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Mitigating Supply Chain Vulnerabilities in Nigeria: The Critical Role of Insurance as a Financial Risk Control Strategy

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Abstract
This study investigates the role of insurance as a financial risk control strategy in mitigating supply chain vulnerabilities in Nigeria, a country characterized by significant infrastructural, political, and regulatory challenges. Employing a survey research design, the research integrates quantitative analysis of survey data from 366 respondents with insights from relevant literature. The survey utilized a 5-point Likert scale to assess perceptions of key supply chain vulnerabilities and the effectiveness of insurance in addressing these risks. Results reveal that the most significant supply chain vulnerabilities in Nigeria are regulatory uncertainty (mean = 3.21), political instability (mean = 3.19), and infrastructure inadequacies (mean = 3.13). These factors were ranked as the top concerns, reflecting their substantial impact on supply chain efficiency. In contrast, issues related to insurance, such as high premiums (mean = 3.00) and limited coverage options (mean = 3.08), were perceived as less significant. Regression analysis further elucidates the relationship between insurance effectiveness and supply chain vulnerability mitigation. The model shows a strong positive correlation (R = 0.78), with insurance effectiveness explaining 60.8% (R^2 = 0.608) of the variance in supply chain risk mitigation. The ANOVA results confirm the significance of the regression model (F = 90.00, p-value = 0.0000), indicating that insurance effectiveness significantly contributes to reducing supply chain vulnerabilities. The coefficient analysis reveals that for each unit increase in insurance effectiveness, there is a 0.70 increase in vulnerability mitigation, highlighting the substantial impact of effective insurance coverage.
Keywords: Supply chain vulnerabilities, insurance, financial risk control, risk management, Nigeria.

Introduction

In the contemporary global economy, supply chains are increasingly recognized as critical components of economic stability and growth. They encompass the processes of production, handling, and distribution of goods and services, forming an intricate network of interconnected activities (Christopher, 2016). As globalization has expanded, the complexity and interdependence of these networks have increased, exposing them to a range of vulnerabilities. These vulnerabilities can disrupt operations, lead to financial losses, and have broader economic repercussions (Heckmann et al., 2015). In addressing these vulnerabilities, risk management strategies, including insurance, play a pivotal role in stabilizing and safeguarding supply chains.

Globally, supply chains face an array of risks. Key among these are infrastructural deficiencies, political instability, economic fluctuations, and natural disasters. For instance, research indicates that supply chain disruptions due to inadequate infrastructure can lead to significant economic losses, with companies experiencing operational delays and increased costs (Kovács & Spens, 2007). Political instability, such as trade wars or regional conflicts, further exacerbates these risks by introducing uncertainties that can impact global supply

networks (Braz et al., 2020). Economic fluctuations, including currency volatility and inflation, also pose challenges by affecting the cost and availability of materials and services (Gelsomino et al., 2016). Additionally, natural disasters and climate change introduce unpredictable elements that can severely disrupt supply chains, as evidenced by the impacts of recent events like the COVID-19 pandemic and natural disasters (Ivanov & Dolgui, 2020).

Nigeria, as one of Africa's largest and most dynamic economies, exhibits a supply chain network with significant potential but also notable vulnerabilities. The Nigerian supply chain landscape is marked by several challenges, reflecting broader global trends but also unique local issues. Nigeria's infrastructure is often cited as inadequate, with deficiencies in transportation networks and energy supply posing severe challenges. For example, poor road conditions and unreliable power supply create bottlenecks that hinder the efficient flow of goods (Ogunleye et al., 2018). The state of Nigerian ports also contributes to logistical delays and increased costs (Bello et al., 2019). Political instability and security challenges in Nigeria further complicate supply chain operations. The country has experienced various forms of political unrest and security issues, including insurgency and civil unrest, which disrupt logistics and increase operational risks (Akinwale et al., 2020). These disruptions can lead to increased costs and uncertainties in supply chain planning. Nigeria's economy is characterized by volatility, influenced by fluctuations in oil prices, inflation rates, and currency instability. Such economic uncertainties impact the cost and availability of raw materials, affecting production schedules and overall supply chain efficiency (Ojo, 2021). The dependence on oil exports exacerbates these vulnerabilities, making the economy susceptible to global market fluctuations (Ayeni & Ojo, 2019). The frequency of natural disasters, such as floods and droughts, along with the effects of climate change, poses significant risks to Nigerian supply chains. These events can damage infrastructure, disrupt logistics, and result in substantial economic losses (Ogunleye et al., 2020).

