Contemporary Journal of Management | *ISSN 2766-1431*
Published by AIR JOURNALS | *https://airjournal.org/cjm*
12011 WestBrae Pkwy, Houston, TX 77031, United States
airjournals@gmail.com; enquiry@airjournal.org

0RESEARCH ARTICLE

Framework for Mitigating the Impact of Risk in the Management of TETfund Building Projects Between 2012 – 2022 In South East, Nigeria

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Abstract

This research investigates the significant risk factors affecting Tertiary Education Trust Fund (TETFund) building projects in Enugu, Anambra, and Imo states of South East Nigeria, spanning from 2012 to 2022. Through factor analysis, six principal risk components were identified: Design development, employer change, planning, construction, financial and economic, and environmental and economic risks. Each component was characterized by specific factors contributing to project delays and complications. The findings underscore the critical importance of addressing these risk factors to ensure the timely and successful completion of TETFund projects. Drawing from the identified risk components, a comprehensive framework for mitigating project risks is proposed. This framework emphasizes proactive risk management strategies, including systematic risk identification, assessment, and allocation throughout project phases. Key elements of effective risk response, such as proper planning and scheduling, clear communication channels, and adequate resource allocation, are highlighted. The study underscores the necessity of early risk allocation during contract formation and emphasizes stakeholder collaboration in risk mitigation efforts. The proposed framework provides practical insights for project managers, policymakers, and stakeholders involved in TETFund building projects. By implementing the recommended risk management strategies, project stakeholders can enhance project outcomes, minimize delays, and mitigate potential challenges such as contract overrun, time overrun, abandonment, disputes, and litigation. Ultimately, this research contributes to enhancing the efficiency and effectiveness of TETFund project management practices in South East Nigeria.

Keywords: *TETFund Building Projects; Risk Mitigation; Factor Analysis; Project Management*

Introduction

Infrastructure development in tertiary institutions is pivotal for enhancing the quality of education and research capabilities. In Nigeria, the Tertiary Education Trust Fund (TETFund) plays a crucial role in financing and supporting infrastructure projects in universities, polytechnics, and colleges of education across the country (Ajayi, 2019). However, despite the significant investment and firm contractual arrangements, TETFund-sponsored building projects in parts of the South East region have encountered various challenges that hinder their successful completion. These challenges include but are not limited to time and cost overruns, project abandonment, and inadequate risk management practices. Such issues not only disrupt project timelines but also lead to budgetary discrepancies, ultimately affecting the quality and scope of infrastructure delivered (Olaopa, 2018). Scholars such as Mangvwat, Ewuga, and Izam (2018) have documented instances of time overruns in building projects across tertiary institutions, while Gambo et al. (2017) have identified factors such as delays in progress payments and material shortages as contributing to poor project delivery.

Moreover, the impact of these challenges extends beyond the immediate project scope, affecting the overall economy and national development goals. Hillson and Hullet (2014) highlight the adverse effects of project delays on economic growth targets, underscoring the urgency for effective risk management strategies in infrastructure projects. Similarly, Isiofia and Ajaelu (2022) emphasize the need for robust risk mitigation frameworks to address key factors driving project cost overruns. In light of these observations, there is a critical need to develop a comprehensive framework for mitigating the impact of risk factors in the management of TETFund building projects in the South East region. Such a framework aims to optimize project delivery, minimize financial losses, and ensure the efficient utilization of resources for the benefit of tertiary institutions and the wider community. This study seeks to address this gap by examining the various risk factors affecting TETFund building projects and proposing strategies for their effective management and mitigation.

