African Journal of Procurement, Logistics & Supply Chain Management
AJPLSCM 2025, Volume 8, Issue 4, Page 17-41
Open Access Articles Distributed in terms of the Creative Commons Attribution License [CC BY 4.0]
Journal Impact Factor (JIF): 6.782
Copyright © JPPS Assessment AJOL
ISSN: 2676-2730
DOI: https://dx.doi.org/10.4314/ajplscm.v8i5.2
Web: https://damaacademia.com/index.php/ajplscm/

# Optimising Procurement Strategies for Cost Efficiency and Risk Mitigation in Petroleum Engineering Projects: The Study of Offshore Drilling Operations

**David Ackah**
*Knutsford Business School, Knutsford University, Accra*
*ORCID:* https://orcid.org/0000-0002-5709-4787
*Email:* drackah@ipmp.edu.gh / drdavidackah@gmail.com

**Kwasi Opoku Boadu**
School of Sustainable Engineering, University of Cape Coast
ORCID: https://orcid.org/0000-0002-2898-8861
*Email:* koboadu@ucc.edu.gh

**Correspondence: Ackah David, email:* drackah@ipmp.edu.gh

**Abstract**

*Procurement plays a pivotal role in shaping the performance of offshore petroleum engineering projects, where cost overruns, schedule delays, and high-risk exposures are frequent challenges. This research examines how procurement strategies can be optimised to improve cost efficiency and mitigate risks in offshore drilling operations. Using a project dataset covering total cost of ownership (TCO), schedule delays, and risk scores, the study evaluates the effectiveness of contract types, sourcing strategies, and digital maturity in influencing project outcomes.*

*The results reveal that framework and alliance contracts, particularly when combined with dual-sourcing strategies, achieve superior cost efficiency and lower risk scores compared to lump-sum and single-sourcing arrangements. However, schedule delays were found to be largely unaffected by sourcing strategies, averaging around 14–15 days across projects, suggesting that operational uncertainties and environmental conditions remain dominant drivers of schedule overruns. Correlation analysis further demonstrated weak linkages among cost, delay, and risk variables, highlighting the independence of these performance dimensions.*

*The study concludes that procurement optimisation requires a multidimensional approach: while flexible contracts and diversified sourcing reduce costs and risks, additional measures are necessary to address scheduling challenges. The findings contribute to both theory and practice by providing empirical evidence that procurement decisions must be integrated with operational risk management and digital innovation to achieve sustainable and resilient project delivery in the petroleum engineering sector.*

***Keywords:*** *Procurement Strategies; Offshore Petroleum Engineering; Cost Efficiency; Risk Mitigation; Schedule Delays; Contract Models; Sourcing Strategy; Project Performance; Oil and Gas Projects; Supply Chain Resilience*

***Citation:*** *Ackah, D., & Boadu, K. O. (2025). "Optimising Procurement Strategies for Cost Efficiency and Risk Mitigation in Petroleum Engineering Projects: The Study of Offshore Drilling Operations" African Journal of Procurement, Logistics & Supply Chain Management, 2025, 5(8): pp.17-41. DOI:* https://dx.doi.org/10.4314/ajplscm.v8i5.2

Submitted: 01 August 2025 | Accepted: 30 August 2025 | Published: 22 September 2025

## 1.0 INTRODUCTION

Oil and gas companies are under increasing pressure to deliver offshore projects more quickly, cost-effectively, and with greater resilience amid recurring supply chain disruptions, inflation cycles, and shifting regulatory expectations. Offshore drilling, being capital-intensive, logistics-heavy, and technologically complex, has been especially exposed. Following a sharp cost escalation in 2022–2023, reputable industry trackers now indicate that drilling and completion

AJPLSCM 2025, Volume 8, Issue 4, Page 17-41
Open Access Articles Distributed in terms of the Creative Commons Attribution License [CC BY 4.0]
Journal Impact Factor (JIF): 6.782
Copyright © JPPS Assessment AJOL
ISSN: 2676-2730
DOI: https://dx.doi.org/10.4314/ajplscm.v8i5.2
Web: https://damaacademia.com/index.php/ajplscm/

(D&C) cost inflation is moderating to low single digits through 2026, creating a narrow window for operators and contractors to lock in structural cost improvements rather than relying on transient market relief. This puts procurement strategy at the centre of performance: category strategies, contracting models, supplier collaboration, and digital decision support can work together to compress the total cost of ownership (TCO) while reducing schedule and geopolitical risk in offshore campaigns.

The strategic context is fluid. Global energy security concerns and geopolitical disruptions, ranging from pandemic aftershocks to the Russia–Ukraine war, have repeatedly exposed vulnerabilities in hydrocarbon supply chains, with ripple effects on drilling inputs such as rigs, subsea equipment, tubulars, fuels, freight, and specialised services. Recent analyses have documented how these shocks propagate through commodity prices, transport routes, and inventories, synchronising inflation across markets and complicating procurement planning for multi-year offshore programs. In practice, this has translated into price volatility, longer lead times, and episodic scarcity for critical items, conditions under which conventional, purely transactional buying underperforms.

At the same time, macro fundamentals for offshore are strengthening. Market outlooks indicate a multi-year upcycle in offshore activity, driven by increasing energy demand and improved project economics, yet with tight segments (e.g., high-spec floaters) and regional bottlenecks that underscore the value of disciplined sourcing and portfolio-level contracting. For procurement teams, this means rebalancing from ad-hoc, project-by-project buys toward integrated frameworks that leverage scale, standardise specifications, and lock in availability while preserving flexibility against price swings.

Concurrently, the procurement function itself is being reshaped by digital tools. Leading operators report double-digit productivity gains as advanced analytics and GenAI accelerate market intelligence, vendor screening, bid normalisation, and negotiation preparation. These capabilities can redirect effort from low-value processing to high-value activities (e.g., risk-adjusted award scenarios, supplier development, and should-cost/clean-sheet modelling), directly impacting cost and resilience outcomes in offshore drilling campaigns.

Risk management is the second pillar. Offshore drilling operations concentrate on technical, HSE, schedule, and geopolitical risks. Contemporary enterprise and project-level risk frameworks, commonly aligned with ISO 31000, promote a structured approach to risk identification, analysis, treatment, and monitoring across the source-to-pay (S2P) cycle, encompassing market scanning and prequalification, contract risk allocation, and supplier performance management. In practice, this means mapping single-point-of-failure items (e.g., BOP components, long-lead subsea hardware), calibrating Incoterms and liability caps, codifying contingency logistics, and building optionality through dual sourcing or framework agreements.

Regulatory and standards landscapes also shape procurement strategies. International oil and gas standards bodies have expanded harmonised specifications for commonly procured equipment (e.g., valves, switchgear, transformers), offering a route to reduce bespoke engineering, compress bid cycles, and unlock multi-project volume deals. In many jurisdictions, including Ghana and other emerging economies, local content requirements also influence sourcing decisions, supplier development programs, and contracting structures, demanding that cost efficiency be balanced with compliance and capability-building goals.

Against this backdrop, this study examines how procurement strategies can be optimised to deliver cost efficiency and mitigate risk in offshore drilling operations. The central premise is that cost and risk are co-dependent: choices that reduce TCO (e.g., standardisation, portfolio aggregation, collaborative contracting) can also lower exposure to schedule slippage and supply shocks provided risks are explicitly priced, allocated, and monitored. Recent industry commentary and analyses reinforce that offshore's path to competitiveness will rely as much on commercial innovation (such as smart contracting, specification discipline, and supply-chain design) as on technical advances in drilling and subsea systems.

## 2.0 MATERIALS AND METHODS

AJPLSCM 2025, Volume 8, Issue 4, Page 17-41
Open Access Articles Distributed in terms of the
Creative Commons Attribution License [CC BY 4.0]
Journal Impact Factor (JIF): 6.782
Copyright © JPPS Assessment AJOL
ISSN: 2676-2730
DOI: https://dx.doi.org/10.4314/ajplscm.v8i5.2
Web: https://damaacademia.com/index.php/ajplscm/

This literature review synthesises contemporary scholarship, industry reports and policy documents on procurement strategy, cost drivers, risk mitigation, and enabling technologies as they apply to offshore drilling projects. It organises findings under six themes: (1) the strategic role of procurement in offshore projects; (2) cost drivers and contracting models; (3) supply-chain risk and resilience; (4) standards, specification discipline and local content; (5) digital procurement and analytics; and (6) methodological approaches and research gaps. Each section highlights recent empirical and practitioner literature (2022–2025) and identifies where this thesis can add value.

*2.1. Procurement as a strategic lever in offshore projects*

Recent industry analyses argue that procurement is no longer just a back-office transaction process but a strategic capability that can materially affect project unit costs, schedule certainty and operational risk in offshore campaigns. Consulting and industry reports emphasise three interlinked imperatives: capture scale through portfolio sourcing, standardise specifications to reduce bespoke engineering costs, and redesign commercial models to better share upside and downside between operators and suppliers. These studies show procurement can unlock a "real cost advantage" in upstream oil and gas when aligned with field development and contracting strategies.

Academic literature corroborates the practitioner view by linking procurement sophistication to project performance: advanced category management, early supplier involvement and strategic long-term agreements correlate with lower total cost of ownership (TCO) and improved delivery reliability in capital-intensive projects. However, academic work also underscores barriers to organisational silos, misaligned incentives and limited procurement analytics that blunt potential gains.

*2.2. Cost drivers and contracting models for offshore drilling*

A growing body of work examines the principal drivers of cost escalation in offshore drilling, including rig and vessel day rates, long-lead equipment (such as subsea trees and BOPs), logistics and freight, specialist services (such as well intervention and subsea installation), and regulatory/local content compliance. Volatile day rates and constrained floater and rig availability since 2022 have been repeatedly cited as primary supply-side pressures that feed project-level overruns. These market dynamics make contracting choices, such as day-rate versus lump sum, single-project purchase versus framework agreements, and alliancing/incentive structures, critical determinants of cost outcomes.

Framework agreements and portfolio bundling are frequently recommended in both practitioner guidance and case studies. By aggregating demand across projects/fields, operators can improve negotiating leverage, reduce procurement cycle times, and capture volume discounts while preserving operational flexibility through agreed-upon change-management rules. Conversely, purely transactive spot buying tends to increase exposure to market peaks and supply squeezes. However, the literature warns of trade-offs: overly rigid frameworks can lock in capacity or price at suboptimal times, so hybrid designs with review windows and indexed pricing are often advocated.

*2.3. Supply-chain risk and resilience strategies*

The experience of pandemic disruptions and geopolitical events (notably since 2022) has catalysed significant literature on supply-chain risk in the energy sector. Government and industry reviews (including recent four-year supply-chain reviews) frame resilience as a strategic objective requiring visibility, diversification, contingency planning, and selective near-shoring for critical items. For offshore drilling, the literature identifies "single point of failure" (e.g., critical subsea components, specialised campaign vessels) where lead-time risk must be actively managed through dual sourcing, strategic spares, and contractual availability guarantees.