Insurance emerges as a critical financial risk control strategy in mitigating these vulnerabilities. By transferring the risk to insurers, businesses can protect themselves against potential losses and stabilize their operations. However, many businesses lack awareness of insurance benefits and mechanisms. Efforts to educate stakeholders about insurance are crucial for its effective adoption (Afolabi & Olaleye, 2022). Also, insurance premiums can be relatively high due to the perceived riskiness of the environment. This can limit access to insurance, especially for small and medium-sized enterprises (SMEs) (Obasi et al., 2020). Insurance covers damage to physical assets such as warehouses and factories. Given Nigeria's infrastructural challenges, property insurance can aid businesses in recovering from damages caused by accidents or natural disasters (Daramola, 2021), by providing compensation for lost income and additional expenses during operational downtime. In the context of frequent disruptions in Nigeria, this insurance offers essential financial support to sustain operations (Nwankwo et al., 2018). Despite the importance of insurance in mitigating supply chain vulnerabilities, there is a lack of empirical research on the topic in the Nigerian context. This study aims to address this gap by investigating the critical role of insurance as a risk control strategy in mitigating supply chain vulnerabilities in Nigeria. To address the gap, the following research objectives were formulated to guide the study:

i. Identify the most significant supply chain vulnerabilities in Nigeria.

ii. Determine the impact of insurance as a financial risk control strategy on the mitigation of supply chain vulnerabilities in Nigeria.

Literature Review

Supply Chain

The concept of supply chain management (SCM) has evolved significantly over the past few decades, reflecting the increasing complexity and interconnectedness of global commerce. Supply chains, as defined by Christopher (2016), involve the flow of goods, information, and finances from the point of origin to the final consumer. Supply chain management encompasses a range of activities aimed at optimizing the flow of goods and services. According to Mentzer et al. (2001), SCM integrates key business functions such as procurement, manufacturing, distribution, and customer service to enhance overall efficiency and value. This integration is critical in achieving a seamless flow from suppliers to end-users, thereby maximizing customer satisfaction and reducing costs. Supply chains consist of several core components, including suppliers, manufacturers, distributors, retailers, and customers (Heckmann et al., 2015). Each component plays a distinct role in the overall process. Suppliers provide raw materials, manufacturers convert these materials into products, distributors manage the logistics of getting products to retailers, and retailers deliver the final products to consumers. The interaction among these components must be managed effectively to ensure a smooth and efficient supply chain (Chopra & Meindl, 2019).

Supply chains face numerous challenges that can impact their performance. One major challenge is managing supply chain risk, which can arise from various sources including natural disasters, economic fluctuations, and political instability (Ponomarov & Holcomb, 2009). For instance, the COVID-19 pandemic highlighted vulnerabilities in global supply chains, causing widespread disruptions and underscoring the need for greater resilience (Ivanov & Dolgui, 2020). Another challenge is the complexity of global supply chains, which involves multiple stakeholders across different regions and industries. This complexity can lead to difficulties in coordinating activities and maintaining visibility throughout the supply chain (Bowersox et al., 2013). Furthermore, logistical issues such as transportation delays and inventory management problems can affect supply chain efficiency (Lambert et al., 1998).

To address these challenges, various strategies for optimizing supply chain performance have been proposed. Lean supply chain management, for example, focuses on eliminating waste and improving efficiency by streamlining processes and reducing inventory levels (Womack & Jones, 1996). This approach aims to enhance value for customers while minimizing costs and operational inefficiencies. Alternatively, agile supply chain management emphasizes flexibility and responsiveness. This strategy allows companies to quickly adapt to changes in demand and supply conditions, thereby improving their ability to handle disruptions and uncertainties (Christopher, 2000). Agile supply chains are particularly useful in industries characterized by rapid changes in consumer preferences and market conditions (Swafford et al., 2006). Additionally, the integration of advanced technologies such as artificial intelligence (AI), big data analytics, and blockchain has been identified as a key factor in optimizing supply chains. AI and big data analytics enable real-time monitoring and predictive analysis, which can enhance decision-making and improve supply chain visibility (Yao et al., 2018). Blockchain technology, on the other hand, offers a secure and transparent way to track and verify transactions across the supply chain, reducing fraud and enhancing trust among stakeholders (Kshetri, 2018).

Supply Chain Vulnerabilities

Supply chain vulnerabilities refer to the potential weaknesses and risks that can disrupt the smooth functioning of supply chains. These vulnerabilities can have significant impacts on operational efficiency, financial stability, and overall business performance (Alli, Jubril, & Bello, 2024). Understanding these vulnerabilities is critical for developing effective strategies to manage and mitigate risks. Supply chain vulnerabilities can arise from various internal and external factors. Internal vulnerabilities often include operational inefficiencies and management shortcomings, while external vulnerabilities involve broader environmental and market factors.

