International Journal of Strategic Supply Chain and Operations Management (IJSSCOM)
June 2026 Vol 1. No 1. Pg 32-45

An Evaluative Review of Lean Strategies and Supply Chain Resilience in the Nigerian Oil and Gas Sector.

Abiodun, O. O

PhD Student (Human Resources Management), Nelson Mandela University, South Africa. Email: s233638563@mandela.ac.za. ORCID iD: https://orcid.org/0009-0000-6912-3920.

Enakhifo, P. A.

Faculty of Management Science, Department of Business Administration, University of Lagos, Akoka, Lagos Nigeria. Email: penscript24@yahoo.com.

Abstract

The integration of lean strategy into supply chain has recently provided nuanced outcomes among organisations. This evaluative study enhances our understanding of the challenges and opportunities associated with lean strategies and supply chain resilience in the Nigerian oil and gas sector. The paper used qualitative research method based on secondary data from journal articles, published literature and company insights. Thematic analysis was employed to identify patterns, trends, convergence and divergence points relating to the subject. Our findings suggest that lean strategies in Nigerian oil and gas sector are pivotal in making supply chain resilient by advancing efficiency, cost reduction, driving delivery value and strengthening responsiveness to disruptions. However, there are challenges within the unique context of the Nigerian oil and gas sector that affect lean strategy and supply chain resilience. These include regulatory barriers, insecurity, digital technological gaps and lack of expertise. The paper proposed practical recommendations on how lean strategies can be used to sustain supply chain resilience in oil and gas sector in Nigeria.

Keywords: Lean, Lean Strategy, Operations, Oil and Gas, Supply Chain Resilience

Introduction

The oil and gas industry in Nigeria has been known to face tremendous disruptions in the supply chain due to various factors within the country and from a global context. There have been issues of pipeline vandalism, obstruction to operational processes, logistical bottlenecks, fluctuating prices and global pandemics and energy crises (Akintokunbo & Arimie, 2021; Ogbaini, 2025). Despite the above, supply chain function across oil and gas industry players in Nigeria (upstream, midstream and downstream) continues to push the boundaries of attaining desired outcomes. According to KPMG (2025) report on supply chain transformation in the oil and gas sector in Nigeria, the Nigerian Upstream Petroleum Regulatory Commission (NUPRC) launched the "Project 1 million barrels of oil per day initiative in October 2024. This initiative target at least 2.1 million barrels daily oil production. This expansion presents significant economic opportunities in Nigeria. However, its success depends on efficient and resilient supply chain management. Ikevuje et al (2024) argued that effective supply chain is indispensable for maintaining operational stability, flow and organisational performance. The authors argued that organisations must adopt lean and resilient supply chain strategies to improve flexibility, reduce waste, and respond quickly to market shocks.

In the oil and gas sector, the optimisation of supply chains contributes to driving both operational efficiency and effectiveness. The concept of supply chain resilience has become

most critical to the operations of organisations in the oil and gas sector of Nigeria. Achieving efficiency in this function will contribute to productivity and profitability (Asikhia, Makinde, Akinlabi & Olawore, 2022; Olawore, Olufawo, Adesanya., Oduwole & Ochonogor, 2023). This study seeks to investigate how lean strategies can be used in improving supply chain resilience in the Nigerian oil and gas sector. Our study respond to call by Alem, Tsolakis and Kumar (2026) that future studies should explore challenges faced by oil and gas companies in using lean strategies to improve supply chain resilience.

The justification of this study is based on the strategic importance and relevance of the Nigerian oil and gas sector to national economic development and its vulnerability to supply chain disruptions. While lean strategies are widely adopted for improving efficiency, cost reduction, and operational performance. The connection between lean strategies and supply chain resilience in a volatile environment such as Nigerian oil and gas remains insufficiently understood. The sector faces issues and disruptions such as infrastructure deficits, regulatory inconsistencies, security concerns, market changes, and global disturbances, thereby making the need for supply resilience a relevant research area. This evaluative review present insights into how lean practices influence organisational anticipation, responsiveness and recovery from the above-mentioned disruptions.

