Assessing The Effect of Supply Chain Risk Management Strategies on the Operational Performance of Nigerian National Petroleum Company Limited (NNPC Ltd)

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ABSTRACT

Operational performance is pivotal to the sustainability of oil and gas operations, with metrics like resource utilization, disruption recovery, and delivery accuracy determining efficiency and stakeholder satisfaction. This study examined the effect of Supply Chain Risk Management Strategiesspecifically Risk Identification Strategies, Supplier Risk Assessment, Contract Management Risk, and Risk Mitigation Strategies on Operational Performance (OPP) at Nigerian National Petroleum Company Limited (NNPC Ltd). Operational performance, in this study, is measured through operational efficiency, supply chain resilience, and customer satisfaction with delivery performance. Operational efficiency assesses resource utilization and process optimization, while resilience evaluates the ability to recover from disruptions. Customer satisfaction gauges delivery accuracy. Using a cross-sectional survey design, data were collected from 258 experienced management and senior officers across five critical departments via structured questionnaires. Partial Least Squares Structural Equation Modelling (PLS-SEM) was employed to analyze the data, revealing that Risk Mitigation Strategies ($\beta = 0.405$, $p < 0.001$), Risk Identification Strategies ($\beta = 0.222$, $p = 0.013$), and Supplier Risk Assessment ($\beta = 0.210$, $p = 0.001$) all significantly affect operational performance, while Contract Management Risk ($\beta = 0.071$, $p = 0.334$) had no significant effect. Collectively, these strategies explain 66.2% of the variance in operational performance ($R^2 = 0.662$). While Contract Management Risk was perceived as relevant, it did not translate into measurable performance gains. This study concluded that proactive, capability-driven risk strategies are vital to ensuring efficiency, resilience, and delivery reliability in volatile environments. Recommendations for NNPC Ltd include prioritizing risk mitigation through diversification and analytics, institutionalizing standardized identification frameworks, enhancing supplier vetting with real-time tools, and digitizing contract oversight to strengthen overall operational resilience.

Keywords: Operational Performance, Supply Chain Risk Management, Risk Identification Strategies, Supplier Risk Assessment, Contract Management Risk, Risk Mitigation Strategies.

INTRODUCTION

Operational Performance is intrinsically linked to the stability and effectiveness of robust Supply Chain Risk Management (SCRM) frameworks across global industries (Ngo et al., 2024; Okoye et al., 2024). De Oliveira (2025) defined OP as an organization's capacity to effectively leverage human, material, financial, and technological resources to fulfill strategic objectives while incorporating controls for safety, quality, and cost. Within global energy sectors, OP is fundamentally secured by proactive risk strategies. For instance, rigorous risk identification enables early detection of vulnerabilities like supplier delays, thereby sustaining efficiency and minimizing waste (Paul, 2023). This is complemented by risk mitigation strategies such as diversification, which reduce disruption impacts, enhancing resilience and improving customer satisfaction through consistent delivery (Tullio, 2024). Furthermore, effective Supplier Risk Assessment (SRA) ensures partner reliability, and strict Contract Management Risk (CMR) controls prevent disputes that erode operational uptime (Akajo, 2024).

The criticality of this link is amplified in the African context, where infrastructural deficits, regulatory inconsistencies, and geopolitical instabilities introduce heightened supply chain challenges (Ifraimu et al., 2024). Empirical evidence from the continent consistently reinforces this connection. Studies in South Africa's public health procurement demonstrate that risk mitigation preferences strengthen supplier commitment, directly improving procurement timelines and operational efficiency (Omoruyi &Quayson, 2023). Similarly, in Kenya, risk identification explains a significant variance in supply chain performance, underscoring its role in process optimization and waste reduction (Nurwin, 2022; Wawire et al., 2022). Finally, strong contract management practices in Uganda and Kenyan energy corporations have been shown to reduce delays and defect rates, explaining up to 49% of performance variance and directly supporting operational efficiency (Akajo, 2024; Kolani &Miroga, 2019).

In Nigeria, Operational Performance in the oil and gas industry faces extreme vulnerability due to endemic domestic risks, including pipeline vandalism, crude oil theft, community disruptions, and price volatility. The Nigerian National Petroleum Company Limited (NNPC Ltd), a major player in the global oil market, operates under these persistent, high-frequency, and severe threats (Asika et al., 2024; Owuso&Ihunwo, 2019). Given that SCRM is described as a structured, proactive cycle of identifying, assessing, mitigating, and monitoring risks to enhance organizational performance (Obi &Fadun, 2025), the successful deployment of integrated SCRM strategies is fundamental to NNPC Ltd's ability to stabilize uptime, preserve efficiency, and achieve its operational mandate.

To address this critical environmental context, this study focuses on empirically establishing the relationship between four specific SCRM capabilities and the resulting dimensions of Operational Performance. These capabilities include: Risk Identification Strategies, defined as the systematic process of recognizing and communicating uncertain events (Paul, 2023); Supplier Risk Assessment (SRA), the process of evaluating and managing risks from partners (McAdoo, 2025); Contract Management Risk (CMR) controls, which manage execution uncertainties that lead to disputes and delays (Kolani &Miroga, 2019); and Risk Mitigation Strategies (RMS), which utilize proactive measures like diversification and contingency planning to reduce negative impact (Asikhia et al., 2022). This study, therefore, seeks to empirically establish the relationship between these specific Supply Chain Risk Management strategies and the resulting dimensions of Operational Performance (efficiency, resilience, and customer satisfaction) within NNPC Ltd.

The oil and gas sector in Nigeria, anchored by NNPC Ltd, serves as the economic lifeblood of the nation, making its Operational Performance a matter of national importance. Despite its dominant market position, NNPC Ltd consistently faces deep-seated operational challenges, manifesting as subpar efficiency, unreliable supply continuity, and persistent difficulties in meeting contractual delivery targets. The fundamental issue is the suspected inadequacy and ineffectiveness of its Supply Chain Risk Management (SCRM) strategies in mitigating the sector's unique and extreme threats. While the presence of risks like pipeline vandalization is well-known (Asika et al., 2024), empirical evidence suggests a poor translation of risk knowledge into protective action.