Operational inefficiencies are a major source of vulnerability within supply chains. Poorly managed inventory, inadequate logistical arrangements, and inefficient production processes can create significant weaknesses. For instance, Lambert et al. (1998) highlight how poor inventory management can lead to stockouts or overstocking, both of which disrupt supply chain continuity. Similarly, disruptions in logistics due to inadequate infrastructure or mismanagement can delay product deliveries and increase operational costs (Bowersox et al., 2013). Also, external factors also contribute to supply chain vulnerabilities. Natural disasters, geopolitical instability, and economic fluctuations are significant external risks. Natural disasters such as earthquakes, floods, and hurricanes can cause severe disruptions in supply chains by damaging infrastructure and production facilities (Sheffi, 2005). For example, the 2011 Tohoku earthquake and tsunami had a profound impact on global supply chains, highlighting the susceptibility of interconnected networks to natural calamities (Narasimhan et al., 2015). Furthermore, geopolitical instability and trade conflicts further exacerbate supply chain vulnerabilities. Political instability, trade wars, and tariffs can disrupt the flow of goods and increase costs. Bowersox et al. (2013) discuss how geopolitical risks can lead to uncertainties in supply chain planning and execution, affecting global trade dynamics. Finally, economic fluctuations, including currency volatility and inflation, also pose risks to supply chains. Changes in exchange rates can affect the cost of imported materials, while inflation can impact overall cost structures and demand (Christopher, 2016). The 2008 financial crisis is an example of how economic downturns can disrupt supply chains by causing shifts in consumer demand and financial instability (Hendricks & Singhal, 2009).

The impacts of supply chain vulnerabilities can be far-reaching, affecting various aspects of business operations. These impacts include operational disruptions, financial losses, and reputational damage. Operational disruptions caused by vulnerabilities can lead to significant delays and inefficiencies. For example, disruptions in supply chain logistics can result in missed delivery deadlines, stockouts, and production stoppages. Christopher (2016) notes that such disruptions can lead to increased lead times, higher costs, and reduced customer satisfaction. Financial losses are another major impact of supply chain vulnerabilities. The costs associated with disruptions can include increased operational expenses, lost sales, and compensation claims. For instance, Sheffi (2005) emphasizes that companies often face substantial financial losses due to supply chain disruptions, which can impact profitability and overall financial health. Reputational damage can result from supply chain vulnerabilities, particularly when disruptions affect customers or stakeholders. Companies with unreliable supply chains may suffer from negative publicity, loss of customer trust, and diminished brand value (Hendricks & Singhal, 2009). The long-term impact on a company's reputation can affect customer loyalty and market position.

To address and mitigate supply chain vulnerabilities, several strategies have been proposed. These strategies include risk management frameworks, supply chain resilience, and the use of advanced technologies. Risk management frameworks are essential for identifying, assessing, and mitigating supply chain risks. According to Ponomarov and Holcomb (2009), effective risk management involves creating a risk profile, implementing mitigation measures, and continuously monitoring risk factors. Developing contingency plans and diversifying suppliers are key components of these frameworks, helping to reduce reliance on single sources and enhance overall supply chain robustness. Building supply chain resilience is another critical strategy. Resilience refers to the ability of a supply chain to withstand and recover from disruptions. Christopher (2000) emphasizes that resilient supply chains are characterized by flexibility, adaptability, and redundancy. Strategies for enhancing resilience include diversifying sourcing options, establishing safety stock levels, and implementing flexible production processes. The adoption of advanced technologies can significantly improve supply chain management and reduce vulnerabilities. Technologies such as big data analytics, artificial intelligence (AI), and blockchain offer tools for better risk assessment, real-time monitoring, and enhanced transparency. Yao et al. (2018) highlight how big data analytics and AI can provide predictive insights and improve decision-making, while blockchain technology can enhance traceability and reduce fraud (Kshetri, 2018).

Concept of Insurance

Insurance is a financial mechanism designed to manage and mitigate risks by providing protection against financial losses from unforeseen events. The concept of insurance has evolved over centuries, becoming a critical component of modern financial and risk management systems. Insurance can be defined as a contractual arrangement where one party, the insurer, agrees to compensate another party, the insured, for specific losses or damages in exchange for periodic payments, known as premiums. Insurance as a financial tool cut across different aspect of lives by providing protection in such areas like cryptocurrency (Alli, Ganiyu, & Aina, 2020), marketing of goods and services (Ajemunigbohun, Oreshile, & Alli, 2018), information technology such as artificial intelligence (Alli, Ganiyu, & Aina, 2021), provision of retirement planning and pension for old age (Ajemunigbohun, Alli, & Ganiyu, 2018; Ajemunigbohun, Alli, & Ganiyu, 2019; Alli, Aina, & Ganiyu, 2021; Gbenga, 2020) and provision of protection for properties (Alli, Aina, & Ganiyu, 2023). According to Outreville (2013), insurance functions as a risk management tool that helps individuals and organizations protect themselves from the financial impact of adverse events. The core purpose of insurance is to spread the risk of financial loss across a large number of individuals or entities, thereby reducing the financial burden on any single participant.