Statement of the Problem

The firm contractual nature of TETFund notwithstanding, building projects still experience time and cost overruns, depriving government-benefited institutions and the people of the South East of the value of federal government interventions. Additionally, project abandonment leads to litigation or arbitration, exacerbating losses and inefficient utilization of taxpayers' funds. Reports from Mangvwat, Ewuga, and Izam (2018) in Plateau State indicate time overruns in all 23 building projects across three tertiary institutions, with five projects experiencing cost overruns. Similarly, at Ahmadu Bello University, Zaria, delays in progress payments, material price escalations, and shortage of materials contribute to poor project delivery (Gambo et al., 2017). Hillson and Hullet (2014) note that delays afflict seven out of ten projects in Nigeria, significantly impacting the national economy and impeding GDP and GNP growth targets (Holmes, 2005). In response, Isiofia and Ajaelu (2022) identify key causes of cost overruns, including insufficient planning, funding, inflation, and incompetent project management. This underscores the urgent need for a comprehensive risk mitigation framework tailored to TETFund building projects in the South East to address these multifaceted challenges.

Research Objectives

The broad objective of the study is to identify major risk factors that mitigate TETfund building projects in parts of South East, Nigeria. The specific objective of the study is to;

i. To evaluate the management of TETFund building projects in parts of South East, Nigeria.
ii. To determine possible ways of mitigating those risk factors by TETFund in parts of South East, Nigeria.

Study Hypotheses

The following hypothesis guided the study;

i. There is no significant pattern of Risk factors affecting the management of TETFund projects in parts of South East, Nigeria.

Significance and Scope of the Study

This research holds significant implications for various stakeholders including society, businesses, professionals, and future research endeavours. Implementing the recommendations derived from this study can serve as a guide to mitigate risk factors in Nigerian construction projects, addressing major barriers to timely project completion and delivery. The findings will offer valuable insights for the construction industry, aiding in future planning and risk mitigation efforts. Moreover, professionals can benefit from this study as it provides a reference material for teaching and research purposes, contributing to the advancement of knowledge in construction project management.

The scope of this study encompasses TETFund construction projects in state universities located in Enugu, Ebonyi, and Anambra states, along with one federal polytechnic in Anambra and one state-owned polytechnic in Enugu. Specifically, the research focuses on mitigating the impact of risk factors in the management of TETFund building projects in parts of South East Nigeria over a period of ten years, spanning from 2012 to 2022. Geographically, the study covers Enugu State University of Science and Technology, Ebonyi State University, Anambra State University Uli, Federal Polytechnic Oko in Anambra, and Institute of Management and Technology in Enugu state. The study is confined to TETFund projects completed or ongoing in these states, chosen due to the concentration of TETFund projects and the accessibility of resources in the South East region.

Conceptual Review

Risk

Risk is defined as not achieving the expected outcome or that an unanticipated event occurred. This broad view of risk includes both certainty due to the future event and the result of limited knowledge, information or experience. It is measured in terms of consequences and likelihood as cited by Odeyinka, Oladapo and Dada (2017). Various definitions of risk and risk management abound, reflecting differing scholarly perspectives. Ahmad, Ahmad, and Saram (2019) posit that risks and opportunities are intertwined, while Akintoye and MacLeod (2017) suggest risk emerges from a lack of information, with past experiences aiding future predictions. Augie and Kreiner (2010) define risk as uncertainties arising from knowledge gaps, and Odeyinka (2010) views risk as the likelihood of unfavourable incidents within projects. Overall, risk embodies inherent uncertainty in plans and the potential to impact project objectives.

Risk Identification

Risk identification, according to Augie and Kreiner (2010), is the process of supplying data for a probability and impact matrix, a tool for quantitative risk analysis also referred to as a risk assessment matrix. The first step in risk management, according to Pott (2008), is the early identification and evaluation of the risks connected to a planned construction project. This stage frequently acts as the foundation for establishing risk uncertainties, policies, and strategies for the management and allocation of risks. Identifying risks to the project requires identifying and recording their features, such as failure to meet project schedule estimates, failure to meet project cost projections, failure to meet project quality estimates, political unrest, and health and safety concerns (Dikmen, Birgonul, and Han, 2007). Risk identification is an iterative process, and frequently the project team or the risk management team does the first pass before the full project team and the key stakeholders execute the second iteration (Augie and Kreiner, 2010). A final iteration can be carried out by individuals who are not involved in the project to prevent bias in the process. Ahmad, Ahmad, and Saram (2019) proposed that straightforward and practical risk management strategies can be created and even put into practice as soon as the risks are identified.