Specifically, there is limited insight into whether current Risk Identification Strategies are sufficiently proactive or predictive, or whether Supplier Risk Assessment effectively screens partners against operational and ethical risks (Omoruyi &Quayson, 2023). Failures often cascade, with unmanaged supplier and contractual risks escalating into Contract Management Risk, ultimately eroding Operational Efficiency and hindering Supply Chain Resilience (Akajo, 2024). Consequently, NNPC Ltd's capacity to consistently satisfy its customers is compromised. The core problem this study addresses is the lack of empirical evidence specifically assessing the effect of these four crucial, distinct SCRM strategies on the measurable components of Operational Performance within NNPC Ltd, hindering management's ability to prioritize and invest in the most impactful risk control mechanisms necessary for sustainable success. The specific objectives are to:

1. Determine the effect of Risk Identification Practices on Operational Performance at NNPC Ltd.

2. Evaluate the effect of Supplier Risk Assessment on Operational Performance at NNPC Ltd.

3. Examine the effect of Contract Management Risk on Operational Performance at NNPC Ltd.

4. Investigate the effect of Risk Mitigation Strategies on Operational Performance at NNPC Ltd.

The null hypotheses for the study are as follows:

H$_{01}$: Risk Identification Practices have no significant effect on Operational Performance at NNPC Ltd.

H$_{02}$: Supplier Risk Assessment has no significant effect on Operational Performance at NNPC Ltd.

H$_{03}$: Contract Management Risk has no significant effect on Operational Performance at NNPC Ltd.

H$_{04}$: Risk Mitigation Strategies have no significant effect on Operational Performance at NNPC Ltd.

LITERATURE REVIEW

Conceptual Review

Operational Performance

Operational performance involves assessing how effectively an organization utilizes its resources to achieve its strategic objectives, particularly in complex environments like the Nigerian National Petroleum Company Limited (NNPC Ltd). Operational performance, defined by de Oliveira (2025) as an organization's ability to efficiently utilize human, material, financial, and technological resources to meet strategic and operational goals, encompassing the management, measurement, and monitoring of key areas like safety, quality, and cost. Buzinkay (2024) described it as a multidimensional construct measuring how well a business executes core activities via quantifiable Key Performance Indicators (KPIs), reflecting efficiency, effectiveness, and quality in production flows. Furthermore, Goncalves (2023) evaluated it as how effectively a company conducts its core activities, using quantifiable KPIs to assess processes and outcomes, tracking, for example, equipment uptime to ensure minimal disruptions. Al Majali (2023) defined operational performance as the evaluation of efficiency and effectiveness in core operations to monitor achievement, providing managers with useful information for decisionmaking.

Operational performance underscored how well an organization executes its fundamental activities to meet its defined objectives, contains a comprehensive measure, extending beyond mere output to include the efficient utilization of all resources human, financial, and material while maintaining quality and controlling costs (de Oliveira, 2025). This systematic assessment uses quantifiable metrics, or KPIs, to reflect the efficiency and effectiveness of processes (Buzinkay, 2024; Al Majali, 2023). For NNPC Ltd, this evaluation must consider not only the achievement of strategic goals but also the resilience and sustainability of its operations.In this study, operational performance (OPP) is measured by operational efficiency, supply chain resilience, and customer satisfaction with delivery performance. Operational efficiency is defined as the optimization of processes to minimize waste and maximize productivity in resource-constrained projects (Khosrow-Pour, 2018; Adewale Akinsulire et al., 2024). It assesses resource utilization and process optimization, exemplified by lean construction techniques reducing time and costs by eliminating non-value-adding activities (Adewale Akinsulire et al., 2024; Mossman, 2009). Supply chain resilience is described by Ponomarov and Holcomb (2009) as the adaptive capability to prepare for unexpected events, respond to disruptions, and recover by maintaining continuity of operations. It evaluates the ability to recover from disruptions, such as a firm swiftly sourcing alternative components after a factory fire, demonstrating an ability to "bounce back" (Sheffi, 2005). Customer satisfaction is defined as the extent to which a product's perceived performance matches buyer expectations (Kotler & Armstrong, 2008), gauging delivery accuracy. High satisfaction stems from timely material delivery and supplier commitment that ensures uninterrupted production and distribution, directly boosting product availability (Atadoga et al., 2021).

Supply Chain Risk Management

Supply Chain Risk Management (SCRM) is a systematic approach vital for organizations like the Nigerian National Petroleum Company Limited (NNPC Ltd) to ensure operational continuity and protect performance against various uncertainties. SCRM is defined by Obi &Fadun (2025) as the systematic processes of identifying,

assessing, mitigating, monitoring, and controlling risks across supply chains to enhance organizational performance. Similarly, Andeobu et al. (2015) described SCRM as involving the planning, identification, assessment, mitigation, and monitoring of uncertainties in supply chains that could disrupt operations. McGrath & Jonker (2025) defined it as the process of finding and addressing potential supply chain vulnerabilities to minimize their negative impact on a company's operations. For Thomas (2023), SCRM is the systematic process of identifying, assessing, mitigating, and monitoring potential disruptions in the supply chain, encompassing direct and indirect suppliers.

SCRM is described as a structured, proactive cycle of activities designed to manage uncertainties throughout an organization's value chain, from raw material sourcing to final delivery. It moves beyond simply reacting to problems by incorporating planning and systematic processes (Obi &Fadun, 2025; Andeobu et al., 2015). The core of SCRM is the methodical sequence of identifying all possible weaknesses, assessing their likelihood and potential negative impact, and then employing strategies such as diversification or contingency planning to mitigate these vulnerabilities (McGrath & Jonker, 2025). This systematic management is an ongoing process, risks must be monitored and controlled continuouslyto maintain operational stability and enhance overall performance, covering risks from all tiers of the supplier network (Thomas, 2023). For NNPC Ltd, applying this framework ensures that uncertainties in the complex energy sector, such as geopolitical events or volatile commodity prices, are managed proactively to safeguard the flow of goods and services.

Risk Identification Strategies

Risk identification strategies form the foundational step in Supply Chain Risk Management (SCRM), enabling NNPC Ltd to proactively manage uncertainties that could threaten its operational performance and goals. Risk identification is defined by Paul (2023) as the systematic process of recognizing, understanding, documenting, and communicating the likelihood and potential impact of uncertain events that may disrupt procurement activities. Mburu et al. (2025) further described it as the process of detecting risks that could hinder the achievement of project, enterprise, or investment goals, emphasizing the importance of documenting and sharing these concerns. According to Asika et al. (2024), these strategies involve systematically detecting potential loss-causing events through analysis of major loss types, immediate causes, underlying factors, and physical inspections to enable proactive control. Owuso and Ihunwo (2019) stated that it is the process by which potential risk sources that may affect organizational sales performance are identified.

