

## Supply Chain Management Strategies on Oil and Gas Companies Performance in Nigeria

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### ABSTRACT

*Nigeria's oil and gas sector, a significant contributor to the country's economy, accounts for 92% of export value and 5.5% of GDP. However, challenges such as supply chain inefficiencies hinder its optimal performance. This study investigates the impact of supply chain management strategies on the performance of Nigerian oil and gas companies. Adopting a mixed-method research design, the study utilized Taro Yamane's formula to determine a sample size of 100 respondents, employing stratified random sampling to select participants from the upstream, midstream, and downstream operational strata of the oil and gas industry. Data collection was conducted through structured questionnaires and interviews, while data analysis employed descriptive statistics, including frequency distributions, percentages, means, and standard deviations. Hypotheses were tested using chi-square statistics to establish relationships and validate findings. The results revealed that the integration of advanced technologies, third-party logistics providers, and effective risk management significantly enhances supply chain performance in the oil and gas sector. The study recommends the adoption of advanced data analytics, artificial intelligence (AI), blockchain technology, the Internet of Things (IoT), and enterprise resource planning (ERP) systems for data-driven decision-making, risk prediction, operational optimization, and demand forecasting. Additionally, oil and gas companies should conduct comprehensive risk assessments, develop robust business continuity plans (BCPs), and implement regular drills and simulations to ensure operational resilience during disruptions. This study contributes to the body of knowledge on supply chain management strategies in the oil and gas sector, particularly within the Nigerian context.*

**Keywords:** Supply Chain Management, Technology Integration, Third-party logistics, Risk Management

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### INTRODUCTION

The oil and gas industry are a cornerstone of global industrial and economic activities, and in Nigeria, it holds an even more critical position as the backbone of the country's economy. Nigeria, Africa's largest oil producer, derives approximately 40% of its GDP, 70% of budget revenues, and 95% of its foreign exchange earnings from the petroleum sector (David et al., 2010). Despite this, the sector faces persistent challenges that hinder its potential, including inefficiencies in supply chain management (SCM). Effective SCM is essential for optimizing operations, minimizing costs, and maintaining competitiveness in this capital-intensive and complex industry. However, the Nigerian oil and gas sector continues to grapple with infrastructural deficits, poor transportation networks, high operational costs, and limited adoption of modern technologies (Ameh, 2024).

Adding to these internal challenges are external factors such as political instability, regulatory changes, and security risks like oil pipeline vandalism, theft, and insurgencies in the Niger Delta. These issues have resulted in production halts, supply shortages, and significant financial losses, thereby affecting not only company performance but also national economic stability (Akintokunbo & Ali, 2021). While the importance of SCM in addressing these inefficiencies is well-established, there is a lack of targeted research focusing on how SCM strategies influence operational efficiency, profitability, and competitiveness in Nigeria's oil and gas sector. Most existing studies have concentrated on SCM optimization in other industries (Adebisi et al., 2021; Phan et al., 2019; Oyedijo et al., 2021), leaving a gap in understanding the unique challenges and opportunities within the oil and gas sector.

This study seeks to bridge this gap by examining the direct impact of SCM practices on the performance of oil and gas companies in Nigeria. It focuses on three critical areas: the integration of technology, the role of third-party logistics, and the effectiveness of risk management strategies. The

Resource-Based View (RBV) and Systems Theory provide theoretical frameworks for this research. The RBV emphasizes the importance of internal resources, such as skilled human capital and advanced technologies, in driving competitive advantage (Rao & Brown, 2024), while Systems Theory underscores the interconnectedness of supply chain components and their collective impact on organizational performance (Kanda, 2023).

The novelty of this study lies in its contextual focus on Nigeria's oil and gas sector, offering actionable insights into how modern SCM strategies can address operational inefficiencies and enhance overall performance. By leveraging recent technological advancements and strategic partnerships, this research aims to provide innovative solutions to longstanding challenges in the sector. Unlike previous studies that have primarily focused on general SCM practices, this study delves into specific strategies tailored to the unique complexities of the oil and gas industry in Nigeria.