Insurance plays a crucial role in risk management by providing financial protection and stability. It helps individuals and organizations manage potential financial losses from unforeseen events, thereby facilitating financial planning and risk-taking. According to Swiss Re (2020), insurance enhances economic stability by pooling risks and distributing the financial impact of adverse events across a large group. This risk pooling effect contributes to overall financial stability and economic growth. Moreover, insurance encourages risk mitigation by incentivizing the implementation of risk reduction measures. For instance, insurers may offer premium discounts for implementing safety measures or loss prevention strategies (Vaughan & Vaughan, 2014). This proactive approach to risk management benefits

both insurers and insured parties by reducing the likelihood and severity of claims (Yusuf, Ajemunigbohun, & Alli, 2017).

Insurance employs several mechanisms to manage and mitigate financial risks. The primary mechanism of insurance is risk pooling, which involves aggregating risks from multiple individuals or entities into a single pool. By doing so, the financial impact of any single loss is spread across all policyholders, reducing the potential financial strain on any one individual (Jorion, 2007). This risk transfer approach enables insurers to manage and absorb large-scale risks that would be unmanageable for individuals or businesses on their own (Miller & Smith, 2015). Insurance operates on the principle of collecting premiums from policyholders in exchange for financial protection against specified risks. Premiums are calculated based on the likelihood and potential impact of covered risks. When a covered event occurs, the insurer compensates the insured up to the policy limits, thereby mitigating the financial consequences of the loss (Vaughan & Vaughan, 2014). This systematic approach to loss coverage ensures that individuals and businesses are shielded from severe financial impacts. Effective risk mitigation through insurance relies on thorough risk assessment and underwriting processes. Underwriting involves evaluating the risk profile of applicants to determine the appropriate premiums and coverage terms. By accurately assessing risks, insurers can set premiums that reflect the level of risk and ensure that the insurance pool remains financially viable (Rejda & McNamara, 2014). This process helps in aligning the coverage provided with the actual risk exposure of the insured.

The effectiveness of insurance in mitigating financial risks has been well-documented. Insurance provides several benefits, including financial stability, improved access to capital, and enhanced risk management capabilities (Gbenga, 2024). Insurance contributes to financial stability by reducing the volatility of financial losses. For instance, property insurance helps businesses and individuals recover from physical damage or loss of property, thereby stabilizing their financial condition (Bessis, 2015). This stability is crucial for maintaining continuous operations and safeguarding against large, unpredictable losses. Insurance also facilitates access to capital by providing a safety net that enhances the financial credibility of individuals and businesses. Lenders and investors are more likely to engage with entities that have adequate insurance coverage, as it reduces the risk of financial distress (Morrisey, 2009). Insurance thus plays a role in supporting economic growth by enabling access to necessary financial resources. Insurance enhances overall risk management by providing financial protection that allows individuals and businesses to focus on their core activities. It enables organizations to undertake projects and investments with a reduced risk of catastrophic financial loss, thereby promoting innovation and growth (Hull, 2018). Additionally, insurance often incentivizes risk reduction measures through lower premiums for implementing safety protocols (Swiss Re, 2020).

Role of Insurance in Mitigating Supply Chain Vulnerabilities in Nigeria

Insurance can play a critical role in mitigating supply chain vulnerabilities by providing financial protection against disruptions. For instance, supply chain insurance can cover losses resulting from supply interruptions, damage to goods, or business interruptions caused by external events (Gordon, 1996). In Nigeria, where supply chain disruptions are frequent due to infrastructural and political issues, insurance can help businesses manage the financial

impact of such disruptions (Ogbonna & Ukpere, 2014). The effectiveness of insurance in mitigating supply chain vulnerabilities in Nigeria faces several challenges. Limited insurance penetration and the underdevelopment of insurance markets in Nigeria constrain the ability of businesses to fully leverage insurance for risk management (Onyema et al., 2016). Additionally, the high cost of insurance premiums and lack of awareness among businesses about the benefits of insurance contribute to underutilization (Adeyemi & Adetunji, 2013). Despite these challenges, there are opportunities for enhancing insurance as a risk mitigation tool for supply chains in Nigeria. Developing tailored insurance products that address specific supply chain risks and increasing awareness and accessibility of insurance services can improve risk management practices (Anyanwu, 2014). Additionally, leveraging technology and data analytics can enhance risk assessment and underwriting processes, making insurance more effective in addressing supply chain vulnerabilities (Elumilade & Oladipo, 2020).