Risk identification strategies consist of methodical approaches and tools used to locate, characterize, and communicate all potential uncertainties and vulnerabilities within the supply chain and procurement processes before they escalate (Paul, 2023; Mburu et al., 2025). The process is described as systematic, involving both abstract analysissuch as mapping underlying causes and consequencesand concrete physical inspections (Asika et al., 2024). This early detection is essential because it allows organizations like NNPC Ltd to prepare for the management of procurement risk, enhancing the efficiency of the procurement function by addressing uncertainties before they can disrupt operations or reduce sales performance (Renault et al., 2016; Owuso&Ihunwo, 2019). For instance, in oil and gas, this involves identifying potential risks related to scope, cost, or regulatory complexities before a project begins (Banerjee Chattapadhyay, 2021). The outcome of these strategies includes documenting the risk sources and characteristics, enabling the organization to develop standardized contract frameworks, like requiring performance securities, to mitigate potential future impacts (Paul, 2023; Bilabaye, 2019).

Risk Mitigation Strategies

Risk mitigation strategies represent the necessary actions taken by NNPC Ltd to counter identified vulnerabilities, ensuring minimal disruption and safeguarding its operational and procurement success in the volatile Nigerian energy sector. According to Osabutey (2016), risk mitigation is the actions taken by management to reduce the impact of identified risks while optimizing opportunities. Tullio (2024) explained that risk mitigation involves proactive measures like supplier diversification, risk mapping, and data-driven decisions to address vulnerabilities and prevent disruptions. Vashisht (2023) added that these strategies focus on assessing and managing supplier-related threats to ensure quality, compliance, and continuity. Furthermore, Asikhia et al.

(2022) referred to these strategies as systematic actions, such as hedging, diversification, and contingency planning, designed to reduce the likelihood and impact of disruptions in high-stakes sectors.

Risk mitigation strategies are proactive and systematic implementation of plans designed to lessen both the probability and the negative consequences of previously identified supply chain threats (Osabutey, 2016; Asikhia et al., 2022). This involves taking planned approaches to manage threats, primarily those related to suppliers, to secure business continuity, quality, and compliance (Vashisht, 2023). For NNPC Ltd, these strategies are essential for enhancing supply chain resilience and operational efficiency. Practical strategies include supplier diversification to avoid over-reliance, contingency planning to quickly recover from events like geopolitical unrest, and using data-driven decisions to anticipate market disruptions (Tullio, 2024; Sharma, 2025). Moreover, collaborative strategies, such as sharing risk information and managing relational risks with partners, have been shown to improve supply chain performance by reducing volatility (Sezen et al., 2019). The goal is to develop tailored, context-specific solutions, such as deploying surveillance systems in pipelines to deter vandalism, or hedging against crude oil price fluctuations to minimize financial losses (Enumah, 2025; Sharma, 2025).

Supplier Risk Management

Supplier Risk Management (SRM) is an important part of Supply Chain Risk Management, focusing specifically on threats originating from the network of partners supplying goods and services to NNPC Ltd. Supplier risk management is defined by Kamoni et al. (2018) as the process of identifying, assessing, and mitigating risks posed by suppliers that could harm an organization's reputation, operations, or financial stability. McAdoo (2025) described Supplier Risk Assessment as a systematic process to identify, evaluate, and manage risks linked to suppliers, safeguarding against disruptions, financial losses, compliance violations, and reputational harm. Oduma and Getuno (2017) explained that these risks include product failures, disruptions, regulatory issues, and financial instability, which require real-time monitoring to maintain continuity. Lamhot and Siagian (2024) highlighted that it involves evaluating potential disruptions from supplier failure in delivery, quality, or reliability, often proxied by supplier involvement and contingency measures.

Supplier risk management is a continuous, structured process of systematically identifying, evaluating, and controlling potential threats that suppliers introduce into an organization's operations (Kamoni et al., 2018; McAdoo, 2025). The goal is to lessen the organization's exposure to consequences that could damage its reputation, operational integrity, or financial sustainability (Kamoni et al., 2018). This systematic assessment analyzes various factors, including the supplier's financial stability, operational performance, regulatory compliance, and capacity for reliable delivery (McAdoo, 2025; Oduma and Getuno, 2017).

For NNPC Ltd, effective SRM is essential for ensuring project success, as it allows for the proactive management of specific risks like non-delivery, poor quality, or price volatility (Ominde et al., 2022). Mitigation strategies include using multiple suppliers (dual sourcing) and maintaining risk mitigation inventories to cope with disruptions more effectively (Hosseini et al., 2019; Owich and Odero, 2023). Ongoing monitoring and strong buyer-supplier relationships are also key to managing these risks in real-time, helping to improve operational efficiency and on-time delivery (Oduma and Getuno, 2017; Alhammadi et al., 2023).

Contract Management Risk

Contract Management Risk is the uncertainty that failures in overseeing contractual agreements will negatively impact NNPC Ltd's supply chain and operational goals. According to Mingle (2025), contract management is described as the structured process of managing agreements to ensure procurement and supplier relationships align with organizational objectives while reducing risks and improving performance. Kolani &Miroga (2019) described Contract Management Risk as encompassing uncertainties in planning, monitoring, and closing contracts that disrupt supply chain performance. Furthermore, Akajo (2024) stated that it encompasses failures in monitoring, enforcing, or adapting contractual terms, leading to delays, disputes, or non-performance.

Contract management risk is the potential for loss or failure arising from inadequate control over the creation, execution, and monitoring of contractual agreements with suppliers and partners (Mbonera, 2024). It is not just about writing contracts; it encompasses the uncertainties that disrupt supply chain performance across the entire

contract lifecycle, from initial planning to final closure (Kolani &Miroga, 2019). This risk is realized through failures in enforcement, monitoring, or adapting terms, which then lead to damaging outcomes like project delays, disputes, or supplier non-performance (Akajo, 2024).