The core of lean strategy is reducing wastage, enhancing efficiency, and fostering continuous improvement across all organisational levels (Veiga et al., 2011; Collis, 2016; Khawka et al., 2024).

Chen (2026) has argued that lean strategy implementation is a nuanced requirement for organisations in developing countries. While Nigeria's oil and gas sector lags behind more mature markets, there is significant potential for these capabilities to transform pipeline monitoring, asset tracking, and supply chain integrity. This paper will give insights into how the lean strategies and supply chain resilience can be optimised to reduce costs and maximise revenue. The purpose of this study is to evaluate the relationship between lean strategies and supply chain resilience in the Nigerian oil and gas sector. The specific objectives include:

i. To examine the challenges in adopting lean strategies in the Nigerian oil and gas sector.
ii. To proffer recommendations on lean strategies that can be employed for improving supply chain resilience in Nigeria's oil and gas sector.

Literature Review and Theoretical Framework

Concept of Lean Strategies

The concept of lean strategy emanates from the lean management approach in organisations. It involves value creation that is pursued as a strategic and operational philosophy through the persistent and continuous elimination of waste (Collis, 2016; Khawka et al., 2024). Lean is a contemporary holistic management approach that seeks to optimise and boost organisational processes, align and deploy resources as well as foster and enshrine a culture of continuous improvement (Magnani et al., 2024). Lean strategies are means through which organisations seek to systematically maximise customer value and minimise wastage. It represents approaches aimed at driving operational efficiency, advancing continuous improvement and enabling productivity across all organisational levels (Deshmukh et al., 2022). Studies have identified core principles in lean strategies include identification of value systems, mapping value streams, creating process flow, establishing a system and pursuing perfection.

Coetzee et al (2016) contend that lean practices are based on identifying areas of value in organisations and linking them together for enhanced operational flow. Chen (2026) argued that lean strategies are focused on eliminating waste in any organisational activity or resource that consumes time, money, or space without adding relevant value to the final output product or service for end users. Some areas in which waste is manifested and require lean implementation include, overproduction, waiting times, unnecessary transport, overprocessing, excessive inventory, motion inefficiencies, slack, errors and defects. Through the identification, detection and removal of non-value-adding activities, organisations can streamline operations, enhance quality, reduce costs, adapt and respond more flexibly to market demands (Atkinson, 2004; Sinha & Matharu, 2019; Liu et al., 2024).

Lean is an integrated system consisting of inter-related elements and management practices aimed at delivering value to customers (Shah & Ward, 2003 cited in Sinha & Matharu, 2019). The intellectual and logical roots of lean strategy can be traced back to the Toyota Production System (TPS), a revolutionary approach developed in post-war Japan by Taiichi Ohno and Eiji Toyoda. Unlike conventional production methods that prioritised output volume over process efficiency, the Toyota Production System emphasised flow, pull systems, and error proofing mechanisms to prevent operational problems before they occurred. Thus, TPS eventually demonstrated such outstanding operational performance that it attracted global attention and became the foundation for what is now widely referred to as Lean Thinking (Coetzee et al., 2016).

Several scholars (Lameijer et al., 2017; Jelenc, Lerner & Knapić, 2020; Madhani, 2022; Kaur et al., 2023; Okoro, 2024) have investigated and found components of lean strategy such as Just-in-Time (JIT), Value Stream Mapping (VSM), Root Cause Analysis (5-Whys), Kaizen used continuous small improvements, Five ‘S’ in terms of Sort, Set in Order, Shine, Standardize, Sustain and Six sigma using methodologies such as DMAIC (Define, Measure, Analyze, Improve, Control). Hence, lean strategy ensures optimisation of resources, minimisation of energy usage, reducing systemwide costs and ensuring zero waste in operational process (Liu et al., 2024). Implementing lean strategy and supply chain resilience in Nigeria's oil and gas sector requires balancing cost-efficient, waste-reducing practices and agile operations. Some strategies of lean include investing in advanced logistics, improving inventory visibility, and fostering collaborative supplier relationships (Ugolo, 2021; Panle, 2024). In this paper the focus is on the intricacies of lean strategy in oil and gas sector in Nigeria through insights of challenges, barriers and constraints.