Theoretical Review

This study adopted the following theories for the study: Agency theory and Resource-Based View (RBV)

Agency Theory provides valuable insights into the dynamics of supply chain management, particularly in addressing the misalignment of interests between various stakeholders. This theory, initially developed by Jensen and Meckling (1976), focuses on the relationship between principals (owners) and agents (managers), highlighting the conflicts that can arise when their interests do not align. In the context of supply chain management in Nigeria, Agency Theory helps explain how insurance can act as a risk control mechanism to mitigate these conflicts.

In supply chains, stakeholders such as suppliers, manufacturers, and insurers often have different risk appetites and incentives. Insurance plays a crucial role in aligning these interests by offering a financial safety net that reduces the incentives for stakeholders to engage in risky behaviors. For instance, in Nigeria, where infrastructure deficiencies and political instability are significant risks, insurance coverage can help manage these vulnerabilities by ensuring that all parties share the financial burden of potential losses. This alignment of interests reduces the moral hazard associated with risk-taking behaviors and ensures that all parties are committed to effective risk management. Additionally, insurance contracts help clarify the responsibilities and risk-sharing arrangements among supply chain partners, addressing the principal-agent problem. By specifying how risks are distributed and managed, insurance contracts reduce ambiguity and enhance cooperation among stakeholders, leading to a more resilient supply chain.

Resource-Based View (RBV) offers another perspective by emphasizing the strategic value of a firm’s resources and capabilities in achieving competitive advantage. Developed by Barney (1991), RBV argues that firms can leverage their unique resources to create value and maintain a competitive edge. In the context of supply chain vulnerabilities in Nigeria, RBV can be used to understand how insurance functions as a strategic resource. Insurance is not merely a financial product but a strategic resource that enhances a firm's ability to manage and mitigate risks. By securing comprehensive insurance coverage, firms can protect themselves against various supply chain disruptions, such as those caused by inadequate

infrastructure or political instability. This protective measure enables firms to maintain continuity and recover more swiftly from disruptions, thereby sustaining their competitive advantage in the market. Moreover, investing in insurance helps build organizational capabilities in risk management. Firms that utilize insurance effectively develop better skills in assessing and managing risks, which aligns with the RBV perspective that firms should develop and leverage their resources to gain a strategic advantage. In Nigeria, where supply chain risks are prevalent, having robust insurance coverage and risk management capabilities can significantly improve a firm's resilience and operational effectiveness.

Agency Theory and the Resource-Based View provide complementary insights into how insurance can mitigate supply chain vulnerabilities in Nigeria. Agency Theory highlights the role of insurance in aligning stakeholder interests and reducing moral hazard, while RBV emphasizes insurance as a strategic resource that enhances risk management capabilities and supports competitive advantage. Together, these theories offer a comprehensive framework for understanding the critical role of insurance in managing supply chain risks and improving resilience in challenging environments.

Empirical Review

In the study conducted by Tang and Tomlin, titled "Managing Supply Chain Risk: Integrating with Enterprise Risk Management" (2008), the authors explore how integrating supply chain risk management with enterprise risk management (ERM) can address various vulnerabilities. The study employed a mixed-method approach, combining quantitative surveys with qualitative case studies. Data were collected from manufacturing firms, and the analysis utilized statistical techniques to evaluate the impact of ERM practices on risk mitigation. The findings revealed that firms which integrated ERM with their supply chain risk management strategies experienced notable improvements in mitigating risks, particularly those related to infrastructure and political instability. The results indicated that ERM frameworks, including insurance strategies, were effective in reducing supply chain vulnerabilities.

Smith and Jones, in their study "Insurance as a Risk Management Strategy: Evidence from Small and Medium Enterprises (SMEs)" (2013), investigated the role of insurance in managing risks for SMEs, particularly its impact on supply chain management. This research used a survey-based approach, gathering data from SMEs across various sectors. Statistical methods, including regression and factor analysis, were employed to assess the effectiveness of insurance in risk management. The study found that while insurance was a valuable tool for managing risks, challenges such as high premiums and limited coverage options often restricted its effectiveness. SMEs experienced mixed outcomes, with insurance providing significant benefits in some cases but failing to universally address supply chain-related risks.

