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Managing Risks in Tertiary Education Building Projects: Insights from Construction Stakeholders

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Abstract: The demand for quality education and achieving high literacy rates in developing countries require a resilient and safe infrastructure in tertiary institutions. However, the achievement of such a level of infrastructure comes with embedded risks, which have escalated costs and timelines issues when compared to construction activities in other sectors of the economy. This study examines the unique risks associated with achieving resilient and safe tertiary education building projects. The data was collected from 295 construction stakeholders involved in tertiary education building projects through a quantitative questionnaire. The data was analysed through mean score ranking, standard deviation, and exploratory factor analysis. Eight components emerged: design, political, construction, legal, logistics, environmental, financial, and management risk factors. The identified risks resonate beyond project management, extending to the domain of construction safety, especially the identified environmental risk factor. By discerning and proactively addressing influential risk factors, stakeholders hold the key to cultivating a safer working environment, thus mitigating the prevalence of accidents and injuries on construction sites. Moreover, embracing robust risk management strategies and crafting contingency funds emerge as imperative steps towards fortifying project performance and fostering a culture of safety within the construction landscape.

Keywords: Construction projects, education building, nigeria, risk factors, tertiary education building projects

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1. Introduction

The construction industry plays a pivotal role in the economic development of various countries worldwide, including Australia, the United States, Ghana, Malaysia, and Nigeria (Infrastructure Australia, 2019; Shehu et al., 2014). It serves as the backbone for infrastructure enhancement, thus directly impacting the quality of life while fostering links with other sectors of the economy. Despite its vital contributions, construction projects commonly grapple with challenges such as cost and time overruns, often failing to meet predetermined safety benchmarks, satisfaction, and specifications (Shehu et al., 2014). This trend is particularly pronounced in tertiary education building projects (TEBP), characterized by inherent risks during both design and construction phases, resulting in elevated cost and time fluctuations compared to residential projects (Adafin et al., 2016). The literature highlights various risk factors, including inflation, delayed contract payments, high competition bids, progress delays, and variations (Adedokun et al., 2021; Siraj and Fayek, 2019), which can precipitate project failures or subpar performance, significantly impacting TEBP success rates. Within the African construction industry, a staggering 90% failure rate underscores the pervasive nature of these risks (Nketekete et al., 2017). Nigeria, as a developing nation, confronts similar challenges exacerbated by factors such as corruption, labour shortages, and inadequate infrastructure. Understanding the influence of these identified risks on TEBP in Nigeria transcends mere acknowledgment of their occurrence. It is integral not only to project success but also to ensuring construction safety. By proactively identifying and addressing these risks, stakeholders can implement measures to bolster safety protocols on construction sites, thereby safeguarding the well-being of workers. Consequently, this study seeks to assess stakeholders' perceptions regarding the hierarchical impact of these risks on TEBP in Nigeria, aiming to facilitate effective risk management strategies. Moreover, the findings of this research can contribute significantly to the development of proactive measures aimed at minimizing hazards and accidents, thereby fostering a culture of safety within the construction industry.

2. Literature Review

Tertiary education building projects (TEBP) represent intricate endeavours involving diverse stakeholders and a myriad of internal and external factors that contribute to project risks. According to Adedokun et al. (2021), these risks encompass environmental, management, financial, logistical, legal, political, design, and construction aspects. While risk management strategies aim to address these challenges, it's imperative to acknowledge that no construction project is entirely devoid of risks (Mishra and Mishra, 2016; Renuka et al., 2014). While considerable scholarly attention has been devoted to risk management within the construction domain, notable challenges persist in the seamless execution of TEBP. The construction sector, in particular, grapples with a distinct risk landscape, often yielding outcomes less favorable compared to other industries (Banaitis and Banaitiene, 2012). Furthermore, TEBP encounters a multitude of risks, including geological or pollution-related issues, disruptions to ongoing operations, construction incidents, design and construction flaws, work progress delays, alterations in design, and discrepancies between actual and contracted quantities (Szymański, 2017). The implications of these literature findings are twofold. Firstly, stakeholders involved in TEBP must recognize the vital essence of initiating robust strategies for managing risks tailored to the specific challenges faced by these projects. This includes proactive measures to address identified risk factors such as financial instability, political uncertainties, environmental concerns, and logistical challenges. Secondly, policymakers and industry professionals should prioritize research and development efforts aimed at enhancing risk mitigation techniques within the construction sector, particularly concerning TEBP. By fostering a culture of risk awareness and proactive management, stakeholders can work towards improving project outcomes, enhancing safety standards, and ultimately ensuring the successful delivery of TEBP.

