which financial planning influence safety of road construction projects in Kenya.
2. To determine the extent to which financial assessment influence safety of road construction projects in Kenya.
3. To assess how project environment influences safety of road construction projects in Kenya.
4. To determine the moderating influence of project environment on the relationship between financial management practices and safety of road construction projects in Kenya.

2 THEORETICAL FRAMEWORK

2.1 BACKGROUND

Safety management is paramount in the construction industry, given the high incidence of accidents and risks associated with road works (Yousif, 2017). As road construction activities continue to escalate globally, the need for enhanced safety protocols becomes increasingly critical. In the United States, efforts to mitigate road construction-related risks include substantial financial investments and implementation of comprehensive safety programs. The Federal Highway Authorities (FHWA) sought approximately $170 billion annually to improve road conditions and safety through the National Highway Work Zone Safety Program (NHWZSP). Despite these efforts, urban road congestion persisted, resulting in an annual loss of $101 billion due to time and fuel wastage, revealing a gap in effective financial planning and risk management (Abdelmohsen, 2016). China's extensive highway network highlights both the progress and challenges in road safety management. The National Trunk Highway System (NTHS), initially anticipated expanding from 2 million km in 2008 to 3 million km by 2020, aimed at addressing traffic congestion. However, the rising number of vehicles and driver violations has exacerbated traffic problems, and existing research has largely overlooked the role of non-motorized road users in accident causation (Chen, Chen & Ma, 2018).

In low-income countries, road safety challenges are compounded by inadequate vehicle maintenance, insufficient infrastructure, and limited funding for safety programs. For instance, Ethiopia has allocated only a small fraction of its road fund to safety initiatives, and the effectiveness of imported safety models has been questioned (World Health Organization, 2009). Similarly, Uganda's struggle with traffic accidents and congestion is due to weak regulatory frameworks and insufficient technical expertise. Kenya's approach to road safety has evolved over time, with significant improvements in road infrastructure, aimed at supporting economic growth. Despite efforts to improve roads, Kenya's urban road projects face challenges such as budget constraints, schedule overruns and scope variations, leading to increased costs and compromised safety. The safety concerns relate to inadequate execution of road works, including lack of barriers, pedestrians' walkways. Others are existence of garbage-clogged drainages, missing footbridges, overgrown vegetation and incomplete road sections. Criticism on the financial management projects has been due to inefficiencies and poor planning, often resulting in delays and substandard work (Ibrahim, 2022). Financial management practices must address

various aspects, including development finance, construction finance, and contingency finance to mitigate delays and cost overruns (Bielenberg et al., 2019). In Kenya, a mix of government sources and multilateral donors often funds urban road construction projects. However, bureaucratic hurdles and inadequate financial planning undermine the effectiveness of these funding mechanisms (Kenya Urban Roads Authority, 2018). The integration of non-motorized transport infrastructure and the need for updated design standards are also critical areas that require attention to improve road safety and efficiency. Financial management of road construction projects links to the project environment, including planning, execution, and stakeholder coordination. Senior management plays a crucial role in guiding project execution and addressing constraints that affect project outcomes, including safety (Mittal et al., 2020). Generally, the intersection of financial management practices and safety in road construction projects is a critical area of study. The challenges faced in different contexts—from developed nations like the USA and China to developing countries like Kenya—underscore the need for comprehensive safety management strategies and effective financial management to ensure success and safety in road construction projects.

2.2 THEORETICAL REVIEW

The theoretical framework guiding this study integrates four key theories: Construction Management Theory (CMT), Wreckers Financial Distress Theory (WFDT), Principal-Agent Theory (PAT) and Control Theory (CT). Together, these theories provide a comprehensive understanding of the influence of financial management practices on safety in road construction projects in Kenya. CMT, proposed by Radosavljevic and Bennett (2012), is fundamental in understanding the dynamics of construction projects. This theory emphasizes managing relationships, processes, and organizational structures to ensure the effective delivery of construction products. In road construction, CMT highlights how financial management practices influences project safety. Proper budgeting and planning enable project managers to allocate sufficient funds for safety measures, such as protective equipment and safety protocols, aligning with the theory's focus on coordinating resources and organizational efforts. WFDT introduced by Hilscher, John, Szilagyi, and Lin (2011), complements CMT by focusing on how financial challenges influences organizational performance. This theory posits that financially distressed firms are less likely to perform effectively. In road construction, financial distress, stemming from late disbursements, poor budget estimations, or inadequate planning, can compromise safety.