Risk Analysis

According to Pritchard (2011), risk analysis is more of a method of looking at an issue than it is a strategy. For instance, it entails determining the important variables that might have an impact on an estimate before determining the likelihood and size of the effect. As a result, information gathered for construction cost estimates is presented in probabilistic terms rather than deterministic terms, for example, by showing both the most likely value and a range of other values along with the likelihood that each individual value will be attained. Furthermore, according to Tang, et al. (2017), risk analysis entails cultivating a mindset that considers the likelihood that events will occur. The paper suggests that project estimating risk factors be properly identified and quantified by construction industry professionals. Governmental owner organizations and other organizations in the local construction industry must support the inclusion of a risk premium in the quote and time estimation.

Risk Management Processes for Building Construction Projects

Controlling schedule and expense overruns poses historic challenges for construction projects in underdeveloped nations, exemplified by Nigeria's construction sector's subpar performance. Research by Okuwoga (1998) indicates consistent concerns from both public and private sector clients regarding Nigeria's construction industry performance, with projects involving federal authorities showing unsatisfactory cost and time performance. Oyewobi et al. (2011) further highlight prevalent cost and time overruns, diminishing work quality, and lack of value for clients. Construction projects in Nigeria often exceed initial budgets, indicating delays. With dynamic project characteristics such as team rotations and exposure to various environmental factors, risk management becomes imperative for construction firms to enhance project success and mitigate hazards (Bobick, 2000). Risk management aims to protect an organization's assets, reputation, and financial success by preventing future losses. Recognized as one of the Project Management Institute's nine knowledge areas, risk management involves activities to identify, analyse, and manage project uncertainties to achieve objectives (Zou et al., 2007).

Risk Classification on Construction Project Delivery

Establishing a systematic framework for classifying project risks is essential due to the vast coverage and complex linkages among risk factors. Aibinu and Odeyinka (2016) identified four main classifications: project risks (related to performance, scope, quality, and technology), business risks (such as insufficient planning time, changes in existing programs, and inexperienced staff), environmental risks (involving hazardous waste, site conditions, government legislation, etc.), and external change risks (including market conditions, political factors, etc.). Project risks directly affect the project's ability to achieve its intended outcomes, while business risks impact post-project functionality. Environmental risks pertain to external factors influencing the project, while external change risks extend beyond immediate project environments but can still have significant impacts. At national or regional levels, risk factors can be categorized into political, economic, and social domains, while within construction projects, they include market fluctuations, regulatory changes, differences in standards, and contractual systems. Additionally, risks within construction projects can be attributed to various stakeholders, including employers, architects, labour, subcontractors, suppliers, and internal company activities.

Risk Response, Planning, Monitoring and Control on Construction Project Delivery

The risk management process primarily focuses on identifying and mitigating project risks, with risk response being the pivotal final step. This emphasizes the importance of integrating risk management as an essential component of project management rather than an optional addition. Effective risk management involves proactive anticipation of events, providing knowledge and information for decision-making, ensuring transparency, and aiding in the delivery of project objectives. It also entails scenario planning, improved contingency planning, and maintaining verifiable records of risk planning and control. Planning for risk response is crucial, with the Risk Action Plan being a common approach, incorporating inputs such as the risk management plan, prioritized risks, probability analysis, stakeholder involvement, and trends from risk analysis outcomes. Risk response actions are based on the "4Ts": terminate, treat, tolerate, and transfer, and can be executed using various tools and techniques, as outlined by Hillson and Hullet (2014).

