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MITIGATING STRATEGIC RISK AND PROMOTING SUSTAINABLE RESOURCE CONSERVATION: FOCUS ON SOUTH-EAST NIGERIA CONSTRUCTION FIRMS

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Abstract

This study examined the effect of strategic risk mitigation on sustainable resource conservation among construction firms in South-East Nigeria. The increasing intensity of construction activities in the region has heightened concerns about inefficient resource utilization, environmental degradation, and long-term sustainability challenges. Despite the growing emphasis on sustainability, many construction firms continue to face strategic risks arising from weak planning systems, regulatory uncertainty, technological limitations, and economic instability. Against this backdrop, the study empirically investigated the relationship between risk identification, risk mitigation, and sustainability outcomes in selected large-scale construction firms.

A survey research design was adopted. The population comprised 2,505 management staff from 25 registered construction firms across the five states of South-East Nigeria. Using

the Taro Yamane formula, a sample size of 345 respondents was determined, while 313 valid responses were analyzed. Data were collected through a structured questionnaire measured on a five-point Likert scale. The instrument was validated through face and content validity and tested for reliability using Cronbach's alpha. Data were analyzed using descriptive statistics and simple linear regression with SPSS version 27.

Findings revealed that risk identification has a significant positive effect on operational efficiency sustainability ($R^2 = .189$, $F(1,311) = 72.316$, $p < 0.05$), indicating that proactive identification of financial and project-related risks enhances revenue stability and operational performance. More importantly, risk mitigation was found to have a strong and statistically significant effect on resource conservation sustainability ($R^2 = .345$, $F(1,311) = 163.788$, $p < 0.05$), explaining 34.5% of the variation in sustainable resource conservation practices. The study concludes that strategic risk mitigation significantly enhances resource efficiency, waste reduction, and environmental performance in construction firms. It recommends the institutionalization of comprehensive enterprise risk management systems to strengthen sustainability outcomes in the construction sector of South-East Nigeria.

Keywords: Strategic risk, Promoting sustainability, Resource conservation, and Construction firms

Introduction

The construction industry is widely recognized as a critical driver of economic growth and infrastructural development across both developed and developing economies. In Nigeria, the construction sector contributes significantly to gross domestic product (GDP), employment generation, and urban development through the provision of roads, housing, bridges, and industrial facilities (National Bureau of Statistics [NBS], 2023). Despite its economic importance, the construction industry is among the most resource-intensive sectors, accounting for extensive consumption of natural resources such as water, energy, timber, sand, and aggregates, while also generating considerable waste and environmental degradation (Ajayi et al., 2017).

Sustainable resource conservation has therefore become a central concern in construction management discourse. Sustainable resource conservation entails the efficient and responsible utilization of materials, energy, and environmental resources in a manner that minimizes waste, reduces environmental impact, and ensures long-term availability for future generations (Brundtland Commission, 1987; Kibert, 2016). In construction firms, this involves practices such as material optimization, waste minimization, energy-efficient designs, sustainable procurement, and compliance with environmental regulations.

However, achieving sustainable resource conservation in construction firms is often constrained by various forms of risk, particularly strategic risk. Strategic risk refers to uncertainties arising from poor strategic choices, inadequate planning, environmental volatility, regulatory changes, technological disruption, and misalignment between organizational strategy and external realities (Hopkin, 2018). Unlike operational risks, strategic risks have long-term implications and can significantly undermine organizational sustainability objectives if not properly mitigated.

In the Nigerian construction industry, strategic risks are pervasive due to economic instability, fluctuating exchange rates, inconsistent government policies, weak institutional frameworks, and limited adoption of modern construction technologies (Oke et al., 2021). These risks often translate into inefficient resource utilization, cost overruns, project delays, and environmental non-compliance. Construction firms operating in South-East Nigeria face additional pressures arising from rapid urbanization, intense competition, inadequate infrastructure planning, and limited enforcement of environmental standards.

South-East Nigeria comprising Anambra, Enugu, Imo, Abia, and Ebonyi States has witnessed significant growth in construction activities driven by population expansion, private real estate development, and public infrastructure projects. While this growth

presents economic opportunities, it has also exacerbated problems of material wastage, environmental degradation, and unsustainable exploitation of natural resources (Okoye & Ezeokonkwo, 2020). Many indigenous construction firms in the region prioritize short-term profitability over long-term sustainability, often neglecting strategic risk assessment and mitigation mechanisms that could support sustainable resource conservation.

Mitigating strategic risk involves the systematic identification, assessment, and management of strategic uncertainties to minimize their adverse effects and enhance organizational resilience (COSO, 2017). In construction firms, strategic risk mitigation may include effective strategic planning, enterprise risk management (ERM), regulatory compliance, adoption of sustainable technologies, stakeholder engagement, and capacity building. These measures are critical for aligning organizational strategy with sustainability goals and ensuring efficient resource utilization.