WFDT is relevant to this study as it explores the relationship between the financial health of road construction agencies, like Kenya Urban Roads Authority (KURA), and their ability to implement projects safely. The theory also helps evaluate contractors' financial management capabilities, as distressed contractors may struggle to meet safety requirements.

Principal-Agent Theory (Mitnick, 1975) addresses conflicts of interest between project owners (principals) and contractors (agents). In road construction, conflicts may arise when agents prioritize cost savings over safety. PAT suggests that financial assessments and audits are crucial tools for principals to monitor agents' activities to ensure maintenance of safety standards. Regular audits can uncover discrepancies in safety expenditures, enabling project owners to enforce compliance. This monitoring is essential to prevent agents from cutting corners on safety, which could lead to accidents and delays. Finally, Control Theory (Fuller, 1976) focuses on the mechanisms organizations use to monitor and control activities to achieve desired outcomes. In construction projects, financial assessments serve as critical control mechanisms, ensuring efficient use of resources, including those allocated for safety. CT emphasizes continuous monitoring and evaluation, enabling project managers to detect and correct deviations from the plan, thus maintaining safety standards. Together, these theories show the interlinkages between financial management practices, project environments, and safety in road construction. CMT underscores the importance of financial management in project success, WFDT highlights the risks of financial distress, PAT addresses the need for effective monitoring to mitigate conflicts of interest, and CT emphasizes the importance of continuous oversight to maintain safety throughout the project lifecycle.

2.3 EMPIRICAL REVIEW

The empirical works show studies related to financial management practices and projects' safety. Inadequate financial planning can lead to cost overruns and omission of essential safety measures. Accurate financial forecasting and planning are crucial to avoid cost overruns and maintain safety standards. Financial assessments evaluate a project's potential by considering monetary commitment, time, and stakeholder involvement (El-Sayegh & Mansour, 2015). Shen et al. (2014) highlighted the importance of incorporating economic, social, and environmental factors into financial assessments. Mushori et al. (2020) and Akali and Sakaja (2018) found that financial capacity directly affects the quality and safety of road construction projects. Continuous financial evaluation is necessary for maintaining high safety standards.

Nyangwara and Datche (2015) identified climate conditions, site waste, and air pollution as significant factors affecting safety. Political and economic factors also play a crucial role, as noted by Akanni, Oke & Akpomiemie (2015), who highlighted that effective budgeting is necessary to address these environmental challenges.

Glaister and Smith (2009) found that inadequate separate funding for road safety activities adversely affects project outcomes. Cheluget and Morogo (2017) further established that proper budgeting and financial management positively influence project performance and safety. The combined influence of financial management practices and the project environment emphasizes the importance of integrating these elements to improve safety in Kenya's road construction projects.

2.4 HYPOTHESES DEVELOPMENT AND CONCEPTUAL FRAMEWORK

2.4.1 Financial planning and safety of road construction projects

Project Management Theory (PMT), Contingency Theory (CT) and Resource-Based View theory (RBV), fashion a better view of financial planning and safety of road construction projects. PMT emphasizes the importance of comprehensive planning and control mechanisms to ensure project success (Etukudo, 2019). It suggests that detailed planning can mitigate risks and improve project outcomes, including safety. Kerzner (2018) argues that comprehensive planning is fundamental to successful project management. This includes detailed financial planning, which involves budgeting, cost estimation, and financial control. Accurate budgeting and cost estimation are crucial for the efficient allocation of resources. Financial planning plays a role in ensuring that there are sufficient funds allocated to address potential risks (Dhankar, 2019), including those related to safety. Finally, PMT emphasizes the need for taking corrective actions based on performance measurements. This is important because regular monitoring and control of financial performance promptly addresses any deviation that could affect safety.