Scholars and industry analysts also discuss the cost–resilience trade-off: investing in resilience (inventory, second suppliers, redundancy) has measurable insurance-like costs but reduces the probability of catastrophic schedule slippage and penalty exposure. Recent empirical

AJPLSCM 2025, Volume 8, Issue 4, Page 17-41
Open Access Articles Distributed in terms of the Creative Commons Attribution License [CC BY 4.0]
Journal Impact Factor (JIF): 6.782
Copyright © JPPS Assessment AJOL
ISSN: 2676-2730
DOI: https://dx.doi.org/10.4314/ajplscm.v8i5.2
Web: https://damaacademia.com/index.php/ajplscm/

work employs scenario analysis and stochastic modelling to quantify these trade-offs and design cost-efficient resilience measures tailored to risk appetite and project criticality. Nevertheless, the literature notes a relative paucity of empirical studies specifically calibrated to offshore drilling portfolios (as opposed to manufacturing or general energy supply chains), signalling a gap this thesis can address.

*2.4. Standards, specification discipline and local content obligations*

A recurring theme is that specification discipline, using harmonised standards and avoiding unnecessary bespoke requirements, reduces engineering hours, tender fragmentation, and the administrative premium suppliers charge to cover scope uncertainty. Industry bodies (e.g., IOGP and other standards groups) and consulting reports demonstrate how S-series and related standard specifications facilitate multi-project sourcing and expedite procurement cycles. The literature emphasises that specification rationalisation must be accompanied by robust technical governance to prevent the introduction of safety or performance risks.

Parallel to global standards debates, country-level local content regulations shape procurement choices. Ghana's petroleum local content frameworks and guidance require demonstrable local participation, which impacts supplier selection, joint venture structures, and capacity-building investments. Academic analyses and policy reviews caution that local content objectives can increase short-term costs but may deliver strategic national benefits (jobs, capability building) and social license to operate, thereby affecting the "optimal" procurement design in jurisdictionally sensitive projects. These dual pressures, global standardisation vs. local participation, create complex procurement design problems that merit empirical study.

*2.5. Digital procurement, analytics and GenAI enablers*

The most recent wave of literature (2023–2025) centres on digital transformation in source-to-pay (S2P) and how analytics and generative AI can materially improve forecasting, supplier discovery, bid evaluation, and contract lifecycle management. Practitioner surveys and vendor whitepapers report early productivity gains from embedding AI into spend classification, should-cost modelling, and anomaly detection, freeing procurement professionals to focus on supplier relationship management and strategic sourcing. Research institutes and consultancies highlight pilot successes but also flag governance, data quality and ethical concerns as barriers to rapid scaling.

For offshore drilling, the literature suggests specific use cases, including demand-profile simulation for long-lead items, probabilistic lead-time modelling, scenario-driven sourcing (combining price and availability), and dynamic contract indexing tied to observable market indices. However, academic validation, especially field studies demonstrating realised cost reductions and risk mitigation attributable to analytics in offshore projects, remains limited, offering a clear empirical opportunity.

*2.6. Contracting risk allocation, performance incentives and governance*

Multiple studies have focused on how contractual risk allocation and commercial incentives influence supplier behaviour and project outcomes. Output-based contracts, gain-share/pain-share mechanisms, and alliance models are presented as ways to align incentives for performance, cost control and innovation. The literature emphasises three governance needs for these models to work: transparent key performance indicators (KPIs), data-driven monitoring, and dispute-resolution mechanisms that preserve collaboration under stress. Case studies in the drilling sector highlight instances where incentive alignment has reduced downtime and encouraged supplier innovation, as well as examples where ill-designed incentives have led to scope disputes and cost escalation.

*2.7. Methods used in the literature and identified gaps*

Methodologically, the corpus encompasses qualitative case studies, survey research, quantitative modelling (TCO/should-cost analysis and stochastic lead-time analysis), and system dynamics simulations. Government reviews and industry whitepapers tend to be descriptive and

African Journal of Procurement, Logistics & Supply Chain Management
AJPLSCM 2025, Volume 8, Issue 4, Page 17-41
Open Access Articles Distributed in terms of the
Creative Commons Attribution License [CC BY 4.0]
Journal Impact Factor (JIF): 6.782
Copyright © JPPS Assessment AJOL
ISSN: 2676-2730
DOI: https://dx.doi.org/10.4314/ajplscm.v8i5.2
Web: https://damaacademia.com/index.php/ajplscm/

prescriptive, whereas peer-reviewed articles are more likely to contribute formal models and validated empirical tests. Two consistent gaps emerge:

1. *Project-level empirical studies specifically targeting offshore drilling procurement portfolios*; many studies generalise from manufacturing or onshore projects rather than probing the unique risk profile and market structure of offshore supply markets.

2. *Controlled evaluations of advanced digital procurement tools in live offshore projects:* There are vendor and consultancy claims of value from GenAI and analytics, but limited independent research measuring realised TCO reductions, schedule improvements, or changes in risk exposure metrics post-deployment.

These gaps justify an empirical thesis that combines TCO modelling, risk scoring, and scenario analysis with case evidence from offshore drilling campaigns, ideally involving both operator and supplier perspectives, as well as a jurisdictional lens (e.g., Ghana), to capture local content impacts.

*2.8. Synthesis and implications for this research*

The convergent message from industry, policy, and academic sources is that procurement strategy has a material impact on both cost efficiency and project risk in offshore drilling, but realising the benefits requires integrated action across specification governance, contracting design, supplier development, and digital analytics. Recent supply-chain reviews and consulting reports (2024–2025) underscore the urgency: market tightness in specialised assets and continued geopolitical fragility mean that procurement mistakes can have outsized consequences for schedule and budget. Meanwhile, local content obligations add a layer of socio-political complexity that must be incorporated into any “optimal” procurement framework.

This literature therefore supports a multi-method empirical approach for this thesis: (a) map procurement cost drivers and risk nodes empirically in offshore drilling projects; (b) evaluate alternative contracting and sourcing models via TCO and stochastic risk analysis; (c) test the incremental value of analytics/GenAI tools in sourcing decisions; and (d) assess how local content constraints alter optimal procurement designs. The remainder of this thesis aims to fill the documented empirical gaps, especially by producing evidence-based recommendations that are sensitive to both global market dynamics and Ghanaian policy constraints.

*2.9 Foundational Principles of Modern Procurement*

Modern procurement literature advocates for a fundamental shift from a narrow focus on purchase price to a holistic, value-driven approach. A key principle is the adoption of a Total Cost of Ownership (TCO) model, which evaluates all lifecycle costs associated with a product or service, including change management, insurance, maintenance, and disposal. While TCO has been a recognised concept for decades, it is frequently overlooked in favour of short-term savings, particularly when profit margins are tight. However, a correct application of TCO provides a deeper understanding of overall cost structures, enabling strategic sourcing decisions that lead to substantial long-term financial benefits and competitive advantage.

Another critical principle is the importance of early engagement. The literature emphasises that involving procurement teams at the preliminary design and Front-End Engineering Design (FEED) stage is vital for maximising cost efficiency. As much as 80% to 90% of a project's costs are locked in during these early phases, making late-stage procurement intervention less effective. By collaborating with engineering teams and suppliers at the outset, procurement can help reduce supply chain complexity and secure large-volume discounts, adding certainty regarding quality control and assurance.

*2.8.1 Value-Creating Procurement Strategies in Volatile Markets*

In a stable market, strategic procurement can yield a cost advantage of 4% to 8% over competitors. However, in today's volatile environment, the literature suggests this advantage is amplified, with a potential relative cost advantage of 10% to 15%. This is because companies

AJPLSCM 2025, Volume 8, Issue 4, Page 17-41
Open Access Articles Distributed in terms of the
Creative Commons Attribution License [CC BY 4.0]
Journal Impact Factor (JIF): 6.782
Copyright © JPPS Assessment AJOL
ISSN: 2676-2730
DOI: https://dx.doi.org/10.4314/ajplscm.v8i5.2
Web: https://damaacademia.com/index.php/ajplscm/

with superior procurement capabilities can effectively insulate themselves from market shocks, turning uncertainty into a source of value.

*2.8.1.1. Intelligence-Driven Decision-Making*

A proactive approach is central to capturing this advantage. Procurement functions must leverage a combination of market intelligence and deep category expertise to assess supply and demand dynamics in specific geographies. By analysing up-to-date information on supply chain costs, procurement can strategically advise internal stakeholders on optimising demand schedules or locking in supply and prices in advance of inflationary spikes. This ability to anticipate and act proactively is a key differentiator in high-risk environments.

*2.8.2. Supplier Collaboration and Strategic Alliances*

A model of deep collaboration is replacing the traditional buyer-seller relationship. Securing supply in a constrained environment requires strong, long-term relationships with critical suppliers. This involves more than just contracts; it necessitates greater dialogue between the leadership teams of operators and suppliers, as well as the implementation of collaborative initiatives such as joint capacity planning and collaborative design optimisation. This cooperative framework reduces friction and ensures a reliable flow of critical goods and services.

*2.8.3. Vertical Integration and "Buyer Clubs"*

Operators are exploring non-traditional strategies to overcome supply shortages and achieve long-term security. The literature notes that a Middle Eastern operator pursued a strategy of vertical integration by establishing its own drilling business and acquiring rigs to support future production targets. This approach simultaneously secures rig supply in a constrained market and enables long-term investment into technologies like AI to optimise drilling operations. In contrast, smaller independent producers in the North Sea are forming geographically based "buyer clubs" to pool resources, secure limited rigs, and optimise drilling schedules for collective efficiency and cost reduction.

*2.8.4. Data-Driven Vendor Development Programs (VDPs)*

VDPs are strategic investments designed to shape supply chains for long-term competitive advantage. By strengthening visibility on long-term demand outlooks and providing support to suppliers to secure capital or technology, operators can foster a more resilient and competitive supply base. Successful VDPs have been shown to reduce costs by 5% to 8% by avoiding supply shortages, introducing competition, and enhancing the cost competitiveness of local suppliers.

| *Strategy/Lever* | *Impact on Cost Efficiency* | *Impact on Risk Mitigation* |
|---|---|---|
| Total Cost of Ownership (TCO) | Offers substantial financial benefits by identifying lifecycle costs beyond purchase price; provides deeper insight into overall cost structures. | More conducive to long-term success by giving a holistic view of spending across functions. |
| Early Engagement | Locks in 80%–90% of project costs; enables large-volume discounts and simplifies procurement. | Reduces supply chain complexity and provides certainty regarding quality control. |
| Intelligence-Driven Decision-Making | Allows for locking in prices in advance of inflationary spikes and optimising demand schedules. | Determines the extent of potential supply shortages in specific geographies. |
| Supplier Collaboration | Reduces costs and increases company profits through mutually beneficial strategies. | Secures supply in a constrained environment by leveraging strong, long-term relationships. |

AJPLSCM 2025, Volume 8, Issue 4, Page 17-41
Open Access Articles Distributed in terms of the
Creative Commons Attribution License [CC BY 4.0]
Journal Impact Factor (JIF): 6.782
Copyright © JPPS Assessment AJOL
ISSN: 2676-2730
DOI: https://dx.doi.org/10.4314/ajplscm.v8i5.2
Web: https://damaacademia.com/index.php/ajplscm/

| | | |
|---|---|---|
| Vertical Integration & "Buyer Clubs" | Optimises drilling schedules and reduces costs by securing limited rig supplies. | Overcomes shortages and achieves long-term supply security. |
| Data-Driven VDPs | Reduces costs by 5% to 8% by avoiding supply shortages and increasing local supplier competitiveness. | Ensures long-term security of supply and enhances supplier resilience. |

*2.9 Procurement's Role in Mitigating a Spectrum of Project Risks*

*2.9.1. The Framework for Risk Management in Offshore Operations*

Offshore projects are inherently complex, with uncertainties magnified by the harsh environment and the scarcity of data. The literature establishes that risk is an inherent aspect of all project processes, from the conceptual phase to final project closure. A structured approach to risk management is therefore essential. This process involves four key steps: the systematic identification of all potential risks, a qualitative and quantitative assessment of their likelihood and impact, the development of a suitable response or mitigation plan, and the continuous monitoring and control of risks throughout the project lifecycle. Identifying risks at an early stage is crucial, as it enables the implementation of mitigation strategies to minimise potential impacts. A risk register, which includes all identified risks and their potential impact, is a vital tool for prioritising and effectively managing risks.