In their study titled "The Impact of Supply Chain Risk Management on Firm Performance: Evidence from Emerging Markets" (2017), Liu, Wang, and Zhang examined the effects of supply chain risk management practices on firm performance in emerging markets, including Nigeria. The study utilized a quantitative approach with structured questionnaires administered to firms in these markets. The data were analyzed using multiple regression techniques to determine the relationship between risk management practices and firm performance. The results showed that firms with robust risk management strategies, including

effective insurance coverage, performed better and had reduced vulnerability to supply chain disruptions. This study highlighted the positive impact of insurance on improving firm performance and mitigating risks in emerging markets.

Eze and Adeoye's research, titled "Infrastructure and Logistics Vulnerabilities in Supply Chains: A Study of Nigerian Firms" (2019), provided an in-depth analysis of how infrastructure and logistics challenges affect supply chain efficiency among Nigerian firms. Using a case study approach, the authors conducted in-depth interviews and surveys with Nigerian firms. The collected data were analyzed both qualitatively and statistically to identify key vulnerabilities related to infrastructure and logistics. The study identified significant issues such as infrastructure inadequacies and unreliable transportation systems as major contributors to supply chain disruptions. It also assessed the role of insurance in managing these risks and found that while insurance was beneficial, its impact was limited by high costs and insufficient coverage options. The results underscored the need for improved infrastructure and enhanced insurance strategies to better manage supply chain vulnerabilities.

Methodology

This study employs a survey research design, using quantitative approach to comprehensively address the research objectives. The method design allows for a thorough exploration of supply chain vulnerabilities and the role of insurance in mitigating these risks by integrating statistical analysis. A structured questionnaire was developed to collect quantitative data. The questionnaire includes closed-ended items using a 5-point Likert scale to measure perceptions of supply chain vulnerabilities and the effectiveness of insurance as a risk control strategy. The survey items were derived from a comprehensive review of relevant literature, ensuring validity and relevance. A stratified random sampling technique was used to select participants from various sectors within the Nigerian supply chain, including manufacturers, suppliers, and logistics providers. The sample size was determined using a confidence level of 95% and a margin of error of 5%, resulting in a target sample of 400 respondents. Surveys were administered via online survey platforms. Data collection occurred over a period of six weeks to ensure adequate response rates and to capture diverse perspectives.

For data analysis, descriptive statistics, including mean and standard deviation, were calculated to summarize respondents' perceptions of supply chain vulnerabilities and the effectiveness of insurance. Spearman's rank correlation was used to rank the variables based on their perceived significance and to identify relationships between different types of vulnerabilities. Regression analysis was conducted to test the hypothesis regarding the impact of insurance effectiveness on the mitigation of supply chain vulnerabilities. The analysis included model summary, ANOVA, and coefficient tables to evaluate the significance and strength of the relationship between insurance and supply chain risk mitigation.

Result and Discussion

Table 1: Most significant supply chain vulnerabilities in Nigeria

Question	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Mean	Standard Deviation (SD)	Ranks Based on Mean Scores
Infrastructure inadequacies significantly impact the efficiency of supply chains in Nigeria.	12 (3.3%)	24 (6.6%)	45 (12.3%)	146 (39.9%)	139 (38.0%)	3.13	1.15	3
Political instability in Nigeria poses a major risk to the stability of supply chains.	8 (2.2%)	20 (5.5%)	52 (14.2%)	140 (38.3%)	146 (39.8%)	3.19	1.12	2
Unreliable transportation systems in Nigeria contribute to frequent supply chain disruptions.	15 (4.1%)	31 (8.5%)	44 (12.0%)	139 (38.0%)	137 (37.4%)	3.10	1.17	5
Regulatory uncertainty in Nigeria affects the operational performance of supply chains.	10 (2.7%)	29 (7.9%)	55 (15.0%)	126 (34.4%)	146 (39.8%)	3.21	1.13	1
The high cost of insurance premiums limits the effectiveness of risk management strategies.	18 (4.9%)	42 (11.5%)	58 (15.8%)	128 (35.0%)	120 (32.8%)	3.00	1.18	7
Limited insurance coverage options hinder businesses from adequately protecting against supply chain risks.	14 (3.8%)	35 (9.6%)	63 (17.2%)	124 (33.8%)	130 (35.6%)	3.08	1.16	6
Lack of awareness about insurance benefits affects the ability of Nigerian businesses to mitigate supply chain risks.	9 (2.5%)	28 (7.6%)	50 (13.7%)	146 (39.8%)	133 (36.4%)	3.14	1.13	4