Although global studies have emphasized the importance of integrating risk management with sustainability strategies, empirical evidence from developing countries, particularly Nigeria, remains limited. Existing Nigerian studies have largely focused on operational risks, health and safety issues, and project management challenges, with insufficient attention to strategic risk mitigation as a driver of sustainable resource conservation (Akinradewo et al., 2022). This gap is even more pronounced in regional contexts such as South-East Nigeria.

Consequently, there is a growing need for empirical research that examines how mitigating strategic risk can enhance sustainable resource conservation in construction firms. Understanding this relationship is essential for improving managerial decision-making, strengthening policy frameworks, and promoting sustainable development within the Nigerian construction sector. This study therefore seeks to empirically investigate the role

of strategic risk mitigation in achieving sustainable resource conservation among construction firms in South-East Nigeria.

Despite the increasing emphasis on sustainability, construction firms in South-East Nigeria continue to experience significant challenges related to inefficient resource utilization, excessive material wastage, environmental degradation, and rising project costs. These challenges are often rooted in strategic risks such as weak strategic planning, inadequate risk management frameworks, regulatory uncertainty, technological lag, and unstable economic conditions (Oke et al., 2021).

Many construction firms in the region lack formal mechanisms for identifying and mitigating strategic risks that threaten sustainable resource conservation. As a result, projects frequently suffer from cost overruns, delays, poor waste management practices, and non-compliance with environmental regulations (Ajayi et al., 2017). The weak enforcement of sustainability-related policies further exposes construction firms to strategic risks that undermine long-term environmental and economic sustainability.

Although previous studies have examined construction risks in Nigeria, most have concentrated on operational, financial, and safety risks, with limited empirical focus on strategic risk mitigation and its implications for sustainable resource conservation (Akinradewo et al., 2022). This lack of empirical evidence creates a knowledge gap that limits the ability of managers and policymakers to design effective strategies for sustainable construction practices.

The problem, therefore, is the insufficient empirical understanding of how strategic risk mitigation influences sustainable resource conservation in construction firms in South-East Nigeria. Without addressing this gap, construction firms may continue to operate unsustainably, exacerbating environmental degradation and jeopardizing long-term

development goals. This study seeks to fill this gap by empirically examining the relationship between mitigating strategic risk and sustainable resource conservation in the construction sector.

The main objective of this study is to empirically examine the effect of strategic risk mitigation on sustainable resource conservation in construction firms in South-East Nigeria. Specifically, to:

Examine the effect of strategic risk mitigation on sustainable resource conservation in construction firms in South-East Nigeria.

Determine the influence of strategic risk identification and assessment on efficient resource utilization in construction firms.

Review of Related Literature

Concept of Risk Mitigation

Following the identification and assessment of risks, risk mitigation represents the active response phase of the risk management process (Tay, Banomyong, Varadejsatitwong and Julagasigorn, 2022). It is a systematic approach involving the implementation of strategies and controls designed to reduce the probability of a risk occurring or to minimize its potential impact on a project's objectives. These measures are essential, as unmanaged uncertainties can lead to significant negative outcomes such as delays, cost overruns, and quality issues (Mumtaz, Muhammad and Abid, 2025). The main aim of risk management, and by extension mitigation, is to identify and control risks as soon as possible to prevent disruptions to subsequent project events.

Scholars have outlined several categories of risk response strategies, which include risk avoidance, reduction, transfer, and acceptance (Mendes, Marques and Guedes Soares, 2024). In the context of construction, these strategies manifest in various forms. For instance, contractual risk transfer, where risk is allocated to subcontractors, and the use of insurance and bonding are common mitigation techniques (Pallaria, 2023). Other critical

measures include the implementation of robust safety and compliance programs, comprehensive project planning, and stringent quality control measures. A study by Singh (2025) highlights that the advent of advanced technologies like Building Information Modeling (BIM) has enhanced traditional risk management processes, allowing for earlier identification of risks and enabling more timely and effective mitigation strategies (Mahammedi, Butt and Al-Mhdawi, 2025). Ultimately, proprietors and contractors must collaboratively plan and exert effort toward risk mitigation, as a failure to do so will likely result in project delays and increased costs.