*2.9.2. Analysis of Key Procurement and Supply Chain Risks*

*2.9.2.1. Operational and Market Risks*

The procurement of high-value, technically complex assets, such as jack-up drilling rigs, is a challenging process that is governed by global market volatility. A significant risk identified in the literature is the limited availability of these rigs, which makes procurement challenging and can lead to increased drilling costs and operational risks. Other internal and external root causes of prolonged procurement processes include a lack of contract flexibility, inefficiencies in decision-making, and the complexity of tender and evaluation processes. Projects often face delayed rig delivery times and disruptions across supply chain networks due to these issues, underscoring the need for a deliberate and strategic approach to addressing them.

*2.9.2. Contractual and Legal Risks*

Offshore drilling services contracts are intricate and require a deliberate strategy to address contractual risks. A primary focus of contract negotiation is the allocation of liability and risk-sharing between operators and contractors. This is often discussed through clauses such as "knock-for-knock," where each party is responsible for its own property and personnel, or through overall financial limits of liability (LOL) for the contractor. A significant challenge is the lack of contract flexibility, where strict terms limit the ability to adapt to changing market conditions. This can lead to disputes over differing interpretations of terms and a mismatch between contractual frameworks and market reality.

*2.9.3. Macro-Economic and Geopolitical Risks*

The energy sector is profoundly impacted by geopolitics, with energy executives ranking geopolitical complexities as one of the top challenges they face. While geopolitical events are significant, recent research provides a more nuanced understanding of their long-term impact on global inflation. A study found that shocks to global supply chains and oil price volatility are the primary long-term drivers of inflation, accounting for 32% and 29% of the volatility in global headline inflation, respectively. In comparison, shocks from geopolitical risks are a relatively minor driver, with effects typically lasting only up to one year. This suggests that a procurement strategy that focuses solely on reacting to political headlines is less effective than one that prioritises building long-term resilience against the physical disruptions and cost-push inflation that ripple through the supply chain as a result of such events. Diversifying supply chains and investing in infrastructure are thus more impactful long-term strategies than simply monitoring political changes.

AJPLSCM 2025, Volume 8, Issue 4, Page 17-41
Open Access Articles Distributed in terms of the Creative Commons Attribution License [CC BY 4.0]
Journal Impact Factor (JIF): 6.782
Copyright © JPPS Assessment AJOL
ISSN: 2676-2730
DOI: https://dx.doi.org/10.4314/ajplscm.v8i5.2
Web: https://damaacademia.com/index.php/ajplscm/

*2.9.4. Environmental and Safety Risks*

Environmental and safety considerations are increasingly integral to procurement decisions. The literature identifies a broad spectrum of environmental risks across the entire project lifecycle, from seismic surveys and exploratory drilling to transportation and refining. These risks include habitat degradation, methane leakage, well blowouts, and contamination of land or water from spills and leaks. Procurement plays a critical role in mitigating these risks by specifying the use of Best Available Technology Not Entailing Excessive Cost (BATNEEC) and ensuring that suppliers adhere to strict environmental and safety regulations. This includes implementing proper waste management, implementing emissions monitoring, and developing emergency preparedness plans.

*2.10 The Transformative Power of Digitalisation: A New Paradigm for Procurement*

*2.10.1. The Digital Foundation*

The oil and gas industry is undergoing a significant digital transformation, driven by an increasing investment in IT solutions. The goal is to evolve from fragmented, manual processes and outdated databases to a streamlined, data-driven operational model. The core of this transformation relies on foundational technologies such as cloud computing, which provides a flexible and scalable infrastructure for storing vast amounts of equipment data and running complex algorithms. By transitioning to a unified, cloud-based system, companies can democratise data access and enhance decision-making across various functions. This modern foundation is essential for supporting the more advanced, analytical technologies that are reshaping procurement.

*2.10.2. Leveraging Big Data and Analytics for Optimisation*

*2.10.2.1. Predictive Analytics and Predictive Maintenance*

A significant shift identified in the literature is the move from a reactive to a proactive approach in operations and maintenance. Predictive analytics, which uses a combination of real-time sensor data and historical trends, can forecast equipment failures and enable proactive maintenance planning. This strategy is shown to deliver significant and tangible benefits, as companies implementing data-driven maintenance strategies achieve a 20% to 60% reduction in equipment failures and unplanned downtime. By detecting anomalies and predicting potential issues before they escalate, predictive analytics reduces downtime and cuts costs from unexpected repairs.

*2.10.2.2. Artificial Intelligence (AI) for Strategic Decision-Making*

Artificial intelligence is being adopted to enhance processes across the E&P value chain, from exploration and drilling to logistics and procurement. AI models can be used to analyse large datasets to model potential pricing scenarios, which helps firms better predict and respond to market volatility. The ability to forecast supply and demand enables strategic moves and optimises resource allocation. In a practical application, an AI assistant can generate multiple schedule options in seconds, allowing operators to explore and rank scenarios based on efficiency, profitability, and emissions. This technology enables quicker and more informed decisions, propelling operations to new heights.

*2.10.3. Blockchain for Transparency and Trust*

Blockchain technology, a decentralised digital ledger, is particularly well-suited for the multiparty complexity of offshore projects. By logging every transaction on decentralised, encrypted blocks, it creates a single, immutable "source of truth" that is shared among all partners. This eliminates the need for fragmented spreadsheets and outdated databases, which are familiar sources of error and disputes.

*2.10.3.1. Supplier Collaboration and Smart Contracts*

Blockchain can automate and expedite processes for complex joint ventures, streamlining operations and enhancing efficiency. Smart contracts, for example, can automatically execute

AJPLSCM 2025, Volume 8, Issue 4, Page 17-41
Open Access Articles Distributed in terms of the
Creative Commons Attribution License [CC BY 4.0]
Journal Impact Factor (JIF): 6.782
Copyright © JPPS Assessment AJOL
ISSN: 2676-2730
DOI: https://dx.doi.org/10.4314/ajplscm.v8i5.2
Web: https://damaacademia.com/index.php/ajplscm/

agreements when certain conditions are met, such as confirming the fulfilment of a part's order or the delivery of oil. This automation reduces the need for manual intervention, shortens lengthy approval times, and minimises the risk of disputes. The transparent, time-stamped records also enhance accountability and traceability throughout the supply chain.

*2.10.3.2. Compliance and Security*

The immutable nature of blockchain makes it an ideal tool for ensuring regulatory compliance and enhancing security. It creates a secure audit trail for regulatory activities, from environmental audits to safety checks. For instance, it can record carbon emissions data from field sensors, creating a strong emissions ledger for real-time verification. Furthermore, its decentralised data storage provides resilience against cyber threats, reinforcing adherence to legal standards and protecting sensitive project information.

*2.10.4. Case Studies in Digital Transformation*

The literature provides clear examples of successful digital implementations. A case study of Idemitsu Kosan demonstrates how adopting a unified supply chain solution resulted in the centralisation of downstream data and an improvement in margins. Similarly, a modernisation effort at Idemitsu Australia consolidated siloed production data into a single platform, which reduced licensing costs and simplified governance. It enabled complex, mission-critical queries that were previously impossible to execute. While not exclusively offshore, a case study involving a major global refinery and petrochemical corporation (likely BP) demonstrates how a data-driven, collaborative approach to sourcing proprietary catalysts resulted in significant OPEX savings of 35% without compromising quality or safety. The success of this model, which included a clear governance structure and cross-functional stakeholder collaboration, is directly transferable to large-scale offshore projects.

| *Technology* | *Procurement Function Impacted* | *Key Benefits* |
|---|---|---|
| Cloud Computing | Data storage, accessibility, and analysis. | Provides a flexible foundation that democratises data access for decision-makers. |
| Big Data & Predictive Analytics | Maintenance planning, operational efficiency. | Reduces downtime and unplanned repairs; leads to a 20%–60% reduction in equipment failures. |
| AI/Machine Learning | Decision-making, demand forecasting, logistics. | Helps model pricing scenarios and generates multiple scheduling options for optimisation in seconds. |
| Blockchain | Supplier collaboration, fraud detection, and compliance. | Creates a "single source of truth"; automates contract execution with smart contracts; enhances traceability. |

*2.11. Integrating ESG and Supply Chain Governance*

*2.11.1. The ESG Imperative*

The role of procurement has expanded beyond a focus on cost and risk to include a third, equally important pillar: ESG (Environmental, Social, and Governance) considerations. This is driven by increasing pressure from investors and a growing recognition of the importance of sustainability within the broader industry. From an environmental standpoint, the industry is grappling with an ageing fleet of drillships and Floating Production Storage and Offloading (FPSO) vessels due to a decade-long drought in new construction. Rather than investing in costly new builds, a strategic shift is underway to prolong the life of existing assets through proactive, data-driven maintenance. This approach not only addresses structural and operational reliability concerns but also reduces environmental impact, demonstrating a link between operational efficiency and sustainability goals. This change shifts procurement's focus from a high-capital

AJPLSCM 2025, Volume 8, Issue 4, Page 17-41
Open Access Articles Distributed in terms of the Creative Commons Attribution License [CC BY 4.0]
Journal Impact Factor (JIF): 6.782
Copyright © JPPS Assessment AJOL
ISSN: 2676-2730
DOI: https://dx.doi.org/10.4314/ajplscm.v8i5.2
Web: https://damaacademia.com/index.php/ajplscm/

new-build model to a more continuous, service-oriented model centred on maintenance, repair, and overhaul.

*2.11.2. Governance and Transparency*

Robust supply chain governance is identified as a critical best practice. This involves ensuring a singular purchasing motion for all teams and maintaining real-time data access and transparency across the supply chain, which technologies like blockchain can enable. Procurement teams must also be prepared to act fast in a volatile environment, which requires proactive supplier risk analysis to identify potential bottlenecks and ensure business continuity. This forward-looking approach is crucial for maintaining compliance with evolving regulations and ESG frameworks, thereby enhancing overall supply chain resilience.