Risk Factors

Determining building project risks has been extensively studied globally, with varied conclusions reported by researchers from different nations. In Saudi Arabia, Assaf et al. (1995) identified 56 risk factors, highlighting concerns such as drawing preparation, progress risks for contractors, payment issues, and design revisions. Ogunlana and Promkuntong (1996) categorized project risk factors in Thailand into infrastructural shortages, client- and consultant-related issues, and contractor concerns. In Hong Kong, Chan and Kumaraswamy (1997) found inadequate site management, unforeseen ground conditions, and slow decision-making to be significant risks. Al-Momani (2000) analysed Jordanian public projects, pinpointing factors like designer involvement, weather, and funding as major risks. Odeh and Battaineh (2002) evaluated risks associated with conventional contracts in Jordan, highlighting owner involvement, contractor experience, and funding issues. Frimpong et al. focused on groundwater projects in Ghana, identifying challenges such as payment delays, poor contractor management, and material shortages

(Frimpong et al., 2015). Fugar and Agyakwah-Baah (2010) in Ghana categorized risks into financial, material, and scheduling issues, while Assaf and Al-Hejji (2006) in Saudi Arabia identified changing orders as a common risk factor. Aziz (2013) in Egypt classified risks into nine categories, including consultant, contractor, design, equipment, and labour-related factors, particularly post-revolution.

Theoretical Framework

The theoretical framework underscores the interconnections of an organization's management operations and risk management through the implementation of a robust risk management framework. This framework must be seamlessly integrated into the organization's overarching strategy, rules, and procedures to ensure its efficacy in embedding risk management across all business levels. Key elements of an effective risk management framework include continual improvement, full accountability for risks, integration into decision-making processes, clear communication channels, and alignment with the organization's governance structure (Aziz, 2013). Emphasis is placed on continuous improvement, necessitating the establishment of performance goals and the measurement, review, and adjustment of processes, systems, resources, capabilities, and competencies. The framework emphasizes the importance of risk accountability, requiring clear delineation of responsibilities for risk controls and treatment, along with equipping individuals with the requisite knowledge, skills, tools, authority, time, and training for effective risk management. It mandates that organizational decision-making processes explicitly consider risks and the application of risk management, with records documenting risk discussions kept in accordance with established standards such as ISO 31000:2009. While some viewpoints may perceive risk management as a distinct supplementary responsibility, the prevailing perspective, endorsed by the researcher, advocates for its inclusion as an integral component of business operations, particularly in the construction industry. Ultimately, the overarching objectives of risk management include providing the organization with a comprehensive understanding of operational risks and ensuring that risk levels align with predefined thresholds.

Empirical Review

Tipili and Ilyasu (2014) identified and assessed the likelihood of occurrence and degree of impact of the risk factors on construction projects within the Nigerian construction industry. A self-administered questionnaire was employed to the construction industry professional for their responses on the likelihood of occurrence of risk factors and the impact of these risk factors on project performance. A total seventy-eight questionnaires were sent to construction industry professionals which comprises of Contractors, Architects, Quantity Surveyors and Engineers but Fifty-eight was return which was later analysed using descriptive statistic and analyses of variance (ANOVA) and subsequently exposure rating levels were determined which enable the categorization of the probability- impact score in Low, medium and high levels. Results of the study indicate a disparity of the ranking of the degree of occurrence and impact among the group. Based on the composite of risk factors, the cost related risk and time related risk was found to be the most likely to occur and have the most impact on project, whereas environmental risk factor was found to be low weighted risk, as it had the least likelihood to occur and the least impact score

Jayasudha and Vidivelli (2016) examined the awareness of professionals in construction industry of the various types of planning techniques and tools used on construction sites, The data obtained were analysed using the Statistical Package for Social Scientist for Windows (SPSS), and the results were presented by the use of statistical tools such as frequency tables and pie charts. The study shows that there is low awareness on the functional use of construction planning tools and techniques, and recommended that the use of the construction planning tools and techniques should be applied in all building projects and there should be regular adequate training of professionals on the effectiveness and improvement in Information Technology in the construction industry especially in project planning and execution.