According to CT, there is no single best way to manage a project. Instead, the effectiveness of management practices, including financial management, depends on the specific internal and external conditions—or contingencies—facing the project (Donaldson, 2001). For example, projects in high-risk environments (e.g., unstable soils, high traffic areas) may require more detailed financial planning and allocation for safety measures than projects in more stable conditions. Donaldson (2001) emphasizes that management practices must be

tailored to fit the environmental context. In the case of road construction, this means adapting financial plans to account for the unique safety risks posed by the project environment. RBV is a strategic management theory that emphasizes the importance of a firm's internal resources in achieving and sustaining a competitive advantage. According to RBV, resources that are valuable, rare, inimitable, and non-substitutable (often abbreviated as VRIN) enable a firm to outperform its competitors (Adnan et al., 2018). In the context of road construction, efficient financial planning can mitigate risks and enhance safety, contributing to the overall success of the project. These various links between financial planning and projects outcomes lead to the testing of this hypothesis in this study:

H1: Financial Planning significantly affects safety of road construction projects

2.4.2 Financial assessment and safety of road construction projects

In the literature, several key theories underpin the relationship between financial assessment and the safety of road construction projects, including Risk Management Theory (RMT), Principal-Agent Theory (PAT), and Control Theory (CT). RMT focuses on the systematic identification, assessment, and management of risks that could affect project objectives. Financial assessment plays a critical role within this framework, especially in complex and high-stakes projects like road construction. In the context of road construction, financial assessments are essential for identifying risks related to budget overruns, inadequate funding, or financial mismanagement (Canesi & Gallo, 2023). PAT examines the conflicts of interest that arise when one party (the agent, such as a contractor) is responsible for acting on behalf of another party (the principal, such as the project owner). These conflicts are particularly evident in construction projects, where agents might prioritize cost savings over safety to enhance their profits (Osipova, 2014).

CT focuses on the mechanisms and processes organizations use to monitor and regulate activities to achieve desired outcomes (Bloch, 2015). The theory posits that through continuous monitoring and evaluation, project managers can identify and rectify deviations from the project plan, thereby maintaining safety standards. In road construction projects, financial assessments are integral to a broader control system designed to ensure effective management of all aspects of the project, including safety. Del Pico (2023) discusses how integrating financial assessments into the project control process helps maintain safety by ensuring that resources are allocated

and used as planned. The links between financial assessment and safety of road construction projects through the lenses of the RMT, PAT and CT theories lead to this hypothesis:

H2: *Financial assessment significantly affects safety of road construction projects*

2.4.3 Project environment and safety of road construction projects

The project environment encompasses various external factors, including technology, physical, economic, political and meteorological indicators (Ansah & Sorooshian, 2017). In the context of road construction, these environmental factors significantly influence project success or failure, often beyond the control of project managers. Project managers must assess the environment to identify potential problems and manage key factors to ensure successful project implementation (Akanni et al., 2015). PESTLE framework categorizes environmental factors in road construction as political, economic, social, technological, legal, and environmental. Each of these factors can have a profound impact on the safety of road construction projects. On political factors, government policies and regulations play a crucial role in road construction projects. Political instability, corruption and changes in government often lead to project delays, increased costs and compromised safety standards. For example, political instability may disrupt supply chains, making it difficult to source materials on time and maintain project schedules. A stable economic environment allows for better financial planning and allocation of resources towards safety (Guo, Yu & Skitmore, 2017).

On social indicators, community attitudes, values, and participation can influence the success and safety of road construction projects. Engaging local communities and addressing their concerns can mitigate social risks and enhance project safety. Ignoring social factors can lead to community resistance, project delays, and increased costs (Kibert, 2016). On technological indicators, technological advancements play a significant role in improving construction efficiency and safety. The adoption of modern construction techniques and tools, such as Building Information Modeling (BIM) and automated machinery, can reduce costs, enhance precision, and minimize risks. However, failure to adopt new technologies can result in outdated practices that compromise safety and efficiency. Underneath legal factors, regulatory requirements, such as environmental regulations, safety laws, and licensing rules affect project performance and safety standards. Compliance with these regulations is essential to avoid legal penalties and ensure the safety of workers and the public (Ansah & Sorooshian, 2017).

Finally, the physical environment, including geological conditions, weather patterns, and natural disasters, significantly influence road construction projects. Harsh weather conditions, such as heavy rains or extreme temperatures, can cause delays, damage materials, and create unsafe working conditions (Akanni et al., 2015). Additionally, geological challenges like unstable soil or seismic activity require specialized construction techniques and safety measures. Incorporating environmental impact assessments and sustainable construction practices can help mitigate environmental risks and enhance project safety (Hannis-Ansah, Sorooshain & Mustafa, 2016). Generally, the project environment influences safety of road construction projects. This relationship highlights the following hypothesis:

H3: The project environment has a significant effect on the safety of road construction projects.