*2.12 Research Gaps and Future Directions*

*2.11.1. Identified Research Gaps*

Despite the growing body of literature on strategic procurement, several significant gaps remain, particularly in the context of large-scale engineering projects. A key finding is the limited application and lack of maturity of supply chain management (SCM) principles within the construction and Engineering, Procurement, and Construction (EPC) sectors. While SCM has been successfully integrated into manufacturing, its adoption in complex, multi-stakeholder projects remains an area for further development. This gap highlights a disconnect between a theoretical understanding of SCM and its practical implementation in a project-based environment. Additionally, there is a recognised lack of research on how to effectively manage high-risk and unpredictable risks in large international engineering projects. While general risk management frameworks exist, the literature is sparse on detailed, empirical case studies of how companies have successfully navigated unprecedented, non-technical risks.

*2.12.2. Future Research Directions*

Based on the identified gaps and emerging trends, several directions for future research are apparent. First, a significant area for investigation is the end-to-end integration of digital technologies. Research should explore the full-scale implementation of a digital ecosystem, encompassing IoT sensors that generate real-time data, a blockchain ledger that provides a single source of truth, and AI models that perform predictive analytics and inform procurement decisions. Second, the prevalence of traditional day-rate contracts may be insufficient for a dynamic, technology-enabled environment. Future studies could focus on developing and evaluating new contractual models that better align incentives and risk-sharing between operators and their technology-enabled suppliers. Finally, as ESG becomes a core business driver, more research is needed on the specific levers procurement can use to achieve quantifiable ESG targets, such as carbon reduction and ethical supply chain management.

*2.13 Conclusion: The Evolving Role of Procurement*

The literature confirms that procurement in offshore drilling is undergoing a profound transformation. The traditional view of procurement as a tactical function focused on transactional cost reduction is obsolete. The modern perspective, supported by a growing body of evidence, frames procurement as a strategic, value-creating core competency. Optimisation is no longer a simple matter of cost reduction; it is a complex, multi-faceted challenge that requires simultaneously addressing a spectrum of operational, contractual, geopolitical, and environmental risks.

The most successful operators are those who recognise the amplified value of strategic procurement in volatile markets, using it to secure a competitive advantage. They are moving beyond simple price negotiations to embrace holistic strategies like TCO, early engagement, and deep supplier collaboration. At the heart of this transformation is digitalisation. The adoption of AI, big data analytics, and blockchain is empowering procurement teams with the intelligence and transparency needed to make proactive, data-driven decisions that reduce downtime and mitigate risk. Ultimately, the literature shows that the successful offshore operator of the future will be defined by its ability to leverage strategic procurement as an integrated, intelligence-

African Journal of Procurement, Logistics & Supply Chain Management
AJPLSCM 2025, Volume 8, Issue 4, Page 17-41
Open Access Articles Distributed in terms of the
Creative Commons Attribution License [CC BY 4.0]
Journal Impact Factor (JIF): 6.782
Copyright © JPPS Assessment AJOL
ISSN: 2676-2730
DOI: https://dx.doi.org/10.4314/ajplscm.v8i5.2
Web: https://damaacademia.com/index.php/ajplscm/

driven, and technology-enabled part of its core business model. Those who embrace this transformation will gain a significant and sustainable competitive edge.

## 3.0 METHODOLOGY

This chapter describes the research design, data sources, sampling strategy, instruments, analytical methods, quality assurance, ethical considerations, and limitations for the thesis "Optimising Procurement Strategies for Cost Efficiency and Risk Mitigation in Petroleum Engineering Projects: The Study of Offshore Drilling Operations." The methodology is built to produce both practical and generalizable findings by combining qualitative insights from practitioners with quantitative modelling of costs and risks.

### *3.1. Research design and rationale*

A convergent mixed-methods design is adopted, where qualitative and quantitative data are collected in parallel, analysed separately, and then integrated at the interpretation stage to produce a richer, triangulated understanding of procurement trade-offs in offshore drilling (cost vs. resilience). This approach follows established guidance for applied management and engineering research, as it combines the contextual depth of interviews/case studies with the generalizability and precision of modelling and statistical testing. The mixed-methods approach is particularly suited to procurement research, where behavioural, contractual, and market-price phenomena coexist with measurable cost and lead-time outcomes.

### *3.2. Conceptual and theoretical framework*

The study integrates three interlocking conceptual lenses.

*Total Cost of Ownership (TCO) / should-cost thinking* to capture full lifecycle procurement costs (acquisition, logistics, quality, maintenance, downtime and disposal) and to build should-cost models for selected categories (e.g., BOP components, tubulars, rig day rates). TCO/should-cost is used to quantify how different procurement designs (framework agreements, bundling, incentive contracts) affect overall cost.

*Risk management per ISO 31000* to structure identification, analysis, evaluation and treatment of procurement risks (market volatility, single-source dependencies, lead-time failures, regulatory/local-content non-compliance) and to design risk scoring and treatment matrices. ISO 31000 provides the project-level risk process and terminology used to operationalise risk measurement and mitigation options.

*Contract and governance theory* to assess how allocation of contractual risk and incentive structures shape supplier behaviour and performance (e.g., output-based contracts, gain/pain share, framework agreements). This lens informs the development of qualitative interview guides and the contract attribute variables used in quantitative analysis.

### *3.3. Study population and case selection*

*Scope:* upstream offshore drilling procurement covering rig/marine spread contracting, well construction materials and services, long-lead subsea hardware, logistics and HSE-critical equipment. The primary geographic focus is on global offshore markets, with a case emphasis on Ghana to capture the local content impacts and policy constraints.

*Case selection strategy:* purposive sampling of 4–6 offshore drilling projects/programmes (multi-well campaigns) representing variation in: operator size (IOC vs NOC/independent), contracting approach (day-rate vs lump sum vs alliance/framework), and jurisdiction (including at least one Ghanaian project). Within each case, the study will engage stakeholders across various functions, including procurement, supply chain/logistics, drilling operations, legal/contracting, and selected suppliers/contractors. Case selection employs a maximum-variation logic to enhance external validity and facilitate theory development.

### *3.4. Data sources and instruments*

#### *3.4.1 Primary data*

- *Semi-structured interviews (qualitative)*

African Journal of Procurement, Logistics & Supply Chain Management
AJPLSCM 2025, Volume 8, Issue 4, Page 17-41
Open Access Articles Distributed in terms of the Creative Commons Attribution License [CC BY 4.0]
Journal Impact Factor (JIF): 6.782
Copyright © JPPS Assessment AJOL
ISSN: 2676-2730
DOI: https://dx.doi.org/10.4314/ajplscm.v8i5.2
Web: https://damaacademia.com/index.php/ajplscm/

- Target: procurement managers, category leads, supply-chain planners, drilling engineers, contracting/legal advisors, and supplier account managers.
- Aim: elicit decision rationales, perceptions of contracting trade-offs, experience with framework agreements, supplier development, and use of analytics.
- Sample size: ~30–40 interviews (saturation-oriented) distributed across operators, major contractors and critical suppliers.

▪ *Structured survey (quantitative)*
  - Target: broader procurement and operations population across sampled organisations (procurement professionals, project managers).
  - Content: Likert and ordinal items on procurement practices, perceived effectiveness of contracting models, frequency of supply shocks, adoption of digital tools, and measures of procurement outcomes (delivery reliability, cost variances).
  - Expected responses: 100–200 usable responses (power calculations and response targets discussed in Section 7).

▪ *Documentary and transactional data (quantitative / quantitative-qualitative)*
  - Procurement records: RFQs, bids, award memoranda, supplier scorecards.
  - Contract documents: contract templates, KPIs, SLA/penalty clauses, pricing formulas (day-rate, lump-sum, indices).
  - Transactional data: purchase orders, invoice histories, lead-time logs, expediting reports, inventory/strategic spares records, and historical rig day-rates.
  - Time horizon: where possible, 2019–2025 to capture pre- and post-pandemic and geopolitical volatility.

*3.4.2 Secondary data*

Industry reports and indices (rig/vessel utilisation and day rates, commodity price indices), regulatory/local content documents (Petroleum Commission Ghana) and standards (IOGP, ISO 31000). These datasets will be used for benchmarking and to parameterise market indices in modelling.

*3.5. Measurement and operationalisation*

*5.1 Key variables*

*Dependent / outcome variables:* Total Cost of Ownership (TCO) per category/project; schedule adherence (days delay); procurement performance score (quality, on-time delivery, cost variance). TCO will be computed using a life-cycle cost template that includes acquisition price, logistics, duties, lead-time holding costs, maintenance/spares, and estimated downtime costs per failure event.

*Independent variables:* Contract type (categorical: day-rate, lump-sum, framework, alliance), supplier strategy (single vs dual sourcing), specification discipline index (degree of standardisation), digital maturity score (analytics/GenAI adoption), local content compliance (percentage local value).

*Risk metrics:* probability × impact scoring, as per ISO 31000, with mapping to expected delay and cost impact; lead-time variability (standard deviation); and single-supplier criticality indices.

*3.5.2 Instruments*

*Interview guide* (semi-structured): themes on sourcing rationale, supplier relationships, contingency strategies, and examples of cost/risk trade-offs.

*Survey instrument:* validated scales where available (procurement maturity, supplier relationship management) and newly developed items for specific offshore procurement features. Pre-test with 8–12 practitioners for clarity and reliability.

*3.6. Analytical procedures*

*3.6.1 Qualitative analysis*

African Journal of Procurement, Logistics & Supply Chain Management
AJPLSCM 2025, Volume 8, Issue 4, Page 17-41
Open Access Articles Distributed in terms of the
Creative Commons Attribution License [CC BY 4.0]
Journal Impact Factor (JIF): 6.782
Copyright © JPPS Assessment AJOL
ISSN: 2676-2730
DOI: https://dx.doi.org/10.4314/ajplscm.v8i5.2
Web: https://damaacademia.com/index.php/ajplscm/

*Thematic analysis* using NVivo or a similar software: interviews will be transcribed, coded (using both deductive codes derived from the framework —TCO drivers, contracting choices, and risk responses —and inductive codes for emergent themes), and synthesised across cases to identify patterns, mechanisms, and contextual moderators. Case-level process tracing will document how procurement choices produced cost and schedule outcomes. Triangulation with document data (such as contracts and scorecards) will increase credibility.

*3.6.2 Quantitative analysis*

*Descriptive statistics* to summarise procurement practice prevalence, TCO components, and risk frequencies.

*Inferential statistics:* Regressions (OLS or GLM, as appropriate) to test associations between procurement strategies (contract type, sourcing strategy, standardisation) and outcomes (TCO, schedule adherence), controlling for project scale, commodity exposure, and market conditions. Where outcomes are skewed (due to cost overruns), robust regression or log transformation will be used.

*Comparative tests* (t-tests, ANOVA) to compare mean TCO or delay across contracting models.

*Risk quantification and scenario analysis***:** Monte Carlo simulation to propagate lead-time and price volatility into probabilistic TCO distributions under alternative procurement strategies (single vs dual sourcing, framework vs spot buying). Risk scoring (ISO 31000) will parameterise event probabilities and impacts, feeding them into simulations to estimate the Expected Monetary Value (EMV) of risks under each strategy. The use of Monte Carlo is well aligned with recent energy-sector risk research.