Tessema, Alene and Wolelaw (2019) identified the risk factors influencing project performance in the construction sector. Data were gathered from 26 valid responses via questionnaire survey using stratified simple random sampling, yielding an 81.25 percent response rate. Factor analysis extracted seventeen independent risk factors and one dependent factor, project performance. SPSS-23 software analysed the relationship between three risk factors and project performance. The top-ranked risk variables impacting project performance included inflation, flawed design, poor material quality, delayed contractor payments, and subpar work, while labour strikes and scope of work clarity were deemed least important. Factor analysis and regression modelling identified eight significant risk variables for building projects, including construction and design risk, poor management, insufficient funding, uncertain political conditions, and unfavourable climate. The regression model highlighted inflation, delays in site access, and late contractor payments as major influences on overall project risk. These findings are expected to aid risk management in the construction sector in Gondar, Ethiopia.

Ishaq, et al. (2021) assessed the impact of risk factors on completion cost of construction projects in Nigeria. Data was collected using structured questionnaires administered to 192 construction practitioners using convenience sampling technique. Descriptive statistics (mean and standard deviation) were used to analyse the data. The study found 'inadequate cost estimate' (MS = 4.39), 'risk incurred due to bribery and corruption' (4.30), 'increase in prices of materials' (4.25), 'increase in cost of labour' (4.11), 'poor cash flow management' (4.04) 'mistakes/errors in design' (4.04) and 'mistakes during construction' to be the topmost risk factors that impact on project completion cost. The study concludes that 'economic', 'financial' and 'contract administration and project management' related factors group are those with high impact on project completion cost.

Research Design and Methodology

The research design employed in this study was a survey research design utilizing cross-sectional data collection. Surveys were utilized as the primary tool to gain insights into individual or group perspectives on the topic of interest. The study population consisted of government officials and professionals involved in TETFund projects in Enugu State University of Science and Technology, ESUT, Ebonyi State University, Abakaliki, Anambra State University Uli, Institute of Management and Technology (IMT), Enugu, and Federal Polytechnic Oko, Anambra State. Purposive sampling techniques were utilized to select respondents based on their availability and willingness to participate. Data analysis was conducted using IBM SPSS version 26, employing descriptive statistics such as frequency, percentages, means, and standard deviations. Inferential statistics including factor analysis and linear regression were utilized to test hypotheses, with p-values less than 0.05 considered significant. Results were presented in tabular format.

Data Analysis

The descriptive statistics show that the respondents' socio-demographic profile reveals that 77% are male, highlighting a gender imbalance in the study. Age distribution shows varied representation across age groups, with 50-54 years being the highest at 28.5%. In terms of education, the majority hold M.Sc. degrees (59%), followed by HND (18.8%) and PhD (12.5%) holders. Additionally, 55% of professionals are registered with their respective bodies, indicating a substantial representation across disciplines. Career status reveals that 81.5% are on regular employment, while 17% hold tenured positions, 17% are in acting roles, and 5% are on secondment.

This is the result of descriptive statistics on the data gathered from respondents with regards to the objectives of the study.

Table 1: Analysis of the first objective: Management of TETFund projects in South East Nigeria

	Frequency	*Percent*
How are TETfund projects initiated?		
By TETfund	134	33.5
By host institution	146	36.5
By an influencer	120	30.0
How are TETfund projects funded?		
Wholly by TETfund	395	98.8
Partially by TETfund	5	1.3
Rate level of difficulties in sourcing funds from TETfund?		
Very easy	45	11.3
Easy	188	47.0
Difficult	143	35.8
Very difficult	24	6.0
How are the projects funds released to host institution?		
Wholly	4	1.0
In tranches	396	99.0
If in tranches, please specify		
2-tranche	23	5.8

3-tranche	215	54.3
As need arise	158	39.9
Time interval (weeks) before release of funds		
At TETfund discretion	138	34.5
Any time they are ready	33	8.3
Any time fund is available	229	57.3

Source: Field Survey, 2023.