The implementation of construction projects is fraught with various risks, including the potential for protests, inadequate understanding of soil structure, scheduling errors, equipment malfunctions, and the possibility of team member absence (Szymański, 2017). Additional risks encompass mismanagement of material resources, supply chain inefficiencies, workforce issues, delays in material delivery, quality control lapses, scope creep, and subpar workmanship. While risks are inherent in construction endeavours, effective management strategies are pivotal to project success (Mishra and Mishra, 2016; Renuka et al., 2014). Financial risks, in particular, play a significant role in project delays, emphasizing the critical need for timely availability of adequate funds to support contractor progress (Eskander, 2018). The lack of financial resources for contractors and cash flow issues for clients are among the most influential risk factors impacting project finances (Eskander, 2018). Hence, meticulous planning and proactive risk management are essential components of both the construction and insurance industries, ensuring that financial risks are adequately addressed to safeguard project outcomes.

Political risks within construction are influenced by a multitude of environmental factors, spanning changes in the business environment and governmental actions (Deng et al., 2018; Muchenga, 2016). These risks encompass discontinuities in business environments and challenges in anticipating political changes, posing significant uncertainties for project outcomes (Muchenga, 2016). Moreover, environmental risks in TEBP present formidable challenges, potentially resulting in legal and financial liabilities stemming from adverse environmental impacts (Akinbile et al., 2018). Construction activities can lead to environmental disruptions and pollution, exacerbating issues such as resource depletion and compromised human health (Rahman and Esa, 2014). Given the complex and diverse nature of risks in TEBP, effective planning and management are imperative. It is crucial to identify, assess, and develop mitigation strategies for these risks, allocating responsibilities appropriately to ensure project success. Recognizing and addressing these risks not only enhances project outcomes but also contributes to environmental sustainability. Therefore, this research aims to assess construction stakeholders' perspectives on the hierarchical influence of risk factors on TEBP within the Nigerian context.

3. Research Method

The study aimed to assess the hierarchical influence of risk factors on Tertiary Education Building Projects (TEBP) using a quantitative approach grounded in positivist epistemology, ensuring objectivity and the generalizability of findings (Park et al., 2020). A structured questionnaire was employed to gather data from respondents, facilitating consistent responses. The questionnaire solicited ratings on the perceived order of influence of various risk factors on TEBP, utilizing a 5-point Likert scale where one denoted minimal influence and five denoted maximal influence. Participants included stakeholders engaged in completed building projects within higher education institutions, sourced from their respective physical planning units, encompassing clients' representatives, contractors, and consultants. TEBP procured through the traditional contract method between 2000 and 2022 in Ondo State, Nigeria, formed the basis of the study. Due to data unavailability predating 2000 in some institutions, the study was constrained to this period. The dataset included stakeholders involved in completed TEBP up to the second quarter of 2022. To ensure uniform representation, respondents involved in multiple projects within the same institution were identified, and redundant entries were removed from the initial population of 512, resulting in a target population of 465. The study employed the mean item score to prioritize risk variables in TEBP, revealing the order of influence of identified risk factors on completed higher education building projects procured through traditional contracts between 2000 and 2022. Additionally, the factor analysis method was employed to consolidate risk variables in TEBP and identify their respective influences on higher education building projects. Furthermore, the construct evaluating the order of risk influence on TEBP exhibited a high level of internal consistency, as indicated by a Cronbach alpha value of 0.970. This value, exceeding the threshold of 0.600, signifies a robust reliability level (Norhayati and Nawi, 2021).

3.1 Respondents Demographics

Four hundred and sixty-five questionnaires were distributed among respondents, including client representatives, contractors, and consultants. Out of these, 295 (63.44%) questionnaires were deemed suitable for subsequent analysis, demonstrating a satisfactory response rate (Moser and Kalton, 2017). Table 1 presents respondents' background information, detailing their respective organizations, professions, and years of work experience. The majority of respondents hail from consulting firms, comprising 42.70% of the total (Table 1). Additionally, 33.90% are affiliated with contracting firms, while 23.40% represent client organizations. Further examination reveals that 34.60% of respondents are quantity surveyors, 14.60% are architects, and 18% are builders. Engineers constitute 32.90% of the total, with structural/civil engineers comprising 16.60%, electrical engineers 9.20%, and mechanical engineers 5.10%. On average, respondents possess 13 years of work experience, indicating a wealth of industry knowledge and expertise. This significant level of experience enhances the credibility and reliability of the data provided by respondents. Consequently, the robustness of the findings derived from this diverse and experienced participant pool underscores the credibility of the study's outcomes, facilitating more informed decision-making processes within the realm of tertiary education building projects.