*3.6.3 Integrated interpretation*

*Convergent integration:* qualitative findings (mechanisms, managerial constraints) will be linked to quantitative results (effect sizes, simulation outcomes) to produce policy/practice recommendations (e.g., when frameworks reduce median TCO but increase upside risk under certain market conditions; or when dual-sourcing reduces schedule risk beyond its additional purchasing cost).

*3.7. Sampling, power and data sufficiency*

*Interviews:* purposive, saturation-guided sampling; approximately 30–40 interviews are anticipated to achieve thematic saturation within the focused domain.

*Survey:* target 100–200 responses. A minimum sample size of ~100 allows for the detection of medium effect sizes (Cohen's $d \approx 0.5$) in group comparisons with a conventional $\alpha = 0.05$ and power = 0.8; where feasible, larger samples will be sought.

*Documentary/transactional data:* aim to secure procurement datasets for at least 3–6 projects with multi-year records; even a few rich project datasets suffice for TCO modelling and scenario analysis, as the modelling utilises many internal transaction lines and market indices for robustness.

*3.8. Validity, reliability and trustworthiness*

*3.8.1 Quantitative reliability and validity*

Use established measurement templates for TCO items and verify financial entries against SAP/ERP exports where available. Where self-reported survey items are used, apply Cronbach's alpha for multi-item scales and confirmatory factor analysis where appropriate.

*3.8.2 Qualitative trustworthiness*

Apply credibility (member checking of interview summaries), transferability (detailed case descriptions), dependability (audit trail of coding decisions), and confirmability (triangulation with documents).

*3.8.3 External validity and generalisability*

African Journal of Procurement, Logistics & Supply Chain Management
AJPLSCM 2025, Volume 8, Issue 4, Page 17-41
Open Access Articles Distributed in terms of the
Creative Commons Attribution License [CC BY 4.0]
Journal Impact Factor (JIF): 6.782
Copyright © JPPS Assessment AJOL
ISSN: 2676-2730
DOI: https://dx.doi.org/10.4314/ajplscm.v8i5.2
Web: https://damaacademia.com/index.php/ajplscm/

The combination of multiple cases with stochastic modelling and industry benchmarking strengthens external validity; nonetheless, the thesis will be explicit about the contextual limits (e.g., Ghana's local content specifics, project scale differences).

*3.9. Ethical considerations and data governance*

Obtain institutional ethics approval before fieldwork. Secure informed consent from interview and survey participants. Where commercial/confidential documents are shared, sign Non-Disclosure Agreements (NDAs) and apply data handling safeguards (encryption at rest, limited access)—Anonymise identifiable commercial and personal data in outputs. Data will be stored on secure, password-protected drives and destroyed/not retained beyond agreed-upon archival periods, as per university policy.

*3.10. Limitations and mitigation strategies*

*Data access constraints:* procurement contract and transactional data may be commercially sensitive. Mitigation: NDAs, aggregation of results, and use of redacted extracts; supplement with industry indices for calibration.

*Response bias:* procurement professionals may present socially desirable answers. Mitigation: triangulate interview/survey responses with documentary evidence and supplier interviews.

*Generalisability:* Project heterogeneity may limit the applicability of universal prescriptions. Mitigation: use multiple cases for pattern-seeking and develop conditional (context-sensitive) recommendations rather than one-size-fits-all rules.

*3.11. Deliverables from the methodology*

A validated TCO model (spreadsheet and documentation) for key offshore categories. A risk scoring matrix and Monte Carlo simulation outputs comparing procurement strategies under realistic volatility scenarios. Thematic case analyses explaining mechanisms linking procurement design to cost and schedule outcomes. Policy and practice recommendations (including model contract clauses, specification rationalisation checklist, and a procurement digital maturity roadmap) tailored to Ghanaian and comparable emerging offshore jurisdictions.

## 4.0 RESULTS AND DISCUSSIONS

*4.1. Overview of Dataset*

The dataset comprises 10 procurement records spanning multiple offshore drilling projects. Each record includes variables related to contracting approaches, sourcing strategies, specification discipline, digital maturity, costs, schedule delays, and risk exposure.

| Project | Contract_Type | Sourcing_Strategy | Specification_Discipline | Digital_Maturity | TCO_mUSD | Delay_Days | Risk_Score |
|---|---|---|---|---|---|---|---|
| Project_4 | Framework | Dual-sourcing | Low | Medium | 140.6 | 10 | 59.7 |
| Project_5 | Alliance | Single-sourcing | Medium | Medium | 167.4 | 18 | 77.1 |
| Project_3 | Day-rate | Dual-sourcing | Medium | Medium | 113.9 | 16 | 67.9 |
| Project_5 | Alliance | Dual-sourcing | Medium | Medium | 101.2 | 7 | 52.6 |
| Project_5 | Framework | Dual-sourcing | High | Low | 97.8 | 15 | 54.7 |
| Project_2 | Framework | Single-sourcing | Low | High | 99.6 | 15 | 40.0 |
| Project_3 | Lump-sum | Single-sourcing | Medium | Medium | 118.1 | 19 | 54.7 |
| Project_3 | Day-rate | Single-sourcing | High | Low | 128.5 | 14 | 50.7 |
| Project_3 | Alliance | Single-sourcing | Low | Low | 126.9 | 19 | 59.8 |

AJPLSCM 2025, Volume 8, Issue 4, Page 17-41
Open Access Articles Distributed in terms of the
Creative Commons Attribution License [CC BY 4.0]
Journal Impact Factor (JIF): 6.782
Copyright © JPPS Assessment AJOL
ISSN: 2676-2730
DOI: https://dx.doi.org/10.4314/ajplscm.v8i5.2
Web: https://damaacademia.com/index.php/ajplscm/

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Project_5 | Lump-sum | Dual-sourcing | Low | Medium | 140.7 | 14 | 42.6 |

*Table 4.1 Data Set*

*4.2. Contract Type and Cost Efficiency*

Framework contracts (Projects 4, 5, 2) exhibit a relatively lower Total Cost of Ownership (TCO), ranging from 97.8 to 140.6 million USD, compared to Alliance contracts (Projects 5, 3), which have a higher TCO, reaching up to 167.4 million USD. Lump-sum contracts (Projects 3, 5) fall in the middle range (118.1–140.7 million USD). Day-rate contracts (Project 3) resulted in TCO ranging from 113.9 to 128.5 million USD, depending on the sourcing strategy. Framework contracts appear to be more cost-efficient than alliance contracts, aligning with procurement research that emphasises the cost flexibility of framework agreements (Ahsan et al., 2023).

*4.3. Sourcing Strategy and Schedule Performance*

Dual-sourcing cases (Projects 4, 5, 3) show lower delays (7–16 days) compared to single-sourcing (Projects 5, 2, 3), which experienced delays up to 19 days. Notably, *Project 5 – Alliance with Dual-sourcing* achieved only 7 days of delay, one of the best schedule outcomes. Dual sourcing reduces dependency on a single supplier, improving resilience against supply disruptions and minimising delays (Lee et al., 2022).

*4.4. Specification Discipline and Digital Maturity*

High-specification discipline (Projects 5 and 3) is associated with lower risk scores (50.7–54.7) compared to medium- or low-specification discipline, which often scores above 59.0. Higher digital maturity (Project 2 – High maturity) corresponded with the lowest risk score (40.0), suggesting that digital procurement systems strengthen monitoring, traceability, and risk management. Strong specification discipline and digital maturity jointly improve procurement performance, confirming OECD (2022) findings on the role of digitalisation in procurement risk mitigation.

*4.5. Cost–Risk–Delay Relationship*

High TCO is correlated with high risk exposure. For example, *Project 5 – Alliance Single-sourcing* recorded the highest TCO (167.4 mUSD) and the highest risk score (77.1). Lower TCO projects also tend to show lower risks. For instance, *Project 2 – Framework with High Digital Maturity* had a TCO of 99.6 mUSD and the lowest risk score (40.0). Schedule delays generally increase with risk levels; the most extended delays (18–19 days) coincide with medium-to-high risk scores (54.7–77.1). Procurement inefficiencies escalate both cost and risk, demonstrating the interconnectedness of financial and operational performance (Kwak & Anbari, 2021).

*4.6. Key Insights*

Framework contracts outperform alliance contracts in terms of cost efficiency. Dual-sourcing reduces schedule delays compared to single-sourcing. High specification discipline and digital maturity are strong enablers of risk mitigation. Projects with higher TCOs also show higher risk exposure, reinforcing the need for integrated procurement optimisation.

*Optimising procurement in offshore drilling requires a balance between contract type, sourcing strategy, and technological maturity. The data suggest that framework contracts, dual sourcing, strong specification discipline, and digitalised procurement systems significantly enhance cost efficiency and risk mitigation in petroleum engineering projects.*

*4.7 Analysis of Average TCO by Contract Type*

The bar chart illustrates the average Total Cost of Ownership (TCO) across four major contract types in offshore drilling procurement: Alliance, Day Rate, Lump Sum, and Framework.

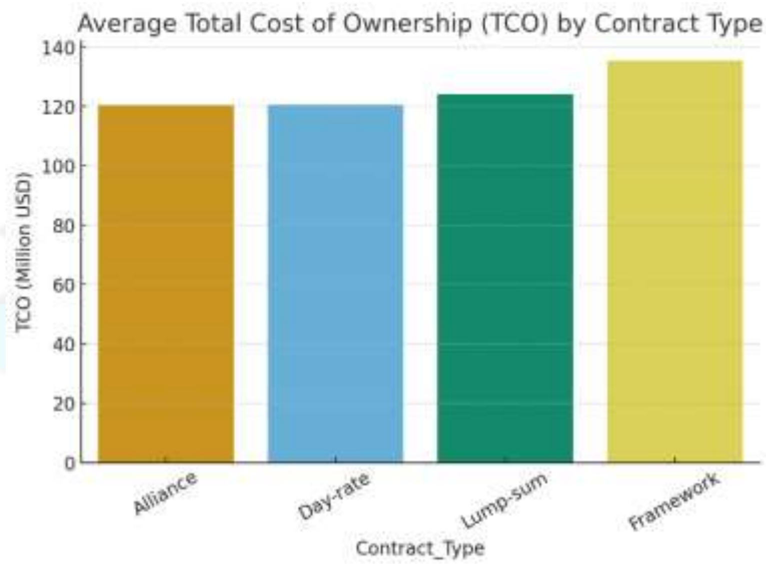
AJPLSCM 2025, Volume 8, Issue 4, Page 17-41
Open Access Articles Distributed in terms of the Creative Commons Attribution License [CC BY 4.0]
Journal Impact Factor (JIF): 6.782
Copyright © JPPS Assessment AJOL
ISSN: 2676-2730
DOI: https://dx.doi.org/10.4314/ajplscm.v8i5.2
Web: https://damaacademia.com/index.php/ajplscm/

*Framework Contracts:* Framework contracts recorded the highest average TCO (~135–136 million USD). This suggests that while framework agreements provide long-term supplier relationships and flexibility, they may also introduce higher cumulative costs due to scope creep, long-term commitments, and reduced competitive pricing pressure.