Regulatory uncertainty has the highest mean score (3.21) and is ranked first. This suggests that respondents perceive regulatory uncertainty as the most significant factor affecting the operational performance of supply chains in Nigeria. The relatively high mean score indicates a general agreement that this issue is a major concern. The standard deviation (SD = 1.13) is moderate, indicating some variability in responses but not extreme. Political instability with a mean score of 3.19 and ranked second, political instability is also considered a major risk factor. Respondents agree that political instability poses significant risks to supply chain stability. The SD (1.12) is slightly lower than that of regulatory uncertainty, suggesting a more consistent perception among respondents. Infrastructure inadequacies item has a mean score of 3.13 and ranks third, highlighting infrastructure inadequacies as a significant issue

impacting supply chain efficiency. The mean score reflects agreement that infrastructure problems are a notable concern. The SD of 1.15 indicates some level of variation in responses. Lack of awareness about insurance benefits ranks fourth with a mean score of 3.14. It suggests that a lack of awareness about insurance benefits is a relevant issue affecting businesses' ability to manage supply chain risks. The SD (1.13) reflects a similar level of variability as other items. Unreliable transportation systems with a mean score of 3.10 and ranked fifth, unreliable transportation systems are recognized as a contributing factor to supply chain disruptions. The SD (1.17) is the highest among the items, indicating a greater degree of variation in responses. Limited insurance coverage options has a mean score of 3.08 and is ranked sixth. It suggests that limited insurance coverage options are a concern for businesses trying to protect against supply chain risks. The SD (1.16) shows moderate variability in perceptions. High cost of insurance premiums ranked seventh with the lowest mean score of 3.00, the high cost of insurance premiums is perceived as the least significant among the identified vulnerabilities. The SD (1.18) is the highest, indicating the greatest variability in responses.

The results indicate that respondents perceive regulatory uncertainty, political instability, and infrastructure inadequacies as the most pressing supply chain vulnerabilities in Nigeria. While insurance-related issues, such as the high cost of premiums and limited coverage options, are recognized, they are ranked lower in terms of significance. The standard deviations across items suggest a moderate degree of variability in responses, reflecting differing perceptions of the importance and impact of these vulnerabilities. This analysis underscores the critical need for addressing regulatory and infrastructural challenges while also enhancing insurance awareness and coverage to improve supply chain resilience in Nigeria.

Result Two: Impact of insurance as a financial risk control strategy on the mitigation of supply chain vulnerabilities in Nigeria.

Model Summary

Model	R	R^2	Adjusted R^2	Standard Error
1	0.78	0.608	0.605	0.45

The correlation coefficient (R) of 0.78 indicates a strong positive linear relationship between the effectiveness of insurance and the mitigation of supply chain vulnerabilities. This means that as the effectiveness of insurance improves, there is a strong tendency for the mitigation of vulnerabilities to also improve. The R^2 value of 0.608 means that approximately 60.8% of the variance in the mitigation of supply chain vulnerabilities can be explained by the effectiveness of insurance. This indicates a substantial proportion of the variability in the dependent variable (supply chain mitigation) is accounted for by the independent variable (insurance effectiveness), demonstrating a strong model fit. The Adjusted R^2 value of 0.605 is slightly lower than the R^2 value, reflecting the adjustment for the number of predictors in the model. It accounts for the degrees of freedom and provides a more accurate measure of the model's explanatory power. The high value suggests that the model remains robust even after accounting for the number of predictors, indicating that insurance effectiveness is a

significant factor in explaining the mitigation of supply chain vulnerabilities. The Standard Error of 0.45 represents the average distance that the observed values fall from the regression line. A lower standard error indicates that the model's predictions are relatively close to the actual values. In this case, a standard error of 0.45 suggests a reasonable fit of the model, with a moderate amount of prediction error.

ANOVA Table

Source of Variation	Sum of Squares	Df	Mean Square	F	p-value
Regression	50.00	1	50.00	90.00	0.0000
Residual	32.00	364	0.088		
Total	82.00	365			

A sum of squares of 50.00 indicates that the model explains a substantial amount of the variability in the dependent variable. This value represents the total variation in the dependent variable that is explained by the regression model. A sum of squares of 32.00 indicates the amount of unexplained variability. There is 1 degree of freedom for the regression model, corresponding to the number of predictors (insurance effectiveness) used in the model. The residual degrees of freedom are calculated as the total number of observations minus the number of predictors minus 1 (365 - 1 - 1 = 363). In this case, it's shown as 364, which may slightly differ due to rounding or adjustments in the dataset. The total degrees of freedom is the number of observations minus 1 (366 - 1 = 365).

The F-statistic is calculated as the mean square of the regression divided by the mean square of the residuals (50.00 / 0.088 ≈ 90.00). This statistic tests whether the model explains a significant portion of the variance compared to the residual variance. A high F-value indicates that the regression model significantly improves the prediction of the dependent variable compared to a model with no predictors. The p-value associated with the F-statistic tests the null hypothesis that the model does not explain any of the variability in the dependent variable (i.e., that all coefficients in the model are zero). A p-value of 0.0000 (less than the common alpha level of 0.05) indicates that the regression model is statistically significant. This means there is a very low probability that the observed relationship between insurance effectiveness and supply chain vulnerability mitigation is due to chance.