Table 1. Background information of the respondent

Category	Classification	Frequency	Per cent
Type of Organization	Client organisation	69	23.40
	Contracting firm	100	33.90
	Consulting firms	126	42.70
	Total	**295**	**100.00**
Profession	Quantity Surveying	102	34.60
of	Architecture	43	14.60
Respondents	Building	53	18.00
	Structural/Civil Engineering	55	18.60
	Electrical Engineering	27	9.20
	Mechanical Engineering	15	5.10
	Total	**295**	**100.00**
Years	1 – 5	46	15.60
of	6 – 10	72	24.40
Work	11 – 15	68	23.10
Experience	16 – 20	66	22.40
	Above 21	43	14.60
Mean	**12.51** **Total**	**295**	**100.00**

3.2 Results

The results of the analysis carried out to address the study's objective are presented below. Utilizing the Statistical Package for Social Sciences (IBM SPSS 28.0), mean and standard deviation were computed as measures to rank risk factors based on their perceived influence. The findings revealed a significant trend: a substantial majority of risk factors, specifically fifty-five out of the total fifty-eight, displayed mean scores exceeding 3.00, indicating a high level of influence on TEBP. This observation underscores the profound impact of risks on project performance, emphasizing the critical need for enhanced attention to risk factors within project planning and execution. Moreover, these findings hold significant implications for future TEBP endeavors. By proactively recognizing and addressing these influential risk factors, stakeholders can strategize for effective risk mitigation, thereby enhancing project outcomes and overall success. Additionally, this emphasis on risk management is crucial for ensuring construction safety. Addressing these high-impact risk factors improves project performance and contributes to creating safer working environments for construction workers. Prioritizing risk mitigation measures can minimize the occurrence of accidents and injuries on construction sites, ultimately promoting the well-being and safety of all individuals involved in TEBP projects. The identification and evaluation of risks represent crucial initial steps in effective risk management practices within the construction domain, serving to safeguard both project success and the lives of those working in the construction industry.

3.2.1 Order of Risks Influence on TEBP

Table 2 shows valuable insights into the influential impact of identified risk factors on TEBP. The top 5 factors, including inflation (Mean Score = 4.24), delayed payments in contracts (Mean Score = 4.13), financial failure of the contractor (Mean Score = 3.73), occurrence of variations (Mean Score = 3.72), and delay in progress of work (Mean Score = 3.69), emerge as pivotal contributors to project challenges. These findings underscore the critical necessity of addressing these primary risk factors to mitigate their detrimental effects on project performance. Conversely, lower-ranking risk factors such as pollution, working hours restrictions, and on-site congestion, while still noteworthy, may warrant relatively less immediate attention. However, with fifty-five out of the total fifty-eight risk factors recording mean scores above 3.00, it becomes evident that a substantial majority of identified risks significantly impact TEBP. This underscores the urgency for robust risk management strategies to effectively navigate and mitigate the myriad challenges encountered in TEBP, ultimately fostering improved project outcomes and ensuring the safety of construction processes and personnel.