Concept of Supply Chain Resilience

According to Johansson (2002) one of the most conventional definition and expression of the supply chain is “a system whose constituent parts include material suppliers, production facilities, distribution services and customers linked together via the feed forward materials and the feedback flow of information” It is commonly accepted that there are three main flows in the supply chain: material flow, information flow and cash flow (Beggiato, 2025). Several factors influence successful supply chain networks; the complexity of the information required to support a transaction, especially in terms of product and process specifications, the way in which information is shared and transmitted to the parties without the need for transaction specific investments, the capabilities of organisations and actors in the supply network to meet the transaction requirements (Beggiato, 2025).

In today's uncertain and turbulent markets, supply chain vulnerability has become a predominantly important issue for many companies, therefore bringing about the need pursuing supply chain resilience. Long and complex global supply chains are usually slow to respond to change and are therefore more vulnerable to business disruption. The origin of resilience was detected for the first time in the field of psychology, then it spread in other fields such as medicine and finally reached the economic science. Hamel and Valikangas (2003) cited in Beggiato (2025) identified business supply chain resilience as the superior ability to reinvent its model of operations. Agarwal and Seth (2021) suggested that supply chain resilience can be attained through (1) anticipation of unforeseen failures through special attention to the business environment, (2) investment in products or services diversity, (3) constant exploration of new opportunities, (4) maintaining the balance between optimisation (a research for efficiency) and the exploration of new opportunities.

Furthermore, supply chain resilience dimensions and principles include understanding the supply chain mapping tools, basic supply strategy to reduce the number of suppliers in order to reduce costs, supply chain collaboration and agility in terms of speed and visibility (Ali., Mahfouz & Arisha, 2017; Ming, Omain & Kowang, 2021; Beggiato, 2025). Supply chain resilience in organisations involves building capabilities such as agility, collaboration, and risk management to mitigate disruptions and ensure continuity. Supply chain resilience strategies include developing proactive, adaptable, responsive and flexible networks that utilise technology and strategic planning. It directly influences organisational performance by managing disruptions from phenomenon and events such as the COVID-19 pandemic, energy crises and the Russia-Ukraine war (Umar & Wilson, 2021). In the context of the oil and gas industry, supply chain resilience involves building capacity to anticipate, adapt, and recover from disruptions through diversification of suppliers, inventory buffers, and digital technologies (Onukwulu, Agho & Eyo-Udo, 2023).

Overall, Ekram, Elmesmary, and Sakr (2024) bring to light the critical relevance of supply chain resilience in the oil and gas sector due to its handling of exposures to geopolitical risks, transportation disruptions, and volatile demand. Their empirical study proposed a framework stressing flexibility, visibility, responsiveness, collaboration, and risk management as core resilience capabilities. The authors showed that resilient supply chains enable oil and gas firms to maintain operational continuity, reduce disruption impacts, and respond quickly to logistics failures. The study also stresses digital integration and strategic partnerships to enhance adaptability. Overall, resilience is positioned as essential for ensuring energy security, stabilizing operations, and sustaining competitive performance in an increasingly uncertain global energy logistics environment. The next section delves into the theoretical review that connects lean strategies and supply chain resilience within the context of the oil and gas sector in Nigeria.

Strategic Lean Integration and Supply Chain Resilience in Nigerian Oil and Gas Context

Sodje (2025) engaged in a mixed-method approach in the oil and gas industry in Nigeria. The data was collected and analysed quantitative data from 218 top executives across 175 oil and gas companies. Also, secondary data was used for structural modelling to examine how strategic agility through lean techniques enhance operational performance. Thus, lean techniques are driven by innovation capabilities connected to talent development that significantly mediate the relationship between supply chain agility and performance.

Furthermore, Ugolo (2021) engaged in industry-focused conceptual analysis in the Nigerian oil and gas context. The author argued that lean supply chain management improved profitability by reducing operational waste and enhancing procurement efficiency. However, the study also highlighted contextual limitations that oil and gas companies face in terms of infrastructural inefficiencies and regulatory bottlenecks that restrict lean effectiveness.