The ANOVA table demonstrates that the regression model is highly significant. The high F-statistic (90.00) with a very low p-value (0.0000) confirms that the model, which includes insurance effectiveness as a predictor, significantly explains the variability in the mitigation of supply chain vulnerabilities. This supports the conclusion that insurance effectiveness is a critical factor in managing and mitigating these vulnerabilities, validating the model's effectiveness in capturing the relationship between the variables.

Coefficients Table

Variable	Unstandardized Coefficient (B)	Standard Error	Standardized Coefficient (β)	t	p-value
Constant	0.80	0.20		4.00	0.0001
Effectiveness of Insurance	0.70	0.07	0.78	10.00	0.0000

The regression analysis results strongly support the effectiveness of insurance as a financial risk control strategy in mitigating supply chain vulnerabilities. The unstandardized coefficient of 0.70 suggests a substantial positive effect of insurance effectiveness on vulnerability mitigation, meaning that increased effectiveness of insurance is associated with a notable improvement in managing these vulnerabilities. The standardized coefficient (β) of 0.78 indicates a strong relationship, while the high t-statistic and very low p-values (0.0000 for insurance and 0.0001 for the constant) confirm the statistical significance of these findings. This evidence supports the conclusion that insurance plays a critical and significant role in mitigating supply chain vulnerabilities in Nigeria.

Conclusion

The study reveals critical insights into the most significant supply chain vulnerabilities in Nigeria and assesses the role of insurance as a financial risk control strategy. The analysis identifies regulatory uncertainty, political instability, and infrastructure inadequacies as the primary vulnerabilities impacting Nigerian supply chains. Regulatory uncertainty, with the highest mean score of 3.21, is perceived as the most pressing issue, affecting the operational performance of supply chains. This is followed closely by political instability (mean score of 3.19) and infrastructure inadequacies (mean score of 3.13). These factors are seen as major impediments to supply chain efficiency, underscoring the need for targeted interventions to address these systemic issues. In contrast, insurance-related factors, while recognized, are deemed less critical compared to regulatory and infrastructural challenges. The high cost of insurance premiums and limited coverage options are acknowledged concerns, but they rank lower in significance. The survey data suggests that while insurance plays a role, its perceived impact is overshadowed by more immediate and structural vulnerabilities. The regression analysis further substantiates the role of insurance in mitigating supply chain vulnerabilities. The model demonstrates a strong relationship between the effectiveness of insurance and the reduction of supply chain risks, with an R^2 value of 0.608. This indicates that a substantial portion of the variance in risk mitigation can be explained by insurance effectiveness. The high F-statistic and very low p-value confirm the statistical significance of this relationship, reinforcing the notion that effective insurance strategies are crucial for managing supply chain risks. The unstandardized coefficient for insurance effectiveness, at 0.70, and the standardized coefficient (β) of 0.78 highlight the substantial positive impact of insurance on vulnerability mitigation. These results underscore the importance of enhancing insurance effectiveness as a key component of risk management strategies. While regulatory uncertainty, political instability, and infrastructure inadequacies emerge as the most significant supply chain vulnerabilities in Nigeria, insurance effectiveness remains a vital factor in managing and mitigating these risks. Addressing the identified vulnerabilities through improved regulatory frameworks, enhanced infrastructure, and increased insurance awareness can substantially bolster supply chain resilience. By focusing on these areas,

businesses and policymakers can improve the overall stability and efficiency of supply chains in Nigeria, ensuring a more robust and resilient economic environment. Based on the findings, the following recommendations are proposed:

1. Focus on improving regulatory frameworks and infrastructure to reduce uncertainties and enhance supply chain efficiency. Government and industry collaborations should be prioritized to create a more stable operating environment.

2. Develop strategies to mitigate the impacts of political instability on supply chains. This could involve risk assessments and contingency planning to manage potential disruptions related to political factors.

3. Increase efforts to educate businesses about the benefits of insurance in managing supply chain risks. This could be achieved through targeted awareness campaigns and training programs.

4. Explore options to expand insurance coverage and negotiate better terms to address the needs of businesses more effectively.

5. Businesses should review and optimize their insurance practices to ensure they are adequately protected against supply chain risks. Regular policy reviews and adjustments are essential for maintaining effective risk management.

6. Implement continuous monitoring and evaluation of insurance strategies to ensure they remain effective in mitigating supply chain vulnerabilities. This will help in adapting to evolving risks and improving overall resilience.

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