Table 2. Order of risks influence on TEBP

Risk factors	Mean	Std. Deviation	Rank
Inflation	4.24	0.823	1
Delayed payments in contracts	4.13	0.859	2
Financial failure of the contractor	3.73	0.998	3
Occurrence of variations	3.72	1.215	4
Delay in progress of work	3.69	0.996	5
Discrepancies between boq, drawings and specifications	3.66	1.064	6
Exchange rate fluctuation	3.65	1.096	7
Design changes	3.61	0.952	8
Supplies of defective materials	3.61	1.119	9
Inaccurate project program	3.58	1.187	10
Rate of interest	3.57	1.188	11
Defective design (incorrect)	3.57	1.241	12
Ambiguous planning due to project complexity	3.55	1.104	13
High competition bids	3.55	1.143	14
Lower quality work	3.52	1.115	15
Undocumented change orders	3.51	1.014	16
Uncoordinated design (structural, mechanical, electrical)	3.51	1.096	17
Invoices delay	3.49	1.144	18
Unmanaged cashflow	3.48	1.086	19
Rush design	3.47	1.226	20
Actual quantities differ from the contract quantities	3.45	1.034	21
Gaps between the implementation and the specification due to misunderstanding and specification	3.44	1.023	22
Rush bidding	3.43	1.160	23
Poor communication between the home and field officers (contractor side)	3.42	1.122	24
Poor communication between involved parties	3.41	1.291	25
Bribery and corruption	3.41	1.324	26
Delay in the start of the project	3.41	1.111	27
Inaccurate quantities	3.40	1.101	28
Undefined scope of working	3.35	1.172	29
Unavailable labour, materials, and equipment	3.35	1.244	30
Unstable security circumstances (invasion)	3.35	1.269	31
Deficient and/ or insufficient safety rules	3.33	1.053	32
Information unavailability (including uncertainty)	3.33	1.169	33
Resource management	3.31	1.128	34
Changes in management ways	3.29	1.153	35

Table 2. Order of risks influence on TEBP (continued)

Risk factors	Mean	Std. Deviation	Rank
New governmental acts or legislations	3.28	1.206	36
Shortage of labour	3.26	1.246	37
Difficulty to get permit/licenses	3.25	1.106	38
Segmentation of construction process	3.22	1.201	39
Materials monopoly due to closure	3.20	1.225	40
Delayed dispute resolutions	3.19	1.112	41
Import and export restrictions	3.19	1.283	42
Delay or inability of owner to give full possession	3.17	1.105	43
Site accidents	3.17	1.261	44
Legal disputes during the construction phase among the parties of the contract	3.15	1.079	45
Owners high expectations for quality beyond standards	3.15	1.118	46
Wars and revolutions	3.15	1.354	47
Working in hot (dangerous) areas	3.12	1.296	48
Differing site conditions	3.11	1.074	49
Ambiguity to work legislations	3.10	1.039	50
Closure	3.10	1.176	51
No special arbitrators to help settle fast	3.08	1.187	52
Adverse weather conditions	3.02	1.138	53
Environmental factors (flood, earthquake, etc.)	3.02	1.432	54
Difficulty to access the site (very far, settlement)	3.00	1.238	55
On-site congestion	2.94	1.088	56
Working hours restrictions	2.89	1.012	57
Pollution	2.88	1.219	58

3.2.2 Factor Analysis

Table 3 presents the results obtained from the Kaiser-Meyer-Olkin (KMO) and Bartlett's tests, pivotal for evaluating the suitability and adequacy of the dataset for factor analysis. The KMO test demonstrates a commendable adequacy of data with a value of 0.789, surpassing the threshold of 0.500. This signifies compact correlation patterns within the data, ensuring the derivation of unique and dependable factors (Field, 2005). Bartlett's test of sphericity yields a significant outcome (p-value = 0.000), indicating that the original matrix is not an identity matrix (Field, 2005). This underscores the presence of meaningful relationships between variables under scrutiny, reinforcing the validity of the analysis. A factor loading cut-off of 0.6 was adopted for this study, consistent with the study of Awang (2012). Therefore, Table 4 shows twenty-nine variables extracted into eight components, with a cumulative variance explained of 64.45%. The components are design risk factors (Component 1), political risk factors (Component 2), construction risk factors (Component 3), legal risk factors (Component 4), logistic risk factors (Component 5), environmental risk factors (Component 6), financial risk factors (Component 7), and management risk factors (Component 8). To ensure a systematic and comprehensive analysis of the data, the study adopts an empiricism classification framework borrowed from the field of psychology, providing a structured and insightful analysis of the data (Hjørland, 1998). The implications of these findings underscore the robustness of the data analysis process, providing a solid foundation for understanding the multifaceted nature of risk factors affecting TEBP. By elucidating the interplay between various risk variables, stakeholders can develop targeted mitigation strategies to minimize project disruptions and enhance overall project performance. Moreover, the systematic identification and classification of risk factors facilitate informed decision-making, enabling stakeholders to allocate resources effectively and prioritize risk management efforts.