The consequences of this risk are often seen as tangible failures, such as delays, non-performance by suppliers, or disputes due to poor communication or unmonitored compliance (Akajo, 2024; Inyang et al., 2018). For NNPC Ltd, the risk is heightened by factors like complex negotiations, ensuring compliance with changing regulations, and the oversight required for large, fixed-price contracts (Kumar, 2023). Effective contract management, therefore, reduces this risk by establishing clear contractual obligations across the value chain to prevent delays and financial losses (Lins, 2024). This requires continuous monitoring and feedback integration, as robust management practices have shown to improve delivery timelines and reduce disputes by ensuring supplier accountability and performance (Akajo, 2024; Mingle, 2025). Ultimately, addressing these uncertainties enhances operational efficiency and supports sustainable project delivery (Lins, 2024; Lawani et al., 2022).

Empirical Review

Risk Identification and Operational Performance

Owuso and Ihunwo (2019) assessed influence of risk identification and sales performance: a survey of quoted petroleum marketing firms in nigeria. The study examined the nexus between risk identification (predictor variable) and sales performance (criterion variable, proxied by profit and sales turnover), adopted descriptive design, used Pearson product moment correlation, targeted quoted petroleum marketing firms in Nigeria with a sample of 33, collected data via unspecified means, and analyzed via SPSS 22.0; findings revealed significant positive effect of risk identification on profit (r = .533, p = .000, inverse association) and sales turnover (r = .348, p = .000, direct association), recommending dedicated supply chain monitoring teams and tailored risk strategies. The strength lay in high Cronbach's alpha reliability (.997–.998). However, the small sample limited generalizability, and inverse profit correlation contradicted stated positive effect.

Paul (2023) assessed the effects of procurement risk management practices on procurement performance in a study titled an assessment of effects of procurement risk management practices on procurement performance: a case of RUWASA Dodoma. The study focused on three objectives: examining the effect of procurement risk identification, risk mitigation, and risk monitoring on procurement performance. It adopted a mixed-methods approach, applying both qualitative and quantitative research designs within a pragmatism paradigm. Data were collected using questionnaires, interviews, and document reviews. The population comprised 70 RUWASA staff, and a census inquiry was used to study the entire population. Descriptive statistics, factor analysis, content analysis, and regression analysis were employed to analyze the data. The findings revealed that procurement risk identification, risk mitigation, and risk monitoring all had positive effects on procurement performance, leading to better project delivery, quality procurement, and reduced cost overruns. The study recommended that procurement teams proactively manage risks to improve procurement outcomes. However, the study was limited by its focus on a single organization, which may affect the generalizability of the findings.

Nurwin (2022) analyzed risk identification and supply chain performance in construction industry in Kenya. The study evaluated the types of risks in the supply chain and determined the impact of procurement risk identification practices on supply chain performance at ITS GOVINDA & SONS (K) LTD construction company. A descriptive survey research design was adopted, and data were collected using structured questionnaires. Validity and reliability were ensured through expert review and pilot testing. The population details and specific sample size were not explicitly stated, but regression analysis was used to analyze the relationship between risk identification practices and supply chain performance. The findings showed that risk identification practices explained 49.9% of the variation in supply chain performance, with a significant positive effect observed. Based on these findings, the study recommended that construction companies should prioritize comprehensive risk identification techniques to enhance their supply chain outcomes. However, a critique of the study lies in its limited generalizability as the study was confined to a single company, and broader industry representation was not considered.

Supplier Risk Assessmentand Operational Performance

Lamhot and Siagian (2024) examined the influence of operational risk and supply chain risk management on operational performance. The study assessed supply risk (including supplier reliability and delivery failure), external risk, demand risk, operational risk, supply chain risk management (extra capacity, alternative transportation, contingency plans), and operational performance (on-time delivery, product quality, productivity), using primary data from questionnaires distributed to 251 logistics employees in Indonesia via purposive sampling and analyzed through structural equation modeling. Findings revealed that supply risk, external risk, and demand risk positively influenced operational risk, while operational risk negatively affected operational performance, and supply chain risk management positively impacted operational performance. The study recommended enhanced supplier involvement and contingency planning. Its strength lay in robust SEM validation of multi-risk interactions in an emerging market context. However, the Indonesia-specific sample limited generalizability to oil-rich contexts like Nigeria.

Owich and Odero (2023) examined supplier risk management practices and performance of supply chain in the health sector in Kenya. The study evaluated the influence of supplier risk management strategies on supply chain performance in four county referral hospitals in western Kenya. It employed a descriptive survey design with a target population of 102 staff, out of which 81 were sampled. Data were collected using structured, closed-ended questionnaires, with content validity ensured and instrument reliability confirmed through Cronbach's alpha. Descriptive statistics such as frequencies and percentages were used alongside inferential statistics through simple linear regression to test the relationship between the variables. The findings indicated a strong and positive relationship between supplier risk management practices and supply chain performance ($\beta = 0.521$, $t = 7.256$, $p < 0.05$), demonstrating that techniques such as risk identification, risk assessment, and dual sourcing significantly enhance supply chain outcomes. The study recommended that healthcare managers adopt structured supplier risk management practices to strengthen supply chain resilience. However, the study was limited by its narrow geographical focus and did not account for other supply chain sectors beyond healthcare, potentially restricting generalizability.

Alhammadi et al. (2023) conducted a critical review of buyer-supplier dynamics in the global petroleum and natural gas industry to redefine procurement paradigms. The study explored prevalent procurement strategies, factors influencing buyer-supplier interactions, and empirically validated methods to enhance interaction efficiency. A literature review was employed, sourcing data from peerreviewed journals, industry reports, and case studies selected via stratified random sampling. Content and comparative analyses, supplemented by regression and hypothesis testing, were used to analyze data. The study found a significant gap in research on strengthening buyer-supplier relationships in the oil and gas sector, highlighting center-led procurement as effective for fostering balanced supplier dynamics. It recommended organizations prioritize relationship management and urged further research into industry-specific strategies. However, the study's reliance on qualitative data introduced potential subjectivity, and limited access to industry-specific reports constrained its scope. Future research should incorporate diverse data sources and quantitative methods to enhance objectivity

Contract Management Risk and Operational Performance

Akajo (2024) examined procurement risk management and contract performance in local governments: a case of mbale district. The study assessed the effects of supplier selection, contract management, and financial stability on contract performance. A descriptive design was employed with a population of 51 procurement stakeholders in Mbale District, Uganda; a sample of 45 was selected via purposive and simple random sampling. Data were collected through questionnaires and interviews, analyzed using descriptive statistics, correlation, and regression in SPSS. Findings revealed contract management correlated positively ($r = .70$, $p < .05$) with contract performance, explaining 49% variance ($R^2 = .490$). Recommendations included enhancing contract monitoring and communication protocols. The strength lay in mixed-methods triangulation for robust local insights. However, the small sample and districtspecific focus limited generalizability to broader contexts.