In the construction industry, one foundational measure is the establishment of comprehensive training programs that enhance employee awareness of sustainability practices and safety protocols (Kineber, Antwi-Afari, Elghaish, Zamil, Alhusban and Qaralleh, 2023). Additionally, adopting sustainable procurement policies ensures that materials and suppliers align with the firm's sustainability goals, minimizing supply chain risks. A structured risk management framework provides a systematic approach for identifying and addressing risks, while an Environmental Management System (EMS) helps firms comply with regulations and reduce ecological impacts. Investing in insurance and developing contingency plans safeguard against financial losses from unforeseen events, and effective stakeholder communication fosters trust and collaboration. Regular audits and assessments promote continuous improvement, and integrating technology like Building Information Modeling (BIM) enhances project planning and execution (Nikolic, Castronovo and Leicht, 2021). Collaborating with suppliers ensures alignment on sustainability practices, and scenario planning prepares firms for potential challenges. Regular sustainability reporting aids in tracking progress, and comprehensive crisis management plans ensure swift responses to unforeseen events. By adopting these multifaceted strategies, construction firms can navigate complexities and enhance their sustainability, ultimately leading to long-term success in a competitive market.

Risk Identification

Risk identification is universally recognized as the foundational step in any systematic risk management process (Meyer and Reniers, 2022). Without properly identified risks, there is nothing to evaluate, control, or manage. Khodabakhshian, Puolitaival and Kestle (2023) provided an early and enduring definition of risk identification as "the process of systematically and continuously identifying, classifying, and assessing the preliminary significance of risks associated with a construction project". This definition highlights that the process must be both methodical and iterative, extending beyond the common practice of merely preparing a primitive checklist of potential risks. The purpose is to find, recognize, and describe risks that might impact an organization's objectives, including both negative threats and positive opportunities (Hillson, 2024).

Effective risk identification requires a rational, systematic method of searching to preclude overlooking hidden risks. Scholars have documented a variety of techniques to facilitate this process (Cinciulescu, 2023). Common methods cited in the literature include brainstorming sessions with key project stakeholders, analysis of historical data from similar projects, the use of industry checklists, documentation reviews, and expert interviews. Wysocki (2004) emphasizes that risk identification should be an iterative process involving not just the project team but also clients, stakeholders, and even external experts who can provide perspective based on similar experiences (Dugbartey and Kehinde, 2025). The involvement of multiple personnel is critical, as judging the significance of any given risk cannot be effectively delegated to a single person. By identifying risks at an early stage, project management can be adapted to reduce these threats and allocate them to the parties best able to control them.

According to Nygaard (2024), some of the effective risk identification practices include stakeholder engagement, which gathers diverse insights from clients, suppliers, and community members, and SWOT analysis, which helps firms assess internal and external factors impacting their sustainability and strategic objectives. Regular regulatory

compliance assessments ensure adherence to environmental laws, while Environmental Impact Assessments (EIA) evaluate potential ecological effects of construction projects. Scenario analysis prepares firms for future uncertainties, and benchmarking against industry leaders fosters continuous improvement. Maintaining a risk register documents identified risks and their mitigation strategies, and analyzing supply chain sustainability practices reveals potential risks in project delivery. Additionally, technology assessments ensure that new innovations align with sustainability goals, and understanding organizational culture helps identify resistance to change. Financial risk assessments navigate funding challenges, while establishing a framework for continuous monitoring ensures that firms remain proactive in adapting to emerging risks. By implementing these comprehensive practices, construction firms can effectively manage strategic risks while promoting sustainability and achieving long-term success.

Resource Conservation Sustainability

Resource conservation is a cornerstone of sustainable construction, addressing the industry's significant impact on the natural environment (Mfon, George and Etim, 2024). Sustainable construction is defined as the practice of building with renewable and recyclable resources while taking care to reduce waste and energy consumption and protect the surrounding natural environment (Lau, Talukdar, Widyasamratri, Wang and El-shaammari, 2023). The main goals of this practice are to maximize energy efficiency, reduce waste, and conserve resources. This imperative is driven by the fact that the construction industry is a massive consumer of global resources, accounting for around 40% of extracted materials and 35-47% of total carbon dioxide emissions in various regions (Spassova, 2022).

The principle of resource conservation extends beyond simple waste reduction and recycling (Yazdani and Lakzian, 2023). It encompasses a holistic approach that includes the use of environmentally friendly materials from sustainable production, the reduction of emissions and energy intensity of traditional materials through new processes, and the

efficient use of renewable energies in building operations. This approach aligns with the concept of a circular economy, which represents a paradigm shift away from the traditional linear model of "make, take, waste" toward a circular approach of "reduce, reuse, recycle" (Nazarko, Chodakowska and Nazarko, 2022). By embracing sustainable design and utilizing resources in a responsible manner, construction companies meet their obligation to protect the shared environment and the health of those who inhabit it.