2.4.4 Moderating role of project environment

The project environment, encompassing regulatory frameworks, government involvement, and site-specific conditions, significantly influences the relationship between financial management practices and safety outcomes in road construction projects. Several theories can explain the concept of the project environment as a moderating factor. Contingency Theory posits that the effectiveness of management practices is contingent on external factors such as the environment (Donaldson, 2001). In the context of road construction, the theory suggests that financial planning and assessment practices will only lead to improved safety if the project environment is conducive. A study by Shen et al. (2014) found that in projects with high stakeholder transparency and engagement, financial assessments are more likely to uncover deviations from safety budgets early on, allowing for timely corrective actions. This leads to formation of this hypothesis:

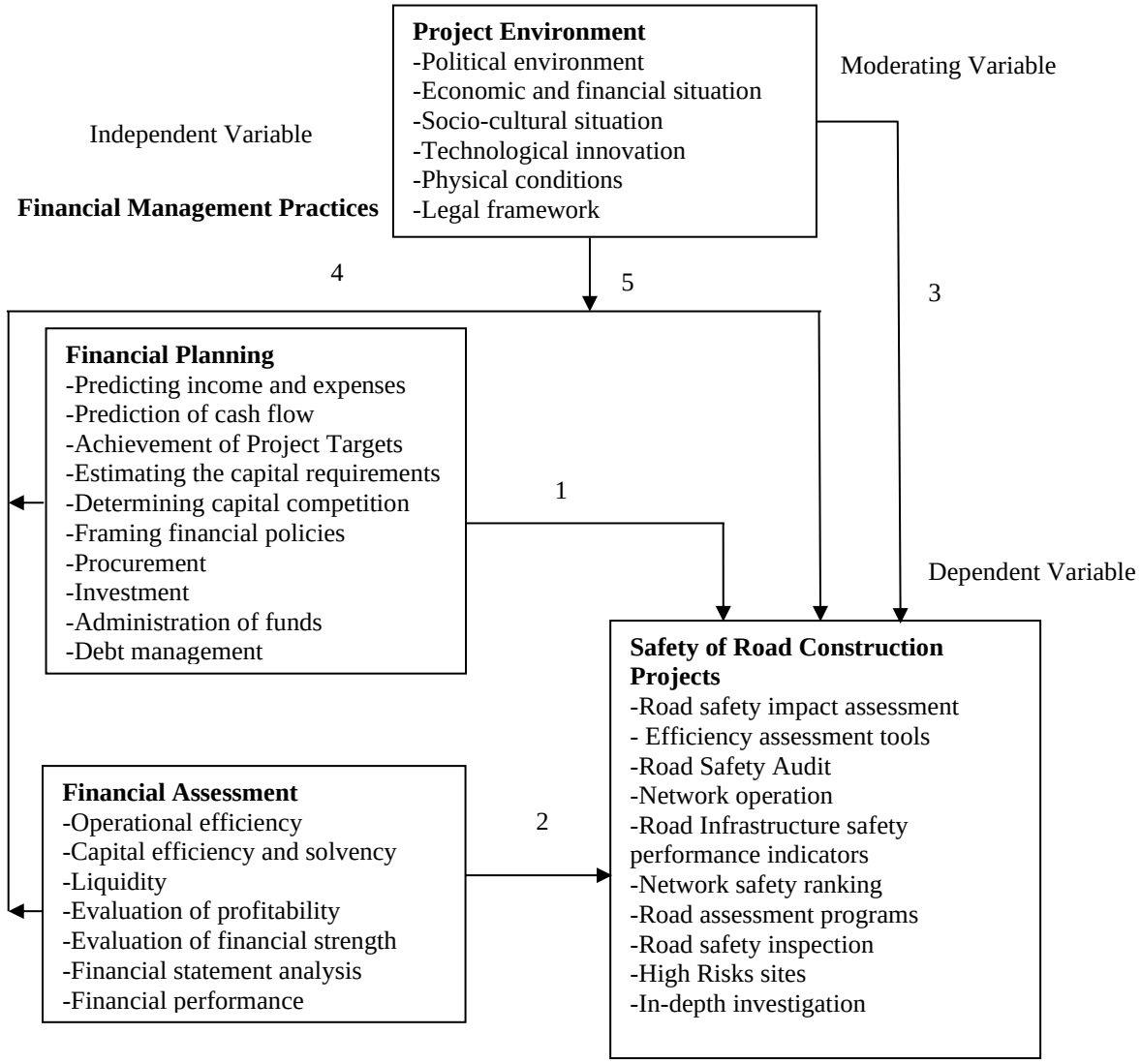
H4: The project environment has a significant moderating effect on the relationship between financial management practices and safety of road construction projects.