Table 1 shows that 33.5%, 36.5% and 30% of the TETFund projects are initiated by TETFund, host institution and an influencer respectively. Most of the TETfund projects are funded wholly by TETFund (98.8%). More than half of the respondents (58.3%) reported that it is easy to source funds from TETfund. Most of them (99%) reported that the project funds are released in tranches and 54.3% reported 3 tranches. Funds are released any time it is available (57.3%).

For Objective Two:

Table 2: Analysis of objective three: Ways for mitigating the impact of risk factors of TETfund projects

	Strongly disagree n (%)	*Disagree n (%)*	*Neutral n (%)*	*Agree n (%)*	*Strongly agree n (%)*	*Mean ± SD*
Identify all potential and significant risk	0 (0.0)	0 (0.0)	0 (0.0)	193 (48.3)	207 (51.7)	4.52 ± 0.50
Evaluate the cause, frequency and severity of risk	0 (0.0)	0 (0.0)	0 (0.0)	279 (69.8)	121 (30.3)	4.30 ± 0.46
Develop and select method to manage risk	0 (0.0)	0 (0.0)	24 (6.0)	286 (71.5)	90 (22.5)	4.17 ± 0.51
Implement the method chosen	0 (0.0)	0 (0.0)	74 (18.5)	189 (47.3)	137 (34.3)	4.16 ± 0.71
Monitor performance on an ongoing basis	0 (0.0)	0 (0.0)	28 (7.0)	186 (46.5)	186 (46.5)	4.39 ± 0.62

Source: Field Survey, 2023.

Table 2 shows that the ways for mitigating the impact of risk factors of TETfund projects include Identifying all potential and significant risk (4.52), Evaluating the cause, frequency and severity of risk (4.30), developing and selecting method to manage risk (4.17), implementing the method chosen (4.16) and monitoring performance on an ongoing basis (4.39).

Hypotheses Testing

H_0: There is no significant pattern of factors affecting the management of TETFund building projects in South East Nigeria

Table 3: KMO test of sampling adequacy and Bartlett's test of sphericity

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.837
Bartlett's Test of Sphericity	Approx. Chi-Square	4115.749
	Df	120
	Sig.	.000

***Source:** Field Survey, 2023 (KMO and Bartlett's Test)*

The Kaiser-Meyer-Olkin measure of sampling adequacy is a statistic that indicates the proportion of variance in the variables that might be caused by underlying factors. A value of 0.837 generally indicates that a factor analysis is appropriate for the data. Bartlett's test of sphericity indicates that the correlation matrix is not an identity matrix ($P < 0.001$), which means that the variables are related and therefore suitable for structure detection.

Table 4: Communalities

	Initial	*Extraction*
Lack of due diligence in pre-qualification of consultants at the early stage	1.000	.661
Change in the scope of the project	1.000	.876
Poor information flow between parties	1.000	.836
Lack of coordination at pre-contract stage	1.000	.764
Poor knowledge of project management and control by consultants	1.000	.860
Materials selection and change in types and specifications during construction	1.000	.832
Mistakes or discrepancies in documents specification issued by consultant	1.000	.878
Incomplete design prior to estimation	1.000	.829
Cash flow and financial difficulties faced by contractors in TETFund projects	1.000	.705
Improper planning and scheduling by contractor	1.000	.655
Frequent breakdown of construction equipment on site	1.000	.753
Poor understanding and interpretation of design and specification	1.000	.843
Variations, insufficient and improper detailing	1.000	.811
Poor contract coordination	1.000	.828
Unexpected inflation/material price escalation	1.000	.878
Irregular release of funds	1.000	.843

Source*: Field Survey (2023), Extraction Method: Principal Component Analysis.*

Communalities indicate the amount of variance in each variable that is accounted for. Initial communalities are estimates of the variance in each variable accounted for by all components or factors. For principal components extraction, this is always equal to 1.0 for correlation analyses. Extraction communalities are estimates of the variance in each variable accounted for by the components. The communalities in this table are all high (greater than 0.5), which indicates that the extracted components represent the variables well.