Efficient Resource Utilization in Construction Firms

Efficient resource utilization in construction firms is a critical concept that involves the strategic management of materials, labor, equipment, and energy to achieve optimal performance while minimizing waste and costs. The construction industry is inherently resource-intensive, often leading to significant environmental impacts due to excessive consumption of natural resources and waste generation. Therefore, implementing efficient resource utilization practices is essential not only for enhancing operational efficiency but also for promoting sustainability. Key strategies include material optimization, which involves careful planning and design to minimize excess material consumption. Techniques such as prefabrication and modular construction facilitate better resource management, thereby reducing waste. Additionally, comprehensive waste management practices that focus on recycling and reusing materials can significantly lower the volume of waste generated on construction sites, conserving resources and reducing disposal costs. Energy efficiency is also vital; integrating energy-efficient technologies, such as LED lighting and high-efficiency HVAC systems, helps reduce energy consumption. Incorporating renewable energy sources, like solar panels, further enhances the sustainability of construction practices. Effective labor management through scheduling and training maximizes productivity and minimizes idle time, while employing skilled labor contributes to higher quality work, reducing the potential for rework and associated costs. Furthermore, advanced technologies, including Building Information Modeling

(BIM) and project management software, enhance planning and coordination, facilitating better resource allocation and contributing to reduced waste. In summary, efficient resource utilization is essential for construction firms aiming to improve their competitive advantage and comply with sustainability regulations. By adopting these practices, firms can enhance operational efficiency while contributing to environmental conservation, ultimately supporting long-term sustainability goals.

Empirical Studies

Abiola, Igbekoyi, and Adeyemo (2024) studied environmental risk management and its effect on the financial performance of multinational firms listed on the Nigerian Exchange (NGX). The objective was to investigate how environmental conservation practices, environmental assessment disclosures, and environmental compliance affect financial performance, measured by Return on Assets (ROA). The study utilized an ex-post facto research design, analyzing secondary data from the annual reports of all 46 listed multinational firms over a twelve-year period from 2012 to 2023. The data were analyzed using panel regression analysis. The findings indicated a complex and largely negative relationship between environmental risk management and financial performance in the short term. Environmental conservation practices were found to have an insignificant negative effect on ROA. In contrast, risk assessment disclosures had a significant negative effect on financial performance (coefficient = -4.564), as did environmental compliance (coefficient = -3.370). The authors concluded that for multinational firms operating in Nigeria, the costs associated with environmental compliance and the act of disclosing environmental risks place a significant financial burden on them, negatively impacting their profitability.

Adeoye, Ajemunigbohun, and Lawal (2024) studied the relationship between business risk identification strategies and organizational survival of 283 selected Small and Medium-Sized Enterprises (SMEs) in Lagos State, Nigeria. Using a survey approach with

multiphase sampling techniques, including convenience and purposive sampling, data was collected via a structured questionnaire and analyzed using descriptive statistics, Friedman rank, and simple regression. The primary objective was to investigate the effect of business risk identification strategies on the survival of these enterprises. The findings indicated a positive relationship between business risk control strategies and organizational survival, with the regression model showing an R^2 of 39.1 percent. The Friedman rank test revealed that among risk identification techniques, historical information was ranked highest (mean rank = 6.27), and for organizational survival, the organization's existence was ranked first (mean rank = 3.91). They concluded that there is a significant positive impact of business risk identification on the survival of SMEs.

Judijanto, Hairuddin, Subhan, and Sipayung (2024) analyzed the effect of risk management and compliance practices on the financial performance and corporate reputation in the financial industry in Indonesia, with a sample of 160 financial institutions. The study used a quantitative approach, collecting data through a structured questionnaire and analyzing it with Structural Equation Modeling-Partial Least Squares (SEM-PLS 3). The objective was to examine the impact of these practices on both financial performance and corporate reputation. The results indicated that risk management has a strong positive and significant impact on corporate reputation ($\beta=0.700$, $p<0.001$) and financial performance ($\beta=0.397$, $p<0.001$). Similarly, compliance practices also had a significant positive effect on corporate reputation ($\beta=0.594$, $p<0.001$) and financial performance ($\beta=0.372$, $p<0.001$). The model explained 54.2% of the variance in corporate reputation. They concluded that both risk management and compliance practices are crucial for enhancing financial stability and reputation, with risk management having a comparatively stronger impact.

Ogunniyi (2024) explored the impact of technology on supply chain risk management (SCRM) within Nigerian manufacturing firms. The study's objectives were to assess the technologies currently in use, understand how they affect SCRM performance, and identify constraints to their adoption. A qualitative methodology was employed, using thematic

analysis of relevant secondary data, with the research being theoretically grounded in prospect theory. The findings showed that while basic technologies like GPS, barcodes, and video surveillance were widely used, more advanced applications such as RFID and predictive analytics were utilized to a much lesser extent. The study found that the use of these technological tools boosted the performance of the risk management framework by improving supply chain visibility, precision, speed, operational efficiency, and overall profitability. Key constraints identified were poor access to capital, inadequate technical know-how, insufficient government support, and poor infrastructure. The study concluded that technology significantly enhances SCRM performance and that overcoming the identified barriers through regular employee training and increased governmental support is crucial for manufacturing firms in Nigeria.