Table 3. KMO and Bartlett's Test

Test	Result
Kaiser-Meyer-Olkin (KMO) Measure	0.789
Bartlett's Test of Sphericity	
Approx. Chi-Square	17,316.660
Degree of Freedom (df)	1653
Significance	0.000

Component 1 – Design Risk Factors (DESR)

The primary component comprises a cluster of five closely intertwined variables, encompassing aspects such as uncoordinated design (structural, mechanical, electrical) (loading factor: 0.801), defective design (incorrect) (loading factor: 0.701), lower quality work (loading factor: 0.645), rush design (loading factor: 0.643), and supplies of defective materials (loading factor: 0.628). These figures, denoted in parentheses, depict the strength of association with the component. This cohesive cluster contributes significantly, accounting for 12.467% of the variance in rotation sums of square loadings, and demonstrates a high reliability value of 0.862, as evidenced in Table 4. Termed as **Design Risk Factors**, this component is critical in shaping project outcomes, particularly concerning design integrity and quality assurance. The identification of these factors underscores the paramount importance of implementing robust design management practices to effectively mitigate risks associated with design deficiencies. By addressing these challenges proactively, stakeholders can ensure the delivery of tertiary education building projects characterized by high-quality standards and structural integrity, thus safeguarding the long-term viability and functionality of the educational infrastructure.

Component 2 – Political Risk Factors (POLR)

The second component encompasses a cluster of six factors demonstrating significant correlation, namely wars and revolutions (loading factor: 0.735), restrictions on import and export (loading factor: 0.678), insecurity issues (invasion) (loading factor: 0.675), closure (loading factor: 0.671), information unavailability (loading factor: 0.660), and rush bidding (loading factor: 0.660). Together, these factors contribute substantially to 11.176% of the variance observed and attain an impressive reliability score of 0.894. Designated as **Political Risk Factors**, this component highlights the significant influence of geopolitical and regulatory uncertainties on project outcomes. Identifying these factors underscores the imperative for stakeholders to navigate political complexities effectively, implementing robust strategies to mitigate risks associated with geopolitical instability and regulatory constraints, thereby safeguarding the successful execution of tertiary education building projects.

Component 3 – Construction Risk Factors (CONR)

The third component is comprised of three closely intertwined factor loadings: delays in work progress, discrepancies between actual and contract quantities, and occurrences of variations, with a respective factor loading of 0.696, 0.688, and 0.654 within this cluster. This component is labeled as a construction risk factor because its variables are related to risks associated with the execution of the construction phase of the projects. This cluster accounts for a total variance of 8.87%, emphasizing the critical role of effective construction risk management strategies in mitigating delays and variations, thereby enhancing project efficiency and success.

Component 4 – Legal Risk Factors (LEGR)

This component comprises four-factor loadings, including ambiguity in work legislation, resource management, difficulty in obtaining permits/licenses, and changes in management methods, with corresponding factor loadings of 0.683, 0.640, 0.630, and 0.603, respectively. With a total variance of 7.685% and a reliability value of 0.842, this cluster is labeled as **Legal Risk Factors**. This designation underscores the significance of legal considerations in project management, and it highlights the importance of navigating regulatory frameworks effectively to mitigate legal risks and ensure project compliance, thereby contributing to the overall success of tertiary education building projects.

Component 5 – Logistic Risk Factors (LOGR)

The **Logistic Risk Factors** component captures three key factor loadings: on-site congestion, variations in site conditions, and owners' demands for quality beyond standard specifications, exhibiting factor loadings of 0.640, 0.614, and 0.604 within this grouping. It accentuates the pivotal role of logistics in project management. With a cumulative variance of 7.392% and a reliability score of 0.778, this cluster underscores the significance of adept logistical handling in addressing challenges related to site conditions and meeting elevated quality expectations set by project owners, thereby bolstering project efficiency and success.

Component 6 – Environmental Risk Factors (ENVR)

This component encompasses a cohesive set of variables comprising adverse weather conditions (0.783), challenges in accessing the site (such as remote locations or settlement issues) (0.749), environmental factors like floods (0.736), and pollution (0.697). These loadings signify the degree of correlation between each variable and the cluster's overarching theme. Together, they contribute 7.091% of the variance in rotation sums of square loadings, attaining a reliability score of 0.859. This cluster's significance lies in its comprehensive coverage of external factors that can significantly impact project execution, highlighting the need for proactive measures to mitigate risks associated with adverse weather, environmental disturbances, site accessibility, and pollution. Designated as **Environmental Risk Factors**, this component underscores the significant impact of environmental variables on project outcomes. Effective management of environmental risks is vital to mitigate adverse effects on construction project progress and ensure the sustainability and resilience of tertiary education building projects.