Kolani and Miroga (2019) examined influence of contract management practices on supply chain performance of state corporations in the ministry of energy. The study determined the effects of relationship management, contract administration, post-contract appraisal, and contract closure on supply chain performance measured via

lead time, customer satisfaction, and delivery defect rate. Descriptive research design was adopted targeting 395 professionals in Kenya's Ministry of Energy state corporations; stratified random sampling yielded 198 respondents. Primary data were collected through questionnaires, with reliability tested via Cronbach's alpha and analysis conducted using SPSS version 21 via descriptive statistics, correlation, and regression. All four practices positively and significantly influenced supply chain performance, explaining 66% of variance (R^2 = .660). State corporations were recommended to prioritize relationship management and post-contract activities. The strength lay in its multi-variable regression and sector-specific focus. However, reliance on selfreported data risked response bias, and the energy sector context limited generalizability.

Lawani et al. (2022) analyzed strategic risk mitigation and contract management in multinational oilfield service tendering, drawing lessons from deepwater operations. The study evaluated how effective contract frameworks and predictive risk assessment tools influenced project performance in offshore environments. Using a comprehensive risk assessment approach, the study integrated both qualitative and quantitative methods, employing expert judgment, historical data analysis, and Monte Carlo simulations. The study assessed risks including oil price fluctuations, supply chain disruptions, environmental liabilities, and contractual disputes. Though the study did not explicitly state its population or sample size, it utilized multiple case studies of major deepwater projects to draw empirical conclusions. Data were collected through document reviews and expert interviews, and analysis involved simulation modeling and thematic evaluation. Findings revealed that adaptive contracting strategies, risk-sharing mechanisms, and digital technologies such as blockchain and realtime monitoring significantly enhanced transparency, reduced disputes, and improved governance. The study recommended adopting smart contracts, enhancing stakeholder collaboration, and aligning with regulatory frameworks to strengthen project resilience. However, the study lacked explicit details regarding sample size and participant demographics, limiting its generalizability and reproducibility despite offering robust strategic insights.

Risk Mitigationand Operational Performance

Asikhia et al. (2022) assessed the impact of supply chain risk management strategies on business performance in the oil and gas sector. The study examined the effects of risk identification, assessment, mitigation, and monitoring as independent variables on operational efficiency, financial returns, and market share as dependent variables, moderated by firm size. It employed a survey research design with a population of 1,044 full-time employees from five downstream oil and gas marketing companies in Lagos, Nigeria, drawing a sample size of 362 via purposive, stratified, and proportionate sampling techniques. Primary data were collected through an adapted, validated questionnaire, and analyzed using descriptive statistics and hierarchical multiple regression. Findings revealed that supply chain risk management strategies significantly enhanced business performance (β = 0.452, p < 0.05), with firm size strengthening this relationship, particularly through proactive mitigation like hedging and diversification reducing disruptions by 28%. The study recommended integrating digital monitoring tools and scenario planning for resilience. Its strength lay in the robust moderation analysis contextualized to Nigeria's volatile market, offering practical insights for state-owned entities like NNPC Ltd. However, the cross-sectional design limited causality inferences, and self-reported data risked bias, while the focus on downstream firms overlooked upstream integration critical for NNPC's holistic operations.

Harju et al. (2024) investigated the role of risk management practices in IT service procurement using a case study approach in the financial services industry. The study examined how risk factors influence procurement outcomes and how practices implemented during procurement processes mitigate those risks. It employed a qualitative methodology, collecting data through interviews and document analysis within a selected financial institution. The study provided a typology of IT procurement risks and developed an explorative framework grounded in the practice-based view. Data were analyzed thematically to identify recurring patterns related to risk identification, mitigation, and collaborative risk management. Findings revealed that proactive and collaborative risk management with service providers significantly improved service performance and reduced procurement disruptions. The study recommended adopting structured risk management practices throughout the procurement lifecycle to support long-term value delivery. However, the single-industry and single-case design limited the generalizability of the findings to broader contexts or industries beyond financial services.

Asikhia et al. (2022) assessed supply chain risk management and business performance of selected oil and gas marketing companies in Lagos State, Nigeria: moderating role of firms' size. The study examined how supply chain risk management strategies influenced the business performance of oil and gas marketing companies, while considering the moderating effect of firm size. A survey research design was used, targeting 1,044 full-time employees of five selected oil and gas marketing companies in the downstream petroleum sector in Lagos. A sample size of 362 was drawn using purposive, stratified, and proportionate sampling techniques. Primary data were collected through an adapted and validated questionnaire. Descriptive statistics and hierarchical multiple regression analysis were employed to analyze the data. The findings revealed that supply chain risk management significantly affected business performance. Furthermore, firm size significantly moderated this relationship. The study recommended the implementation of strategic agility measures by oil and gas marketing companies to adapt to Nigeria's volatile business environment for improved performance. However, the study did not sufficiently address the specific supply chain risk dimensions or contextual factors such as regulatory pressures or technological readiness that might influence the effectiveness of risk management strategies.

THEORETICAL FRAMEWORK

The underpinning theory for this study, "Assessing the Effect of Supply Chain Risk Management Strategies on the Operational Performance of Nigerian National Petroleum Company Limited (NNPC Ltd)," is the Resource-Based View (RBV). This theory was propounded by Jay Barney (1991), building on earlier work by Wernerfelt (1984). The RBV suggested that an organization's sustained competitive advantage stems from possessing and effectively utilizing valuable, rare, inimitable, and nonsubstitutable (VRIN) internal resources and capabilities, rather than solely from external industry positioning. Capabilities, such as effective Supply Chain Risk Management (SCRM) strategies, are viewed as bundles of skills and resources that are difficult for competitors to copy. For NNPC Ltd, the ability to manage complex risks inherent in the oil and gas supply chainsuch as geopolitical instability, security threats, and infrastructure failurecan be considered a rare and inimitable capability.