2.5 CONCEPTUAL FRAMEWORK

The conceptual framework model in Figure 1 illustrates that the safety of road construction projects is a function of effective financial management practices moderated by the project environment. The interaction between these variables determines the overall safety and success of road construction projects.

Figure 1

Conceptual Framework



Source: Author's Computation

The following equations the model:

$$Y = \beta_1 + \beta_1 X_1 + \varepsilon \quad (1)$$

$$Y = \beta_0 + \beta_2 X_2 + \varepsilon \quad (2)$$

$$Y = \beta_0 + \beta_2 X_3 + \varepsilon \quad (3)$$

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \varepsilon \quad (4)$$

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \varepsilon \quad (5)$$

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_m X_1 * X_3 + \beta_m X_2 * X_3 + \varepsilon \quad (6)$$

Where

Y represents safety of road construction projects,

X_1 is financial planning,

X_2 is financial assessment,

X_3 is the project environment.

The interaction terms represent the moderation effects measured by β_m, while ε represents the error term assumed, as Independent and Identically Distributed (IID).

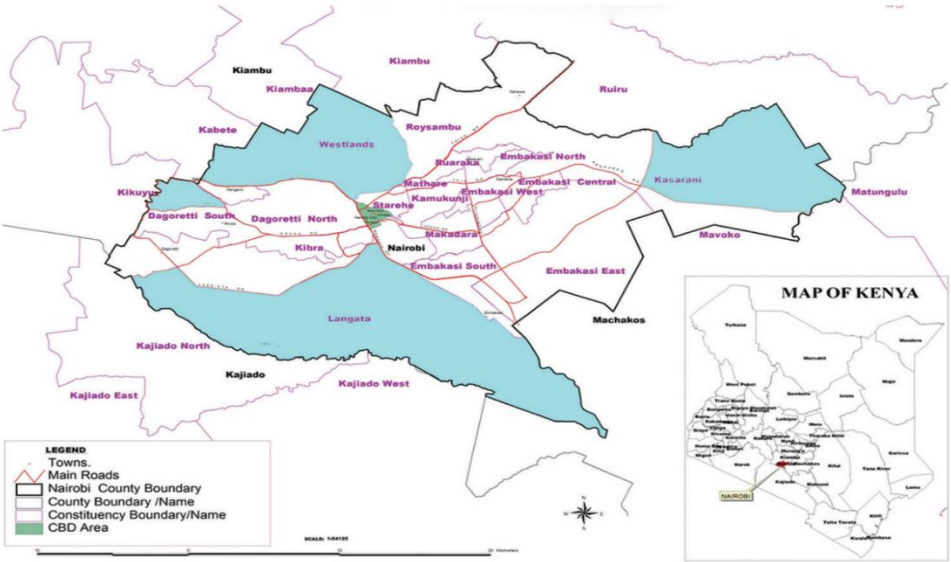
3 METHODOLOGY

3.1 SAMPLE DATA COLLECTION

The study employed a pragmatic paradigm and a mixed method approach by using both quantitative and qualitative methods. The study involved road projects undertaken by KURA in Nairobi County. Nairobi is the capital city of Kenya and Figure 2 shows the sub-counties of the sampled projects.

Figure 2

Nairobi City County highlighting the sub-counties of sampled projects.



The study area (KURA, Nairobi Region) follows Nairobi County Administrative Boundaries.
[Source: Independent Electoral and Boundaries Commission, Kenya
https://www.iebc.or.ke/uploads/resources/WHXao7x83D.pdf]

The design used for the study was descriptive cross-sectional survey and the target population was 364 consisting of 16 project engineers, 7 directors, 27 resident engineers, 47 project managers, 2 finance officers, 47 project accountants, 54 site surveyors, 47 site agents and 47 road inspectors. A sample of 191 respondents were obtained by (Yamane, 1967), formula: n = N/(1+N (e)2 and (Krejcie & Morgan, 1970) table. This was 53% of the target population, an adequate sample due to the population size, allowable sampling error and risks, and the purpose of the study (Miaoulis & Michener, 1976). Sampling took place in KURA (employer) and the 47 active toad contracts. Stratified proportionate allocation enabled placement of project managers, engineers, resident engineers, site surveyors, site agents, project accountants and road inspectors into strata as shown in Table 1.