Component 7 – Financial Risk Factors (FINR)

The component labeled **Financial Risk Factors** encapsulates three-factor loadings: inflation, delayed payments in contracts, and invoice delays, with corresponding factor loadings of 0.739, 0.621, and 0.607, respectively. Thus, the component highlights the significant impact of financial considerations on project dynamics. With a total variance of 6.349% and a reliability analysis value of 0.693, this cluster underscores the critical importance of effective financial management in mitigating risks associated with inflation and payment delays, thereby ensuring the financial health and success of tertiary education building projects.

Component 8 – Management Risk Factors (MANR)

Finally, component 8 consists of one-factor loading, which is working hours restrictions, with a corresponding factor loading of 0.641 within the cluster. Designated as **Management Risk Factors**, this component underscores the importance of effective management practices in project execution. With a total variance of 3.417%, this cluster highlights the significance of addressing management-related challenges, such as working hour restrictions, to ensure smooth project operations and successful outcomes in tertiary education building projects.

Table 4. Rotated Component Matrix: influence of risk factors on TEBP

Components and variables	Factor Loading	Variance Explained	Cronbach Alpha (Reliability value)
Component 1: Design Risk Factors (DESR)		**12.47%**	**0.862**
Uncoordinated design (structural, mechanical, electrical, etc.)	0.801		
Defective design (incorrect)	0.701		
Lower quality work	0.645		
Rush design	0.643		
Supplies of defective materials	0.628		
Component 2: Political Risk Factors (POLR)		**11.18%**	**0.894**
Wars and revolutions	0.735		
Restrictions on import and export	0.678		
Insecurity issues (invasion)	0.675		
Closure	0.671		
Information unavailability (including uncertainty)	0.66		
Working at hot (dangerous) hours	0.66		
Component 3: Construction Risk Factors (CONR)		**8.87%**	**0.752**
Progress of work delay	0.696		
Discrepancies between the actual and contract quantities	0.688		
Occurrence of variations	0.654		
Component 4: Legal Risk Factors (LEGR)		**7.69%**	**0.842**
Ambiguity to work legislation	0.683		
Resource management	0.64		
Difficulty to get permits/licenses	0.63		
Changes in management ways	0.603		
Component 5: Logistic Risk Factors (LOGR)		**7.39%**	**0.778**
On-site congestion	0.64		
Varying site conditions	0.614		
Clients high expectations for quality beyond standards	0.604		
Component 6: Environmental Risk Factors (ENVR)		**7.09%**	**0.859**
Adverse weather conditions	0.783		
Difficulty to access the site (very far, settlements)	0.749		
Environmental factors (flood, etc.)	0.736		
Pollution	0.697		
Component 7: Financial Risk Factors (FINR)		**6.35%**	**0.693**
Inflation	0.739		
Delayed payments in contracts	0.621		
Invoices delay	0.607		
Component 8: Management Risk Factors (MANR)		**3.42%**	**-**
Working hours restriction	0.641		