The RBV underscored that Operational Performance is a direct outcome of how well these internal resources and capabilities are deployed. Specifically, robust SCRM strategies (the capabilities) translate into superior operational outcomes like enhanced resilience and efficiency (the performance). Mbonera (2024) support this application; for example, studies examining performance in the public sector suggested that internal capabilities, like contract management staff competence and organizational capability, positively affect Value for Money (Mbonera, 2024), mirroring the RBV's focus on internal factors driving success. Furthermore, the concept of building supply chain resilience through adaptive strategies aligns perfectly with the RBV's emphasis on developing unique, hard-to-replicate organizational strengths that allow a firm to withstand external shocks better than its rivals (Sheffi, 2005). This theory best explains the study relationship because it frames successful SCRM not as a response to market forces alone, but as an inimitable internal strength that directly enables higher, sustained operational performance, positioning well-executed risk management as a valuable resource for NNPC Ltd in a volatile environment.

METHODOLOGY

This study adopted a cross-sectional survey research design to examine the effect of Supply Chain Risk Management Strategies on the Operational Performance of Nigerian National Petroleum Company Limited (NNPC Ltd). The cross-sectional design was selected to collect data at one point in time from a diverse group of experienced professionals, allowing for the evaluation of relationships between risk identification strategies, supplier risk assessment, contract management risk, risk mitigation strategies, and operational performance indicators. The target population comprised 1,801 experienced management and senior officers within NNPC Corporate Headquarters involved in Supply Chain, Procurement, Operations, Logistics, and Risk Management departments (Eboh, 2020). Using Taro Yamane's (1967) formula for sample size determination at a 95% confidence level and 5% margin of error, the calculated sample size was 327 respondents. A stratified random sampling technique was applied to ensure proportional representation across the five departments, enhancing the generalizability of findings within the organization.

Data were collected using a structured 5-point Likert-scale questionnaire (Strongly Disagree to Strongly Agree) adapted from validated instruments in Paul (2023), Thomas (2023), Asika et al. (2024), Owuso and Ihunwo (2019), Lamhot and Siagian (2024), Chowdhury et al. (2019), Akajo (2024), Kolani and Miroga (2019), Kumar (2023), Tullio (2024), Asikhia et al. (2022), Sezen et al. (2019), Khosrow-Pour (2018), Buzinkay (2024), and Goncalves (2023). The instrument measured the four independent variablesRisk Identification Strategies (RIS1– RIS5), Supplier Risk Assessment (SRA1–SRA5), Contract Management Risk (CMR1–CMR5), and Risk Mitigation Strategies (RMS1– RMS5)and the dependent variable, Operational Performance (OPP1–OPP5), focusing on operational efficiency, supply chain resilience, and customer satisfaction with delivery performance.

Data analysis was conducted using Partial Least Squares Structural Equation Modeling (PLS-SEM) via SmartPLS3, chosen for its suitability with complex models, smaller sample sizes relative to parameters, and ability to handle non-normal data distributions. A two-stage approach assessed measurement model reliability and validity (composite reliability, AVE, discriminant validity) before structural model evaluation through path coefficients, R^2, and predictive relevance (Q^2).

Out of the 327 questionnaires administered, 258 were properly completed and returned, yielding a high response rate of 78.9%. This rate was deemed sufficient for statistical analysis and ensured that the findings were representative of the population of experienced management and senior officers across Supply Chain, Procurement, Operations, Logistics, and Risk Management departments at NNPC Corporate Headquarters. Questionnaires were distributed electronically via secured organizational channels and Google Forms with a 10-day completion window to accommodate operational schedules and field commitments, while targeted follow-ups through departmental coordinators ensured accessibility for personnel with limited digital access. Ethical considerations, including informed consent, data anonymity, confidentiality, and voluntary participation, were strictly adhered to during the data collection process, with approval obtained from NNPC's Research and Ethics Committee prior to commencement. Below is the model of the study:

Figure 1: Model Specification
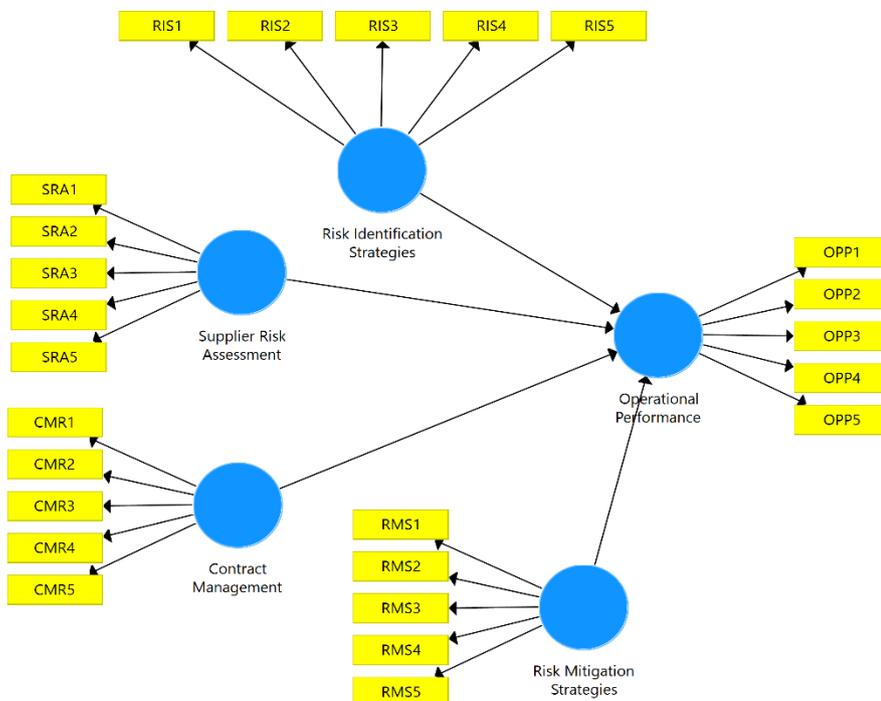
Data Presentation and Analysis