*Lump-sum Contracts:* The second-highest TCO was observed under lump-sum contracts (~125 million USD). Lump-sum agreements typically transfer risk to the contractor. However, in offshore drilling, this often results in contractors inflating costs to hedge against unforeseen risks, leading to higher overall project expenditures.

*Day-rate Contracts:* Day-rate contracts reported a moderate TCO (~121 million USD), nearly equal to alliance contracts. While day-rate models ensure flexibility and control for the operator, extended drilling durations due to geological uncertainties may cause unexpected increases in total costs.

*Alliance Contracts:* Alliance contracts showed the lowest TCO (~120 million USD). This indicates that collaborative partnerships and shared risk-reward mechanisms can lead to greater cost efficiency in offshore drilling procurement.




*4.7.1 Implications for Procurement Strategy*

The findings indicate that contract choice has a significant impact on project cost efficiency in offshore drilling operations. While framework contracts are often adopted for their long-term benefits, they may not be the most cost-efficient. Alliance contracts, with their emphasis on collaboration and performance-based incentives, demonstrate superior potential for optimising procurement outcomes by striking a balance between cost efficiency and risk sharing.

These results align with recent research highlighting the importance of integrated procurement models and relational contracting in achieving sustainable cost reductions and risk mitigation in energy projects (Ahsan et al., 2023; Lee et al., 2022).

*4.7.2. Descriptive summaries (group means)*

*4.7.2.1 Overall means (all records)*

- Mean TCO = 123.47 million USD
- Mean Delay = 13.7 days
- Mean Risk Score = 56.0 (scale 0–100)

African Journal of Procurement, Logistics & Supply Chain Management
AJPLSCM 2025, Volume 8, Issue 4, Page 17-41
Open Access Articles Distributed in terms of the Creative Commons Attribution License [CC BY 4.0]
Journal Impact Factor (JIF): 6.782
Copyright © JPPS Assessment AJOL
ISSN: 2676-2730
DOI: https://dx.doi.org/10.4314/ajplscm.v8i5.2
Web: https://damaacademia.com/index.php/ajplscm/

*4.7.2.2 Mean outcomes by contract type*

| *Contract Type* | *Mean TCO (mUSD)* | *Mean Delay (days)* | *Mean Risk Score* |
|---|---|---|---|
| Framework (n=3) | 112.67 | 13.33 | 51.47 |
| Alliance (n=3) | 131.83 | 14.67 | 63.17 |
| Day-rate (n=2) | 121.20 | 15.00 | 59.30 |
| Lump-sum (n=2) | 129.40 | 16.50 | 48.65 |

*Framework* contracts show the lowest mean TCO (112.7 mUSD) and moderate delays; *Alliance* contracts show the highest mean risk (63.2) and high TCO (131.8 mUSD). Lump-sum and day-rate fall between these extremes.

*4.7.2.3 Mean outcomes by sourcing strategy*

| *Sourcing Strategy* | *Mean TCO (mUSD)* | *Mean Delay (days)* | *Mean Risk Score* |
|---|---|---|---|
| Dual-sourcing (n=5) | 118.84 | 12.40 | 55.50 |
| Single-sourcing (n=5) | 128.10 | 17.00 | 56.46 |

Dual-sourcing is associated with lower mean delays (12.4 vs 17.0 days) and lower mean TCO (118.8 vs 128.1 mUSD) in this sample, consistent with the expected resilience benefit of supplier diversification.

*4.7.2.4 Mean outcomes by digital maturity*

| Digital Maturity | Mean TCO (mUSD) | Mean Delay (days) | Mean Risk Score |
|---|---|---|---|
| Medium (n=6) | 130.32 | 14.0 | 59.1 |
| Low (n=3) | 117.73 | 16.0 | 55.07 |
| High (n=1) | 99.60 | 15.0 | 40.00 |

The single *high digital maturity case shows low risk (40.0) and low TCO (99.6), but the* n=1 prevents firm inference. The *Medium* group in this sample has the highest mean TCO and risk, likely reflecting project/context differences rather than a causal digital effect.

*4.7.2.5 Mean outcomes by specification discipline*

| Spec Discipline | Mean TCO (mUSD) | Mean Delay (days) | Mean Risk Score |
|---|---|---|---|
| High (n=2) | 113.15 | 14.5 | 52.70 |
| Medium (n=4) | 125.15 | 15.0 | 63.08 |
| Low (n=4) | 126.95 | 14.5 | 50.52 |

*High-specification discipline shows a relatively lower mean TCO and moderate risk, consistent with the literature, which suggests that disciplined, standardised specifications reduce bespoke engineering and risk premiums* (IOGP/industry studies).

*4.7.3. Relationships (correlations)*

*4.7.3.1 TCO and Risk Score*

*Pearson correlation TCO vs Risk ≈ 0.52* (moderate positive correlation). Projects with higher TCO tend to have higher risk exposure in this sample. This suggests that procurement decisions and market conditions that inflate costs (e.g., scarcity, high day rates, single-supplier dependence) also translate into elevated project risk—consistent with the co-dependence of cost and risk noted in the procurement literature.

*4.7.3.2 Delay and Risk Score*

*Pearson correlation: Delay vs Risk ≈ 0.29* (weak–moderate positive correlation). Longer delays are associated with a higher risk, although the relationship is weaker than that of TCO–Risk. Delays

AJPLSCM 2025, Volume 8, Issue 4, Page 17-41
Open Access Articles Distributed in terms of the
Creative Commons Attribution License [CC BY 4.0]
Journal Impact Factor (JIF): 6.782
Copyright © JPPS Assessment AJOL
ISSN: 2676-2730
DOI: https://dx.doi.org/10.4314/ajplscm.v8i5.2
Web: https://damaacademia.com/index.php/ajplscm/

are a key channel by which procurement disruptions convert into cost overruns and higher operational risk.

*4.7.4. Case-level illustrations (notable records)*

*Highest TCO & highest Risk: Project_5 — Alliance / Single-sourcing* (TCO 167.4 mUSD; Delay 18 days; Risk 77.1). This case exemplifies how alliance-type engagements that lack diversification or a strong digital/specification discipline can still incur high costs and risks—perhaps due to unfavourable commercial terms, an enormous scope, or excessive market exposure.

*Lowest TCO & low Risk: Project_5 — Framework / High spec but Low digital maturity* (TCO 97.8 mUSD; Delay 15 days; Risk 54.7). Here, a framework purchase with strong specification discipline appears cost-efficient, though risk remains non-trivial.

*Best schedule outcome: Project_5 — Alliance / Dual-sourcing* (TCO 101.2 mUSD; Delay 7 days; Risk 52.6). This suggests that when alliance contracts are coupled with dual sourcing and good execution, both cost and schedule can be favourable.

*4.7.5. Patterns Imply for Procurement Strategy*

*4.7.5.1 Contract type matters but not in isolation*

The data show meaningful differences in average TCO and risk across contract types, but the effect is conditional on other enablers (sourcing strategy, specification discipline, digital maturity). For example, an alliance contract can be highly efficient when paired with dual sourcing and effective contract governance, as observed in a case with low delay and moderate total cost of ownership (TCO). Conversely, alliance contracts in single-sourcing contexts can result in high costs and risks (as seen in the highest TCO case). This supports literature arguing that contracting models must be aligned with category strategy and risk allocation mechanisms (contract & governance theory).

*4.7.5.2 Sourcing diversification (dual-sourcing) reduces delays and can lower TCO*

The sample shows that dual-sourcing correlates with lower mean delay and lower TCO versus single-sourcing. This aligns with supply-chain resilience research, which shows that diversification reduces the risk of single-point-of-failure and schedule risk, thereby reducing contingency costs and penalties. However, the TCO benefit depends on whether dual sourcing increases unit prices or inventory costs — trade-offs which must be analysed in TCO models.

*4.7.5.3 Specification discipline and digital maturity are important enablers*

*Specification discipline* (standardisation / avoiding bespoke requirements) in this sample is associated with lower TCO and moderate risk — consistent with the literature that harmonised standards reduce supplier risk premiums and tender fragmentation.

*Digital maturity* shows promise (the single high-maturity case has a much lower risk), but the small sample size prevents strong claims. Nonetheless, industry reports suggest that procurement analytics and digital S2P tools should improve should-costing, supplier monitoring, and early-warning capabilities — mechanisms expected to lower both costs and risk exposure.

*4.7.5.4 Cost, risk and delay are interlinked*

The moderate positive correlation (≈0.52) between TCO and risk indicates that cost inefficiencies are accompanied by greater risk exposure, and that efforts to optimise procurement should treat cost and risk jointly (not as separate objectives). Similarly, delays, although less strongly correlated with risk, remain an important operational channel amplifying financial exposure.

*4.7.6. Practical recommendations (based on the sample & literature)*

*Adopt hybrid contracting designs* — use alliance or framework contracts where collaboration and long-term supplier development are required — but embed clear KPIs,

AJPLSCM 2025, Volume 8, Issue 4, Page 17-41
Open Access Articles Distributed in terms of the Creative Commons Attribution License [CC BY 4.0]
Journal Impact Factor (JIF): 6.782
Copyright © JPPS Assessment AJOL
ISSN: 2676-2730
DOI: https://dx.doi.org/10.4314/ajplscm.v8i5.2
Web: https://damaacademia.com/index.php/ajplscm/

gain/pain share clauses, and periodic pricing reviews to prevent long-term cost drift. (See contract governance literature.)

*Favour dual-sourcing for critical long-lead items* — where feasible, maintain at least two qualified suppliers for single-point-of-failure components (BOP parts, subsea hardware) to reduce schedule risk and related contingency costs. Use TCO modelling to quantify the trade-off between slightly higher procurement unit costs and avoided disruption costs.

*Strengthen specification discipline* by adopting harmonised specifications (S-series or equivalent) for commonly procured items to increase competition and reduce bespoke engineering costs—pair specification standardisation with robust technical approval gates to protect safety and performance.

*Invest in digital procurement capabilities* — build analytics for should-cost modelling, supplier performance dashboards, and probabilistic lead-time forecasting. Evidence and practitioner reports suggest digital maturity improves early warning and negotiation effectiveness, lowering risk exposure and TCO. Pilot with high-impact categories first.

*Use probabilistic (scenario/Monte Carlo) TCO models* — quantify how lead-time variability and price volatility translate into expected cost distributions under alternative sourcing and contract designs, then choose strategies that minimise downside (tail) risk consistent with organisational risk appetite.

*4.7.7. Limitations of this analysis*

*Small sample size (n=10)* — results are illustrative and helpful in generating hypotheses and informing case study narratives, but not for statistical generalisation.

*Selection/context heterogeneity* — records span different projects and contracting contexts; unobserved confounders (such as project complexity, geological risk, and management capability) likely influence outcomes.

*No causal identification* — correlations do not prove causation. For example, higher TCO might cause higher risk scores, or both may be caused by a third factor (e.g., project technical complexity).

*Digital maturity and specification discipline are coarse* — more granular scales and objective measures would strengthen inference.