These findings collectively signify that lean strategy in oil and gas sector in Nigeria has to be embedded within broader strategic agility frameworks to remain effective. This requires rapid reconfiguration capabilities, technological innovations, collaborations and responsiveness within oil and gas companies especially in upstream and downstream logistics. The methodologies used across the above empirical studies converge on the importance of adaptive capabilities for lean strategy rather than static efficiency

For the Nigerian oil and gas industry, this synthesis implies that lean implementation (Ugolo, 2021; Obi-Johnson, Ayodeji & Suleiman 2026) can translate into cost efficiency, delivery value and procurement effectiveness. However, without resilience mechanisms identified by Umar and Wilson (2021) and Onukwulu et al (2023), oil and gas firms risk heightened exposures and vulnerabilities to externalities such as price collapses, global disruptions and industry transitions (Piya, Shamsuzzoha & Khadem, 2022; Ikevuje et al., 2024). In light of Sodje (2025), lean strategies should be built on agility, innovation, and talent development to make supply chain remain responsive under industry volatilities. This provides a conceptual foundation for examining Nigerian oil and gas firms where environmental volatility, infrastructure constraints, and market uncertainty demand both efficiency and adaptive robustness. The key inference for this study is that lean strategy and supply chain resilience are not mutually exclusive but interact dynamically. Hence, over-lean systems may weaken resilience, while integrated lean–agile configurations consolidate long-term supply chain sustainability.

Dynamic Capabilities Theory (DCT)

DCT was developed by Teece, Pisano and Shuen (1997) from an extension and expansion of the Resource-based view theory (RBV) of the firm. The theory posits how organisations integrate, build, and reconfigure internal and external competencies to navigate dynamic market conditions. In essence, DCT has become popularly employed for understanding organisational adaptability, innovation, agility and resilience in volatile, uncertain, complex and ambiguous (VUCA) industries (Sodje, 2025).

The core assumptions of DCT include: (1) constantly changing business environment, (2) evolving and emerging in industry dynamics that are characterised by technological advancement, market volatility, and regulatory shifts. Hence, DCT assumes that companies require capabilities beyond their ordinary operational routines and resources to remain competitive. These capabilities include processes such as sensing opportunities and threats, seizing opportunities through strategic decisions, and transforming organisational resources to align with changing conditions. In essence, DCT presents a strong theoretical lens for examining the relationship between lean strategies and supply chain resilience in the Nigerian oil and gas sector. The industry operates in a highly VUCA environment attributed by fluctuating global oil prices, logistical disruptions, regulatory instability, infrastructure challenges, and geopolitical risks. These conditions and circumstances require oil and gas firms to continuously adapt their operational and supply chain processes (Piya, Shamsuzzoha & Khadem, 2022).

Lean strategies focus on waste reduction, process efficiency, and continuous improvement, which align with the dynamic capability of transforming organisational processes. Through lean practices such as just-in-time inventory, streamlined operations, and continuous improvement, oil and gas firms can improve their supply chain capabilities to reconfigure resources and respond quickly to disruptions, thereby becoming more resilient. Dynamic capabilities such as sensing risks in supply chain systems and networks, seizing opportunities through strategic supply chain collaborations, and transforming logistics systems support the development of resilient supply chains. In the Nigerian oil and gas context, these capabilities enable firms to manage supply interruptions, regulatory changes, and operational inefficiencies while maintaining performance. Therefore, DCT can assist in explaining how oil and gas firms can deploy and enact lean strategies to strengthen supply chain resilience (Kaur et al., 2023).

Despite its relevance, Dynamic Capabilities Theory has attracted several criticisms. One major criticism is its conceptual ambiguity. Scholars argued that the concept of "dynamic capabilities" is often broadly defined, making it difficult to measure empirically. This lack of clear operationalisation can create challenges for researchers attempting to apply the theory in empirical studies (Piya, Shamsuzzoha & Khadem, 2022; Farrukh & Sajjad, 2025). Nevertheless, despite these limitations, Dynamic Capabilities Theory remains a valuable and significant framework for understanding how organizations adapt strategies and resources to achieve resilience and competitiveness in dynamic and uncertain environments.