Table 1

Sampling Procedures

Strata	Staff (X)	Proportionate Allocation {X*191/364}
Directors	7	4
Project Engineers	16	8
Resident Engineers	27	14
Finance officers	2	1
Project Managers	47	25
Site surveyors	54	28
Contractor Project Accountants	47	25
Site agents	47	25
Road Inspectors	117	61
Total	**364**	**191**

Purposive sampling and simple proportionate random sampling produced 191 respondents. The study's research instruments were questionnaires, interview schedules and observation guides. Questionnaires contained closed-ended and open-ended questions. Interview guides were for key informants. To minimize cost and travel time, the researcher administered questionnaires, interviews and made observations at the same time by visiting the projects' sites. There was a pilot study in KURA, Lower Eastern Region, to improve validity and reliability.

3.2 MEASUREMENT OF VARIABLES

Measurement of safety of road construction projects was by a 12-item scale($\alpha = 0.9451$). Financial management practices were a composition of two indicators, financial planning and financial assessment. Measurement of each of these indicators were on the 12-

item scale Likert scale. The Cronbach for financial planning was 0.9451 while for financial assessment it was 0.9536 indicating a significant internal consistency for the items used to measure these constructs. This suggests that the Likert scale items for both financial planning and financial assessment were reliable and consistently reflected the underlying dimensions that they were measuring. Project environment test was by a 12-item scale($\alpha = 0.9210$), hence reliable. Figure 1 shows the indicators for all these study variables.

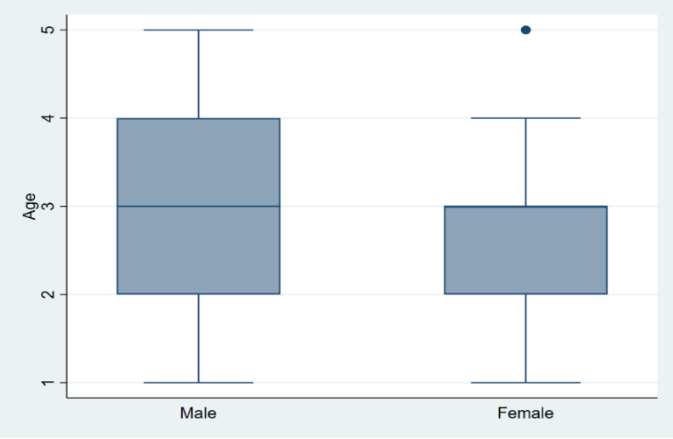
4 RESULTS AND DISCUSSIONS

4.1 DESCRIPTIVE STATISTICS

The numbers of returned questionnaires were 152 out of 191 administered which was a return rate of 79.6%, good enough for analysis and generalization. A response rate of 70% and above is highly acceptable in data analysis (Saunders, Lewis & Thornhill, 2016). A 50% return rate is reliable in analysis, 60% regarded as good and 70% is excellent (Babbie, 2003). The respondents' characteristics were age, gender, education attainment, current employment and period served. This facilitated a balanced data collection. From the analysis 98 (64.5%) men and 54 (35.5%) women. The age under 29 were (5.9%), 30 to 39 years old were 38.8% and 40 to 49 (29.6%) as shown in Figure 3.

Figure 3

Response Rates

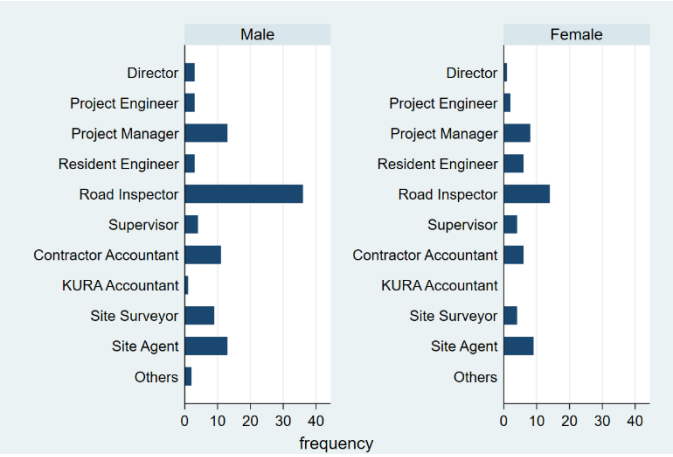


Source: Author's Computations

Majority of the respondents were road inspectors 32.9%, site agents 14.5% and project managers 13.8% as shown in Figure 4.