The study aligns with previous research by supporting the notion that SCM is a critical driver of organizational performance (Christopher, 2020; Grover et al., 2024), but it also seeks to extend this understanding by addressing the specific operational bottlenecks and external risks faced by Nigerian oil and gas companies. Through this approach, the study aims to contribute to the existing body of knowledge while offering practical recommendations for industry stakeholders and policymakers.

The objectives of this study are to examine the impact of technology integration on the supply chain performance of oil and gas companies in Nigeria, to assess the role of third-party logistics in enhancing operational efficiency and performance within the Nigerian oil and gas sector, and to evaluate the effectiveness of risk management strategies in mitigating supply chain disruptions and enhancing the performance of oil and gas companies in Nigeria. This research not only addresses a significant gap in the literature but also provides a roadmap for improving the efficiency, profitability, and resilience of Nigeria's oil and gas sector. The findings will be instrumental for industry stakeholders, policymakers, and practitioners seeking to foster sustainable growth and competitiveness in this vital industry.

## **METHOD**

This study employed a mixed-method research design, integrating both quantitative and qualitative approaches to ensure comprehensive analysis. The Nigerian oil and gas sector operates across three streams: upstream, midstream, and downstream. Regulatory oversight is provided by the Nigerian Upstream Petroleum Regulatory Commission (NUPRC) for upstream operations and the Nigerian Midstream and Downstream Petroleum Regulatory Authority (NMDPRA) for midstream and downstream activities. The sample size of 100 respondents was determined using Taro Yamane's formula. Stratified random sampling was employed to select respondents from the three operational strata (upstream, midstream, and downstream). In addition, a purposive sampling technique was used to select key informants based on their specific roles, expertise, and experience in supply chain management. Data collection was conducted using structured questionnaires that were reviewed by experts in oil and gas management and business administration to ensure validity. The questionnaires were administered directly to respondents. Secondary data was sourced from company records, as well as reports from NUPRC and NMDPRA. Data analysis involved the use of descriptive statistics, such as frequency distribution tables, percentages, means, and standard deviations, to summarize and interpret the data. Hypotheses were tested using chi-square statistics to establish relationships and validate findings. This methodological approach ensured the reliability and robustness of the study's outcomes.

## RESULT AND DISCUSSION

**Research Question 1:** What is the impact of technology integration on the supply chain performance of oil and gas companies in Nigeria?

**Table 1.** Respondents ranking of the impact of technology integration on supply chain performance in Oil and Gas companies

| The effects of Technology integration on supply chain performance. | Rank            | Frequency  | Percentage  |
|--------------------------------------------------------------------|-----------------|------------|-------------|
| Optimizes decision-making processes                                | 1 <sup>st</sup> | 37         | 37          |
| Improves data accuracy                                             | 2 <sup>nd</sup> | 25         | 25          |
| Reduces operational costs                                          | 3 <sup>rd</sup> | 17         | 17          |
| Enhances operational efficiency                                    | 4 <sup>th</sup> | 11         | 11          |
| Streamlines inventory management                                   | 5 <sup>th</sup> | 10         | 10          |
| <b>Total</b>                                                       |                 | <b>100</b> | <b>100%</b> |

**Table 2.** The role of 3PL plays in enhancing operational efficiency in oil and gas companies.

| Options                                           | Rank            | Frequency  | Percentage  |
|---------------------------------------------------|-----------------|------------|-------------|
| Streamlining supply chains                        | 1 <sup>st</sup> | 40         | 40%         |
| Reducing operational costs                        | 2 <sup>nd</sup> | 33         | 33%         |
| Improving delivery timelines                      | 3 <sup>rd</sup> | 14         | 14%         |
| Enhance specialization in area of core competence | 4 <sup>th</sup> | 13         | 13          |
| <b>Total</b>                                      |                 | <b>100</b> | <b>100%</b> |