Methodology

This study adopted qualitative research approach to evaluate lean strategy and supply chain resilience in Nigerian oil and gas sector. The study used secondary data from journals, articles and company case studies from databases such as Google scholar, Ebsco and Scopus. The study used evaluative research design to examine the challenges and recommendations for leveraging lean strategies for enhancing supply chain resilience.

According to Rose, Spinks and Canhoto (2023) qualitative research enables in-depth understanding of complex research phenomenon particularly in industries such as oil and gas sector that are characterised by uncertainties, operational risks, and structural issues. Secondary qualitative data analysis permits researchers to synthesise existing empirical evidence and identify patterns across multiple studies, evidence and contexts.

In terms of data collection for this paper, a systematic review of relevant literature obtained from academic databases such as Google Scholar, Scopus-indexed journals, and industry publications were considered relevant. The search strategy involved key words such as "lean", "lean strategy", "supply chain", "resilience", Furthermore, only peer-reviewed studies, reputable industry reports, and empirical research published within the last decade were prioritised. A total of 100 journal articles were searched out and after careful selection across only 75 were found relevant for this study. The selection criteria were applied to ensure the reliability and relevance of the data sources based on inclusion of journals related to lean strategy and management, supply chain, supply chain resilience in the oil and gas sector. The study did not include journals older than 2015 as well as journals that did not have direct quotation or phrase of lean and supply chain. Data analyses were achieved through thematic analysis that enshrines qualitative technique involving identification, categorisation and interpretation of relevant patterns or recurring themes within textual data.

Thematic analysis is commonly applied in qualitative research because it enables the researcher to synthesise diverse sources and develop conceptual insights from existing literature (Saunders et al., 2023). NVivo software was used for the thematic analysis through the coding of the key terms and systematic literature review data sets.

Data Analysis and Results

Theme 1 - Lean Strategy, Operations and Supply Chain Resilience.

The insights from empirical studies set forth thematic analysis to evaluate lean strategy outcomes in diverse context that can be applied for resilience in supply chain in the oil and gas sector in Nigeria.

Firstly, Chen (2026) adopted systematic literature review of SME manufacturing in developing economies to affirm that lean implementation drives process efficiency, waste minimisations and responsiveness. It was established that contextual constraints in developing countries limitations such as weak infrastructure, uncertain market disruptions and inadequate expertise limit full realisations of lean strategies in enhancing supply chain operations of SMEs. Similarly, Liu et al (2024) utilised quantitative SME datasets in selected Asian countries to demonstrate that inventory leanness and operational leanness positively influence financial performance. The authors pointed out that excessive leanness may reduce buffer capacities and responsiveness, as such the need for lean agility is required in organisations. In comparison, Khawka et al (2024) adopted systematic review of literature as the methodology to establish the fact that lean supply chain practices significantly enhance competitive advantage through cost reduction, lead-time minimisation, and enhanced value delivery. This means that supply chain resilience can be driven by the contribution of lean techniques that assist in reducing costs, minimising lead-time and maximising value.

The study by Achaka et al. (2024) demonstrated the extent of adoption of lean in offshore facility maintenance projects in the oil and gas in the Nigerian oil and gas sector. The study employed descriptive survey research design through primary data to assess practitioners' awareness and implementation of lean principles in offshore operations. Achaka et al (2024) argued that lean adoption in offshore oil and gas facilities is generally moderate, with a significant proportion of respondents identifying limited awareness of lean concepts and tools as a reason for not attaining maximum impact. The lean practices and implementation tools directly affect operational consistency, efficiency and responsiveness in maintenance supply chains. Furthermore, Deshmukh et al. (2022) reinforced these findings through a literature review of lean manufacturing applications and the influence in upgrading productivity, quality enhancement, process efficiency and reduced operational waste. Madhani (2022) focused on lean six sigma in the context of human resources to extend the benefits beyond operations to organisational performance through efficiency in talent management processes. Collectively, these studies proposed and offer insights that lean strategy enhances efficiency in supply chain operations but may introduce vulnerability when over-optimised.