Figure 4

Distribution of Respondents



Source: Author's Computations

4.2 INTERPRETATION OF RESULTS

The analysis reveals a strong and positive relationship between financial planning and safety in road construction projects. As demonstrated in Model 1, of Table 2 financial planning significantly enhances safety outcomes ($\beta = 0.812, p < 0.01$). This reflects the importance of careful financial planning in ensuring efficient allocation of resources, unto which it contributes to safer project execution. Similarly, Model 2 highlights the critical role of financial assessment. The coefficient for financial assessment is not only positive but also highly significant($\beta = 0.909, p < 0.01$). This suggests that regular and thorough financial assessments allow for continuous monitoring and adjustment of financial resources, thereby mitigating financial risks that could compromise project safety. The robustness of financial assessment practices ensures that projects remain within budget and can accommodate unforeseen expenses, which often links to safety lapses if inadequately managed.

Table 2

Regression Results

	(1)	(2)	(3)	(4)	(5)	(6)
Plan	0.812***			0.300***	0.294***	-0.765
	(0.0407)			(0.0605)	(0.0608)	(0.483)
Assess		0.909***		0.638***	0.627***	1.954***
		(0.0362)		(0.0642)	(0.0653)	(0.470)
Env			0.452***		0.0359	0.384***
			(0.0731)		(0.0376)	(0.142)
Plan*Env						0.268**
						(0.124)
Assess*Env						-0.353***
						(0.119)
Constant	0.811***	0.341**	2.453***	0.241	0.174	-0.901**
	(0.173)	(0.156)	(0.289)	(0.147)	(0.163)	(0.445)
Observations	152	152	152	152	152	152
R-squared	0.726	0.808	0.203	0.835	0.836	0.852

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Plan=Planning, Assess=Assessment, Env=Environment

The project environment itself emerges as a significant factor influencing safety, as indicated in Model 3($\beta = 0.452, p < 0.01$). This shows that a supportive and well-structured project environment, which includes factors such as regulatory compliance and availability of resources, is associated with improved safety outcomes. This finding emphasizes that while financial management is crucial, the broader context within which a project operates can also significantly affect its safety. When considering financial planning alongside the project environment in Model 4, the positive impact of financial planning on safety remains significant, though with a reduced coefficient ($\beta = 0.300, p < 0.01$). This suggests that the project environment may partly account for the variance in safety outcomes attributed to financial planning, indicating interplay between these factors. However, in Model 5, the inclusion of the project environment alongside financial assessment results in the environment becoming insignificant, while financial assessment remains a strong predictor of safety ($\beta = 0.638, p < 0.01$). This implies that the effect of the project environment on safety might possibly be overshadowed by the rigorous financial assessment processes that directly safeguard against financial mismanagement and its associated risks.

The full model (Model 6) introduces interaction terms to examine the moderating role of the project environment on the relationship between financial management practices and safety. Interestingly, the direct effect of financial planning ($\beta = -0.765$), becomes insignificant suggesting that the simple relationship between financial planning and safety is

more complex when the project environment is considered. The interaction term for financial planning and project environment, however, is positive and significant($\beta = 0.268, p < 0.05$). This indicates that the project environment positively moderates the relationship between financial planning and safety—meaning that a favorable project environment amplifies the benefits of financial planning on safety. Conversely, the interaction between financial assessment and project environment reveals a negative and significant coefficient($\beta = -0.353, p < 0.01$). This suggests a more intricate relationship, which diminishes the positive effects of financial assessment on safety under certain environmental conditions. This could be due to factors such as environmental challenges that financial assessment alone cannot mitigate, requiring additional project management strategies to ensure safety.