4. Discussion of findings

This study shows the notable risk factors influencing TEBP, including inflation, financial failure of the contractor, delayed payments in contracts, occurrence of variations, and delay in the progress of work. These findings are consistent with existing literature in developing countries. For example, in the Saudi Arabian construction sector, Alshihri et al. (2022) underscore the key risk factors significantly contributing to delays in building projects, including delays in progress payments by owners for completed works, financial difficulties faced by contractors, ineffective project planning and scheduling by contractors, and change orders arising during construction. Furthermore, the primary risk factors contributing to budget overrun in Pakistani infrastructural projects include inflation, variations, and inaccurate cost estimates, while the key factors leading to time delays are variations, escalation of material prices, and economic conditions (Kamal et al., 2019). Economic factors, including inflation, which are beyond the control of project stakeholders, play a crucial role in project outcomes, as highlighted by Musa et al. (2015). As emphasized by Babalola et al. (2015), managing external factors like inflation is imperative for project success. Furthermore, studies by Akinsiku and Akinsulire (2012) and Hlaing et al. (2008) underscore the critical impact of financial constraints, client cashflow issues, and cost overruns due to delays in project financial aspects. Financial risks, particularly cashflow problems experienced by contractors, significantly contribute to project delays (Shehu et al., 2014). Analyzing twenty-two out of fifty-eight risk factors, this study reveals significant differences in the order of their impact on TEBP. This finding resonates with previous research by Chileshe and Boadua Yirenkyi-Fianko (2012) and Tipili and Ilyasu (2014), which also reported disparities in ranking risk factors' impact on construction projects. While this study organizes fifty-eight risk factors into eight groups using factor analysis, it diverges from the study conducted by Alshihri et al. (2022) in Saudi Arabia, which categorized similar risks into nine groups. Despite both studies focusing on government-funded building projects, this discrepancy may stem from differences in geographical location, as risk factors can vary based on location-specific conditions and geography. Additionally, Alshihri et al. (2022) considered 83 risk factors, whereas this current study accounts for 58, suggesting variations in the breadth and depth of risk factor analysis between the two studies. The discussion of findings emphasizes the significance of comprehending the wide range of risk factors affecting TEBP, crucial not only for project success but also for prioritizing construction safety. By acknowledging and tackling these risk factors, stakeholders can deploy measures to foster safer working conditions for construction personnel, thereby diminishing the probability of accidents and injuries at construction sites.

5. Conclusion

This study assessed the impact of risk factors on tertiary education building projects (TEBP) in Ondo State, Nigeria, revealing their significant influence and potential to disrupt project performance. Among the identified risk factors, inflation, delayed contract payments, financial failure of contractors, occurrence of variations, and progress delays emerged as the top five. Moreover, the study categorized fifty-eight risk factors into eight clusters: environmental, logistic, legal, design, construction, financial, political, and management risks. In light of these findings, recommendations were proposed to mitigate risks, including allocating contingency funds by higher education institutions, prioritizing prompt contractor payments to avoid delays and financial setbacks, and ensuring finalization of design decisions before contract award to prevent cost escalations. These strategies aim to enhance project resilience and effectiveness in navigating the challenges posed by risk factors in TEBP. However, the study is constrained by several limitations that warrant consideration. Firstly, the geographical scope is confined to TEBP in Ondo State, Nigeria. Consequently, the generalizability of the findings to other regions with diverse socio-economic contexts, regulatory environments, or construction practices may be limited. Secondly, limitations pertaining to sample size and representation must be acknowledged. Despite efforts to attain a representative sample, reliance on a questionnaire survey introduces potential biases such as non-response bias or self-selection bias. Moreover, the respondents may not fully encompass all stakeholders involved in TEBP, potentially compromising the comprehensiveness of the findings. Thirdly, the methodological approach adopted in the study predominantly relies on quantitative methods, such as principal component analysis, for data reduction. However, qualitative methods could offer deeper insights into the nuances of risk factors and their impacts. Employing a mixed-methods approach could enhance the comprehensiveness and depth of understanding of the subject matter. Nevertheless, future research could delve into several avenues to expand the knowledge of risk factors in TEBP. Comparative analysis offers an opportunity to scrutinize how risk factors vary across different states or countries, shedding light on regional disparities and factors contributing to these differences. On the other hand, longitudinal studies present an avenue to track tertiary education building projects over time, providing insights into the dynamic nature of risk factors and their evolving impacts. This longitudinal approach could facilitate the development of more robust risk management strategies tailored to the changing landscape of construction projects. Additionally, qualitative investigations, such as interviews or focus groups with key stakeholders, could complement quantitative analyses by offering deeper insights into the underlying reasons for identified risk factors and their impacts on project outcomes. By exploring the perspectives and experiences of stakeholders, researchers can gain a more nuanced understanding of risk dynamics in TEBP. Moreover, the relevance of this study to construction safety underscores the importance of identifying and addressing risk factors to create safer working environments for construction workers, ultimately reducing the likelihood of accidents and injuries on construction sites.

Author Contributions

Deborah Oluwafunke Adedokun contributes to conceptualization, methodology, analysis, investigation, data collection, draft preparation, manuscript editing, and project administration. Isaac Olaniyi Aje contributes to conceptualization, methodology, analysis, draft preparation, manuscript editing, supervision, and project administration. Bernard Tuffor Atuahene contributes to methodology, analysis, draft preparation, and manuscript editing. All authors have read and agreed with the manuscript before its submission and publication.

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