Table 5: Total Variance Explained

Component	*Initial Eigenvalues*			*Extraction Sums of Squared Loadings*			*Rotation Sums of Squared Loadings*		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	4.541	28.384	28.384	4.541	28.384	28.384	2.752	17.200	17.200
2	2.251	14.070	42.454	2.251	14.070	42.454	2.297	14.355	31.555
3	1.873	11.706	54.160	1.873	11.706	54.160	2.229	13.933	45.487
4	1.528	9.553	63.713	1.528	9.553	63.713	1.971	12.317	57.804
5	1.418	8.862	72.575	1.418	8.862	72.575	1.916	11.978	69.782
6	1.238	7.740	80.315	1.238	7.740	80.315	1.685	10.533	80.315
7	.840	5.252	85.567						
8	.561	3.507	89.074						
9	.455	2.846	91.920						
10	.347	2.170	94.090						
11	.270	1.686	95.776						
12	.220	1.377	97.153						
13	.158	.990	98.143						
14	.128	.799	98.943						
15	.117	.731	99.674						
16	.052	.326	100.000						

Source*: Field Survey (2023), Extraction Method: Principal Component Analysis.*

The total column gives the eigenvalue, or amount of variance in the original variables accounted for by each component. The % of variance column gives the ratio, expressed as a percentage, of the variance accounted for by each component to the total variance in all of the variables. So, factor 1 explains 28.4% of total variance, factor 2 explains 14.1%, factor 3 explains 11.7%, factor 4 explains 9.6%, factor 5 explains 8.9% while factor 6 explains 7.7%. The first factor explains larger amount of variance whereas the rest of the factors explain smaller amounts of variance. According to Kaiser's criterion, retain all factors with eigenvalues above 1 and 0.6 average communality. Therefore, all factors with eigenvalues greater than 1 were extracted. The eigenvalues associated with these factors are again displayed and the percentage of variance explained in the columns labeled Extraction Sums of Squared Loadings. The cumulative percentage for the 6 components is 80%. They explain 80% of the variability in the original 16 variables, so we can considerably reduce the complexity of the data set by using these components, with only a 20% loss of information. In the final part of the table (labeled Rotation Sums of Squared Loadings), the eigenvalues of the factors after rotation are displayed. Rotation has the effect of optimizing the factor structure; however, some changes occurred after the rotation. The rotation maintains the cumulative percentage of variation explained by the extracted components, but that variation is now spread more evenly over the components. The changes in the individual totals suggest that the rotated component matrix will be easier to interpret than the unrotated matrix.

Table 6: Rotated Component Matrix indicating the extracted components and factor loadings

	Component					
	1	2	3	4	5	6
Mistakes or discrepancies in documents specification issued by consultant	.922					
Incomplete design prior to estimation	.877					
Lack of coordination at pre-contract stage	.598					
Poor information flow between parties	.523					
Poor knowledge of project management and control by consultants		.836				
Frequent breakdown of construction equipment on site		.766				
Poor understanding and interpretation of design and specification		.676				
Improper planning and scheduling by contractor			.739			
Variations, insufficient and improper detailing			.735			
Materials selection and change in types and specifications during construction			.569			
Change in the scope of the project			.566			
Poor contract coordination				.849		
Lack of due diligence in prequalification of consultants at the early stage				.675		
Irregular release of funds					.889	
Cash flow and financial difficulties faced by contractors in TETFund projects					.806	
Unexpected inflation/material price escalation						.823
Source: Field Survey (2023), Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.						
a. Rotation converged in 8 iterations.						