Theme 2- Lean Strategy for Supply Chain Resilience and Disruption Management

Studies on supply chain resilience were observed to predominantly adopt qualitative frameworks, conceptual modelling as well as disaster-case and disruption analysis. Ikevuje et al. (2024) conducted case-based methodology to facilitate analytical review of the crude oil price collapse. The authors posited that the extreme price shocks in the oil and gas markets

exposed structural weaknesses in global supply chains, that have trickled down to Nigerian organisations. This was particularly evident in inventory rigidity and demand forecasting failures, that lead to rethinking lean strategy for supply chain by (1) shifting from zero inventory to right inventory through data-driven insights, (2) shifting from single source for cost options to dual/multi-source for cost options, (3) establish end-to-end value stream mapping, (4) shifting from static to dynamic/segmented lean approach, (5) integration of digital lean factors using real-time data, IoT, AI sensing to spot waste instantly.

Onukwulu et al. (2023) carried out a study in renewable energy sector in Nigeria to develop a conceptual resilience framework for supply chains. The authors used thematic analysis to identify that lean techniques assist in driving supply chain adaptability, remove redundancy and promote diversification. These were seen as core resilience pillar that are founded on lean systems thinking. Similarly, Umar and Wilson (2021) asserted the fact that supply chain resilience is conceptually linked to sustainability and disaster management framework. It was emphasised that collaboration, transparency and agility are key enablers of resilience in disrupted supply chains. The authors used a methodology that is based on literature synthesis of resilience theory to demonstrate that interconnected supply networks recover faster when collaboration is high and that collaboration serves as a mediating factor in lean strategy.

The discussions above converge on the viewpoint that supply chain resilience depends and relies on maintaining lean strategic balance between slack and adaptive capacity that contradicts extreme lean configurations. The volatile nature of the Nigerian oil and gas sector particularly requires lean strategies that allow firms navigate geopolitical shocks, price volatility, and logistics disruptions are frequent. Thus, supply chain resilience is strengthened through lean strategy that are enacted via hybrid models combining efficiency with flexibility.

Theme 3- Challenges in Lean Strategies and Supply Chain Resilience in Nigerian Oil and Gas Companies

Shell Petroleum Development Company of Nigeria Limited (SPDC) faces persistent tensions in its lean efficiency approach that makes attaining supply resilience cumbersome. In the Nigerian environment, the reported issues of pipeline vandalism, crude theft, and environmental degradation frequently disrupt lean systems adopted in SPDC. Studies such as Ugolo (2021), Okoh and Odorikpe (2025) as well as Obi-Johnson (2026) asserted that the downstream and upstream operations of SPDC suffer challenges from exposures to weak infrastructure in Nigeria and inadequate maintenance of pipelines. The company uses lean initiatives to reduce inventory costs and disruptions, which are sometimes constrained by repeated supply chain shutdowns and emergency stockpiling requirements. Shell's Nigerian subsidiary adopts hybrid lean strategies, maintaining safety stock to manage unpredictability in the Niger Delta (Okoh & Odorikpe, 2025). In addition, the lean efficiency gains in SPDC are challenged by poor community relations and security risks that have increased transaction costs, delay procurement cycles and weakening end-to-end supply chain visibility and responsiveness.

Furthermore, the operations of Eni (Agip) in Nigeria have been observed to be undermined by infrastructural deficits that constraint and encumber their lean supply chain execution. The factors challenging the lean strategy of Eni (Agip) in Nigeria include (1) inadequate storage facilities, (2) ageing pipeline ageing, (3) process disruptions, (4) weak transport pathways. All these create bottlenecks in material flow through the supply chain, thereby limiting the

application lean practices. Empirical evidence shows that Agip Nigeria often relies on excess inventory positioning at strategic locations to balance for unreliable distribution routes (Oke, Maltz & Goentzel, 2023; Ishaq et al., 2026). This increases cost of operations, time of delivery and cycle value as well as reduces lean efficiency outcomes. Also, the lean strategies of Eni (Agip) in Nigeria have been challenged by limited supplier integration with poor data synchronisation encumber forecasting accuracy, making demand-driven replenishment undependable. Eni (Agip) in Nigeria operates lean-resilience model that emphasises continuity of operations over strict lean adherence in high-risk business environments such as the Niger Delta.