**Table 3.** The effectiveness of risk management strategies in mitigating supply chain disruptions

| Option       | Frequency  | Percentage  |
|--------------|------------|-------------|
| High         | 54         | 54%         |
| Moderate     | 36         | 36%         |
| Low          | 10         | 10%         |
| <b>Total</b> | <b>100</b> | <b>100%</b> |

Among 100 respondents from oil and gas companies, 37% indicated that the optimization of the decision-making process is the most significant impact of technology integration on supply chain performance. Subsequently, 25% identified the enhancement of data accuracy as the second most significant impact. Additionally, 17% identified the decrease in operational costs as the third most significant advantage. The enhancement of operational efficiency and the streamlining of inventory management were ranked fourth and fifth, respectively, indicating their significance in utilizing technology to optimize supply chain operations.

**Research Question 2:** What is the role of third-party logistics in enhancing operational efficiency and performance within the oil and gas sector in Nigeria?

Table 2 illustrates that the majority of respondents identified the Streamlining of Supply Chains as the most significant way third-party logistics (3PL) providers enhance the operational efficiency of their oil and gas companies. This was followed by the reduction of operational costs, which ranked second. Additionally, improving delivery timelines and enhancing specialization in core competencies were ranked third and fourth, respectively, highlighting the multifaceted contributions of 3PL services to organizational performance.

**Research Question 3:** How effective are risk management strategies in mitigating supply chain disruptions of oil and gas companies in Nigeria?

The findings reveal that a majority of respondents (54%) rated their company's risk management strategies as highly effective in mitigating supply chain disruptions. Conversely, 36% of respondents assessed their risk management efforts as moderately effective, while a minority (10%) rated the risk management strategies as ineffective.

**Table 4.** Analysis of the effects of Supply Chain Management Strategies on the Performance of Oil and Gas Companies in Nigeria.

| S/N | Variables                                                                                                     | A           | D           | SA        | SD            |
|-----|---------------------------------------------------------------------------------------------------------------|-------------|-------------|-----------|---------------|
| 1.  | The implementation of supply chain management strategies has improved the overall performance of the company. | 55 (55%)    | 15 (15%)    | 30 (30%)  | 0 (0.00%)     |
| 2   | Effective supply chain management contributes to cost reduction in the oil and gas sector.                    | 61 (61%)    | 29 (20%)    | 10 (10%)  | 0 (0.00%)     |
| 3   | Collaborative partnerships with suppliers enhance operational efficiency in the company.                      | 89 (89%)    | 5(5%)       | 4 (4%)    | 1 (1%)        |
| 4   | Inventory management strategies are well-optimized to meet the company's demands.                             | 90 (90%)    | 2 (2%)      | 5 (5%)    | 3 (3%)        |
| 5   | The use of technology in supply chain management has enhanced performance.                                    | 85 (85%)    | 5 (5%)      | 4 (4%)    | 6 (6%)        |
| 6   | Logistics strategies are effectively managed to ensure timely delivery of products.                           | 68 (68%)    | 32 (32%)    | 1 (1%)    | 0 (0.00%)     |
| 7   | The company's supply chain management strategy supports sustainability and environmental compliance.          | 50 (50%)    | 40 (40%)    | 5 (5%)    | 4 (4%)        |
| 8   | Risk management strategies in the supply chain are effective in mitigating disruptions.                       | 91 (91%)    | 9 (9%)      | 0 (0.00%) | 0 (0.00%)     |
| 9   | Supply chain integration across departments improves decision-making and responsiveness.                      | 0 (0.00%)   | 0 (0.00%)   | 0 (0.00%) | 100 (100.00%) |
| 10  | Supplier relationship management positively impacts the quality of materials received.                        | 68 (49.28%) | 24 (24%)    | 8 (8%)    | 0 (0.00%)     |
| 11  | The company invests adequately in staff training for supply chain management practices.                       | 40 (40%)    | 20 (20%)    | 10 (10%)  | 20 (20%)      |
| 12  | Supply chain performance metrics are regularly monitored and evaluated.                                       | 15 (15%)    | 55 (55%)    | 30 (30%)  | 0 (0.00%)     |
| 13  | The company's supply chain strategy aligns with its long-term corporate goals.                                | 29 (20%)    | 61 (61%)    | 10 (10%)  | 0 (0.00%)     |
| 14  | The company leverages data analytics to improve supply chain operations.                                      | 5(5%)       | 89 (64.49%) | 5(5%)     | 2 (2%)        |
| 15  | Delays in the supply chain are effectively managed and minimized.                                             | 2 (2%)      | 90 (90%)    | 8 (8%)    | 0 (0%)        |