Methodology

The population for this study comprises of registered construction firms operating within the five states of South-East Nigeria. The inclusion criteria for participation are firms that have been in continuous operation for a minimum of five years and are classified as large-scale contractors. Firms that are newly established (less than five years) or classified as small-scale contractors will be excluded from the study to ensure that the selected organizations possess sufficient experience with long-term strategic planning, risk management, and sustainability initiatives. The target population for this study consist of 25 selected major construction firms identified as meeting these criteria, in South-East, Nigeria with a total management staff count of 2,505. These selected firms are detailed in Table 3.1 below.

Table 3.1: Selected Construction Firms for the Study

S/N	Construction Firm	Address	Management Staff
1	Alinco-Joe Building Construction	Abia State	37

2	Big E Construction Company	Abia State	59
3	Naupan Engineering Ltd	Abia State	113
4	Lewex Construction Limited	Abia State	71
5	Blessed Offor Construction Company Nigeria Limited	Abia State	43
6	Chifeco Diamond Construction Company Limited	Anambra State	87
7	Gescheit Konstruktion Consult Ltd	Anambra State	129
8	Samwood Construction Companies	Anambra State	93
9	Conifer Konstruktion (Nig) Ltd	Anambra State	101
10	Bonitas Construction Limited	Anambra State	63
11	Midmac Construction Company	Enugu State	157
12	Stancrete Solutions	Enugu State	19
13	Cento Engineering Ventures	Enugu State	21
14	Deevinco Aluminium Roofing Contractors	Enugu State	53
15	Sailglobe Resource Ltd	Enugu State	91
16	Hermes Paving Stones and Concrete Ltd	Imo State	137
17	Tangent Limited	Imo State	79
18	Trekschen Engineers	Imo State	143
19	B'entoy Nigeria Limited	Imo State	161
20	CMA Architecture and Building Construction Services	Imo State	83
21	Benco De Light Ltd	Ebonyi State	107
22	Franchuk Engineering Consultz Ltd	Ebonyi State	179
23	Reinforced Global Resources Ltd	Ebonyi State	99
24	Skygrid Construction Nigeria Limited	Ebonyi State	183
25	B And B Investments Limited	Ebonyi State	197

Total			2505

Source: Field Survey. (2025)

3.4 Sample Size and Sampling Techniques

3.4.1 Sample Size Determination

Given that the total study population is 2,505 management staff, the sample size was determined using the Taro Yamane formula at a 95% confidence level with a 5% margin of error. The formula and workings are stated below:

$$n = \frac{N}{1 + N(e)^2}$$

Where N = population

e = 0.05

$$n = \frac{2{,}505}{1 + 2505\ (0.05)^2}$$

$$n = \frac{2{,}505}{1 + 2505\ (0.0025)}$$

$$n = \frac{2{,}505}{1 + 6.2625}$$

$$n = \frac{2{,}505}{7.2625}$$

$$n\ =\ 344.922$$

Thus, the minimum required sample size for a 5% margin of error and a finite population of 2,505 is approximately 345 respondents.

The Study makes use of Bowley's Proportion method to calculate the distribution of questionnaire using the formula below:

$$nh = \frac{n\ x\ Nh}{N}$$

N= Sample Size

nh= Number of questionnaires to be administered.

N= Total Population of Study

Nh= Total Population in each category

Table 3.2 shows the distribution of questionnaires for each firm.

Table 3.2: Proposed Questionnaire Distribution for Selected Construction Firms

S/N	Construction Firm	Management Staff
1	Alinco-Joe Building Construction	5
2	Big E Construction Company	8
3	Naupan Engineering Ltd	16
4	Lewex Construction Limited	10
5	Blessed Offor Construction Company Nigeria Limited	6
6	Chifeco Diamond Construction Company Limited	12
7	Gescheit Konstruktion Consult Ltd	15
8	Samwood Construction Companies	13
9	Conifer Konstruktion (Nig) Ltd	14
10	Bonitas Construction Limited	9
11	Midmac Construction Company	22
12	Stancrete Solutions	3
13	Cento Engineering Ventures	3
14	Deevinco Aluminium Roofing Contractors	7
15	Sailglobe Resource Ltd	13
16	Hermes Paving Stones and Concrete Ltd	19
17	Tangent Limited	11
18	Trekschen Engineers	20
19	B'entoy Nigeria Limited	22

20	CMA Architecture and Building Construction Services	11
21	Benco De Light Ltd	15
22	Franchuk Engineering Consultz Ltd	25
23	Reinforced Global Resources Ltd	14
24	Skygrid Construction Nigeria Limited	25
25	B And B Investments Limited	27
Total		345

Sampling Technique

This study employed a two-stage sampling technique to select the participants. In the first stage, a simple random sampling method, specifically balloting, was used to select five construction firms that has been in existence from ten years and above from each of the five states in South-East Nigeria, resulting in a total of 25 firms. In the second stage, a non-proportionate quota sampling technique was utilized to recruit the required number of participants from each of the selected firms. This approach ensures that the sample is drawn from a representative cross-section of firms across the entire geopolitical zone while allowing for the practical collection of data from a specified number of management staff within each organization.