Finally, the rotated component matrix (also called the rotated factor matrix in factor analysis) which is a matrix of the factor loadings for each variable onto each factor shows factor loadings greater than 0.5 and sorted by order of size. The result reveals six factors (components). The variables that load highly on factor 1 is design development risk factor, factor 2 is employer change risk factor, factor 3 is planning risk factor, factor 4 is construction risk factor, factor 5 is financial and economic risk factor, while factor 6 environmental and economic risk factor.

Rotated component matrix indicating the extracted components and factor loadings or factor analysis is risk factors affecting TETFund projects in South East, Nigeria. From the above, there are six identified components

Component 1: Design development risk factor, which has mistakes or discrepancies in documents and specification issued by consultants as .922, while incomplete design prior to estimate has .877, lack of coordination at pre-contract stage .598, while poor information flow between parties has .523.

Component 2: Employer change risk has poor knowledge of project management and control by consultants has .836, frequent breakdown of construction equipment on site has .766, poor understanding and interpretation of design and specification has .676.

Component 3: Planning risk factor has improper planning and scheduling by contractor has .739, variations insufficient and improper detailing .735, materials selection and change in types and specifications during construction has .569 and change in the scope of the project has .566.

Component 4: Construction risk has the following poor contract coordination .849 and lack of due diligence in prequalification of consultants at the early stage .675.

Component 5: Financial and economic risk has irregular release of funds .889, while cash flow and financial difficulties faced by contractors in TETFund projects has .806.

Component 6: Environmental and economic risk has unexpected inflation/material price escalation .823.

In conclusion, therefore, the six principal or major factors extracted shows that among other factors that are militating as TETFund projects, that these are the key factors that are posing threat to early completion of TETFund projects and if not checked could either lead to contract overrun or time overrun among others like abandonment, dispute and litigation. The implication is that if adequate attention is being paid to these key factors posing threats to TETFund projects completion in South East, Nigeria the problem/challenges would be about 98% solved.

Conclusion

This study analyzes risk factors impacting TETFund building projects in Enugu, Anambra, and Imo states in South East Nigeria, aiming to develop a policy framework for project management outcomes. Understanding these risk factors and their patterns can help alleviate project management challenges. Effective risk management involves systematic identification, assessment, and allocation of risks throughout project stages. Allocation of risks should ideally occur during contract formation, with stakeholders responsible for mitigating them. The study identifies and mitigates key risks, offering insights for tender invitations and emphasizing the importance of agreeing on risk allocation and mitigation methods before project commencement. Adequate financial and material resources are essential for effective risk response implementation.

Recommendation

Early involvement of competent consultants plays a pivotal role in the successful assessment and mitigation of construction and financial projects on behalf of TETFund initiatives. Their expertise is instrumental in devising strategies to minimize both contract and time overruns, which are common challenges faced in TETFund building projects. Consultants should provide valuable insights to TETFund on the most suitable procurement routes that can mitigate the level of exposure to construction and financial risks inherent in such projects within the Nigerian context.

During the tender return stage, consultants are tasked with conducting a comprehensive evaluation of tender returns, aiming to identify and assess all potential risks associated with each return. This process involves utilizing qualitative risk assessments and mitigation techniques to establish the risk profile of each option effectively. The utilization of a six-component risk matrix, as evidenced in Table 6, facilitates the extraction and loading of risk components, enhancing the accuracy of risk profiling.

Moreover, the appointment of a dedicated risk manager is essential for TETFund building projects. In the absence of a designated risk manager, the responsibility falls on the Quantity Surveyor to allocate and mitigate risk responsibilities among team members effectively. While collaborative efforts are required from all project stakeholders to identify risks and opportunities, the onus lies on the risk manager or Quantity Surveyor to assess and mitigate risks diligently. This entails working closely with various risk owners and the project team to evaluate the cost impact associated with each risk and devise appropriate mitigation strategies tailored to the specific project context.

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