|    |                                                                                                     |           |           |           |               |
|----|-----------------------------------------------------------------------------------------------------|-----------|-----------|-----------|---------------|
| 16 | Outsourcing decisions are made based on thorough cost-benefit analysis.                             | 5 (5%)    | 85 (85%)  | 10 (10%)  | 0 (0%)        |
| 17 | The company's supply chain management strategies are competitive within the oil and gas industry.   | 32 (32%)  | 68 (68%)  | 0 (0%)    | 0 (0%)        |
| 18 | Supply chain strategies effectively address fluctuations in market demand.                          | 40 (40%)  | 50 (50%)  | 5 (5%)    | 5 (5%)        |
| 19 | Supplier selection criteria prioritize quality, reliability, and cost-effectiveness.                | 9 (9%)    | 91 (91%)  | 0 (0%)    | 0 (0%)        |
| 20 | The supply chain management strategies have had a positive impact on the company's market position. | 0 (0.00%) | 0 (0.00%) | 0 (0.00%) | 100 (100.00%) |

### Test of Hypotheses

**Table 5.** Test Statistics

|                    |                      |
|--------------------|----------------------|
| Chi-Square         | 105.520 <sup>a</sup> |
| Df                 | 3                    |
| <b>Asymp. Sig.</b> | <b>.000</b>          |

**Table 6.** Test Statistics

|                    |                      |
|--------------------|----------------------|
| Chi-Square         | 109.520 <sup>a</sup> |
| Df                 | 3                    |
| <b>Asymp. Sig.</b> | <b>.000</b>          |

### **Ho1: Technology integration has no significant positive impact on the supply chain performance of oil and gas companies in Nigeria.**

If the p-value is less than the level of significance, reject the null hypothesis (H0). Otherwise, accept the null hypothesis. 0 cells (.0%) have predicted frequencies below 5. The lowest anticipated cell frequency is 25.0. We reject the null hypothesis and find that technology integration has a substantial beneficial influence on the supply chain performance of Nigerian oil and gas businesses (p-value = 0.000 vs. 0.05).

### **Ho2: Risk management strategies have no significant positive effect on mitigating supply chain disruptions and improving the performance of oil and gas companies in Nigeria.**

Level of significance is 0.05. Decision rule is to reject the null hypothesis H0 if the p value is less than the level of significance. Accept the null hypothesis if otherwise. a. 0 cells (.0%) have expected frequencies less than 5. The minimum expected cell frequency is 25.0. Decision: Since the p-value= 0.000 is less than the level of significance (0.05), we reject the null hypothesis and conclude that Risk management strategies have a significant positive effect on mitigating supply chain disruptions and improving the performance of oil and gas companies in Nigeria.