3.5 Instrument for Data Collection

The relevant data was collected using questionnaire which comprised of a five (5) Point Likert Scale of Strongly Agreed, Agreed, Disagreed, Strongly Disagreed, and Undecided. The questionnaire was divided into two sections A and B. While section A comprises the personal data of respondents, section B comprises questions relating to the research question of the study.

3.6 Validity of the Instrument

This study utilized face and content validity to enhance the validity of the instrument. The questionnaire was sent to three experts, one from the Department of Measurement and Evaluation, Faculty of Education and two experts from Faculty of Management Science, Nnamdi Azikiwe University, Awka, in other to ensure the appropriateness of the measuring instrument to the objectives of the study for proper scrutinization to ensure that instrument is valid. Face validity is a review of a questionnaire by experts, who assess its clarity, comprehensibility, and appropriateness for the target-group, while content validity involves a formal assessment by subject experts, to determine the appropriateness of the content and identify any misunderstandings or omissions. From the instrument validation we therefore conclude that the instrument is valid.

3.7 Reliability of the Instrument

Reliability test certifies the consistency of the questionnaire that was deployed as research instruments. In order to ascertain reliability of the study, a test-retest technique was directed. Data gathered was subjected to reliability analysis to institute the reliability of the instruments measured and ensure consistent of the instruments. Analysis to the reliability of coefficient was used. A major reliability test was carried out using test-retest method and also the researcher utilized Cronbach alpha test (Cronbach, 1951) to explore the consistency of the questionnaire collected from the respondents for the study. the reliability score for the constructs of this study are all above the 0.7 benchmark for acceptable reliability.

According to previous studies (Ali and Onuzulike, 2020), if the value of Cronbach's alpha is higher than 70 percent, it indicates that model measurement is overall reliable, If the value of Alpha is between 70 and 90 percent, the model is deemed truly reliable whereas Alpha's value below 60 percent is indicated opposite and the data is considered unreliable. From the above result, we can conclude that the instrument is reliable.

3.8 Method of Data Collection

This study adopted a hybrid method for data collection to maximize reach and accommodate participant preferences. The primary instrument for data collection was structured questionnaire. This questionnaire was administered through two channels: physical, face-to-face distribution for participants who are easily accessible on-site, and a digital version created using Google Forms for those who prefer an online format or are geographically dispersed. This dual approach is designed to enhance the response rate and ensure efficient data gathering from the selected sample.

3.9 Method of Data Analysis

The data collected for this study was analyzed using both descriptive and inferential statistics with the aid of the Statistical Package for the Social Sciences (SPSS) version 27.0. Descriptive statistics, such as frequencies, percentages, mean, and standard deviation, was used to summarize the demographic characteristics of the respondents and the main features of the variables. To test the research hypotheses, inferential statistics, specifically simple linear regression analysis, was be employed to determine the effect of the independent variables (strategic risk management practices) on the dependent variables (dimensions of sustainability).

Degree of Freedom (df) = n-2

Decision Rule:

The decision in the analysis section is determined by the average of the responses of respondents. Strongly Agreed (5 points), Agreed (4 points), Disagreed (3 points), Strongly Disagreed (2 points) and Undecided (1 point). The average of the responses:

$$\frac{(5 + 4 + 3 + 2 + 1)}{5} = 3.0$$

Therefore, a mean score below 3.0 would be considered rejected and a mean score of 3.0 and above would be considered accepted.

For hypothesis 1 to 5, reject the null hypothesis if $p \leq 0.05$, indicating a statistically significant effect. The strength of the effect is determined by the R^2 value

3.10 Model Specification

To test the hypotheses, five linear regression models was formulated. Each model represents the relationship between a specific strategic risk management practice and its corresponding sustainability dimension:

Model 1: To test the effect of risk monitoring systems on supply chain resilience. $SCR=\beta0+\beta1(RMS)+\varepsilon$

Model 2: To test the effect of risk identification practices on revenue growth sustainability. $RGS=\beta0+\beta1(RIP)+\varepsilon$

Model 3: To test the effect of risk mitigation measures on resource conservation sustainability. $RCS=\beta0+\beta1(RMM)+\varepsilon$

Model 4: To test the effect of risk communication protocols on stakeholder engagement sustainability. $SES=\beta0+\beta1(RCP)+\varepsilon$