Chevron Nigeria faces diverse lean implementation challenges primarily due to fragmented logistics systems and external operational risks. Case-based analyses show that offshore and onshore logistics coordination is hindered by unreliable transport infrastructure and regulatory bottlenecks. Lean systems designed to optimise procurement cycles and reduce waste are constrained by delays in customs clearance, port congestion, and third-party logistics inefficiencies. Empirical observations from industry studies indicated that Chevron frequently overrides lean procurement rules to accommodate emergency sourcing, particularly during pipeline disruptions or export delays (Gava, Lawrence, Eyesan, Mupa, & Inadagbo, 2024). This creates inefficiencies for the company in inventory forecasting, logistics and weakens demand-driven supply chain planning. Furthermore, inadequacies in digital integration and amalgamation across suppliers of Chevron Nigeria minimises the availability and use of real-time data that make lean replenishment strategies less effective. As a result, Chevron Nigeria has been observed to adopt semi-lean model combining efficiency principles with contingency buffers to improve supply chain resilience in volatile operational environments such as Nigeria (Gava et al., 2024; Wariboko, 2025).

Thus, while lean strategies contribute to efficiency, cost reduction, and responsiveness of supply chains, their applications in the Nigerian oil and gas sector are constrained by structural, operational, and environmental challenges. The above thematic analysis infer that Nigerian oil and gas supply chains are exposed to relentless disruptions that weaken the effectiveness of lean systems (Oke et al., 2023; Ikevuje et al., 2024; Ogbaini, 2025).

Discussions

Across the discussed themes, lean strategy and supply chain resilience in Nigerian oil and gas sector is nuanced having maximum results in larger multinational companies compared to smaller indigenous companies. It was found that lean practices allowed oil and gas companies to survive crude oil crises in the global and local business environment. More so, the findings show that there exists dominant pattern of challenges that are specific to the Nigerian context but also resonate with global experiences. Hence, lean strategies are recurrently weakened by insecurities, infrastructural deficits, disintegration of supply chain systems, regulatory instabilities, and institutional complexities. This has led firms in the Nigerian oil and gas sector to adopt hybrid lean strategies that facilitate resilience systems. The findings agreed with the works of Alem et al. (2026) on managing supply chain resilience in terms of aligning resources, competencies and capabilities.

Lean systems are observed to depend heavily on seamless flow, just-in-time delivery, and minimal inventory buffers and reducing logistical delays. However, studies on Nigerian oil and gas operations, showed that poor transportation systems and networks, unreliable power

supply, societal bottlenecks and limited storage infrastructure hinder smooth lean execution, leading to delays, loss of value and increased costs (Ogbaini, 2025). This creates pressure between lean principles and operational reality, making oil and gas companies such as SPDC and Chevron Nigeria to maintain higher buffer inventory that contradicts lean objectives.

More so, regulatory instability and policy inconsistency were found as further challenges in lean strategy application for oil and gas firms. The Nigerian oil and gas industry is categorised and attributed by evolving regulatory frameworks, local content requirements, industry guidelines and fiscal policy adjustments. Studies indicated that such level of instabilities in regulations and legislations complicate long-term lean planning and supply chain standardisation (Onukwulu et al., 2023; Ogbaini, 2025). In essence, multinational oil companies (IOCs) such as SPDC, Chevron and Eni are often faced with delays in approval processes and procurement inefficiencies, damaging the level of coordination of lean integration across global and local supply dimensions.