Assessment of Measurement Model

The measurement model was evaluated by examining item outer loadings, with a preference for loadings above 0.708 to ensure constructs explain over 50% of indicator variance (Hair et al., 2019). Indicators with loadings

between 0.50 and 0.708 were retained if they supported construct validity. In this study, all indicators exceeded 0.70, with the lowest being CMR3 (0.711), confirming strong reliability and validity, as shown in Figure 2.
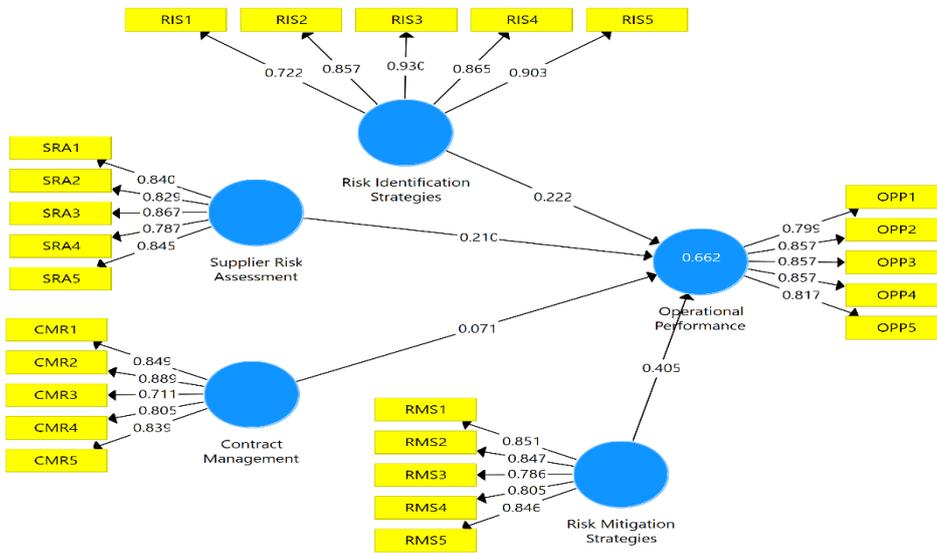
Figure 2: Indicator Loadings

Table 1: Reliability of Study Scale

S/N	Variables	Factor Loadings	Cronbach's Alpha	rhoA	Composite Reliability	AVE	f²	R²
1	Risk Identification Strategies	RIS1 (0.722), RIS2 (0.857), RIS3 (0.930), RIS4 (0.865), RIS5 (0.903)	0.909	0.928	0.933	0.737	0.084	
2	Supplier Risk Assessment	SRA1 (0.840), SRA2 (0.829), SRA3 (0.867), SRA4 (0.787), SRA5 (0.845)	0.890	0.892	0.919	0.695	0.043	
3	Contract Management Risk	CMR1 (0.849), CMR2 (0.889), CMR3 (0.711), CMR4 (0.805), CMR5(0.839)	0.878	0.890	0.911	0.674	0.008	
4	Risk Mitigation Strategies	RMS1 (0.851), RMS2 (0.847), RMS3 (0.786), RMS4 (0.805), RMS5(0.846)	0.886	0.898	0.916	0.685	0.178	
5	Operational Performance	OPP1 (0.799), OPP2 (0.857), OPP3 (0.857), OPP4 (0.857), OPP5 (0.817)	0.894	0.896	0.922	0.702		0.662

Source: SmartPLS Output, 2025.

Table 1 presents reliability results for the study constructs. Factor loadings all exceed 0.70, confirming strong indicator representation (Hair et al., 2019). Cronbach's Alpha values range from 0.878 (CMR) to 0.909 (RIS), indicating high internal consistency (Nunnally, 1978). rho_A values, from 0.890 (CMR) to 0.928 (RIS), further support reliability. Composite Reliability values, from 0.911 (CMR) to 0.933 (RIS), exceed 0.70, affirming construct reliability (Fornell & Larcker, 1981). AVE values, ranging from 0.674 (CMR) to 0.737 (RIS), surpass 0.50, confirming convergent validity. Effect sizes (f^2) assess the substantive impact of each predictor on Operational Performance: Risk Mitigation Strategies ($f^2 = 0.178$) exert a medium effect, Risk Identification Strategies ($f^2 = 0.084$) a small effect, and Supplier Risk Assessment ($f^2 = 0.043$) and Contract Management Risk ($f^2 = 0.008$) small effects (Cohen, 1988). The R^2 for Operational Performance is 0.662, with an adjusted R^2 of 0.654, indicating 66.2% of variance is explained by the four predictors, Risk Identification Strategies, Supplier Risk Assessment, Contract Management Risk, and Risk Mitigation Strategiesdemonstrating substantial predictive accuracy (Hair et al., 2019). The measurement model is reliable and valid for structural analysis.

TABLE 2: HETEROTRAIT-MONOTRAIT RATIO (HTMT)

Variables	RIS	SRA	CMR	RMS	OPP
Risk Identification Strategies (RIS)					
Supplier Risk Assessment (SRA)	0.094				
Contract Management Risk (CMR)	0.183	0.768			
Risk Mitigation Strategies (RMS)	0.302	0.541	0.683		
Operational Performance (OPP)	0.394	0.525	0.557	0.670	

Source: SmartPLS Output, 2025.

Table 2 presents the Heterotrait-Monotrait Ratio (HTMT) values for the constructs Risk Identification Strategies (RIS), Supplier Risk Assessment (SRA), Contract Management Risk (CMR), Risk Mitigation Strategies (RMS), and Operational Performance (OPP). The HTMT assesses discriminant validity, with values below 0.90 indicating distinct constructs (Henseler et al., 2015). HTMT values range from 0.094 (RIS and SRA) to 0.768 (SRA and CMR), all below 0.90. These results confirm that the constructs are sufficiently distinct, exhibiting strong discriminant validity with no excessive shared variance. Thus, the measurement model is valid in terms of both convergent and discriminant validity, aligning with Henseler et al. (2015) guidelines.

TABLE 3: MODEL FIT INDICES

	Saturated Model	Estimated Model
SRMR	0.061	0.061
d_ULS	1.196	1.196
d_G	0.614	0.614
Chi-Square	1044.729	1044.729
NFI	0.814	0.814

Source: SmartPLS Output, 2025.

The model fit indices confirm a good fit between the hypothesized model and observed data. SRMR (0.061 < 0.08) indicates low approximation error, while d_ULS and d_G values support exact fit consistency. NFI (0.814)

approaches acceptable incremental fit, and identical saturated/estimated values affirm structural stability (Henseler et al., 2015; Hair et al., 2019).

Assessing the Structural Model

Having satisfied the measurement model assessment, the next step in evaluating PLS-SEM results is to assess the structural model. Standard assessment criteria, which was considered include the path coefficient, t-values, p-values and coefficient of determination (R^2). The bootstrapping procedure was conducted using a resample of 5000.