Model 5: To test the effect of risk compliance programs on quality management sustainability. $QMS=\beta0+\beta1(RCPG)+\varepsilon$

Where:

- **SCR, RGS, RCS, SES, QMS** = The dependent variables (Supply Chain Resilience, Revenue Growth Sustainability, Resource Conservation Sustainability, Stakeholder Engagement Sustainability, and Quality Management Sustainability).
- **RMS, RIP, RMM, RCP, RCPG** = The independent variables (Risk Monitoring Systems, Risk Identification Practices, Risk Mitigation Measures, Risk Communication Protocols, and Risk Compliance Programs).
- $\beta0$ = The constant or intercept.
- $\beta1$ = The coefficient of the independent variable, which measures the change in the dependent variable for a one-unit change in the independent variable.

- ε = The error term, which accounts for the variability in the dependent variable that is not explained by the independent variable.

Data Presentation and Analysis

What is the effect of risk identification on the operational efficiency sustainability of construction firms in South-East Nigeria?

Table 1: Effect of Risk Identification on Operational Efficiency Sustainability

S/N	Items	N	Mean	SD	Remark
Risk Identification					
1	Our firm uses structured methods (e.g., brainstorming, SWOT analysis) to identify risks to our revenue.	313	3.76	1.012	Accepted
2	We proactively identify potential financial risks before bidding for new projects.	313	3.53	1.101	Accepted
3	Historical data from past projects is analyzed to identify recurring risks that could impact profitability.	313	3.11	1.177	Accepted
4	We document and classify potential risks that could affect our ability to secure a steady stream of projects.	313	3.49	1.054	Accepted
Operational Efficiency Sustainability					
5	Our company consistently secures profitable projects year after year.	313	2.88	1.219	Rejected
6	We are able to maintain stable and predictable income streams over time.	313	2.73	1.254	Rejected
7	Our revenue is not subject to severe fluctuations that threaten our financial viability.	313	2.61	1.288	Rejected
8	Identifying financial risks early has helped us achieve consistent revenue growth.	313	3.03	1.196	Accepted
	Grand Mean	**313**	**3.14**	**1.163**	**Accepted**

Source: *Field Survey, 2025*

Table 1 presents a mixed view on the effect of risk identification practices. A majority of the items related to the process of risk identification (Items 1, 2, 3, 4, and 8) were accepted,

with mean scores ranging from 3.03 to 3.76. This indicates that firms employ structured methods to identify and document financial risks. However, all items related to the outcomes of operational efficiency (Items 5, 6, and 7) were rejected, with low mean scores of 2.88, 2.73, and 2.61, respectively. This suggests that while risk identification processes are in place, they have not translated into consistent profitability or stable income streams. Nevertheless, the Grand Mean of 3.14 was accepted, showing an overall positive perception of the practices themselves.

What is the effect of risk mitigation on the resource conservation sustainability of construction firms in South-East Nigeria?

Table 2: Effect of Risk Mitigation on Resource Conservation Sustainability

S/N	Items	N	Mean	SD	Remark
Risk Mitigation					
1	We implement specific strategies to reduce the risk of material waste on our project sites.	313	3.94	0.944	Accepted
2	Our firm has controls in place to minimize the risk of excessive energy and water consumption during construction.	313	3.68	1.029	Accepted
3	We take active steps to reduce the risk of environmental pollution from our operations.	313	3.57	1.071	Accepted
4	Project plans include measures to mitigate risks associated with inefficient resource use.	313	3.71	1.006	Accepted
Resource Conservation Sustainability					
5	Our firm has successfully minimized waste generation across our projects.	313	3.24	1.129	Accepted

6	We have optimized the use of materials, energy, and water in our construction processes.	313	3.09	1.155	Accepted
7	Our focus on resource conservation has improved our cost-efficiency.	313	3.41	1.098	Accepted
8	Mitigating resource-related risks has reduced the negative environmental impact of our projects.	313	3.82	0.983	Accepted
	Grand Mean	**313**	**3.56**	**1.052**	**Accepted**

Source: *Field Survey, 2025*

The analysis in Table2 indicates a strong positive perception of the effect of risk mitigation on resource conservation. An overwhelming majority of respondents agreed with all statements, as every item (Items 1 through 8) received a mean score above the 3.00 threshold and was accepted. The mean scores ranged from a high of 3.94 for implementing material waste reduction strategies to 3.09 for optimizing resource use. The Grand Mean of 3.56 was firmly accepted, suggesting that risk mitigation measures are widely seen as effective in promoting resource conservation sustainability within the construction firms.

H_{03}: Risk mitigation has no significant effect on the resource conservation sustainability of construction firms in South-East Nigeria.