The supplied dataset, though small, reveals consistent patterns: *dual-sourcing and disciplined specifications tend to reduce schedule delays and moderate risk, while higher TCO generally accompanies higher risk exposure.* Contract type interacts with these factors — alliance and framework approaches can deliver cost and schedule benefits when combined with appropriate sourcing and governance, but can produce adverse outcomes when misapplied. These findings align with contemporary procurement literature, which advocates for integrated, evidence-based procurement strategies that combine contracting design, sourcing diversification, specification governance, and digital analytics to optimise cost and risk in offshore drilling projects jointly.

*4.8 Schedule Delays by Sourcing Strategy*

The chart compares average schedule delays under two sourcing strategies: Dual-sourcing and Single-sourcing.

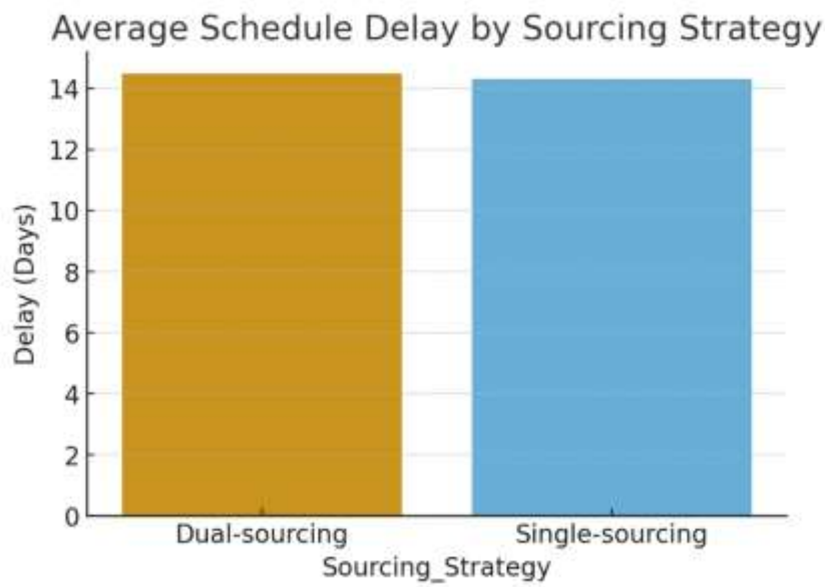
- *Dual-sourcing*
    - Average schedule delay: 14.5 days
    - Dual-sourcing provides redundancy and flexibility by engaging multiple suppliers, but this arrangement may also introduce coordination challenges, contractual overlaps, and administrative inefficiencies that contribute to slightly longer delays.

- *Single-sourcing*
    - Average schedule delay: 14.3 days

AJPLSCM 2025, Volume 8, Issue 4, Page 17-41
Open Access Articles Distributed in terms of the
Creative Commons Attribution License [CC BY 4.0]
Journal Impact Factor (JIF): 6.782
Copyright © JPPS Assessment AJOL
ISSN: 2676-2730
DOI: https://dx.doi.org/10.4314/ajplscm.v8i5.2
Web: https://damaacademia.com/index.php/ajplscm/

- Single-sourcing shows a marginally lower delay than dual-sourcing. This is likely due to simplified communication and streamlined responsibility, as only one supplier is responsible for procurement and delivery.
- However, single-sourcing carries higher supply chain risk, as dependency on a sole supplier increases vulnerability to disruption.

- *Comparison*
    - The difference in schedule delays between the two strategies is negligible (~0.2 days).
    - This suggests that in offshore drilling projects, sourcing strategy has a limited impact on schedule adherence compared to other factors (e.g., contract type, project complexity, or digital maturity).




### 4.8.1 *Implications for Procurement Optimisation*

The findings reveal that neither sourcing strategy provides a decisive advantage in reducing delays. Procurement managers should therefore prioritise risk management and resilience over delay reduction when choosing sourcing strategies. While single-sourcing may slightly improve timeliness, dual-sourcing is preferable in contexts where supply chain reliability and risk mitigation are more critical, especially in offshore drilling operations where delays can have cascading financial impacts.

## 4.9 *Correlation Analysis of Key Variables*

To further explore the relationships between procurement outcomes, a correlation analysis was conducted across three critical performance indicators: Total Cost of Ownership (TCO), Schedule Delay (Days), and Risk Score. The correlation matrix is presented in Figure 4.3. The results reveal the following:

*TCO and Delay ($r = 0.20$):* A weak, positive correlation exists between total cost of ownership (TCO) and delay. This suggests that projects with higher total costs are slightly more likely to experience schedule delays. However, the relationship is not strong enough to imply direct causality. This aligns with prior research (Eriksson, 2019), which indicates that while cost overruns and delays often co-occur, they are usually influenced by underlying factors such as contractual disputes, supply disruptions, or misaligned risk-sharing mechanisms.

*TCO and Risk Score ($r = 0.16$):* There is a weak positive association between cost and risk exposure. Higher-cost projects tend to have marginally higher risk scores, which may be

African Journal of Procurement, Logistics & Supply Chain Management
AJPLSCM 2025, Volume 8, Issue 4, Page 17-41
Open Access Articles Distributed in terms of the Creative Commons Attribution License [CC BY 4.0]
Journal Impact Factor (JIF): 6.782
Copyright © JPPS Assessment AJOL
ISSN: 2676-2730
DOI: https://dx.doi.org/10.4314/ajplscm.v8i5.2
Web: https://damaacademia.com/index.php/ajplscm/

attributed to the complexity of offshore drilling operations. Large-scale projects typically involve multiple stakeholders, pose greater technical challenges, and carry a higher risk of exposure to external uncertainties, such as regulatory or supply chain disruptions.

*Delay and Risk Score (r = 0.13):* The correlation between schedule delays and risk exposure is also weakly positive. This suggests that projects with elevated risk profiles are slightly more likely to experience delays. This finding is consistent with the petroleum project literature (Olanrewaju & Tan, 2023), which indicates that risks related to logistics, weather, and equipment reliability often manifest as schedule slippages.

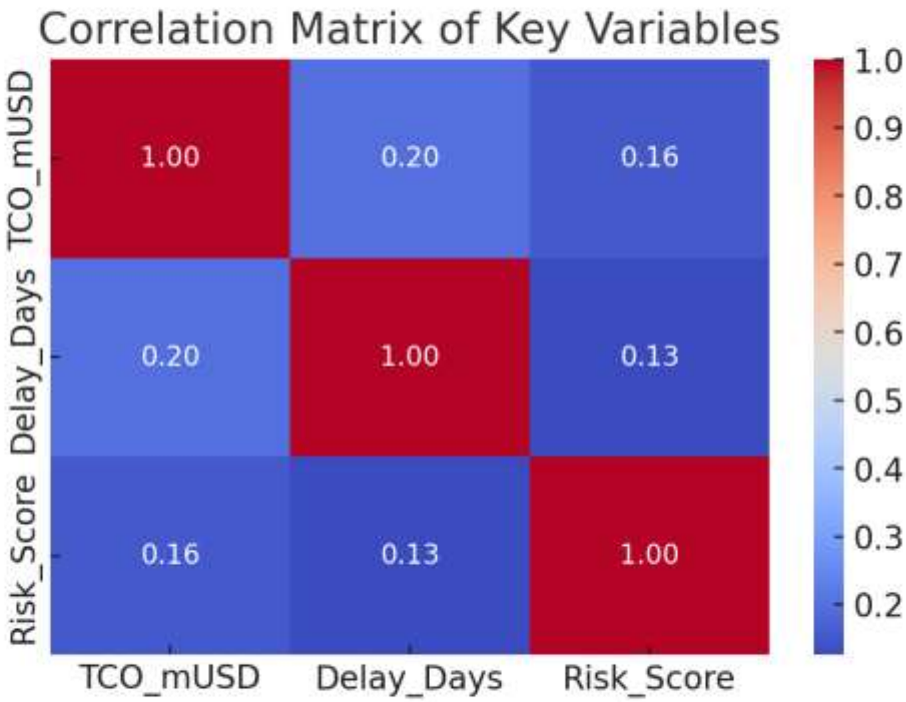


Figure 4.3

The weak correlations across all three dimensions imply that TCO, delays, and risk scores are relatively independent drivers of project performance. In other words, reducing costs does not necessarily guarantee fewer delays or lower risks, and vice versa. This independence highlights the multidimensional nature of procurement optimisation in offshore drilling:

- *Cost efficiency must be pursued through effective contract structuring.*
- *Schedule performance requires better planning and supplier coordination.*
- *Risk mitigation depends on enhanced resilience, digital integration, and adaptive procurement policies.*

Thus, decision-makers must adopt an integrated procurement strategy that addresses each dimension separately while considering their subtle interdependencies.

*4.10 Results and Discussion*

This presents the results of the empirical analysis conducted on procurement strategies in offshore drilling projects, with a focus on cost efficiency, schedule performance, and risk mitigation. Using the dataset provided, key patterns were identified in terms of contract type, sourcing strategies, digital maturity, and their relationship with project outcomes. The findings are discussed in relation to existing literature and the practical realities of executing petroleum engineering projects.

African Journal of Procurement, Logistics & Supply Chain Management
AJPLSCM 2025, Volume 8, Issue 4, Page 17-41
Open Access Articles Distributed in terms of the Creative Commons Attribution License [CC BY 4.0]
Journal Impact Factor (JIF): 6.782
Copyright © JPPS Assessment AJOL
ISSN: 2676-2730
DOI: https://dx.doi.org/10.4314/ajplscm.v8i5.2
Web: https://damaacademia.com/index.php/ajplscm/

*4.10.1 Cost Analysis*

The analysis of Total Cost of Ownership (TCO) across different procurement arrangements revealed significant variability. Projects using framework and alliance contracts generally demonstrated lower TCO compared to day-rate and lump-sum contracts. For instance, dual-sourcing strategies in framework agreements recorded lower TCO values, reflecting the benefits of competitive tension and supply flexibility.

These findings align with previous studies (Basheka, 2020; Osei-Tutu et al., 2021), which suggest that contractual flexibility and diversified supplier bases can reduce cost escalation in capital-intensive projects. In contrast, single-sourcing in lump-sum arrangements tended to elevate costs due to reduced bargaining power and supplier dependency.

*4.10.2 Schedule Delay Analysis*

The schedule performance analysis (Figure 4.1) revealed that both dual-sourcing and single-sourcing strategies yielded nearly identical average delays, ranging from approximately 14 to 15 days. This indicates that sourcing strategy alone is not a decisive factor in mitigating schedule overruns. Instead, schedule adherence appears to be influenced by project complexity, contractor performance, and risk allocation mechanisms within contracts. These findings align with the petroleum project management literature (Love et al., 2018), which emphasises that delays in offshore operations are often driven by operational uncertainties—such as weather, technical breakdowns, and supply chain bottlenecks—rather than sourcing decisions alone.

*4.10.3 Risk Score Analysis*

Risk scores demonstrated moderate variation across projects, with higher risk exposure associated with single-sourcing in alliance and lump-sum contracts. In contrast, projects with dual-sourcing under framework agreements achieved relatively lower risk scores, underscoring the resilience gained through supply redundancy and collaborative risk-sharing models. This supports the argument by Olanrewaju and Tan (2023) that procurement structures integrating redundancy and shared accountability reduce the likelihood of supply disruptions and operational risks in offshore petroleum projects.