Figure 3: Path Coefficients of the Regression Model.

TABLE 4: PATH COEFFICIENTS

	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (|O/STDEV|)	P Values	Decision
Risk Identification Strategies -> Operational Performance	0.222	0.222	0.068	3.267	**0.013**	**Rejected**
Supplier Risk Assessment -> Operational Performance	0.210	0.213	0.062	3.370	**0.001**	**Rejected**
Contract Management -> Operational Performance	0.071	0.073	0.073	0.968	**0.334**	**Accepted**
Risk Mitigation Strategies -> Operational Performance	0.405	0.403	0.067	6.051	**0.000**	**Rejected**

Source: SmartPLS Output, 2025.

Table 4 presents the path coefficients, T-statistics, and p-values for the relationships between the independent variables (Risk Identification Strategies, Supplier Risk Assessment, Contract Management Risk, Risk Mitigation Strategies) and the dependent variable (Operational Performance, OPP) at the Nigerian National Petroleum Company Limited (NNPC Ltd).

H_{01}: Risk Identification Strategies have no significant effect on Operational Performance at NNPC Ltd.

The analysis of the relationship between Risk Identification Strategies (RIS) and Operational Performance (OPP) yielded a path coefficient of 0.222, indicating a moderate positive effect. The sample mean (0.222) and standard deviation (0.068) suggest data consistency. With a T-statistic of 3.267, exceeding the critical threshold of 1.96, and a p-value of 0.013 (below 0.05), the relationship is statistically significant, leading to the rejection of H_{01} (Hair et al., 2019). This result implies that Risk Identification Strategies significantly enhance Operational Performance by enabling early detection of vulnerabilities like pipeline risks, improving efficiency, resilience, and delivery satisfaction. Systematic tools such as HAZOP foster proactive planning, reducing disruptions (Paul, 2023). This aligns with Owuso and Ihunwo (2019), who found risk identification boosts sales performance in Nigerian petroleum firms, and Nurwin (2022), noting it explains 49.9% of supply chain variance.

H_{02}: Supplier Risk Assessment has no significant effect on Operational Performance at NNPC Ltd.

The relationship between Supplier Risk Assessment (SRA) and OPP shows a path coefficient of 0.210, indicating a moderate positive effect. The sample mean (0.213) and standard deviation (0.062) suggest consistency. The T-statistic of 3.370 exceeds 1.96, and the p-value of 0.001 (below 0.05) confirms statistical significance, leading

to the rejection of H_{02} (Hair et al., 2019). This finding suggests that Supplier Risk Assessment significantly improves Operational Performance through evaluations of financial stability and reliability, enhancing resilience against delays and efficiency in resource use. Contingency plans like dual sourcing ensure delivery accuracy (Kamoni et al., 2018). It supports Lamhot and Siagian (2024), where supply chain risk management positively impacts productivity, and Owich and Odero (2023), showing β=0.521 for supply chain outcomes in Kenya.

H_{03}: Contract Management Risk has no significant effect on Operational Performance at NNPC Ltd.

The path coefficient for Contract Management Risk (CMR) and OPP is 0.071, indicating a weak positive effect. The sample mean (0.073) and standard deviation (0.073) suggest variability. The Tstatistic of 0.968, below 1.96, and a p-value of 0.334 (above 0.05) indicate no statistical significance, leading to the acceptance of H_{03} (Hair et al., 2019). This result implies that Contract Management Risk does not significantly influence Operational Performance, possibly due to inadequate monitoring or complex negotiations failing to prevent disputes and delays. While clear terms could boost efficiency, bureaucratic issues limit impact (Akajo, 2024). This echoes Kolani and Miroga (2019), where practices explain 66% variance but require robust implementation, and Lawani et al. (2022), noting digital tools needed for deepwater resilience.

H_{04}: Risk Mitigation Strategies have no significant effect on Operational Performance at NNPC Ltd.

The relationship between Risk Mitigation Strategies (RMS) and OPP shows a path coefficient of 0.405, indicating a strong positive effect. The sample mean (0.403) and standard deviation (0.067) suggest consistency. The T-statistic of 6.051 exceeds 1.96, and the p-value of 0.000 confirms statistical significance, leading to the rejection of H_{04} (Hair et al., 2019). This suggests that Risk Mitigation Strategies significantly bolster Operational Performance via diversification and contingency planning, heightening resilience to vandalism or price volatility and optimizing efficiency. Hedging minimizes costs, ensuring satisfaction (Tullio, 2024). It aligns with Asikhia et al. (2022), where mitigation reduces disruptions by 28% in Nigerian oil firms, and Harju et al. (2024), emphasizing collaborative approaches.

CONCLUSION

This study examined the impact of Risk Identification Strategies (RIS), Supplier Risk Assessment (SRA), Contract Management Risk (CMR), and Risk Mitigation Strategies (RMS) on Operational Performance (OPP) at NNPC Ltd. The findings are summarized as follows:

i.   Risk Mitigation Strategies (RMS) significantly enhances OPP (β=0.405, p=0.000), improving efficiency, resilience, and delivery satisfaction by countering disruptions like vandalism.

ii. Risk Identification Strategies (RIS) has a significant effect on OPP (β=0.222, p=0.013), enabling proactive vulnerability detection for better resource optimization.

iii. Supplier Risk Assessment (SRA) significantly influences OPP (β=0.210, p=0.001), strengthening reliability and resilience through supplier vetting.

iv. Contract Management Risk (CMR) showed no significant effect on OPP (β=0.071, p=0.334), likely due to monitoring gaps in complex contracts.

RECOMMENDATIONS

The following recommendations aim to address identified gaps and leverage effective practices to improve operational efficiency, supply chain resilience, and customer satisfaction in Nigeria's oil and gas industry:

i.   NNPC Ltd should prioritize Risk Mitigation Strategies via supplier diversification, contingency drills, and predictive analytics to enhance resilience and minimize disruptions.

ii.   Strengthen Risk Identification Strategies with standardized tools like FTA and crossdepartmental sharing to preempt risks and optimize processes.

iii.   Enhance Supplier Risk Assessment through continuous ESG evaluations, dual sourcing, and real-time monitoring to ensure delivery accuracy and efficiency.

iv. Improve Contract Management Risk practices by adopting digital platforms for monitoring, clear adaptable terms, and dispute resolution mechanisms to reduce delays.

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