**Discussion of findings**

This study's findings indicate that technology integration markedly improves supply chain performance in Nigerian oil and gas firms. Specific contributions include the optimization of decision-making processes (37%), improvement in data accuracy (25%), cost reduction (17%), enhanced operational efficiency (11%), and streamlined inventory management (10%). These results validate the hypothesis that technology integration has a significant positive impact on supply chain performance, addressing the first research question. Furthermore, the findings align with those of Akintokunbo and Arimie (2021) and Adewusi et al. (2024), which highlight the role of technologies such as real-time monitoring, predictive maintenance, blockchain for data integrity, and AI for demand forecasting. Notably, this study reveals additional dimensions, particularly the ability of technology integration to reduce costs, improve operational efficiency, and streamline inventory management. The implication is that companies in the oil and gas sector—and potentially those in other industries such as manufacturing, healthcare, agriculture, and services—can achieve superior supply chain performance by adopting advanced technologies. However, the generalization of these findings is limited due to the study's focus on the oil and gas sector. Regarding the role of third-party logistics (3PL) providers, the study found that the streamlining of supply chains is the most significant contribution to enhancing operational efficiency. This is followed by cost reduction, improvement in delivery timelines, and enhanced specialization in core competencies. These findings support Jean (2024), who emphasized the value of outsourcing logistics functions to specialized service providers, enabling companies to focus on their core competencies. The implication is that oil and gas companies should engage 3PL providers with specific expertise and experience in the sector to optimize supply chain operations.

Finally, the study assessed the effectiveness of risk management strategies in mitigating supply chain disruptions, addressing the third research question. The majority of respondents (45%) rated their company's strategies as highly effective, while 36% rated them as moderate and 10% as low. Hypothesis testing further confirmed that risk management strategies have a significant positive effect on mitigating supply chain disruptions and improving performance. These findings align with Asikhia et al. (2022), who observed similar impacts in oil and gas marketing companies in Lagos. However, the moderate and low ratings by 36% and 10% of respondents highlight critical gaps that could expose supply chains to significant disruptions. This suggests a need for oil and gas companies to closely monitor changing environmental trends and adopt more innovative, dynamic, and proactive risk management approaches. Overall, the implication of the findings emphasizes the transformative potential of technology integration, the strategic value of engaging specialized 3PL providers, and the importance of robust and adaptive risk management strategies. These insights are particularly valuable for industry stakeholders seeking to enhance operational efficiency, reduce costs, and build resilience in the increasingly complex and dynamic oil and gas sector.

**CONCLUSIONS**

This research examined the effects of technology integration, third-party logistics (3PL), and risk management strategies on supply chain performance within Nigeria's oil and gas industry. The findings indicate that technology integration substantially improves supply chain performance through enhanced decision-making, increased data accuracy, reduced costs, greater operational efficiency, and better inventory management. Advanced tools, including artificial intelligence, IoT, blockchain, Enterprise Resource Planning (ERP), cloud-based solutions, and predictive analytics, enhance firms' capabilities to anticipate, respond to, and recover from disruptions. The study highlights the essential function of 3PL providers in optimizing supply chains, minimizing costs, accelerating delivery timelines, and strengthening specialization in core competencies. Collaborating with 3PL providers that possess industry-specific expertise is crucial for enhancing operational efficiency in this sector. Risk management strategies significantly enhance the mitigation of supply chain disruptions and improve overall performance. The identification of

moderate and low ratings among certain respondents indicates gaps that necessitate more innovative and proactive risk management strategies. This research enhances the comprehension of supply chain management within the Nigerian oil and gas sector by highlighting the transformative role of technology, the strategic significance of third-party logistics partnerships, and the necessity for effective risk management. The findings offer practical recommendations for industry stakeholders seeking to improve efficiency, profitability, and resilience in a changing business landscape. Recommendations for improving supply chain management in the Nigerian oil and gas sector oil and gas companies should implement advanced data analytics and artificial intelligence for data-driven decision-making to predict supply chain risks, optimize operations, and enhance demand forecasting. The adoption of blockchain technology is essential to enhance transparency and traceability within the supply chain, thereby reducing fraud and errors, tracking material movement, and ensuring compliance with regulatory standards. Oil and gas companies should adopt Internet of Things (IoT) technology to enhance supply chain visibility and facilitate real-time asset monitoring. This can be achieved by installing IoT sensors on pipelines and storage facilities to monitor conditions such as pressure, temperature, tracking, logistics, and fleet management.

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