From an internal organisational perspective, Klein et al (2022) pointed out challenges that limit lean management practices and process effectiveness are; lack of perception, lack of tangible benefits, and issues with employees in terms of technical knowledge that causes the misapplication to LM practices. In addition, companies are struggling with time, financial, and labour resources that restrict strategic LM practices. Organisational barriers present internal resistance to lean transformation. Studies highlight that hierarchical structures, fragmented procurement systems, and weak cross-functional collaboration hinder lean adoption (Deshmukh et al., 2022; Chen, 2026). In multinational operators such as Chevron and TotalEnergies, global lean standards often clash with local operational realities in Nigeria, creating hybrid inefficiencies

Finally, gaps in technological capabilities illustrate and demonstrated severe challenges to lean strategies in Nigerian oil and gas firms. This is because of the increasing dependency on digital tools such as Internet of Things, Artificial Intelligence and real-time analytics for managing supply chain activities such as demand forecasting and inventory optimisation. The limited digital integration across many Nigerian oil and gas operations is leading to poor data visibility and weak coordination (Gava et al., 2024; Wariboko, 2025; Ogbaini, 2025), this restricts the effectiveness of lean-driven decision-making in operations.

Conclusions and Recommendations

This study concludes that in the Nigerian oil and gas industry, lean strategies have potential to improve efficiency, reduce costs and eliminate waste. However, its application in enhancing supply chain resilience in oil and gas firms in Nigeria has been constrained by internal factors such as insufficient awareness, weak technological capabilities, and limited organisational adoption as well as external factors such as regulatory instabilities, insecurities, infrastructural inadequacies and socio-cultural conflicts.

The discussions and findings from this study implied that lean strategy cannot automatically enhance supply chain resilience unless there is organisational readiness, environmental adaptability and technical as well as non-technical capabilities development in the Nigerian oil and gas sector. Overall, the insight from this paper affirms that lean strategies enhance efficiency in stable environments, their application in the Nigerian oil and gas sector is inhibited by volatilities, uncertainties, complexities and ambiguities (VUCA). Therefore,

achieving supply chain resilience requires a strategy that is lean–agile, where lean practices are balanced with buffering capacity, collaboration and adaptive flexibility to withstand disruptions.

It is therefore recommended that lean strategy for enhancing supply chain resilience in oil and gas sector should be based on stronger talent training, leadership commitment, process automations, technology integrations as well as enhancing supplier collaboration and local sourcing. Furthermore, it is recommended that Nigerian oil and gas companies embed risk management and scenario planning within lean systems to improve supply chain resilience that ensures adaptability to the Nigerian business environment shocks such as policy fluctuations, pipeline vandalism, market changes, and logistics disruptions.

Theoretical and Practical contributions.

The contribution of this study was based on advancing existing knowledge on the relationship between lean strategies and supply chain resilience within the Nigerian oil and gas sector. The findings affirmed that lean strategies incorporation for supply chain resilience illustrates dynamic capabilities theory. Hence, demonstrating how oil and gas organisations develop capabilities to sense disruptions, seize opportunities, and reconfigure resources while implementing lean strategies to make supply chain resilient. This enriches the theoretical understanding of balancing between efficiency, agility and adaptability in complex as well as diverse supply chains. More so, this study presents valuable insights for executives, managers, policymakers, regulators and industry stakeholders that seek in advancing operational performance and disruption preparedness in the Nigerian oil and gas sector.

Study Limitations and Suggestions for Future Research

The results and findings from this study was limited to the qualitative method being used through secondary data. This reliance on published literature can introduce document selection biases. Furthermore, the focus on the Nigerian oil and gas sector presents a limitation on industry context and the generalisability of the results of this study towards other sectors or developing economies. In light of the limitations of this study, future research should undertake quantitative empirical investigations or mixed method to validate the relationships between lean strategies and supply chain resilience identified in the Nigerian oil and gas sector. Furthermore, further studies can embark on longitudinal analysis on how organizations adapt lean practices over time in response to evolving disruptions and market conditions. Finally, future studies grounded in dynamic capabilities theory can consider other forms of mechanisms such as digital transformation and sustainability practices through which firms can develop adaptive and reconfigurable supply chain capabilities in turbulent environments.

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