4.3 DISCUSSION

In this section, we discuss the implications of these findings, relate them to existing theoretical frameworks and literature, and consider their practical applications. The strong positive relationship between financial planning and safety outcomes observed in this study aligns with the resource-based view (RBV) of the firm, which posits that well-allocated resources contribute to superior performance, including safety performance. The findings also align with empirical studies that highlight the importance of financial assessments in reducing project risks and ensuring compliance with safety standards (Zwikael & Smyrk, 2019). The significant positive effect of the project environment on safety outcomes also highlights the importance of external factors such as regulatory frameworks, resource availability, and stakeholder engagement. This result is in line with the contingency theory of management, which posits that the effectiveness of management practices is contingent upon the environment in which a project operates. The study's findings suggest that a supportive project environment can create conditions that enhance the effectiveness of financial management practices, ultimately leading project safety and success (Ika, 2009).

The positive interaction between financial planning and the project environment suggests that favorable environment amplifies the benefits of financial planning. This finding is consistent with the concept of dynamic capabilities, where firms that can leverage their internal resources (e.g., financial planning) in alignment with external opportunities (e.g., a supportive project environment) achieve superior outcomes. These results may suggest that while financial assessments are critical, they might not fully mitigate safety risks in more

challenging environments. The findings highlight the limitations of financial assessments in isolation and suggest that a holistic approach, integrating both financial and environmental strategies, necessary to ensure safety in road construction projects (Hillson & Simon, 2020).

The findings support and extend existing theories, such as the resource-based view, contingency theory, and dynamic capabilities framework, by providing empirical evidence from the context of road construction in Kenya. This study's findings align with and contribute to a growing body of literature on project management and safety in construction. Previous research has emphasized the role of financial management in project success. This study extends the insights by demonstrating the moderating effect of the project environment on the relationship between financial management and safety (Zwikael & Smyrk, 2012).

The limitation of the study lays in delimitation to Nairobi County; hence limit generalizability beyond Kenya's road construction projects. Future studies can extend to other regions, using a longitudinal survey to determine long-term influences and causal inferences hence widen knowledge on financial management and road construction safety. Other studies can investigate the role environmental audits in promoting road safety.

5 CONCLUSION

The findings reveal the critical importance of financial planning and financial assessment in enhancing project success and safety, with a significant impact of the project environment on these relationships. The coefficient for financial assessment was positive and highly significant indicating that continuous monitoring and adjustment of financial resources mitigates financial risks, which might compromise project safety. These insights contribute to the broader understanding of how internal financial management practices and external environmental factors like socio-political stability, regulatory frameworks, infrastructure resilience and resource availability interact to influence safety outcomes in construction projects. The policy recommendations seek to enhance the safety of road construction projects through improved financial management and consideration of the project environment. Policymakers and project managers should prioritize rigorous financial planning at the outset of road construction projects, including detailed budget allocations, resource planning, and risk assessments that account for potential safety hazards. The positive impact of financial planning on safety suggests that projects with well-structured financial plans are more likely to achieve safe and successful outcomes. The strong link between financial assessment and safety,

recommends a robust financial oversight to mitigate risks and ensure compliance with safety standards. Further audit of project environment integrates environmental risk assessment into the project-planning phase to align financial management with anticipated environmental risks, which compromise safety. An integrated model of the financial and environmental variables contribute a nuanced understanding towards theoretical and practical applications, which guide government agencies, policy makers and regulatory bodies to work towards creating an enabling project environment through clear regulatory frameworks, adequate resource provision, and active stakeholder engagement. The focus on the influence of financial management on safety in the context of project environment in Kenya provides crucial insights in developing countries, where traditional models are ineffective risk factors and environmental constraints. The financial-safety dynamics could expand the literature in financial management practices like budgeting, expenditure tracking and cost control, hence theoretical and empirical insights, which link financial stability and operational safety. The integrated model empirically quantifies how project environments influences financial management to enhance outcomes of road construction safety, a model that other developing regions can adapt, hence contributing to literature in global construction safety.

Practically, the developed model guide project managers and firms to align financial management practices to environmental conditions to enhance safety, such as developing a conservative budgeting and contingency funds to mitigate safety risks. For policy makers the model identifies financial control practices required to maximize and safeguard safety. Further, construction firms can apply the model as a risk assessment tool for determination of project feasibility, setting financial strategies and adjusting budgets based on anticipated environmental challenges, hence ensuring financial resilience required for safety.

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