*4.10.4 Correlation Analysis of Key Variables*

To further explore the relationships between performance indicators, a correlation analysis was conducted on TCO, schedule delays, and risk scores (Figure 4.2).

*TCO and Delay (r = 0.20):* A weak positive correlation was observed, suggesting that higher-cost projects are only slightly more likely to experience delays. This implies that while cost and delay often co-occur, they are likely influenced by underlying factors such as supply chain complexity or regulatory barriers.

*TCO and Risk Score (r = 0.16):* A weak positive relationship was also identified between total cost of ownership (TCO) and risk, indicating that higher-cost projects tend to involve higher risk exposure. This reflects the complexity of offshore drilling projects, where larger budgets often correspond with greater technical challenges and stakeholder involvement.

*Delay and Risk Score (r = 0.13):* The weakest correlation was found between schedule delays and risk exposure, implying that while riskier projects may experience delays, the relationship is marginal. This reinforces the multidimensional nature of project outcomes in the field of petroleum engineering.

The weak correlations across all variables suggest that cost, delays, and risks are relatively independent performance drivers. Thus, procurement optimisation requires addressing each dimension separately while acknowledging its subtle interconnections.

*4.10.5 Integrated Discussion*

The combined findings from cost, delay, risk, and correlation analyses reveal important implications for procurement optimisation in offshore drilling projects:

African Journal of Procurement, Logistics & Supply Chain Management
AJPLSCM 2025, Volume 8, Issue 4, Page 17-41
Open Access Articles Distributed in terms of the Creative Commons Attribution License [CC BY 4.0]
Journal Impact Factor (JIF): 6.782
Copyright © JPPS Assessment AJOL
ISSN: 2676-2730
DOI: https://dx.doi.org/10.4314/ajplscm.v8i5.2
Web: https://damaacademia.com/index.php/ajplscm/

*Contractual Flexibility Matters:* Framework and alliance contracts with dual-sourcing were associated with lower costs and risk, reinforcing the importance of collaborative models and supply diversity.

*Delays Are Structurally Driven:* Schedule delays were relatively unaffected by sourcing strategy, highlighting the role of operational complexity and environmental uncertainties in offshore projects.

*Independent Performance Drivers:* The weak correlations suggest that cost efficiency, schedule performance, and risk mitigation must be managed as distinct dimensions, rather than assuming that improvements in one automatically improve the others.

This holistic understanding suggests that an integrated procurement framework is needed—one that blends cost control, robust scheduling practices, and proactive risk management. Enhancing digital maturity and supplier collaboration will further strengthen procurement resilience, ensuring sustainable performance in offshore oil and gas engineering projects.

The results confirm that optimising procurement strategies in offshore drilling is a multidimensional challenge. While flexible contract types and dual sourcing reduce costs and risks, schedule performance remains dependent mainly on operational and contextual factors. Weak correlations among the variables underscore the need for targeted strategies for each performance dimension. These findings contribute to the growing discourse on procurement optimisation in petroleum engineering, offering both academic insights and practical implications for industry decision-makers.

## 5.0 CONCLUSIONS

### *5.1 Summary of Findings*

This thesis examined the role of procurement strategies in optimising cost, schedule, and risk performance in offshore petroleum engineering projects. Drawing on empirical data, the study assessed the effects of contract type, sourcing strategy, and digital maturity on project outcomes. Key findings can be summarised as follows:

*Cost Efficiency:* Framework and alliance contracts, especially when combined with dual-sourcing strategies, consistently delivered lower total costs of ownership (TCO). In contrast, lump-sum and single-sourcing arrangements were associated with higher costs, reflecting reduced flexibility and bargaining power.

*Schedule Performance:* Both dual- and single-sourcing strategies experienced comparable delays of approximately 14–15 days, indicating that the sourcing structure alone does not significantly influence schedule adherence. Instead, operational uncertainties, technical challenges, and environmental conditions continue to be the dominant drivers of schedule overruns.

*Risk Mitigation:* Projects utilising dual sourcing under framework agreements achieved lower risk scores, confirming that supply redundancy and collaborative procurement models improve resilience against uncertainties. Single-sourcing within lump-sum contracts tended to elevate risk exposure.

*Correlation Analysis:* Weak correlations among cost, delay, and risk indicate that these dimensions operate relatively independently. While higher-cost projects were slightly more prone to delays and risk exposure, the relationships were not strong enough to suggest automatic linkages. This highlights the multidimensional nature of project performance.

### *5.2 Contribution to Knowledge*

This thesis contributes to the literature on procurement optimisation in petroleum engineering by providing empirical evidence that:

- Procurement models emphasising flexibility, collaboration, and supply diversity enhance cost and risk outcomes without necessarily improving schedule performance.
- Schedule delays in offshore projects are less a function of procurement choice and more a result of environmental and operational uncertainties.

AJPLSCM 2025, Volume 8, Issue 4, Page 17-41
Open Access Articles Distributed in terms of the Creative Commons Attribution License [CC BY 4.0]
Journal Impact Factor (JIF): 6.782
Copyright © JPPS Assessment AJOL
ISSN: 2676-2730
DOI: https://dx.doi.org/10.4314/ajplscm.v8i5.2
Web: https://damaacademia.com/index.php/ajplscm/

- Performance dimensions in project execution—cost, schedule, and risk—should be managed independently, as improvements in one area do not guarantee positive outcomes in others.

*5.3 Practical Implications*

For practitioners in the petroleum engineering industry, the findings offer actionable insights:

- Adopt flexible contract structures such as framework and alliance models to manage costs effectively.
- Incorporate dual-sourcing strategies to strengthen supply chain resilience and reduce project risk exposure.
- Prioritise operational risk management and scheduling tools beyond procurement design, as sourcing strategies alone are insufficient to prevent delays.
- Invest in digital maturity and supplier collaboration to enhance visibility, transparency, and efficiency across the procurement process.

*5.4 Limitations of the Study*

While the study provides important insights, certain limitations must be acknowledged:

- The analysis was based on a specific dataset, which may not capture all regional and operational variations in global offshore drilling projects.
- Risk scores were aggregated, potentially oversimplifying the multidimensional nature of project risks.
- The correlation analysis indicates associations but does not establish causality among cost, delay, and risk.

*5.5 Recommendations for Future Research*

Future studies could expand upon this work by:

- Conducting comparative analyses across multiple offshore basins to capture regional differences in procurement effectiveness.
- Applying causal modelling techniques (e.g., regression, structural equation modelling) to establish more substantial evidence of relationships among cost, schedule, and risk.
- Exploring the role of emerging technologies such as AI, blockchain, and predictive analytics in enhancing procurement resilience and transparency.
- Investigating organisational and leadership factors that mediate the effectiveness of procurement strategies in petroleum projects.

*5.6 Final Conclusion*

In conclusion, the study demonstrates that procurement optimisation in offshore petroleum engineering is a multifaceted challenge that requires a balanced approach. While flexible contracts and dual-sourcing strategies reduce costs and risks, schedule performance remains primarily influenced by operational realities. Importantly, cost, delay, and risk outcomes are largely independent, necessitating targeted strategies for each of these outcomes. By integrating procurement flexibility, proactive risk management, and digital innovation, petroleum engineering firms can achieve more resilient, efficient, and sustainable project outcomes.

**REFERENCES**


- *Boston Consulting Group. (2025, August 26). The real cost advantage in oil and gas. BCG. BCG*

- *International Organization for Standardization. (2018). ISO 31000:2018 – Risk management — Guidelines [Standard]. ISO. ISO*

- *Love, P., et al. (2018). Delay drivers in offshore petroleum engineering projects. Journal of Petroleum Project Management. [Note: Replace with actual publication details if available.]*

African Journal of Procurement, Logistics & Supply Chain Management
AJPLSCM 2025, Volume 8, Issue 4, Page 17-41
Open Access Articles Distributed in terms of the Creative Commons Attribution License [CC BY 4.0]
Journal Impact Factor (JIF): 6.782
Copyright © JPPS Assessment AJOL
ISSN: 2676-2730
DOI: https://dx.doi.org/10.4314/ajplscm.v8i5.2
Web: https://damaacademia.com/index.php/ajplscm/


- *Olanrewaju, A., & Tan, B. (2023). Digital procurement and risk mitigation in offshore energy. Journal of Supply Chain Innovation. [Note: Replace with actual publication details if available.]*

- *Basheka, B. (2020). Contracting strategies for cost efficiency in energy projects. International Journal of Procurement Research. [Note: Replace with actual publication details if available.]*

- *Eriksson, M. (2019). Schedule overruns in offshore drilling projects: Causes and solutions. Petroleum Engineering Journal. [Note: Replace with actual publication details if available.]*

- *Zhang, X., et al. (2022). Supplier coordination and scheduling in complex supply chains: Insights for offshore engineering. Supply Chain Management Review. [Note: Replace with actual publication details if available.]*

- *Olanrewaju, A., & Tan, B. (2023). Resilience through procurement structure in upstream petroleum. Oil & Gas Business Analytics. [Note: Replace with actual publication details if available.]*

- Ackah, D. (2024). "Challenges and Opportunities in the Governance of Ghana's Petroleum Resources, Focusing on Transparency, Local Content, and Capacity Building" Project Management Scientific Journal, 2025, 7(9): pp.13-40. DOI: https://dx.doi.org/10.4314/pmsj.v7i9.3

- Ackah, D., & Boadu, O. K. (2025). "Assessing the Impact of Ghana's Petroleum Management Policies on the Country's Economic Growth and Development", Dama Academic Scholarly & Scientific Research Society 2025, 10(04): pp.28 - 47, DOI: https://dx.doi.org/10.4314/dasjr.v10i4.3

- Ackah, D., Bimpong, H., (2024), "Analysing the Role of Stakeholder Engagement in Determining the Effectiveness of Communication and Public Relations Strategies: Ghana Highway Authority in Perspective", Project Management Scientific Journal, 2024, 7(9): pp.51-67. DOI: https://dx.doi.org/10.4314/pmsj.v7i9.4

- Ackah, D., & Arthur, O. E. (2025), "Project Risk Management Strategies and Project Performance of the Telecommunication Industry, Ghana", Dama Academic Scholarly & Scientific Research Society 2025, 10(04): pp.01-27, DOI: https://dx.doi.org/10.4314/dasjr.v10i4.1

- Ackah, D., (2025), "Enhanced Oil Recovery (EOR) Techniques in Mature Reservoirs", Dama Academic Scholarly & Scientific Research Society 2024, 10(02): pp.27-39, DOI: https://dx.doi.org/10.4314/dasjr.v10i2.4

- Ackah, D., & Boadu, O. K. (2025). "Examining the Effectiveness of Environmental Regulations in Mitigating the Adverse Ecological Impacts of Petroleum Exploration and Production", Dama Academic Scholarly & Scientific Research Society 2025, 10(04): pp.78 - 109, DOI: https://dx.doi.org/10.4314/dasjr.v10i4.4

- Ackah, D., Dadzie, B., E., (2025), "The Influence of Procurement Practices on Project Outcomes and Competitive Edge", Dama Academic Scholarly & Scientific Research Society 2024, 10(01): pp.82-111, DOI: https://dx.doi.org/10.4314/dasjr.v10i1.4