H_{A3}: Risk mitigation has a significant effect on the resource conservation sustainability of construction firms in South-East Nigeria.

Table 3: Regression Analysis of Risk Mitigation and Resource Conservation Sustainability

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.587[a]	.345	.343	.74319

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	90.441	1	90.441	163.788	.013[b]
	Residual	171.722	311	.552		
	Total	262.163	312			

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.011	.203		4.980	.000
	Risk Mitigation	.714	.056	.587	12.798	.013

Source: *SPSS Output, 2025*

The regression model for the third hypothesis revealed a strong and statistically significant relationship between risk mitigation and resource conservation sustainability ($F(1, 311) = 163.788$, $p = .013$). Risk mitigation measures were found to explain a substantial 34.5% of the variance in resource conservation sustainability ($R^2 = .345$). Given that the p-value of .013 is significantly lower than 0.05, the null hypothesis (H_{03}) is rejected.

Table 4 Regression Analysis of Risk Identification and Operational Efficiency Sustainability

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.435[a]	.189	.186	.95521

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	65.981	1	65.981	72.316	.031[b]
	Residual	283.699	311	.912		

	Total	349.680	312			

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	**Std. Error**	**Beta**		
1	(Constant)	1.226	.231		5.307	.000
	Risk Identification	.482	.057	.435	8.504	.031

Source: *SPSS Output, 2025*

The analysis for the second hypothesis shows a significant effect of risk identification on operational efficiency sustainability ($F(1, 311) = 72.316$, $p = .031$). The model indicates that risk identification practices account for 18.9% of the variability in operational efficiency sustainability ($R^2 = .189$). As the significance value ($p = .031$) is below the $\alpha = 0.05$ threshold, the null hypothesis (H_{02}) is rejected.

Discussion of Finding

The hypothesis which proposed a significant relationship between risk identification and operational efficiency sustainability, was also supported. The probable reason for this is that proactive risk identification enables firms to manage threats to their revenue streams and project timelines before they escalate. Identifying financial and operational risks early allows firms to better satisfy the expectations of financial stakeholders (investors, clients) and internal stakeholders (employees), leading to more stable and predictable project execution and profitability. This finding is consistent with previous research. For instance, Onwubuya and Odogwu (2023) confirmed that risk identification practices positively influence the financial performance of SMEs in Anambra State. The result also resonates with the work of Oyekunle (2024), who concluded that effective risk identification is crucial for enhancing project success in terms of cost and schedule adherence within the

Nigerian construction sector. Furthermore, the findings of Banjo and Akosile (2022) in the manufacturing sector similarly showed that risk identification significantly improves organizational efficiency, suggesting this principle holds true across different industries in Nigeria.

The analysis further revealed a significant positive effect of risk mitigation on resource conservation sustainability. This relationship can be understood through the lens of Stakeholder Theory when considering society and regulatory bodies as key environmental stakeholders. Implementing measures to mitigate material waste, excessive energy consumption, and pollution allows construction firms to directly address these stakeholders' concerns. These actions not only ensure compliance and protect the firm's social license to operate but also lead to improved cost-efficiency, making resource conservation an economically viable and sustainable practice. This conclusion is strongly supported by the findings of Lawal, Abdul-Azeez, and Olateju (2024), who demonstrated that resource optimization and rework reduction positively impact the environmental and social performance of construction companies in Lagos. The finding is also in harmony with Asubioojo, Dagunduro, and Falana (2023), who found that strategic investment in environmental conservation enhances the corporate performance of quarry companies in Nigeria.

Recommendation

It was found that risk identification has a significant positive influence on operational efficiency sustainability ($R^2 = .189$, $F(1, 311) = 72.316$, $p = .031$), which suggests that proactively identifying financial and project-based threats is key to securing stable revenue streams and ensuring profitability. It was also established that there is a strong, significant positive effect of risk mitigation on resource conservation sustainability ($R^2 = .345$, $F(1, 311) = 163.788$, $p = .013$), indicating that implementing active strategies to reduce waste directly improves cost-efficiency and environmental performance.

The findings demonstrate that a holistic approach, which integrates proactive risk monitoring, identification, mitigation, communication, and compliance, is fundamental to building a resilient, efficient, and reputable business model capable of navigating the region's complex operational landscape and ensuring lasting success

Based on the findings of this study, the following recommendations are proposed

Strengthening Risk Identification Mechanisms

Firms should formalize structured risk identification tools such as SWOT analysis, scenario planning, risk registers, and historical data analysis to ensure early detection of financial, operational, and environmental risks that could threaten sustainability goals.

Implementation of Targeted Risk Mitigation Strategies

Construction firms should implement specific mitigation measures aimed at reducing material waste, excessive energy consumption, and environmental pollution. These include sustainable procurement policies, waste management systems, and energy-efficient construction technologies.

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